



EDITOR

Brendan M. Laurs (blaur@gia.edu)

CONTRIBUTING EDITORS

Emmanuel Fritsch, *IMN, University of Nantes, France* (fritsch@cnsr-immn.fr)

Henry A. Hänni, *SSEF, Basel, Switzerland* (gemlab@ssef.ch)

Kenneth V. G. Scarratt, *AGTA Gemological Testing Center, New York* (kscarratt@email.msn.com)

Karl Schmetzer, *Petershausen, Germany* (schmetzerkarl@hotmail.com)

James E. Shigley, *GIA Research, Carlsbad, California* (jshigley@gia.edu)

Christopher P. Smith, *Gübelin Gem Lab Ltd. Lucerne, Switzerland* (cpsgg12@hotmail.com)

DIAMONDS

Australia's Ellendale diamond mine opens. On June 24, 2002, the Kimberley Diamond Company (KDC) started production on its Ellendale 9 lamproite pipe. Ellendale is

Figure 1. The Ellendale mine in Western Australia opened in June 2002. Here, an excavator is used to load overburden into a truck from the first mining bench at the Ellendale 9 lamproite pipe. Photo courtesy of Kimberley Diamond Co.



Australia's third active diamond mine; Argyle and Merlin, opened in 1983 and 1999, respectively, are currently operated by Rio Tinto. The Ellendale field encompasses at least 60 lamproite pipes; more than a third of these are on property leased by KDC. The mine (figure 1) is located on a flat, sandy plain along the southwestern periphery of Western Australia's Kimberley region, 140 km (87 miles) east of Derby. The lamproites erupted only ~20 million years ago, which makes them the youngest commercially diamondiferous pipes known (see A. L. Jaques et al., "The age of the diamond bearing pipes and associated leucite lamproites of the West Kimberley region, Western Australia," *BMR Journal of Geology and Geophysics*, Vol. 9, No. 1, 1984, pp. 1-7).

A well-furnished camp built on-site currently houses 80 people involved in the mining (by open pit) and processing

Figure 2. These gem-quality diamond crystals (approximately 0.3-0.5 ct) were mined from the Ellendale 9 pipe. Note the characteristic rounded shape of the crystals. Photo courtesy of Kimberley Diamond Co.



of the ore. The ore grade from the first two months of production is 15 carats per 100 tonnes. A gem-quality diamond of 7.64 ct was found in the first two weeks of production, and in mid-September an 11.4 ct gem was recovered. Gem-quality diamonds weighing 6.9, 7.9, 8.0, and 9.5 ct were found during the 2000/2001 evaluation stage, which indicates that this mine will produce many 5+ ct stones.

Estimates call for the production of 60,000 carats in the first full year of production (July 1, 2002 to June 30, 2003). The first sale, in June 2002, of 4,552 carats recovered during exploration and evaluation generated US\$99/ct. Most of these diamonds, which were sold to David Lapa of Overseas Diamonds in Antwerp, derived from Ellendale pipe 4, which has a higher grade but lower quality than pipe 9. The latest sale (on August 30, 2002) to the same buyer of 4,320 carats from the first mine production of pipe 9 (see, e.g., figure 2) had an average value of US\$133/ct. These results confirm and slightly exceed estimates made in the mining feasibility study by Snowden Mining Associates of Perth. Snowden's study projected two stages of production that would sustain a mining operation of 4–5 million tonnes (yielding 400,000 to 500,000 carats) per year for 10 years.

KDC purchased the Ellendale prospect from Rio Tinto for Aus\$23.25 million in October 2001 after a protracted legal action. A payment of Aus\$2 million was made when the purchasing agreement was signed, and the remainder is to be paid in four installments over three years. Feasibility studies have shown that these payments are well within the economic parameters of the mining operation. After three years the mine should be virtually debt-free.

A. J. A. "Bram" Janse (archon@space.net.au)
Archon Exploration Pty. Ltd.
Carine, Western Australia

COLORED STONES AND ORGANIC MATERIALS

Aquamarine and spessartine from Tanzania. In April 2002, Dr. Horst Krupp (Fire Gems, La Costa, California) showed the *G&G* editors some rough and cut gems that were representative of new production from Tanzania.

An eluvial deposit in the Songea area has produced attractive crystals of aquamarine within the past year. Dr.

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Figure 3. Songea, Tanzania, is the source of these unheated beryl crystals (over 80 grams) and this heated cut aquamarine (32 ct). Courtesy of Horst Krupp; photo by Maha Tannous.

Krupp estimated that 1,000 kg of rough has been recovered, in a range of colors (figure 3); most was sent to Germany for cutting. Crystals up to 800 g have been found, yielding faceted stones as large as 200 ct. The rough typically does not have any eye-visible inclusions, and the vast majority of material is heated to remove the green color component. Reportedly, the deposit is now worked out.

In central Tanzania, mining for spessartine in the Iringa region has accelerated recently. Although production remains sporadic, these recent activities have yielded several kilograms of rough, in sizes up to 25 grams. As can be seen in figure 4, the material shows a rather even consistency of color.

Figure 4. These spessartines (approximately 6–8 ct faceted) were recently mined in central Tanzania. Courtesy of Horst Krupp; photo by Maha Tannous.



Brown beryl from Mozambique. At the Tucson gem show last February, Intergeoresource of Sofia, Bulgaria, offered "black beryl" from the Conco mine in the famous Alto Ligonha pegmatite region of Mozambique. The dark brown, tumble-polished pebbles ranged from <1 ct to almost 10 ct; this contributor obtained two samples for examination and determination of the source of the unusual color.

When viewed with 10× magnification, the material was seen to consist of very light blue aquamarine with black inclusions that lay in planes perpendicular to the optic axis and were surrounded by brown "clouds" of color (figure 5). At 40× magnification, the inclusions appeared to be typical skeletal ilmenites, as well as ilmenite needles oriented in three directions at 120° from one another. Although too small to analyze by laser Raman microspectrometry, skeletal ilmenite inclusions are well known in beryl (see, e.g., E. J. Gübelin and J. I. Koivula, *Photoatlas of Inclusions in Gemstones*, ABC Edition, Zurich, Switzerland, 1986, p. 240), and have been documented together with rutile needles in a brown beryl from Brazil showing asterism (W. F. Eppler, "Notes on asterism. . .," *Journal of Gemmology*, Vol. 6, No. 5, 1958, pp. 195–212).

The darkest part of one sample showed a schiller effect due to these oriented inclusions, but no asterism. When viewed perpendicular to the optic axis, the beryl appeared strongly color zoned, with numerous extremely thin, very dark brown lamellae in an otherwise light blue background (again, see figure 5). These lamellae were correlated to the planar orientation of the skeletal ilmenites and associated brown halos. When the samples were tilted and observed with a rotating polarizer, the brown color showed strong pleochroism (light and dark brown); it was darkest with the light polarized perpendicular to the optic axis. The brown halos surrounding the included crystals suggested that the color might be related to the elements in the inclusions: iron and titanium.

Prior to Eppler (1958), brown beryl from Brazil was described by J. Sinkankas ("Some freaks and rarities among gemstones," Fall 1955 *Gems & Gemology*, pp. 197–202) and E. H. Rutland ("An unusual brown beryl," *The Gemmologist*, Vol. 25, No. 304, 1956, pp. 191–192). More recently, a brown beryl was described in the Winter 1999 Lab Notes section (p. 202). The new material from

Mozambique and the brown beryl described in the Winter 1999 Lab Note share many properties (i.e., color, pleochroism, and lamellar color zoning). The color of that sample was attributed to dense layers of brown inclusions along lamellar "twin" planes, although to this contributor's knowledge twinning in beryl is unknown.

The absorption spectra of brown beryl from Brazil were studied by C. J. Cristino ("Utilisation des techniques de laboratoire de gemmologie sur quelques gemmes brésiliennes," Diplôme d'Université de Gemmologie, University of Nantes, France, 2001). To better ascertain the origin of color in the Mozambique brown beryls, this contributor obtained optical absorption spectra using a Unicam UV4 spectrophotometer. The brown beryls from both Mozambique and Brazil show a progressive increase in absorption from the red to the ultraviolet region, with no other significant absorption features. When the spectrum of an essentially colorless area is subtracted from that of a brown area (with both spectra taken in the same crystallographic orientation from a parallel-window sample), part of a very broad band appears in the blue and violet region. (The short-wave side of this band is extremely difficult to resolve due to the subtraction of two almost vertical curves.) The very broad nature of the band and the strong pleochroism with which it is associated both suggest a charge-transfer phenomenon (see S. M. Mattson and G. R. Rossman, "Identifying characteristics of charge transfer transitions in minerals," *Physics and Chemistry of Minerals*, Vol. 14, 1987, pp. 94–99).

Qualitative chemical analyses of the very light blue and brown areas were obtained with a JEOL 5800 scanning electron microscope equipped with a PGT energy-dispersive secondary X-ray detector. The spot size resolvable by this technique is about 1 μm, and the analyses were done on the broader lamellae (i.e., about 10 μm in thickness). Both the light blue and brown areas showed identical contents of all elements, including iron, within the detection limits. A titanium peak was seen using a long counting time (i.e., 1,000 seconds), but this element was present in concentrations below the detection limit (i.e., about 1,000 ppm) for our analytical routine.

One hypothesis for the origin of the brown color that is consistent with all of the results mentioned above is

Figure 5. When this brown beryl was viewed parallel to the optic axis, skeletal ilmenite inclusions with brown halos could be seen (left; magnified 30×). Perpendicular to the optic axis, several thin, very dark brown lamellae were visible (right; magnified 40×). Photomicrographs by E. Fritsch.



Fe²⁺-Ti⁴⁺ charge transfer (Cristino, 2001). This mechanism typically gives a brown color in most minerals (e.g., dravite tourmaline) except corundum and kyanite, and only extremely low concentrations of Ti are needed. An alternate explanation would be absorption caused by molecular clusters or submicroscopic inclusions of ilmenite, which might still give rise to pleochroism. These hypotheses may also apply to some rare examples of pleochroic brown sillimanite [G. Rossman, pers. comm., 2002]. A detailed investigation using a transmission electron microscope might determine the true coloration mechanism, but this is well beyond the scope of the present study. EF

Yellowish green and green chrysoberyl from Ilakaka, Madagascar. Recently we encountered one yellowish green and one green chrysoberyl (figure 6) in two parcels of faceted yellow chrysoberyls that originated from the large Ilakaka mining area in southern Madagascar. Although greenish yellow to yellowish green chrysoberyl from Ilakaka has been mentioned in the literature (see Summer 1999 Gem News, p. 150, and C. C. Milisenda et al., "New gemstone occurrences in the south-west of Madagascar," *Journal of Gemmology*, Vol. 27, 2001, pp. 385-394), the properties of these gems have not been published. It was particularly interesting for us to evaluate the cause of color in these stones.

According to information from knowledgeable gem traders in Madagascar, yellowish green to green chrysoberyl is rare at Ilakaka, and typically only small stones are found. No distinct color change was observed for either stone; the color was yellowish green or green in daylight and somewhat grayish green in incandescent light. The pleochroism in daylight was yellowish green to bluish green. The R.I. values of the yellowish green stone were 1.740-1.750, and of the green stone, 1.740-1.748 (birefringence 0.010 and 0.008, respectively). These R.I.'s are somewhat lower than

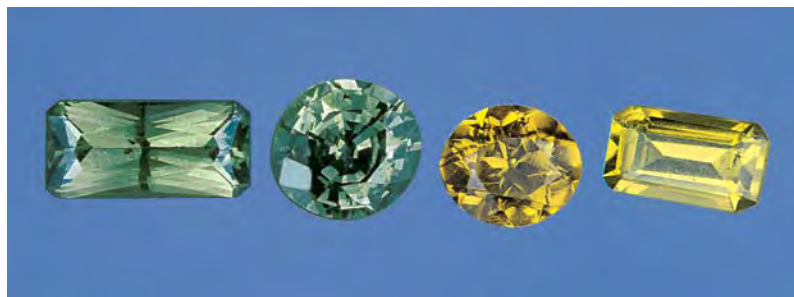


Figure 6. Yellow chrysoberyl from Ilakaka, Madagascar (as seen on the right, 0.42 and 0.37 ct), is typically colored by iron. The yellowish green and green chrysoberyls on the left (0.59 and 0.63 ct), which are also from Ilakaka, owe their color to additional traces of Cr and V. Photo by Maha Tannous.

those commonly reported for chrysoberyl in the literature (1.75-1.76; see R. Webster, *Gems*, 5th ed., revised by P. Read, Butterworth-Heinemann, Oxford, England, 1994, pp. 134-135). The S.G. values of 3.70 and 3.71, obtained by the hydrostatic method, are within the range normally recorded for chrysoberyl. Microscopic examination revealed growth structures, but no mineral inclusions were observed in either sample.

Chemical analyses by electron microprobe (table 1) showed traces of vanadium and chromium (with twice as much V and Cr in the green sample), as well as iron contents of approximately 1 wt.% Fe₂O₃.

Absorption spectroscopy in the UV-Vis range revealed the normal absorption spectrum of Fe³⁺ in chrysoberyl (i.e., absorption bands at 377 and 440 nm), superimposed by weak, broad absorption bands of Cr³⁺ (centered at approximately 426 and 571 nm).

These data indicate that the samples have compositions intermediate between those of yellow chrysoberyl and alexandrite. The Cr and V contents are sufficient to cause a yellowish green or green color (instead of the pure yellow iron-related coloration of Cr- and V-free chrysoberyl), but not high enough to produce the distinct color change characteristic of alexandrite.

KS

Thomas Hainschwang
Gemlab Gemological Laboratory
Ruggell, Liechtenstein
Heinz-Jürgen Bernhardt
Ruhr University, Bochum, Germany

TABLE 1. Physical and chemical properties of two yellowish green and green chrysoberyls from Ilakaka, Madagascar.

Property	Yellowish green	Green
Weight	0.59 ct	0.63 ct
Refractive indices	1.740-1.750	1.740-1.748
Specific gravity	3.70	3.71
Microprobe analyses (wt.%) ^a		
Al ₂ O ₃	78.83	78.74
TiO ₂	0.04	0.10
V ₂ O ₃	0.02	0.05
Cr ₂ O ₃	0.06	0.12
Fe ₂ O ₃ ^b	1.07	1.04
MnO	0.01	0.01

^a Average composition of 10 analyses each.

^b Total iron as Fe₂O₃.

"Tashmarine": Diopside from Central Asia. Columbia Gem House (CGH) of Vancouver, Washington, introduced "Tashmarine" at the June 2002 JCK show in Las Vegas. This yellowish green diopside is sourced from Central Asia, near the borders of China, Kazakhstan, and Uzbekistan. According to CGH president Eric Braunwart and cutting manager Bart Curren, CGH initially purchased 50 kg of rough that was mined in 2001, and has subsequently negotiated an agreement with the miner to purchase his entire

production. So far, two additional shipments weighing a total of about 45 kg have been obtained. Most of the rough is heavily included and must be trimmed extensively in preparation for cutting. The final yield in cut stones has averaged only about 3% from the original rough.

Five faceted stones and three crystals were loaned to GIA by CGH. The crystals, which contained some facetable areas, were well formed with shiny faces (except for some light etching, particularly on the terminations). These large crystals (up to 11.8 × 3.6 × 2.5 cm) appeared very similar to the somewhat smaller diopsides from China that were described in the Summer 1989 Gem News (pp. 111–112). Examination of the cut stones (1.57–25.16 ct; figure 7) by one of us (EQ) showed the following properties: color—light yellowish green to yellowish green, with weak or no pleochroism; R.I.—1.667–1.692 or 1.693 (birefringence 0.025–0.026); S.G.—3.29; Chelsea filter reaction—yellow-green; inert to long- and short-wave UV radiation; and an absorption line at 440 nm, with additional lines at 490, 505, and 550 nm in larger samples, visible with the desk-model spectroscope. These properties are consistent with those reported for diopside by R. Webster (*Gems*, 5th ed., revised by P. Read, Butterworth-Heinemann, Oxford, England, 1994, pp. 330–331), except that the R.I. values in that publication are slightly higher (1.675–1.701). Three of the five stones were free of inclusions. One sample contained a feather and pinpoint inclusions, and another had a minute mineral inclusion. Moderate doubling of the facet junctions was visible in all samples.

Figure 7. Yellowish green diopside from central Asia is being marketed as “Tashmarine.” The gems shown here range up to 25.16 ct; the largest stone displays concave facets. Courtesy of Columbia Gem House; photo by Maha Tannous.



Total reserves are unknown, but Mr. Braunwart expects the deposit will produce about 20 kg of rough per month. The largest crystal acquired so far weighed 1,160 grams. Attractive cut goods are available in sizes up to 35 ct, although most range from 2 to 8 ct. Stones less than 3 ct are generally cut with flat facets, with most larger stones cut using concave facets. Mr. Braunwart reported that the hardness of Tashmarine is 5.5 to 6.0 on the Mohs scale, and it handles “much like tanzanite” in jewelry manufacturing and wear. He added that the material has a very narrow range of color, and does not respond to heat treatment. CGH claims that Tashmarine has not been subjected to any treatments to enhance color or clarity.

Russell Shor
GIA, Carlsbad
russell.shor@gia.edu
Elizabeth Quinn
GIA Gem Trade Laboratory, Carlsbad

Carved emeralds from the Malagana archeological site in Colombia. A collection of emeralds, which includes 15 carved beads and one natural crystal that are reportedly of pre-Columbian origin, were shown to GIA by Ugo Bagnato. The beads are all carved in a similar primitive style that resembles the example seen in the Winter 1994 Lab Notes section (pp. 264–265). All are drilled (including the crystal), and one contains an open hoop of yellow metal (see, e.g., figure 8).

According to Mr. Bagnato, who obtained the collection about nine years ago, the pieces came from an important archeological site that was discovered in a large sugar cane field called Malagana, near the village of El Bolo in the township of Palmira, which is located northeast of Cali in western Colombia’s Cauca Valley (see also S. Archila, *Los Tesoros de los Señores de Malagana*, Museo del Oro, Banco de la República, Bogotá, Colombia, 1996, 95 pp.). He obtained the stones about three months after the site was discovered by a farmer who found a piece of gold while plowing the field with a tractor. Soon after the discovery, thousands of *guaqueros* (“grave robbers”)—young and old, male and female, of many cultures—began frenzied digging at the ancient tomb site. Thousands of rectangular holes were sunk within a few months. The largest excavation (about 50 m wide) was located near the center of the field, and in it were found the best artifacts. The chaotic situation was monitored by police and military personnel, and the government eventually closed the area, but not before most of the scientific context of this unique archeological discovery was destroyed. In late 1994, archeologists, anthropologists, and other scientists were finally able to begin organized excavation of what remained of the Malagana site.

Most of the artifacts recovered from Malagana consisted of gold, pottery, and quartz; carnelian and green jasper beads also were found, in addition to the carved emeralds (which were relatively rare, according to Mr. Bagnato). The



Figure 8. These five carved beads (4.81–32.66 ct) and one natural crystal of emerald were reportedly recovered from an important archeological site at Malagana, near Cali, Colombia. Photo © Harold & Erica Van Pelt.

age of the treasures is thought to fall anywhere from the 4th century BC to the 2nd century AD. Based on their carving style, Mr. Bagnato believes that the emerald beads originated from the Tairona culture of the Sierra Nevada de Santa Marta mountains in northern Colombia.

A gemological examination of the five carved samples in figure 8 (4.81–32.66 ct) was performed by one of us (EQ). The following characteristics were recorded: color—slightly bluish green; R.I.— $n_o=1.580-1.581$ and $n_e=1.572-1.573$ for three samples with flat polished surfaces, and 1.57 for the other two samples by the spot method; Chelsea filter reaction—red; inert to long- and short-wave UV radiation, except for weak yellow fluorescence to long-wave UV in some fractures in four of the stones; and typical chromium absorption lines in the desk-model spectroscope. Microscopic examination revealed two- and three-phase inclusions, fractures (some containing a colorless or whitish substance), partially healed fractures, and color zoning. These characteristics are consistent with those of Colombian emeralds. The four samples exhibiting yellow fluorescence in some fractures also showed evidence of clarity enhancement when viewed with the microscope.

This collection of carved emerald beads is noteworthy for the number of pieces, as well as for the fine quality of several of the emeralds. The clarity enhancement could have been performed by the dealers who sold the stones, so the presence of a filler does not preclude their reported pre-Columbian origin. It is interesting to note that there are no known emerald deposits in the Cauca Valley region; the famed deposits at Muzo and Chivor lie more than 300 km to the northeast. For additional information on the

Malagana site, see: W. Bray et al., "The Malagana chiefdom, a new discovery in the Cauca Valley of southwestern Colombia," in A. J. Labbé, Ed., *Shamans, Gods, and Mythic Beasts: Colombian Gold and Ceramics in Antiquity*, American Federation of Arts (New York) and University of Washington Press, 1998, pp. 121–154; and W. Bray, "Malagana and the goldworking tradition of southwest Colombia," in C. McEwan, Ed., *Precolumbian Gold: Technology, Style and Iconography*, British Museum Press, London, 2000, pp. 94–111.

BML and Elizabeth Quinn

Hemimorphite from Congo. According to Hussain Rezayee and Sherry Shafa of Pearl Gem LA, Los Angeles, in March–April 2002 bright blue, gem-quality hemimorphite was found about 200 km from Brazzaville in southern Congo. Mr. Rezayee reported that specimens from this new locality attain weights of 10–20 kg, but only small portions are suitable for cutting cabochons. Unfortunately there has been no additional production of high-quality material for several months, due to armed conflict between rebels and government forces in the area.

Two freeform cabochons were loaned to GIA for examination. The samples weighed 50.65 and 114.96 ct (see, e.g., figure 9), and the following properties (listed for each stone in that order) were determined by one of us (EQ): color—mottled blue, and banded blue and white; pleochroism—none; diaphaneity—translucent; aggregate reaction with the polariscope; R.I.—1.61 and 1.62, by the spot method (neither piece showed a birefringence "blink," as would be expected for smithsonite); S.G.—3.41 and 3.34; inert or weak bluish white to long-wave, and weak greenish blue

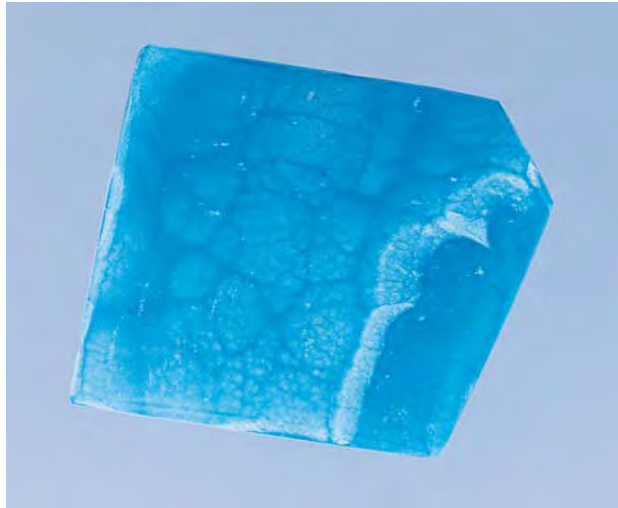


Figure 9. This 114.96 ct hemimorphite was mined from a new locality in southern Congo. Note the botryoidal structure showing through the polished surface. Courtesy of Pearl Gem LA; photo by Maha Tannous.

fluorescence to short-wave UV radiation; and no spectrum seen with the desk-model spectroscope. Both samples displayed a fibrous banded structure and fractures when observed with the microscope, and the larger cabochon also showed a botryoidal structure. This larger piece also showed evidence of a filler in some of the fractures and cavities. Although many of these properties are similar to those reported for hemimorphite in the Lab Notes section (see Spring 1998, pp. 44–45, and p. 254 of this issue), the

Figure 10. In the Erongo Mountains of central Namibia, fine, gem-quality crystals of jeremejevite were mined in 2001 from cavities found above steep granite slopes (beyond the area shown to the upper right). Photo by Georg Gebhard.



S.G. of the larger, banded stone is rather low. Also, the fluorescence noted in this hemimorphite was not present in the other sample. These anomalous characteristics are probably due to the filling substance that was present.

With its bright color and potential for interesting patterns, the Congo hemimorphite could provide an interesting design element for unusual jewelry pieces. However, future production of the material from this politically unstable area remains uncertain.

BML and Elizabeth Quinn

Jeremejevite from the Erongo Mountains, Namibia. In March 2001, attractive gemmy crystals of an intense blue color and a high luster were found in a small miarolitic cavity in granite on the eastern side of the Erongo ring complex in central Namibia (figure 10). Cavities within this area of the Erongo Mountains have been the source of high-quality crystals of aquamarine, black tourmaline, and other minerals since 1999 (see GNI entry on pp. 266–268 of this issue and G. Gebhard, *Minerals from the Erongo Mountains, Namibia*, CD-ROM, January 2002, GG Publishing, Großenseifen, Germany, ggpublishing@t-online.de). The intense blue crystals were found on the Ameib Farm, near the common borders with the Davib Ost and Brabant Farms, at coordinates 21°45'27"S, 015°35'00"E. The crystals were initially believed to be beryl and, due to their relatively small size (<1 cm long), little effort was devoted to finding more. However, this contributor, suspecting they might be a rare mineral, submitted some to Dr. Jochen Schlüter at Hamburg University for examination. X-ray powder diffraction proved that they were jeremejevite.

Requests to the local miners for more of this material soon resulted in the recovery of a few hundred crystals of various colors, but mostly colorless (see G. Gebhard and J. Brunner, "Jeremejevite from Ameib, Erongo, Namibia—A new and probably the best find ever made," http://www.mineralnews.de/New_finds/Jeremejevite/jeremejevite.html, posted May 2001). By the time production ceased in July 2001, several additional pipe-like cavities in the vicinity had yielded between 3,000 and 3,500 crystals, of which 50% were colorless or near colorless and measured up to 1 cm long and 0.1 cm wide. A small portion (about 500) measured 1–3 cm long, and very few attained sizes up to 5 cm. This contributor knows of fewer than 10 crystals that reached 5–7 cm.

The colored crystals varied from pale yellow to many shades of blue, to violet (see, e.g., figure 11). The last color was the least common, in crystals up to 4 cm; the "sky" blue or saturated blue crystals reached up to 7 cm long and 13 g in weight. Although many had surface markings that suggested they were originally intergrown with one another, very few were found in clusters or attached to their feldspar/quartz matrix; almost all were recovered as loose single crystals. They ranged from needle-like to columnar; most were highly transparent, but the cutting

material was limited by the typically small diameter of the crystals (< 3 mm).

Nevertheless, the jeremejevites from the Erongo Mountains are prized for the fine gemstones that have been cut (figure 12). This contributor estimates that only about 1% of the faceted stones exceed 1 ct. A few (probably less than 10 stones) range up to 5 ct. The largest cut stone, at almost 13 ct, is truly exceptional (figure 13).

Three faceted jeremejevites (0.48, 0.62, and 0.80 ct) were supplied to GIA for examination. Elizabeth Quinn at the GIA Gem Trade Laboratory in Carlsbad determined the following characteristics: color—very light blue to blue, with slightly darker blue bands visible in the lighter stones; pleochroism—moderate to strong, in blue to near-colorless hues; R.I.—1.639–1.640 and 1.648–1.649 (birefringence 0.009); S.G.—3.29–3.32; inert to long- and short-wave UV radiation; and no features seen with the desk-model spectroscope. Magnification revealed partially healed fractures and “fingerprints,” as well as mineral inclusions. These characteristics are consistent with those reported by K. Scarratt et al. (“Jeremejevite: A gemological update,” Fall 2001 *Gems and Gemology*, pp. 206–211).

Two jeremejevite crystals, one colorless and the other blue, were submitted to Dr. Schlüter and colleagues at Hamburg University for electron microprobe analysis. The data showed the Al and F contents expected for jeremejevite, and no trace elements were detected. However, using energy-dispersive X-ray fluorescence (EDXRF) spectroscopy, a technique that is more sensitive to trace elements, Dr. George Rossman (California Institute of Technology, Pasadena) has confirmed the presence of iron in blue jeremejevite from the Erongo Mountains; he feels that the color is caused by Fe^{2+} - Fe^{3+} intervalence charge transfer (G. Rossman, pers. comm., 2002).

The spectacular jeremejevite finds in the Erongo Mountains have supplied some of the world’s largest and

Figure 11. These transparent crystals (up to 4.6 cm long) of jeremejevite from the Erongo Mountains show a variety of colors, including pale yellow, blue to greenish blue, and violet. Photo by Georg Gebhard.



Figure 12. The violet color of these crystals (2.7 and 3.3 cm long) is rare in jeremejevite from the Erongo Mountains. More commonly, the material ranges from colorless to blue (usually with color banding), as shown by these relatively large faceted stones (2.92–4.10 ct). Courtesy of Georg Gebhard; photo by Maha Tannous.

finest single crystals, as well as some of the best faceted stones in terms of size and quality. The deposit now appears exhausted, despite further mining and exploration in the area, there has been no significant production since July 2001.

Georg Gebhard (gtcgg@t-online.de)
Großenseifen, Germany

New morganite mine in Madagascar. At the June 2002 JCK show in Las Vegas, Tom Cushman of Allerton Cushman & Co., Sun Valley, Idaho, had some attractive morganites from a new find in Madagascar. The facet rough was derived from large, fractured crystals that came from a pegmatite in the Fianarantsoa district of south-central Madagascar, in the Ambositra area. Mr. Cushman has obtained about 3.5 kg of rough, and the stones are typically faceted in sizes ranging from 6 × 4 to 8 × 6 mm (i.e., approximately 0.4–1.2 ct, although he has seen gems up to 9 ct). He estimates that several hundred carats have been faceted. The color is fairly

Figure 13. At 12.92 ct, this is the largest faceted jeremejevite from the Erongo Mountains that is known to this contributor. Faceted by Helmut Schäfer, Walter Bohrer Co., Idar-Oberstein, Germany; photo by Georg Gebhard.





Figure 14. These three morganites (3.34–4.19 ct) were obtained recently from a new pegmatite mine near Ambositra in south-central Madagascar. Courtesy of Allerton Cushman & Co.; photo by Maha Tannous.

consistent, resembling saturated rose quartz. Most of the material is “peach” colored when mined, and turns pink after exposure to sunlight for a few hours or days. According to Federico Pezzotta (Museo Civico di Storia Naturale, Milan, Italy), the “pinking” is also done in Madagascar by brief exposure to an alcohol flame.

Three of the morganites (3.34–4.19 ct; figure 14) were loaned to GIA for examination, and the following properties were determined by one of us (EQ): color—light pink, slightly purplish and orangy pink; R.I.— $n_o = 1.586$ – 1.587 and $n_e = 1.578$ – 1.579 (birefringence— 0.008); S.G.— 2.75 ; inert to long-wave and very weak chalky green fluorescence to short-wave UV radiation; and no absorption features observed with the desk-model spectroscope. Microscopic examination revealed needles, fractures, “fingerprints,” and pinpoint inclusions.

Figure 15. The color of these unheated aquamarines (3.14 and 3.53 ct) is representative of the finest material from the Erongo Mountains of Namibia. Courtesy of Chris Johnston; photo by Maha Tannous.



Although Mr. Cushman was not aware of any clarity enhancements, the fractures showed low relief, and some contained air bubbles, indicating the presence of a filling substance. On returning to Madagascar in July–August 2002, he learned that some of the material is placed in a dilute honey solution by local dealers, to improve the appearance of the rough. There is also a possibility that cutting oil entered some of the fractures during the initial processing of the rough.

Mr. Cushman helped direct mining activities when he visited the deposit in August, and is optimistic that the pegmatite will yield more gem-quality morganite. Due to the recent political and logistical problems in Madagascar, however, access to the area is difficult.

BML and Elizabeth Quinn

Update on some Namibian gem localities. In conjunction with his attendance at a geological conference in Namibia in July 2002 (see GNI report on pp. 273–274), GNI editor Brendan Laurs visited some granitic pegmatite–hosted gem deposits in central Namibia. Most were seen on a pre-meeting field trip led by Drs. G. I. C. Schneider (Geological Survey of Namibia, Windhoek) and J. A. Kinnaird and Paul Nex (University of the Witwatersrand, Johannesburg, South Africa).

The deposits of topaz and aquamarine at **Klein Spitzkoppe** (see article by B. Cairncross et al. in the Summer 1998 issue of *G&G*, pp. 114–125) were visited first. The gem crystals formed in miarolitic cavities (i.e., open “pockets”) within Early Cretaceous granites and associated pegmatites. These granites are similar in age to those in the Erongo Mountains, but are significantly younger than other pegmatitic gem deposits in Namibia, which are of late Pan-African age (approximately 520 million years old). Local people continue to mine both primary and secondary deposits around Klein Spitzkoppe, although most have left the area for Erongo.

Figure 16. The Usakos pegmatite near Usakos, Namibia, is being actively mined for gem tourmaline in a large open pit. Photo by Brendan M. Laurs.



According to Chris Johnston (Johnston-Namibia C.C., Omaruru, Namibia), about 300–400 people are working the **Erongo** deposits. For the past four years, miarolitic cavities in granites and pegmatites on the northern side of the Erongo igneous complex have yielded attractive, occasionally world-class crystal specimens of aquamarine, black tourmaline, smoky quartz, feldspars, fluorite, and other minerals (see S. Jahn and U. Bahmann, "Die Miarolen im Erongo-Granit. . .," *Mineralien-Welt*, Vol. 11, No. 6, 2000, pp. 42–56). More recently, in March 2001, a significant find of gem-quality jeremejevite was made in the area (see separate GNI entry in this issue and W. E. Wilson et al., "Jeremejevite from Namibia," *Mineralogical Record*, Vol. 33, 2002, pp. 289–301, abstracted in this issue). Most of the Erongo crystals are sold as mineral specimens, although some attractive aquamarines (see figure 15) and jeremejevites have been faceted. Much of the production initially came from near-surface cavities, but now the miners must dig 4–5 m to reach productive areas and they do not have access to explosives. A few use pneumatic hammers or heavy-duty electric hammer drills, but most dig by hand, working in small groups. An abundance of Erongo material was being sold along the road to Klein Spitzkoppe, together with minerals from elsewhere in Namibia.

The **Usakos** tourmaline mine (figure 16), located a few kilometers southwest of the town of Usakos, is being actively worked by Jo-Hannes Brunner and partners. They purchased the property from Rochelle Mansfield, daughter of well-known Namibian gem and mineral dealer Sid Pieters, in late 2000—shortly after a rich pocket of gemmy greenish blue tourmaline was found (see, e.g., photo in Winter 2000 *G&G*, p. 322). A team of six miners is enlarging the open pit by drilling and blasting; debris is removed using a front-end loader. Over the past two years, numerous small cavities have yielded gem tourmaline in a wide range of colors (figure 17, top). However, finding the cavities in the large pegmatite has proved difficult due to their irregular distribution, as well as the lack of recognizable mineralogical or textural zoning that can be used to indicate probable areas of mineralization. According to Mr. Brunner, approximately 300 kg of tourmaline (mostly green to blue-green) has been recovered since his group began mining the deposit, but only a small percentage was gem quality. Most of the tourmaline is heated before cutting to brighten the colors. Also, when heated up to 700°C, some of the blue-green tourmalines become an attractive light green. All of the colors achieved with heat treatment have also been found naturally at the mine.

One of Namibia's most important gem tourmaline deposits is **Neu Schwaben** in the Karibib area, which produced large quantities of clean, attractive stones in bright blue-to-green colors during 1996–1997 (figure 17, center; see also Spring 1997 *Gem News*, pp. 66–67). Since then, organized mining has been hampered by social and political problems. Currently there are approximately 200 local miners working the primary and alluvial deposits associat-

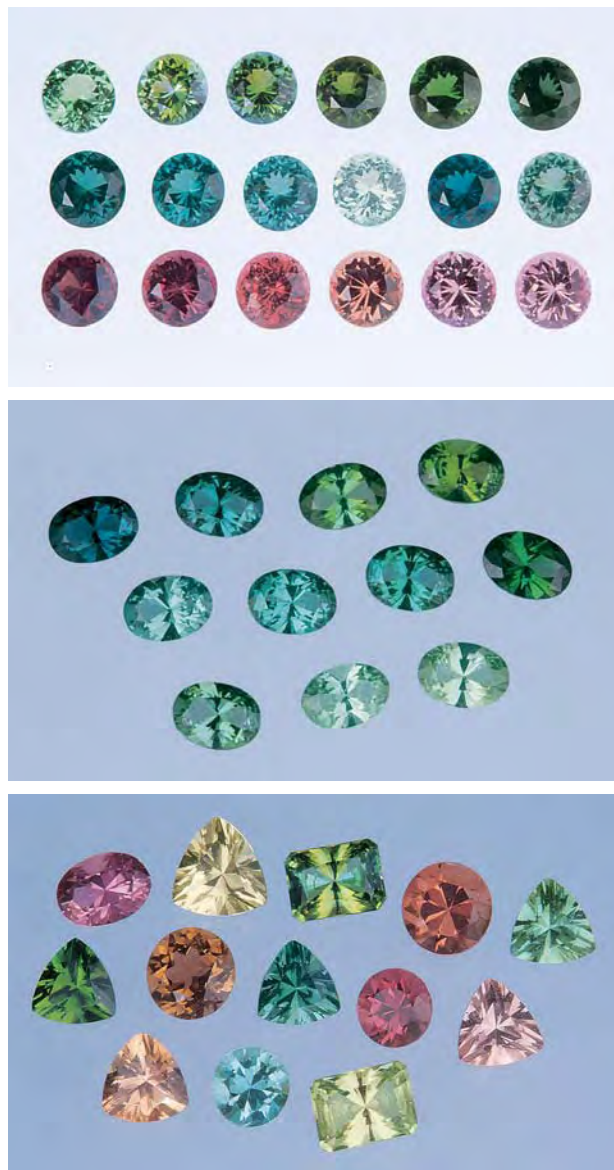


Figure 17. Tourmaline from Namibia comes in a range of colors, even from a single mine. These photos show the representative color range of tourmalines from the Usakos mine (top, approximately 0.50 ct each), Neu Schwaben (center, approximately 0.40 ct each), and Omapyo (bottom, 0.60–1.10 ct). Nearly all of the tourmalines have been heated to lighten their tone or remove a brown hue. Courtesy of Jo-Hannes Brunner (top) and Chris Johnston (center and bottom); photos by Maha Tannous.

ed with the large pegmatite. Production has been small and sporadic, due to the difficult working conditions and disorganized mining. A cooperative initiative under consideration would grant legitimate title of the mining rights to a nonprofit trust formed on behalf of the independent



Figure 18. These matrix opals (up to 21 × 18 mm) are from Piauí State in Brazil. Photo by Jaroslav Hyrsl.

diggers. The mining license is expected to be granted by the end of 2002.

The **Otjua** pegmatite in the Karibib area became famous during the period 1985–1990, when a 45-m-deep cavity excavated by the present mine owner (Hannes Kleynhans) yielded enormous clusters of smoky quartz (see Fall 1989 Gem News, p. 180). Specimens from the mine, including a quartz cluster weighing 14.1 tonnes and faceted tourmalines in a variety of colors, are on display at the Kristall Galerie museum in Swakopmund.

Many decorative mineral specimens from this mine were sold in the U.S. during the early 1990s by Bryan Lees (Collectors Edge, Golden, Colorado). Mr. Lees (pers. comm., 2002) reported that gem tourmaline was recovered

Figure 19. White matrix opal from Piauí, Brazil, is treated to black to enhance the play-of-color. The bottom-center stone is 16 × 10 mm; photo by Jaroslav Hyrsl.



from the pegmatite “pockets” and large quantities of melee-sized rough (ranging from green to purple to red, in particular) also were extracted from tourmaline in the crystallized wall rock of the pocket zones.

The pegmatite has been mined in an elongate open cut and shallow tunnels, and measures up to 40 m wide and at least 100 m long. It dips moderately to steeply northward, and has intruded along the contact between marble (to the north) and a dark-colored, fine-grained metamorphic rock (to the south). According to Mr. Kleynhans, the large quartz crystal “cave” was found at the western end of the open pit, whereas the eastern end subsequently produced about 120 small cavities that contained smoky quartz and/or light green tourmaline. At the time of our visit, there had been no mining activity at Otjua since January 2001, mainly due to disputes over the mineral rights. However, Mr. Kleynhans reports that these problems are now resolved, and he has resumed mining of the pegmatite.

Significant quantities of gem tourmaline also have been recovered from several pegmatites that collectively are referred to as the **Omapyo** mine (originally called the Chandler mine), located approximately 35 km southeast of Omaruru. The pegmatites are hosted by fine-grained mica schists, dip moderately southeast, and range up to ~4 m thick. According to Chris Johnston, the property was claimed in the 1980s by Gawie Cloete, who worked it intermittently for about 10 years, hitting one particularly profitable pocket in the early 1990s. The property later changed hands and eventually fell under the control of the Namibian government. Over the past three years, a government-funded company known as the Development Brigade Corp. worked one of the pegmatites, and another pit was dug nearby by John Alcott, an independent miner based in Karibib. Mr. Johnston estimates the total production over the past 20 years at about 50 kg of good gem tourmaline. This mining area has produced a particularly wide range of hues, including some unusual colors (figure 17, bottom). Although currently inactive, Omapyo has the potential to produce significant tourmalines in the future.

Some interesting new opals from Brazil. For years, Piauí State in northern Brazil has been a source of white opal, often with a pronounced layered texture. Matrix opal has been produced there less commonly (see Gem News, Spring 1994, p. 52, and Spring 1999, p. 53), and in July 2001 this contributor obtained some polished natural-color Piauí opal with matrix in Brazil (figure 18). Although some pieces resemble a doublet when viewed from the side, they can easily be distinguished by the irregular boundary between the opal and its matrix. The host rock is gray to light brown sandstone, and is quite distinctive from the darker, finer-grained ironstone matrix associated with boulder opal from Queensland, Australia.

Piauí is also the source of white matrix opal that is treated to black by an undisclosed process to enhance the play-of-color (figure 19). The material is locally referred to

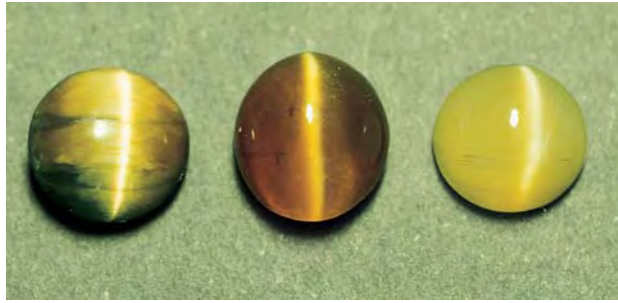


Figure 20. Attractive cat's-eye opal recently became available in Brazil. The center stone weighs 2.37 ct; photo by Jaroslav Hyrsl.

as "queimado" ("burned") and looks very similar to the treated matrix opal from Andamooka, South Australia, described by G. Brown ("Treated Andamooka matrix opal," Summer 1991 *Gems & Gemology*, pp. 100–106). Concentrations of black color between the grains, easily seen with a loupe, readily identify this material as treated. During a recent (July 2002) trip to Brazil, this contributor noted that thousands of these treated opals were available.

Cat's-eye opal from northern Bahia State (see Spring 1994 *Gem News*, p. 52) is typically of low quality. However, much better-quality material, reportedly from the same locality, appeared on the Brazilian market in July 2001. This new opal is semitransparent and has a yellow to "honey" brown color and a sharp eye (figure 20). In 2001, stones exceeding 5 ct were available, and the best pieces were comparable to those from Tanzania (see Summer 1998 *Gem News*, pp. 138–140). This contributor saw a few hundred carats in Brazil in 2002.

Jaroslav Hyrsl (hyrsl@kuryr.cz)
Kolin, Czech Republic

Bicolored spessartine from Brazil. Natural garnets often are chemically zoned, but color zoning in gem-quality garnets is uncommon. There are only a few examples of gem garnets with color zoning in the literature (see, e.g., *Gem News*, Winter 1990, pp. 303–304, and Fall 1997, pp. 224–225).

Five bicolored orange and orangy brown garnets were purchased in Brazil in July 2001 by one of these contributors (JH). They ranged from 0.96 to 5.61 ct (see, e.g., figure 21). According to the cutter, they were mined from the famous Galilea pegmatite region near Governador Valadares. This area has long produced orange to reddish brown spessartines, but these five samples are the only bicolored Galilea garnets this contributor has seen.

The diaphaneity of the five samples varied according to the color, from transparent (the orange zones) to translucent (the orangy brown portions). Specific gravity values ranged from 4.10 to 4.25. As with the garnets in the *Gem News* items cited above, the refractive index varied slightly within each of the five samples, from about 1.80 in the orange area to about 1.81 in the orangy brown zone, as measured with a Gemeter reflectometer (Sarasota Instruments). With a handheld spectrocope, the orange

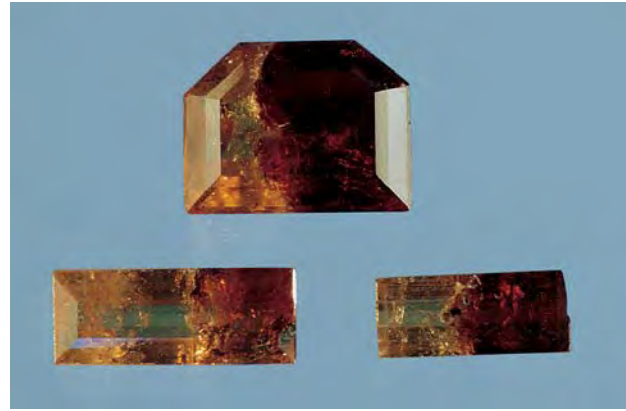


Figure 21. These bicolored spessartines from Brazil (up to 5.61 ct) show distinct orange and orangy brown portions. Photo by J. Hyrsl.

zone in each sample showed a typical spessartine spectrum (of weak intensity), while the orangy brown portions were too dark to obtain a spectrum. The two color zones also showed differences when examined with magnification. In the orange part the color was homogeneous, but swirl-like growth features were evident as well as (in places) a granular structure, sometimes with black grain boundaries. The orangy brown area was itself color zoned, with rounded areas of darker color; it also contained veils of two-phase (liquid and gas) inclusions and jagged, saw-blade-like growth structures. Near the boundary between the orange and orangy brown zones in all five samples were numerous euhedral to rounded, strongly anisotropic crystals (figure 22).

To better understand the nature of the zoning, we studied a 0.96 ct rectangular cut stone in detail. We obtained chemical analyses using an energy-dispersive PGT detector coupled with a JEOL 5800 scanning electron micro-

Figure 22. Elongated two-phase inclusions and anisotropic rounded crystals are present in the orangy brown part of this bicolored spessartine. Photomicrograph by J. Hyrsl; field of view is 3.5 mm.





Figure 23. Gem-quality pink/yellow spodumene was recovered from Laghman Province, Afghanistan, in October 2001. The crystal shown here weighs 734 grams, and the faceted stones weigh 226.95 and 168.80 ct. Courtesy of Dudley Blauwet Gems; photo by Jeff Scovil.

scope, and UV-Vis absorption spectra using a Unicam UV4 spectrophotometer. We found a higher iron content in the orangy brown zone than in the orange part (1.3 vs. 0.8 atomic % Fe, the other components being nearly constant), but it was difficult to measure accurately due to interference in the detection of Fe and Mn with this technique. However, the only difference between the two colored portions in their visible-range absorption spectra was a gradually increasing continuum from the near-infrared toward the UV region; the typical spessartine spectrum was superimposed over this continuum in the orangy brown portion, whereas the continuum was absent in the lighter orange zone. (An almandine component was not obvious in either portion.) It is well known that this increasing continuum is due to Fe^{2+} - Ti^{4+} charge transfer (see R. K. Moore and W. B. White, "Intervalence electron transfer effects in the spectra of the melanite garnets," *American Mineralogist*, Vol. 56, 1971, pp. 826–840). Titanium was below the detection limit of our instrument (about 1,000 ppm) in both parts of the stone, but the Ti concentrations necessary for the charge transfer are much less than 1,000 ppm. The color zoning caused by this charge transfer may be explained by variations in iron concentration, a zonation in titanium concentration that we could not measure, or a combination of both.

EF and Jaroslav Hyrsl

Pink/yellow spodumene from Afghanistan. For nearly three decades, large, well-formed crystals and attractive

faceted stones of spodumene from Afghanistan have been coveted by gem and mineral collectors. The crystals are commonly blue-violet or green when mined, and turn pink after brief exposure to sunlight (see G. W. Bowersox, "A status report on gemstones from Afghanistan," Winter 1985 *Gems & Gemology*, pp. 192–204). Gems cut from Afghan spodumene (as from other localities) are most commonly of the pink variety, kunzite. However, significant amounts of large bicolored pink/yellow spodumene crystals were produced last year, which yielded some interesting faceted gems (figure 23). According to Dudley Blauwet (Dudley Blauwet Gems, Louisville, Colorado), the find occurred in October 2001, at a pegmatite near Khauraz in Laghman Province. He obtained 14 kg of material, about half of which was gem quality. Several large stones have been cut; the largest faceted so far by Mr. Blauwet weighs 243.15 ct.

Gemological properties were obtained by one of us (EQ) on two faceted spodumenes that Mr. Blauwet donated to GIA. These oval modified brilliants weigh 45.31 and 205.02 ct; the smaller one has a light orangy brown face-up appearance that results from the combination of yellow and pink hues, and the larger one is greenish yellow. Both show weak to moderate pleochroism—light brownish pink and light brown-orange in the smaller sample, and yellowish brown and greenish yellow in the larger stone. The R.I. values recorded were 1.660–1.676 and 1.661–1.677, respectively, both yielding a birefringence of 0.016. The stones showed weak to moderate orange fluorescence to long-wave UV radiation, and were inert to short-wave UV. Both also showed a single absorption band at 438 nm when examined with a desk-model spectroscope. Microscopic examination revealed a twin plane and needle-like tubes in the small stone, and the same internal features in the large stone along with "fingerprints," three-phase inclusions, and crystals that were transparent, birefringent, and appeared near colorless to pale brown. The properties of these stones are generally consistent with those listed for kunzite by Bowersox (1985) and for spodumene in general by R. Webster (*Gems*, 5th ed., revised by P. Read, Butterworth-Heinemann, Oxford, England, 1994, pp. 186–187).

On one occasion, yellow spodumene submitted to the GIA Gem Trade Laboratory was radioactive due to irradiation with neutrons (G. R. Rossman and Y. Qiu, "Radioactive irradiated spodumene," Summer 1982 *Gems & Gemology*, pp. 87–89). Testing of the present samples with a Geiger counter revealed no evidence of radioactivity.

BML and Elizabeth Quinn

SYNTHETICS AND SIMULANTS

Some glass imitations encountered in Namibia. While in central Namibia in July 2002, GNI editor Brendan Laurs encountered two examples of imitation gem rough (figure 24). Both subsequently were confirmed as glass by Phil



Figure 24. These glass imitations of amethyst (3.9 × 2.3 cm) and tourmaline (2.5 × 0.7 cm) were recently encountered in Namibia. Photo by Maha Tannous.

Owens of the GIA Gem Trade Laboratory in Carlsbad, using Fourier transfer infrared (FTIR) spectroscopy.

In Karibib, a local dealer had a small parcel of rough amethyst that was reportedly from the Platveld area in Namibia. One piece was noticeably larger and more transparent than the others, although the color was typical for amethyst. Examination with 10× magnification revealed several gas bubbles, one of which was also noticeable to the unaided eye. Swirled growth zoning could also be seen, along with a partially healed fracture. The dealer obtained the material from an associate in Karibib, apparently without knowing that the parcel contained a fake.

In Omaruru, gem and mineral dealer Chris Johnston (Johnston-Namibia C.C.) had a glass imitation of a tourmaline crystal that was obtained from local dealers. The dark bluish green color was typical of tourmaline that is mined in the Karibib area. The shape of the “crystal” also was convincing, and the surfaces were partially rounded to give an abraded appearance. However, the striations that are typical of tourmaline were absent, and close inspection revealed that some of the edges were not quite parallel. The imitation also had a lighter heft than would be expected for tourmaline, and felt “warmer” to the touch than a natural stone. Microscopic examination revealed several minute gas bubbles and curved growth zoning, which are typical of glass.

Although convincing at first sight, both imitations could be easily identified in the field by careful observation of their surface and internal features with 10× magnification.

Plastic and steel pearl imitations. During the Basel World Watch & Jewellery Show in April 2002, the SSEF Swiss Gemmological Institute received three parcels of predominantly small brownish gray to dark gray and pink “pearls” for testing (some of which are shown in figure 25). The 548 samples were all undrilled, and ranged from approximately 2 to 12 mm in diameter. They were round to button shaped, drop shaped, and baroque. At first glance, all looked quite convincing. However, when they were

immersed in carbon tetrachloride for X-radiography, two black, slightly baroque samples (each approximately 3 mm in diameter) were seen to float, which indicated they were imitations. When examined with a gemological microscope, these two samples revealed a slightly uneven, granular surface. They also appeared to be very soft, as evidenced by the fact that when tested with a needle on an inconspicuous spot, the surface was indented. A hot point applied to the surface produced a typical smell of burned plastic. On the basis of these characteristics, these “pearls” were identified as black plastic.

X-radiographs revealed a second pair of imitations in the same parcel. Both were perfectly round (4.75 mm in diameter) and showed complete absorption of X-rays. Microscopic examination of these silvery gray spheres revealed small brownish spots on their surface, but not the suture lines that are commonly seen on natural or cultured pearls. Also, each weighed approximately 2.20 ct, which is about three times greater than genuine pearls of similar dimension. Qualitative chemical analysis with EDXRF spectrometry revealed only iron with a trace of titanium. On the basis of these combined characteristics, these spheres were identified as steel. All of the other samples in the parcel revealed features characteristic of natural (i.e., not cultured) pearls in the X-radiographs.

Although the SSEF laboratory has seen plastic imitation pearls on occasion, these are the first steel imitations that we have encountered.

Michael S. Krzemnicki (gemlab@ssef.ch)
SSEF Swiss Gemmological Institute
Basel, Switzerland

Figure 25. The samples on the left are representative of three parcels of natural pearls obtained by SSEF for identification last April. In one of the parcels were the two black samples in the middle (~3 mm each, which proved to be plastic imitations) and the two silvery gray spheres (4.75 mm each) on the right, which are made of steel. Photo by Michael S. Krzemnicki; © SSEF Swiss Gemmological Institute.



MISCELLANEOUS

Gem cutting factories in Namibia. While visiting Namibia for a geological conference in July 2002 (see GNI report on pp. 273), GNI editor Brendan Laurs visited two diamond cutting factories in Windhoek. These visits were arranged by Kennedy Hamutenya, who is the diamond commissioner at Namibia's Ministry of Mines and Energy. According to Mr. Hamutenya, there are currently five diamond cutting factories in Namibia. The first one—Namgem Diamond Manufacturing Co., a subsidiary of Namdeb Diamond Corp.—opened in August 1998 in Okahandja (about 70 km north of Windhoek). There are three factories in Windhoek: NamCot Diamonds, Hardstone Processing, and Nam Diamonds Inc. Another diamond cutting operation, run by the Russian company Mars Investment Holding, is located in Walvis Bay on the central coast.

At NamCot Diamonds, general manager Eyal Laybel explained that the factory was opened by Steinmetz Diamond Group, a DTC sightholder. Cutting operations began in May 2001, and the facility officially opened in October 2001. All of the workers are local Namibians who have completed the company's intensive training program. At the time of the site visit, there were 56 diamond polishers working with plans to expand to 80 polishers (for a total of 120 employees). State-of-the-art equipment is used, including customized brutting machines and a computerized proportion analyzer. Mr. Laybel is happy with the results, and indicated that 1+ ct diamonds are now routinely being cut by some workers in the factory (figure 26).

The Nam Diamonds factory, which is operated by Pro Diamonds Manufacturing (Pty) Ltd. in Windhoek, is Namibia's newest diamond cutting and jewelry manufacturing center; it officially opened in July 2002. The facility cost US\$1.8 million and employs 40 people, and will expand to

Figure 26. At the NamCot factory in Windhoek, Namibia, diamond cutter Ipangelwa Gelasius (left) routinely facets 1+ ct diamonds. Photo by Brendan M. Laurs.



70–80 employees as training is completed. Chief executive officer Andrew Clocanas indicated that labor costs in Namibia are comparable to the middle range of Asian wages. He explained that with the support of the Namibian government, the company plans to cut diamonds and colored stones, design and manufacture a diverse jewelry line, and develop an “indigenous branding concept.” Diamonds from Namibia and elsewhere will be cut at the Windhoek facility, and Mr. Clocanas expects that initially 5,000–10,000 carats of diamonds will be faceted each month. Namibian colored stones—such as tourmaline, aquamarine, and garnet—will be faceted in a new factory located in Karibib (165 km northwest of Windhoek). This facility, referred to as Progem, will initially employ approximately 15–20 workers; the number is scalable based on training and market demand. A modern casting facility at the Windhoek factory will have the capacity to manufacture 1,000–2,000 pieces of jewelry per month in yellow and white gold.

In the near future, plans call for a major diamond manufacturing company to open a much larger cutting factory in Windhoek, which is slated to employ 500 workers. Clearly, diamond manufacturers are very interested in taking advantage of the savings offered by Namibia's tax-free EPZ (Export Processing Zone) program, which was activated in 1996. The resulting employment opportunities for Namibians are also contributing to the economic development of the country.

CONFERENCE REPORTS

Gemstone Deposits of Colorado and the Rocky Mountain Region. More than 100 people attended this educational symposium, which was held at the Colorado School of Mines in Golden on September 7–10, 2002. The event was sponsored by several organizations, including the Colorado chapter of the Friends of Mineralogy, the Colorado School of Mines Geology Museum, the Denver Museum of Nature and Science, and the U.S. Geological Survey. Presentations by 22 speakers occurred over two days, and field trips over the next two days included a visit to the Kelsey Lake diamond mine in the State Line district along the Colorado-Wyoming border.

Dr. Jack Murphy of the Denver Museum of Nature and Science explained the development of a Colorado gem and mineral database and locality map, which will employ GIS (Geographic Information System) software and include listings for aquamarine, topaz, diamond, amethyst, turquoise, and lapis lazuli. **Bryan Lees** of Sweet Home Rhodo Inc. in Golden reported on exploration activities for gem-quality rhodochrosite at the Sweet Home Mine near Alma, Colorado; geologic mapping, structural analysis, and geochemical data (As/Sb ratios) have all proved useful. **Howard Coopersmith** of the Great Western Diamond Company in Fort Collins, Colorado, reviewed the discovery (in 1987) and current status of the Kelsey Lake diamond mine. Although not currently in operation, the mine has yielded some large

stones (e.g., 28.2 and 28.3 ct) since production began in 1996. **Dan Kile** of the U.S. Geological Survey in Boulder, Colorado, discussed the formation of agate “thunder eggs” from Del Norte, Colorado. The “plume” and “moss” structures probably resulted from the rhythmic precipitation of Fe- and Mn-compounds within a colloidal silica suspension that subsequently crystallized to form concentrically banded chalcedony. **Dr. Peter Modreski** of the U.S. Geological Survey in Denver reviewed the occurrences of topaz and turquoise in Colorado. The most important localities for topaz are in the Pikes Peak batholith, whereas turquoise is produced from the Florence mine at Cripple Creek. Colorado peridot localities were reviewed by **John Rhoads** of D&J Rare Gems Ltd. in Salida, Colorado. The faceted peridot is attractive, but small: Most stones weigh less than 1 ct, and the largest is 2.47 ct. **Tom Michalski** of the U.S. Geological Survey in Denver described four localities for gem-quality amethyst within Colorado; the best gem material has come from calcite-rich veins at the Amethyst Queen mine in Mesa County.

Efforts to discover the source of the major deposits of alluvial sapphires in Montana were discussed by **Dr. Richard Berg** of the Montana Bureau of Mines and Geology in Butte. Although their origin is still under debate, the sapphires were probably derived from Tertiary volcanic rocks. **David Baker** (Little Belt Consulting Services, Monarch, Montana) and **Dr. Lee Groat** (University of British Columbia, Canada) proposed that sapphires from Yogo Gulch, Montana, formed due to contact metamorphism between magma and metasedimentary host rock in the lower crust. **Leigh Freeman**, a consultant in Evergreen, Colorado, reported that 1,900 carats of sapphires were faceted in 2001 from the Vortex mine near Yogo Gulch; as of July 2002, 2,500 carats had been cut and an additional 1,500 carats were anticipated by the year’s end. **W. Dan Hausel** of the Wyoming State Geological Survey in Laramie summarized historical and newly discovered occurrences of gems in that state, which include nephrite jade, diamond, iolite, and sapphire. He also described the infamous 1872 hoax in which prominent individuals invested significant money in a false occurrence of diamonds in northwestern Colorado (ironically, however, in the vicinity of diamonds found along the Colorado-Wyoming border a century later).

Dr. James Shigley of GIA Research described the formation of gem-quality red beryl in the Wah Wah Mountains of southwestern Utah. The beryl formed in fractures within the 22-million-year-old altered rhyolite, probably as a result of the interaction between magmatic fluids, groundwater, and preexisting minerals. **Michael Gray** of Coast-to-Coast Rare Stones in Missoula, Montana, provided a summary of the largest faceted colored stones that are known from localities in the Rocky Mountain region, such as a 111.42 ct aquamarine from the Sawtooth Mountains, Idaho. **David Wilson** of Precious Gems and Jewelry in Colorado Springs discussed the mining of “sun-

stone” plagioclase feldspar near Plush, Oregon, which owes its schiller to tiny copper inclusions.

*JES and
Michael Gray
Coast-to-Coast Rare Stones
Missoula, Montana*

Gemological reports at Namibian geological conference.

The 11th Symposium of the International Association on the Genesis of Ore Deposits was presented together with the Geological Society of South Africa’s biennial Geocongress meeting in Windhoek, Namibia, on July 22–26. Nearly 400 delegates from 44 countries were present, and approximately 240 presentations were given. GNI editor Brendan Laurs attended the conference, and supplied this report on presentations of gemological significance.

Dr. I. J. Basson (University of Cape Town, South Africa) and coauthors examined the structural controls of kimberlite emplacement in Southern Africa. They correlated the peak of kimberlite emplacement in this region—which occurred during the Cretaceous Period, from 124 to 83 million years (My) ago—to several factors, including accelerated plate motion, above-normal mantle convection and temperatures, and alignment of minerals in the mantle. **R. J. Jacob** (University of Glasgow, U.K.) and co-workers studied alluvial diamond deposits in the lower 250 km of the Orange River (between South Africa and Namibia). Most of the diamonds were deposited in bedrock trap sites or in stationary areas of turbulence within Miocene age (17.5–19 My) gravels.

Marine diamonds are found in a variety of depositional settings, and **L. Apollus** (Namdeb Diamond Corp., Windhoek) and colleagues studied their distribution in pocket beach gravels about 100 km north of the present Orange River delta. Relatively higher diamond grades were found at the northern end of the beach, where the northward-directed wave energy was concentrated against a rocky headland. In the shallow marine environment, **C. M. August** (Namdeb Diamond Corp., Windhoek) and co-workers described how two sophisticated geophysical techniques are used to distinguish potentially diamond-bearing gravels on the seafloor: Side-scan sonar generates detailed elevation maps of the seafloor and another technique called “chirp sub-bottom profiling” provides data on subsurface features (down to 10 m). These techniques have also been used further offshore, as described by **R. Gray** (De Beers Marine, Cape Town, South Africa), to locate what is probably the former Orange River delta. The geophysical data suggest the ancient delta is located 20 km north and 15 km offshore of the present river mouth, at water depths ranging from 90 to 120 m; the sedimentary deposits consist of conglomerates and diamondiferous gravels that are partially covered by recent sands.

Colored stone presentations focused mainly on gems derived from granitic pegmatites. **Dr. J. A. Kinnaird** (University of the Witwatersrand, Johannesburg, South Africa) provided a status report on the development of gem



Figure 27. In Somaliland, emeralds are mined from small pits, such as this one at Simodi (left). Some attractive emerald crystals have been found in that country (right). Gem miners and dealers in Somaliland have recently benefited from training in gem identification and proper small-scale mining techniques. Photos by J. A. Kinnaird.

deposits in Somaliland. Aquamarine and emerald (figure 27) are being mined at several localities in an east-west trending belt parallel to the Gulf of Aden, and the country also contains significant deposits of opal and garnets. **Dr. C. Preinfalk** (University of Munich, Germany) and coauthors evaluated the mineralization potential of gem-bearing granitic pegmatites in Minas Gerais, Brazil. Trace-element data from K-feldspar and muscovite samples indicate that the Araçuaí and Safira districts contain the most geochemically evolved pegmatites, as well as those showing the widest range of evolution; these districts host important deposits of gem tourmaline, beryl, and spodumene. **Dr. V. Bermanec** (University of Zagreb, Croatia) and colleagues studied dark blue, gem-quality apatite from Bahia, Brazil. The apatite samples are radioactive, due to the presence of uranium- and thorium-bearing oxides in microfractures. In separate presentations, **Dr. I. Haapala and S. Frindt** (University of Helsinki, Finland) provided new data on the evolution of the Gross- and Klein Spitzkoppe granitic intrusions in central Namibia. Gem-quality topaz and aquamarine formed in miarolitic cavities within the late-stage portions of the intrusions, which are characterized by pegmatite or greisen textures. **Dr. B. M. Shmakin** (Institute of Geochemistry, Irkutsk, Russia) proposed that rare minerals (e.g., of arsenic, bismuth, and antimony) found in several types of granitic pegmatites result from extreme concentration of certain elements during closed-system crystallization—that is, while isolated from chemical exchange with host rocks and the surrounding pegmatite.

ANNOUNCEMENTS

Yearly updates to the *G&G* “Twenty Year” Index. The online author and subject indexes (<http://www.gia.edu/gandg/indices.cfm>), which start with Spring 1981, have now been updated to include items from the 2001 issues of *Gems & Gemology*. Future online updates of the index are planned for the first quarter of each year.

Visit *Gems & Gemology* in Tucson. Meet the editors and take advantage of special offers on subscriptions and back issues at the *G&G* booth in the Galleria section (middle floor) of the Tucson Convention Center during the AGTA show February 5–10, 2003, and at the Tucson Gem & Mineral Society (TGMS) show February 13–16. A limited number of recently acquired out-of-print issues will also be available. For more information, contact subscriptions manager Debbie Ortiz at dortiz@gia.edu.

GIA Education’s traveling Extension classes will offer hands-on training in Tucson with *Gem Identification* (February 3–7) and *Advanced Gemology* (February 8). To enroll, call 800-421-7250, ext. 4001. Outside the U.S. and Canada, call 760-603-4001. GIA will also present two free seminars on February 9, *Business for Jewelers* and a *GIA Research Update*.

The GIA Alumni Association will host a Dance Party in Tucson on February 7, featuring a silent auction, an industry awards presentation, and a live auction. Included in the live auction will be a poster of the Spring 2002 cover of *G&G*, signed by Richard Liddicoat and a complete set of *Gems & Gemology* issues from 1981 to the present, donated by a former GIA employee. To reserve tickets, call 760-603-4204 or e-mail events@gia.edu.

The theme of this year’s TGMS show is “Gems and Minerals of the Andes Mountains,” which will be the topic of a one-day symposium on February 15. For more information, visit www.tgms.org.

New map of Russian gem resources. The Russian State Museum of Gems (also known as the Samotzveti Museum) in Moscow published a *Map of Deposits of Gemstones of Russia and Adjacent States 1:7,000,000* in 2000. The large (130 × 90 cm), full-color geologic map shows the locations for 130 gem and paleontological materials in the former Soviet Union. Accompanying the map is a 19-page booklet that contains explanatory notes and a

listing of the 380 deposits indicated on the map. The map is available for US\$50.00 by contacting the Museum's director, Dr. Anvar Yusipov, at samotzvety@mail.cnt.ru; fax 7-095-197-6763.

Conferences

Australian Diamond Conference. Scheduled to be held December 2–3, 2002 in Perth, Western Australia, this conference will include presentations by diamond producers and marketers in Australia and elsewhere. A pre-conference excursion (November 29–December 1) will visit the Argyle and Ellendale diamond mines. Contact Brooke Boardman at 61-8-9321-0355 (phone) or e-mail brooke@louthean.com.au.

ICA Congress. The 2003 International Colored Gemstone Association (ICA) Congress will occur in Jaipur, India, January 4–10, 2003. In addition to presentations and panel discussions on myriad colored stone topics, a tour of Sri Lankan gem mines has been organized for January 10–15. Visit www.icaindia.net.

Exhibits

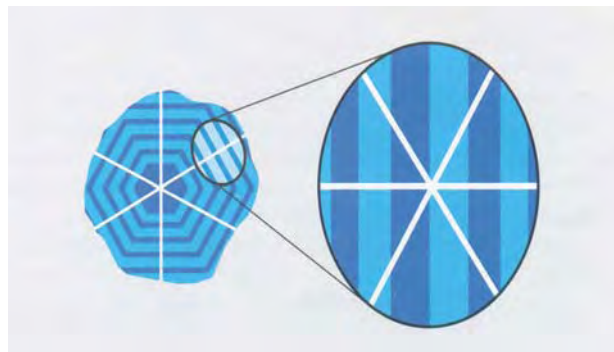
GIA Museum exhibits in Carlsbad. "Best of the Best," an exhibition of award-winning jewelry from industry association competitions, will be displayed in the Rotunda Gallery November 10, 2002, through May 2003. Winning pieces from the AGTA-sponsored Spectrum and Cutting Edge Awards, as well as the Diamond Information Center-sponsored Diamonds Today and Diamonds of Distinction awards, will be among those on exhibit. For further information, contact Alexander Angelle at 800-421-7250, ext. 4112 (or 760-603-4112), or e-mail alex.angelle@gia.edu.

Events at the Carnegie Museum of Natural History. On November 22–24, 2002, the fifth annual Carnegie Gem & Mineral Show will be held at this museum in Pittsburgh, Pennsylvania; it will include a special emerald exhibit from the Houston Museum of Natural Science. In addition, the exhibition *Fascinating Fakes* will run through December 8, 2002; it features nearly 20 examples of mineral specimens that have been altered to deceive the buyer and thus increase their apparent value. This exhibit is free with museum admission; call 412-622-3131, or visit www.carnegiemuseums.org/cmnh.

Gems at the Bowers Museum extended. "Gems! The Art and Nature of Precious Stones" (announced in Winter 2001 *Gems & Gemology*, p. 342) has been held over until January 5, 2003. Visit www.bowers.org or call 714-567-3600.

ERRATA

1. In the Winter 2001 Lab Note "Sapphires with Diffusion-Induced Stars" (pp. 324–325), the orientation of the stars to the color banding was incorrectly described in the text, as well as in the drawing of figure 21. On p. 325, the second sentence in the main paragraph in the center column should read (changes in italics): "Because color zoning is also related to the hexagonal crystal structure, the rays of *rutile-caused stars are most commonly perpendicular* to the six sides of the hexagon created by the growth/color zoning (see figure 21); *if the stars are created by ilmenite or hematite platelets, the rays point to the corners of the hexagon and are parallel to the color banding.*" The next sentence should read: "For stars caused by rutile, even if only one section of zoning is visible (as seen in the smaller of the two cabochons) two of the star's six rays would still be *perpendicular* to the visible banding." The last sentence of the caption to figure 21 should read: "Note that two of the six rays of a rutile star are always *perpendicular* to the color zoning." A corrected version of figure 21 is shown below. *Gems & Gemology* thanks Dr. Karl Schmetzer for bringing this error to our attention.



2. In the Spring 2002 GNI entry on etch features in beryl and quartz (pp. 102–103), Falk Burger of Los Alamos, New Mexico should have been acknowledged as the lapidary who polished the pieces shown in figures 26 and 27. We apologize for this omission.
3. In figure 10 of the Summer 2002 article on garnets from Tranoroa, Madagascar, by K. Schmetzer et al. (p. 154), samples Y and Z were inadvertently transposed. The pyrope-spessartines are actually positioned, from left to right: Samples E (Tranoroa, Cr>V), X (Bekily, V>Cr), Z (Bekily, V>Cr), and Y (Bekily, V<Cr).