

2003 LAB NOTES

EDITORS

Thomas M. Moses, Ilene Reinitz,
Shane F. McClure, and Mary L. Johnson
GIA Gem Laboratory

CONTRIBUTING EDITORS

G. Robert Crowningshield
GIA Gem Laboratory, East Coast
Karin N. Hurwit, John I. Koivula, and
Cheryl Y. Wentzell
GIA Gem Laboratory, West Coast

Dyed Black CHALCEDONY

Relatively common opaque black materials may provide challenging identifications because of their surface condition, their shape, or the way they are set in a piece of jewelry. The West Coast laboratory was recently asked to identify the black carved material in the pendant shown in figure 1.

This black hololith had been inset with numerous transparent near-colorless round brilliants in white metal mountings and was further embellished with a row of what appeared to be small pearls around its periphery. The black material was unpolished and showed a dull luster. It was obvious that only limited stan-

dard gemological testing could be performed on such a piece.

Our initial examination with a microscope showed that the black material was homogeneous. We also noticed a few dull conchoidal fractures. A detailed examination with intense fiber-optic illumination revealed that the black-appearing hololith actually was dark brown in color, and there were indications of a layered structure. Using hardness points in an inconspicuous place, we estimated the Mohs hardness to be approximately 6. Next, we attempted to obtain a refractive index reading by carefully placing the back of the hololith on the refractometer in a small area where the white metal mountings were less obstructive; the result was a vague reading in the mid-1.5s.

On the basis of these properties, we determined that the hololith had been carved out of chalcedony. To support this conclusion, we analyzed the material with the Raman spectrometer. The presence of two distinct peaks, one at 1600 cm^{-1} and the other centered at 461 cm^{-1} , identified the black material as chalcedony and

Figure 1. The carved black hololith ($14.70 \times 4.10 \times 2.90\text{ mm}$) in this attractive pendant proved to be dyed black chalcedony.



Editor's note: The initials at the end of each item identify the editor(s) or contributing editor(s) who provided that item. Full names are given for other GIA Gem Laboratory contributors.

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indicated the presence of a carbonized compound (sugar). In addition, infrared spectroscopy showed two peaks at approximately 2235 and 2133 cm^{-1} , which—our research has found—indicate that the color is the result of treatment by sugar and acid (and/or heat). This material is typically known in the trade as black onyx.

*KNH, JIK, Dino DeGhionno,
and Philip Owens*

Some Unusual Type II DIAMONDS

In contrast to the more common type Ia diamonds, type IIa diamonds are relatively pure, containing little (if any) nitrogen impurities. By definition, type IIb diamonds contain traces of boron (usually less than 1.0 ppm), but the overall concentration of impurities in type IIb diamonds is typically even less than in type IIa diamonds. Because of their high purity, type II diamonds (both IIa and IIb) display fairly consistent luminescence features in comparison to type Ia diamonds. Natural type IIa diamonds may show a weak-to-moderate blue fluorescence to long-wave UV radiation, and weak blue or yellow fluorescence to short-wave UV; they rarely phosphoresce. The vast majority of type IIb diamonds show no observable fluorescence to either long- or short-wave UV radiation. Of the small number that do show a readily observable fluorescence, the reaction is a weak yellow, chalky blue, or, rarely, red to either wavelength. Type IIb diamonds also commonly phosphoresce to short-wave UV radiation, showing yellow, chalky blue, or red or orangy red.

The East Coast laboratory recently examined one type IIa (1.53 ct) and two type IIb diamonds (5.69 and 42.05 ct; figure 2) that displayed unusual luminescence features and photoluminescence spectra, which suggest a new type of lattice defect in diamond. All three diamonds were apparently submitted by coincidence, within a narrow time frame, from two different clients. The smaller type IIb diamond, fashioned as a



Figure 2. These type IIb diamonds (5.69 and 42.05 ct) showed unusual luminescence features and photoluminescence spectra.

cushion brilliant, was graded Fancy grayish blue. The larger type IIb diamond, reportedly from southern Africa, was only partially faceted (and thus not graded). It showed strong blue coloration, and was partially covered by natural resorbed surfaces. Unlike most type IIb diamonds that show luminescence, these two diamonds fluoresced weak orange to long-wave UV, and moderate to strong yellow (with a very strong blue phosphorescence—lasting more than 60 seconds) to short-wave UV (figure 3). The same luminescence features also were observed in the type IIa diamond, which was a D-color pear-shaped brilliant. The two faceted diamonds were free of inclusions when examined with the gemological microscope, up to 60 $\times$. Our preliminary examination of the larger type IIb blue diamond did not reveal any inclusions. No indications of any coating or overgrowth in these three diamonds were observed.

Nearly identical photoluminescence spectra were recorded from the three diamonds with 514.5 nm laser excitation using a Raman spectrometer at liquid nitrogen temperatures. We recorded more than 20 sharp emission lines in the visible-infrared range, which in our experience is very unusual for type II diamonds. Six point analyses performed on randomly selected spots on the type IIa diamond yielded no observable differences in peak position or relative intensity. This observation also was confirmed

for the two type IIb diamonds. In general, the emission lines could be divided into two groups according to their positions. Eight sharp lines occurred in a narrow region of 725–745 nm, with the four strongest lines at 727.2, 729.2, 734.8, and 736.9 nm. A total of 19 sharp emission lines occurred in the region 768–791 nm, with the four strongest lines at 770.1, 774.4, 781.5, and 782.8 nm. This kind of emission spectrum is quite distinct from the vibronic optical centers that usually occur in diamond, which each consists of a sharp zero-phonon line and a broad side band at the lower energy side. Interestingly, when photoluminescence spectra were recorded using

Figure 3. As shown here for the 5.69 ct stone, the type IIb blue diamonds displayed very strong blue phosphorescence to short-wave UV that lasted more than 60 seconds.



red laser excitation (632.8 nm), the second group of emission lines was absent.

Many of these emission lines, such as those at 780–800 nm, have not been reported in the literature previously; however, the line at 727.2 nm is very close to the well-studied 727.0 nm emission in type Ib synthetic diamonds grown in high pressure/high temperature conditions, which is attributed to Ni-related defects (see, e.g., S. C. Lawson et al., "Spectroscopic study of cobalt-related optical centers in synthetic diamond," *Journal of Applied Physics*, Vol. 79, 1996, pp. 4348–4357). The emission line at 736.9 nm is slightly but clearly shifted away from the Si-related defect at 737.5 nm seen in many synthetic diamonds grown by chemical vapor deposition. Considering that these three diamonds were all type II, and all showed the unique multi-emission lines in a narrow region, it is unlikely that they could contain any detectable Ni or Si impurities. EDXRF analysis of the 5.69 ct blue diamond confirmed that there was no detectable chemical impurity above sodium. Because these emission lines were nearly identical in the type IIa and IIb diamonds, a direct relationship of the defect(s) to boron or a boron/nitrogen complex could also be ruled out.

The physics of the defect(s) responsible for these emission lines remains unclear, but it is reasonable to assume that more than one defect was involved based on the reactions of those emission lines to different laser wavelengths. It is also reasonable to assume that the defect(s) contributed to the uncommon reactions of these diamonds to UV radiation. Based on their spectroscopic data and gemological features, we are confident that these diamonds have not been HPHT treated. To the best of our knowledge, there is no published report that irradiation or ion implantation could produce the unusual spectroscopic features either.

Wuyi Wang, Matthew Hall,
Christopher P. Smith, and TM



Figure 4. This 6.34 ct colorless leadhillite may be the only faceted specimen of this unusual mineral.

A Faceted LEADHILLITE

The West Coast laboratory recently had the opportunity to examine a very rare 6.34 ct faceted leadhillite. According to Cynthia Renée, of Cynthia Renée Co. in Fallbrook, California, this stone was faceted from a specimen featured in John Barlow's *The F. John Barlow Mineral Collection* (Sanco Publishing, Appleton, WI, 1996). In the book, the specimen (reportedly from Tsumeb, Namibia) was described as having "large areas of 'flawless' material," and it was speculated that it could be cut into "the only known faceted gem leadhillite" (p. 303). Leadhillite— $\text{Pb}_4(\text{SO}_4)(\text{CO}_3)_2(\text{OH})_2$ —is typically found as small-to-microscopic tabular pseudohexagonal crystals, but it can also be massive and granular. Usually, the material is transparent to translucent, and it may be colorless to white, gray, yellow, or pale green. It is named for the district in Scotland where it was first discovered (R. Gaines et al., *Dana's New Mineralogy*, 8th ed., John Wiley & Sons, New York, 1997, p. 520). Since leadhillite is extremely soft (2 1/2 to 3 on the Mohs scale) and has perfect cleavage in one direction (001), with indistinct cleavage in another (100), faceting it would be quite a challenge.

The stone we examined was a transparent, colorless, modified oval step cut with moderate dispersion (figure 4). Because the R.I. of leadhillite (1.87–2.01) is over the limits of a standard refractometer, and the hemicylin-

der (with a hardness of 4), could potentially scratch the stone, we opted not to attempt to determine the refractive index. The specific gravity (measured hydrostatically) was 6.53, which matches published values for leadhillite. This stone displayed only very weak violet fluorescence to both long- and short-wave UV radiation. Microscopic examination revealed "fingerprints," fractures, twinning, cleavage planes, growth tubes, and strong doubling.

Since our standard gemological examination was limited by the nature of the material, we found it necessary to perform more-advanced testing. Unfortunately, Raman analysis was of little help to us in this identification because, due to its rarity, leadhillite was not in our database. However, the stone did yield a good spectrum, which will be used for future reference. The pattern produced by X-ray powder diffraction of a minute sample (taken with the client's permission) contained several strong lines that matched both leadhillite and susannite (a polymorph of leadhillite).

To help distinguish between leadhillite and susannite, we had to closely observe the optic figures. Leadhillite is biaxial with a small 2V angle (formed by the separation between optic axes in biaxial materials, which is evidenced by the relationship between the two optic figures when the stone is viewed through crossed polarizing filters). Susannite is typically uniaxial, but can be slightly biaxial with a 2V angle of up to 3°. In the polariscope, the optic figures revealed that the stone had a 2V angle of at least 10°, which effectively eliminated the possibility of susannite. On the basis of this and the other findings, we concluded that the stone was indeed leadhillite.

Elizabeth P. Quinn

PEARLS

Cultured Pearl Mystery

A small lot of 12 undrilled white pearls that recently came into the East Coast laboratory were unlike

any we have seen before. The pearls were symmetrical, primarily off-rounds and oval button shapes, and ranged from approximately 6 to 8 mm in diameter (figure 5). They all showed a very high luster and fine orient, but their most remarkable feature was the transparency of the nacre layer. This particular quality, known among pearl connoisseurs as "water," is not often encountered. An X-radiograph revealed evidence of growth structures associated with tissue and/or bead nucleation, which proved that the pearls were cultured. Testing for luminescence to X-rays produced no reaction in any of the cultured pearls, which indicated that they were of saltwater origin.

However, it remains a mystery as to which mollusk produced these cultured pearls. To our knowledge, the only species that shows this nacre transparency in white pearls is the black-winged pearl oyster *Pteria penguin*. However, this pearl oyster is used primarily to produce the top portion of a cultured mabe pearl assemblage (see, e.g., R. Crowning-shield, "Cultured 3/4 blister pearls," Spring 1982 *Gems & Gemology*, p. 38). We would welcome information from our readers on whether this oyster is now also being used to culture whole pearls.

KNH

Treated-Color "Golden" South Sea Cultured Pearl

The 12.7 mm undrilled orangy yellow cultured pearl shown in figure 6 was submitted to the West Coast laboratory for testing. The owner was suspicious that the intense orangy yellow color might not be natural.

Indication of color treatment was observed during an initial low-power microscopic inspection with fiber-optic lighting. Although the color appeared even to the unaided eye, magnification revealed a faint patchiness: Spots of more intense color distributed over the surface produced a subtle "leopard skin" appearance.

Subsequent exposure to long-wave



Figure 5. These cultured pearls of unknown origin (approximately 6–8 mm) displayed unusual transparency of their nacre layer.

UV radiation produced a strong, slightly uneven, light greenish yellow fluorescence, with a slightly orangy overtone in some areas. This is uncharacteristic for natural-color strong orangy yellow cultured pearls from the *Pinctada maxima*. However, a strong light greenish yellow fluorescence is typical for light yellow natural-color *P. maxima* cultured pearls, and the orangy component of the fluorescence is indicative of color treatment.

As part of an ongoing study into the identification of treated color in cultured pearls, the sample was then characterized by UV-visible spectroscopy. The UV-Vis spectrum exhibited a prominent broad absorption at 456 nm, which was unlike any previous UV-Vis feature obtained for natural- or treated-color "golden" cultured pearls. The UV absorption between 330 and 385 nm, characteristic of natural yellow color, was absent.

Analysis by energy-dispersive X-ray fluorescence (EDXRF) spectroscopy showed that, in addition to calcium and strontium, iron and trace amounts of sulfur were also present. While Ca and Sr are inherent to the chemistry of nacre, and it is not

uncommon to find traces of sulfur in *P. maxima* shells or cultured pearls, the presence of iron is not consistent with natural color.

In some cases, color treatment can be detected by Raman analysis. However, no spectral signature was observed for this sample, as the Raman signal was masked by the strong fluorescence.

All of these findings are inconsistent with natural-color "golden" South Sea cultured pearls. We believe

Figure 6. The color of this 12.7 mm "golden" cultured pearl is due to treatment.



that these characteristics represent a distinctive type of treatment that is being applied to produce the “golden” color. Unlike many color treatments, which can be difficult to detect, this one exhibits a suspicious long-wave UV fluorescence and is readily identifiable by magnification, UV-Vis spectroscopy, and EDXRF.

Shane Elen and CYW

QUARTZ

Crystal with “Lizard” Inclusion

Gems and gem-mineral objects that appear to contain small animals or other unusual but recognizable forms are always popular because they serve to stimulate the observer’s imagination. When such features are highlighted by lapidaries and jewelry designers, they often result in

Figure 7. This 51-mm-long partially polished phantom quartz crystal contains the likeness of a tiny green lizard with an angular dark head that can be seen perched on top of the brown phantom.



Figure 8. Raman analysis of similar inclusions revealed that the 1-cm-long “lizard’s” body and tail are composed of chlorite, while its head is an anatase crystal.

interesting fashioned items and one-of-a-kind pieces of jewelry. A recent example of this seen in the lab was a pseudo-“lizard” in a partially polished crystal from the famous phantom quartz locality near Buenópolis, Minas Gerais, Brazil. The specimen was obtained from Kevin Lane Smith of Tucson, Arizona. Mr. Smith had polished a clear flat window to offer the best possible view of the inclusion scene.

The 51-mm-long quartz crystal was a very light smoky brown (figure 7). It contained a phantom composed primarily of altered brown chlorite that had the appearance of a mound of dirt or brown rock. While such phantoms are well known from this locality, what made this one unique was the 1-cm-long bimineralic “lizard” sitting on the tip of the phantom, the “body and tail” of which appeared to be composed of green chlorite, with an angular dark submetallic gray “head” formed by what looked like a single anatase crystal (figure 8).

The “lizard” was too deep in the host for Raman analysis, but inclusions similar to both of these minerals were exposed on the surface at the base of the crystal. The Raman

spectra of these exposed inclusions confirmed that the green mineral was chlorite, possibly clinocllore, while the crystal that resembled a lizard’s head was anatase. Chlorite is relatively common in quartz, but anatase is not. While these analytical results might take away some of the “magic” of this unusual inclusion construct, the pursuit of the solution to a mystery offers its own rewards.

JIK and Maha Tannous

Unusual Mottled Pink

Two faceted mottled pink and colorless quartz gems were submitted to the West Coast laboratory by Luciana Barbosa, of the Gemological Center in Belo Horizonte, Minas Gerais, Brazil. The rough from which the two stones were cut was reported to have come from the Araçuaí region of Minas Gerais. This is the same locality that produced the distinctly color-zoned pink and colorless quartz that was reported in the Fall 1993 Lab Notes section (pp. 203–204). Magnification revealed that the earlier sample derived its fairly uniform pink face-up color

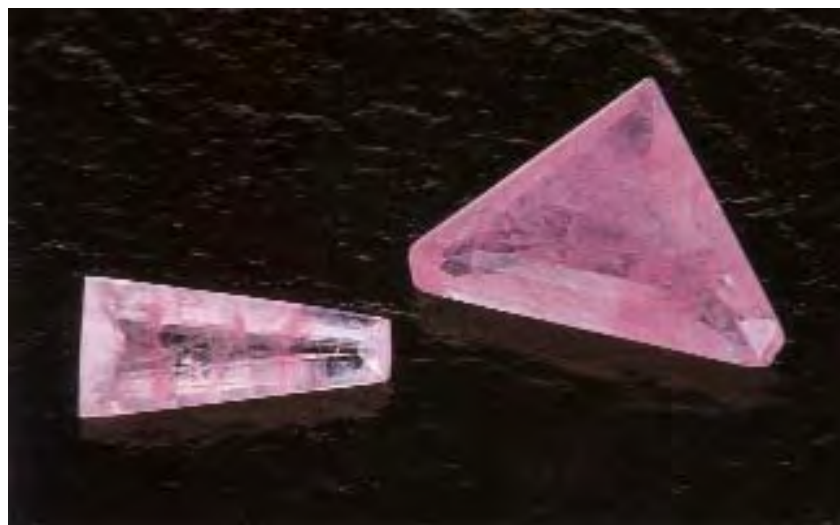


Figure 9. These two faceted examples of pink and colorless quartz (0.98 and 2.67 ct) have an unusual mottled color distribution.

from sharply defined parallel bands of intense pink color in an otherwise colorless stone. The gems examined recently had uneven coloration that was obvious even to the unaided eye (see figure 9). The smaller, 0.98 ct, stone was a trapezoidal step cut; the larger, 2.67 ct, stone was a triangular step cut.

Using standard gemological testing, we first confirmed the identification of these stones as quartz. This was a straightforward procedure with—almost—no anomalies or surprises. The exception was the distribution of color seen with magnification, as shown in figure 10; we had never before seen a roiled appearance such as this in quartz of any color.

For comparison with the quartz reported in 1993 (which contained, and was probably colored by, iron), we performed EDXRF qualitative chemistry on the 2.67 ct stone, since it was the more saturated of the two. Just as with the earlier gem, this testing revealed the expected abundant silicon, as well as iron as the only trace element. This chemistry gave further support to the strong possibility that these two gems did in fact come from the same deposit near Araçuaí that produced the sharply zoned stone examined earlier.

JIK, Maha Tannous,
and Sam Muhlmeister

QUARTZITE Dyed to Imitate Ruby

"If you wish to make a ruby from Crystal . . ." is the beginning of a "recipe" for dyeing colorless quartz to simulate ruby that dates back to at least 400 A.D. (see K. Nassau, "The early history of gemstone treatments," Spring 1984 *Gems & Gemology*, pp. 22–33). Many of the basic methods and principles used to treat gems have actually been in practice for thousands of years, with written accounts dating



Figure 10. At 10× magnification, the roiled appearance of the coloration in the unusual mottled quartzes shown in figure 9 could be seen.

back almost two millennia. Nevertheless, only occasionally do we encounter these early treatments in the laboratory.

Recently, the East Coast laboratory received a yellow metal necklace with 29 variously shaped semitransparent purplish pink to purplish red beads (figure 11), which ranged from approximately $8.05 \times 5.90 \times 4.00$ mm to $5.80 \times 5.25 \times 3.90$ mm. At first glance, the beads resembled fine ruby or pink sapphire, but closer examination with diffused transmitted light pointed in a very different direction (figure 12). Magnification revealed that each bead was riddled with tiny concentrations of purplish red dye around and between the grains of this aggregate material, as well as in surface-reaching fractures. The beads fluoresced a mottled medium-strong to very weak orange to long-wave UV radiation, and

Figure 11. The 29 beads in this necklace are quartzite that has been dyed to imitate ruby (left). The dye fluoresces orange to long-wave UV radiation (right). The fluorescing dye can sometimes be seen defining the grain boundaries and/or other surface-reaching fractures it fills.





Figure 12. With diffused lighting, dye concentrations can be seen in this bead even without magnification (left). The dye concentrations in this aggregate are found in the spaces between and around the individual quartz grains, as well as in small surface-reaching fractures and fissures within the grains, as seen here at 120 $\times$ (right).

only slightly weaker to short-wave UV (again, see figure 11). Such fluorescence has been noted previously in purple and red dye used to color quartz in conjunction with quench crackling (see Lab Notes, Spring 1996, pp. 49–50; Fall 1997, pp. 216–217). However, these beads did not have to be quench-crackled to accept the dye, due to the aggregate nature of the material.

No chromium or iron lines were visible in the desk-model spectroscope, as should have been seen if these beads were ruby. However, there was a feature that might have fooled inexperienced gemologists—an absorption band with a maximum at about 570 nm and a “shoulder” at an average of approximately 530 nm. A similar band was reported by K. Schmetzer et al. in a study of corundum dyed to simulate ruby (“Dyed natural corundum as a ruby imitation,” Summer 1992 *Gems & Gemology*, pp. 112–115). The authors concluded that the absorption band of the dye, which mimics the major chromium absorption band in ruby (at about 550 nm), was probably the cause of the convincing color in the imitation.

The beads we tested gave spot refractive index readings of 1.54. Since they also showed an aggregate reaction in the polariscope, and no optic figure could be found, they were identified as quartzite, a crystalline to microcrystalline rock consisting primarily of quartz.

Although we don’t regularly see

dyed quartz in the laboratory, this necklace serves as a reminder, once again, that some of the oldest and simplest gem treatments practiced by ancient alchemists are still being used today.

Wendi M. Mayerson

Unusual Inclusions in a Beryllium-Diffused SAPPHIRE

The West Coast laboratory recently examined an interesting 4.75 ct light yellow cut-cornered rectangular brilliant that gemological testing proved to be a beryllium-diffused natural sapphire (figure 13).

The refractive indices were 1.761–1.769, and no visible-light spec-

Figure 13. This 4.75 ct light yellow sapphire proved to be beryllium diffused.



trum was observable through the spectroscope. When the stone was exposed to long-wave ultraviolet radiation, a moderate-to-strong orange luminescence was seen; to short-wave UV, it fluoresced a moderate chalky reddish orange with a slightly bluish white overcast. All of these properties are consistent with yellow sapphire.

Microscopic examination revealed straight growth zoning and a small partially healed fracture (“fingerprint”) inclusion. In addition, immersion in methylene iodide showed a yellow surface-conformal color zone around a colorless center, which proved that the stone had been lattice diffusion treated (see, e.g., J. L. Emmett et al., “Beryllium diffusion of ruby and sapphire,” Summer 2003 *Gems & Gemology*, pp. 84–135).

However, as shown in figure 14, this stone also contained numerous very unusual ribbon-like semicircles composed of minute white particles and what looked like stringers of tiny bubbles. We had never encountered this type of inclusion in any corundum, natural or synthetic. Since most inclusions are adversely affected by high-temperature heat treatment, we interpreted these to be a result of the heat treatment this sapphire had undergone during the lattice-diffusion process.

JIK, KNH, and Maha Tannous

Figure 14. These unusual ribbon-like semicircles observed in the 4.75 ct yellow sapphire are made up of minute white particles and what appear to be bubbles. Magnified 40 $\times$.



STICHTITE Flowers

The West Coast laboratory recently examined an interesting 6.97 ct cushion-shaped polished double cabochon that was submitted for identification together with three small rough slabs, each of which had one polished face. The semi-translucent to opaque cabochon, which measured $16.30 \times 12.17 \times 4.97$ mm, showed a mottled texture and very slightly pinkish purple color (figure 15). The three slabs were identical to the cabochon in color, diaphaneity, and texture.

We first used standard testing to acquire the basic gemological properties. The refractive index obtained from a flat polished surface on one of the slabs was 1.52–1.55; specific gravity for the cabochon (determined hydrostatically) was 2.13. A typical chromium absorption spectrum, showing three lines in the red region, was observed with the desk-model spectroscope on all four samples. All of the samples were inert to both long- and short-wave UV radiation.

As seen in figure 16, microscopic examination revealed an almost oolitic structure composed of numerous pinkish purple, circular to ovoid, platy floral masses, some of which had tiny opaque black grains at their centers. The cabochon and slabs were all slightly attracted to a magnet, which we attributed to the presence of the tiny black mineral grains. We surmised that these grains might be either chromite or hematite, although chromite was the first choice because of the chromium spectrum shown by the material. Since all of the visible mineral grains seemed to be at the centers of the pinkish purple “flowers,” we speculated that these grains formed the nucleus for growth of the purple mineral.

One of the slabs was tested with a minute droplet of hydrochloric acid, and it showed a weak carbonate effervescence that was clearly visible through the microscope. When a thermal reaction tester was touched to the edge of one of the slabs, the mineral lost its pinkish purple color and decrepitated to brown particles,



Figure 15. This 6.97 ct cabochon proved to be the ornamental gem material stichtite.

which suggested that it might be hydrated as part of its chemistry.

The gemological properties and general appearance of the samples served to identify them as stichtite, a rather unusual massive gem material with the chemical formula $\text{Mg}_6\text{Cr}_2(\text{CO}_3)(\text{OH})_{16} \cdot 4\text{H}_2\text{O}$. Since we rarely see such material, we decided that advanced testing should be done to get a full documentation for our records. The additional tests performed included X-ray powder diffraction and EDXRF of one of the samples, as well as Raman spectroscopy on both the material itself and the tiny black grains.

X-ray powder diffraction showed a structural match that fit stichtite better than its dimorph, barbertonite; the gemological properties also supported this distinction. EDXRF gave a qualitative composition that was consistent for both stichtite and barbertonite, with Mg and Cr as the two major elements. Raman analysis gave us a good standard pattern for stichtite, and identified the tiny black grains as chromite.

Gem-quality stichtite has been found in Australia, Canada, and South Africa. It occurs in serpentine rocks in association with chromite; this association fits well with the data we obtained from these samples. Although it is unusual, such stichtite has been previously described in *Gems & Gemology*, by R. Webster (“Stichtite, an ornamental stone,” Spring 1955, pp. 149–150, 156), and more recently in the *Australian Gemmologist*, by R. S.



Figure 16. These “flowers” of stichtite appear to have nucleated around minute opaque black crystals of chromite. Magnified 25 $\times$.

Bottrill and G. Brown (“Rare Australian gemstones: Stichtite,” Vol. 20, No. 9, 2000, pp. 391–393).

JJK, Dino DeGhionno,
Philip Owens, Sam Muhlmeister,
KNH, and Maha Tannous

Addendum: Cat’s-eye OPAL

In the Summer 2003 Lab Notes (p. 148), we reported on a chatoyant opal with an eye that “opened and closed,” much as cat’s-eye chrysoberyl and many other chatoyant materials do when viewed under two light sources. This phenomenon had apparently not been reported before in those rare cat’s-eye opals with eyes composed entirely of play-of-color.

Note, however, that the 4.59 ct cat’s-eye opal reported in the Spring 2003 Lab Notes (pp. 43–44) also displayed this phenomenon. Since the focus of that report was on the fact that the stone showed a strong cat’s-eye composed of play-of-color, with a full range of spectral colors when it was viewed in the right position, we neglected to report that the eye also opened and closed. *SFM*

PHOTO CREDITS

Maha Tannous—1, 4, 6, 7, 9, and 13;
Elizabeth Schrader—2 (left), 3, and 11;
Wuyi Wang—2 (right); Don Mengason—5
and 15; John I. Koivula—8, 10, 14, and 16;
Wendi Mayerson—12.