The New Mexico Facetor

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In This Issue

NMFG President Scott Wilson

Don't forget: next meeting is January 10, 2002 at 7:00 pm. NM Museum of Natural History. Dues $20.

The Prez Sez:

by Scott R. Wilson, Ph.D.

Greetings to all and best wishes for the New Year!

The Pavlovian response evoked in gemcutters by the changing of the calendar is clearly that of anticipation and suspense over what exactly will be the coolest goodie found at the February Tucson Show. I am making a mental list of hotspots to check. The real fun is in discovering a new and intriguing design approach or new gem rough material.

Gem rough might well be in an odd state this year. Last year saw a general decrease of affordable quality rough, mostly due to the new marketing approaches used to sell rough via the Internet. The prospects for this year are all over the map. Consider that the trading of gem materials has been implicated in terrorist financing as a medium of exchange in the informal currency transfer network used by terrorists. This development might make rough more available to legitimate traders and also to us as faceters, as channels are slowly but surely shut down. Some areas in central Asia, notably Afghanistan but in others as well, have been freed from authoritarian rule and may be seeking a resurgence of gem rough suppliers eager to make a living without the tyrannical influence of a terrorist regime in their life. This also may make more gem rough available. However, these areas may have been emplaced with minefields during the last few months of the anti-terrorism campaign, which might discourage exploration and gem rough production.

Travel from all parts of central Asia has become more difficult, due to the increased security precautions being taken. Gem suppliers from that part of the world may not be able to reach the Tucson market to sell their goods. Gem producing areas in central Asia, notably the Hindu Kush mountain chain, parts of Burma, Pakistan, and other areas are now potential war zones. This may either discourage gem production from those areas or may increase it as funds are traded on the black market. Keep an eye out at the show. By careful observation, you may discover interesting facts about future prospects for gems by visiting gem rough suppliers. This will add a new dimension to your experience at Tucson.

Minutes of the NMFG Meeting

November 8, 2001

by Nancy L. Attaway

President Scott Wilson called the meeting to order at 7:10 p.m. and welcomed all members and guests. He then asked everyone to introduce themselves to the group.

Old Business

Ernie Hawes reported on the workshop held at the home of **Steve** and **Nancy Attaway** and remarked on its success. Ernie would like to have Guild members continue with their faceting projects, but he would also like to cover other aspects of faceting. These include: the selection and orientation of gem rough, dopping and transferring techniques, preforming gem rough, explaining how to render some faceting designs, and the importance and use of GemCad. **Treasurer Ina Swantner** will reimburse Ernie Hawes for the many copies he made for the workshop.

Paul Hlava reminded everyone to attend the **Eighth Annual AGATE Show** (Albuquerque Gem Artisans Trade Expo) scheduled for **November 17 and 18** at the UNM Conference Center (the Continuing Education building). Several Guild members will be AGATE dealers.

Special Events Coordinators Rainy Peters and **Eileen Smith** scheduled the **Guild Christmas Party** on **December 15** at the party room in **Villa Di Capo's Italian Restaurant, 722 Central Avenue SW.** Cocktail hour will begin at 5:00 p.m., and at 6:00 p.m. we will order dinner. The entertaining gift exchange will begin after dessert. Rainy and Eileen invite Guild members and their guests to dress up and join the fun.

New Business

The **next workshop** is scheduled for **December 8** from 9:00 a.m. until 5:00 p.m. at the home of **Steve** and **Nancy Attaway**. Members attending workshops are asked to give $5 towards food and the copies of information and faceting designs. Contact Ernie regarding any and all workshops.

Nancy Attaway reserved one of the party rooms at **El Parador** restaurant, **2744 East Broadway** in **Tucson**, for a party on Friday, **February 8 at 6:00.** Guild members, along with special guests, like noted gem author and photographer Fred Ward, famous gemcarver Steve Walters, Merle White, Editor of Lapidary Journal, and her husband John have all attended Nancy's Tucson parties. Famed facetor John Rhoads and his wife, Donna have also attended, as have Edna Anthony, our Guild Gemologist, and her husband Tony. They will all be at the 2002 party. Nancy hopes to continue her Tucson party tradition in 2002 for Guild members and special guests. RSVP Nancy soon.

President Scott Wilson announced that elections for Guild officers was overdue. Elections should have begun during the September meeting. A slate of officers was to have been published in the last Guild newsletter, and a vote was to have been taken during the November meeting. Since Scott Wilson, Paul Hlava, and Steve Attaway were all out of state for business during the September meeting, and since Nancy Attaway ran the meeting and also took notes, everyone forgot about proposing a slate of officers. So, Scott opened the meeting tonight for nominations for a slate of Guild officers to serve during 2002 and 2003.

Betty Annis moved that the slate of officers have the same people serving the same slots, and **Paul Hlava** seconded the motion. When asked by **President Scott Wilson** if they would serve another term, the current officers present all agreed. **Paul Hlava** moved for a vote, and **Nancy Attaway** seconded the motion. A unanimous vote by the membership confirmed the slate of officers.

Scott Wilson will continue as **President**, **Paul Hlava** as **Vice-President/Programs**, **Ina Swantner** as **Treasurer**, **Russ Spiering** as **Guild Librarian, Rainy Peters** and **Eileen Smith** as **Special Events Coordinators**, and **Nancy** and **Steve Attaway** as **Editors** of the *New Mexico Facetor.* **Paul Hlava** will also continue as **Guild Mineralogist**, and **Edna Anthony** had agreed by phone to continue as **Guild Gemologist. Ernie Hawes** will be the new **Guild Workshop Chairman.** Thank you all.

Show and Tell

The Show and Tell Case tonight held faceted and carved stones and jewelry rendered by Guild members.

Russ Spiering displayed four items of opal jewelry that he had handwrought in 14Kt. gold. Russ carved the opals. One opal, set in a pendant/pin combination, was accented by a large Chinese freshwater pearl and rainbow hematite. Another crystal opal set in a pendant was accented by party-colored sapphires that were set in tubed bezels. A mokume gane metalwork (27 layers of copper and silver) with two African sapphires accented one opal pendant. A box pendant set with a large greenish Mintabie opal was accented by two salmon-colored African sapphires and two lines of tsavorite garnet melee. Russ also displayed one of Katherine's handwoven 14Kt. gold chains.

Ernie Hawes displayed three stones. One was an absolutely stunning blue topaz cut in Ernie's "*Queen's Fancy*". The other two were citrines. One was a dark yellow citrine cut in Ernie's new simple square design that showed a scissors crown. The other was a lighter colored yellow citrine also cut in Ernie's new simple square design that showed a step cut crown. Ernie asked folks to rate the two citrines as to which crown arrangement they liked better. Ernie sent his revised version of the "*Queen's Fancy*" to Lapidary Journal for publication in a future issue.

Dylan Houtman displayed seven stones. Three were emeralds that he had "cooked" in the microwave oven with corn oil for nine minutes to improve clarity and color. Remarkably enough, he said that the process seemed to work. One of the emeralds was a standard round brilliant, one was a barion emerald cut, and the other was cut in Ernie's "*Regal Cushion*". Dylan displayed a tanzanite triangle with the top corner rounded. He also showed three colorless grossular garnets: a truncated marquis with blunted ends, a new type of oval, and a standard round brilliant.

Gary Peters displayed the first stone that he has cut on his Facetron, a square amethyst that was faceted at the workshop in October. He polished the stone on a cerium oxide dyna lap. He displayed two square ametrines that he had carved "bubbles" or spheres and lines in the culet area of the pavilion. Gary also showed one of his handwrought 14Kt. gold rings set with two emerald cut emeralds.

Scott Wilson displayed several of the interesting mineral specimens that he recently collected with members of the Albuquerque Gem and Mineral Club at Petaca, New Mexico, near Ojo Caliente. The Petaca pegmatite district includes the Globe mine, where large books of mica can be found, as well as clevelandite, green fluorite, columbite in feldspar, and quartz. The Petaca district also includes the Sunnyside mine, where purple fluorite and green/blue beryl crystals can be found. Also at Petaca is the Cotes mine, where columbite, feldspar, quartz, mica/biotite, and ilmenite can be found. At the Sunnyside mine, Scott found a yellow-green beryl crystal about an inch and a half long and over a half of an inch wide. He found a large cube-octahedron purple fluorite, a rare form of fluorite that shows distinct cleavage faces. Scott also found a fine-grained muscovite in a six-inch diameter mica book.

Nancy Attaway displayed ten stones in preparation for the AGATE Show: five tourmalines, two peridots, one rhodolite garnet, one aquamarine, and one citrine. Of the five tourmalines from Nigeria, four were emerald cuts and one was a flasher cut twelve-sided round. The round and one of the emerald cuts were from the same crystal. That crystal was originally slated for a large emerald cut, but it developed a stress crack and had to be sliced in two. One piece yielded a bright peach-colored emerald cut on the long axis. The other smaller piece became a round rubellite that was cut down the C axis. Two of the other tourmalines were emerald cut rubellites. The fifth tourmaline was a bi-colored emerald cut, where the short end facets of 24 and 72 were cut at 80 degrees. The tourmalines were polished on a Last lap and a ceramic lap, both with 60K diamond.

The two peridots were from Pakistan. One was a pear-shape, and the other was a "*Flared Shield*" cut, a new design recently developed by Nancy. The rhodolite garnet, from Tanzania, was an emerald cut. The aquamarine, from Mozambique, was also cut in the new "*Flared Shield*" design. The original aquamarine rough, just like the peridot rough, had been an odd-shaped, elongated piece that required a special cut. The new design is easy to cut and yields a sparkling stone. The rhodolite garnet and the peridots were also polished like the tourmalines, on a Last lap and a ceramic lap, both with 60K diamond. The aquamarine was polished on a cerium oxide dyna lap. The citrine was cut in Nancy's "Cushion Flair" design, published in the September/October, 2001 issue of the *New Mexico Facetor.*

Refreshments

Rainy Peters and **Eileen Smith** brought home-baked refreshments to the November meeting. Gourmet coffee was also served. Thank you very much. **Scott Wilson** and **Nancy Attaway** volunteered to bring refreshments to the meeting in January.

Future Programs

Paul Hlava will present **Emeralds: Part 2** during the meeting on January 10, 2002. Paul will discuss the history associated with emeralds, as well as cutting, treatments, synthesis, and noted inclusions. Don't miss this talk.

As **Vice President/Programs, Paul Hlava** will appreciate any suggestions for ideas from Guild members regarding future programs. If there is any topic that members wish to have presented, or if you know of a particular speaker you want to have address the Guild, please notify Paul. Thanks.

Program Speaker

by Nancy L. Attaway and Scott Wilson

President Scott Wilson presented his talk on “Opal Synthesis” and discussed his experiments in synthesizing opal. Born and raised in Los Alamos, Scott studied one year at New Mexico State University in Las Cruces, and he graduated from the University of New Mexico with three degrees (BS, MS, and Ph.D.). While still an undergraduate, Scott started his own company, Sandia Systems, where he developed techniques of non-contact machining of precision optics and laser instrumentation for semi-conductor metrology. The company changed hands several times and is now owned by Accent Optical Technologies, for whom Scott now works.

Scott began his talk by outlining what he intended to cover. The five divisions of his talk included a definition of opal, a description of how opal is formed in nature, an explanation of the laboratory growth of opal, and the presentation of results. Scott concluded his talk with a discussion of technology related to opals and opal synthesis. Scott provided copies of several references on opal synthesis that included: “Controlled Growth of Monodisperse Silica Spheres in the Micron Size Range” by Stober and Fink; “Origin of Precious Opal” by Darragh, et. al.; “Color of Precious Opal” by Sanders, and copy of a patent on “Opaline Materials and Method of Preparation”.

Scott described opal as a three-dimensional diffracting array composed of hydrated silica, active in the optical wave length region. Opal is a crystal-like lattice of objects in space, in this case, silica microspheres. The spacing and the uniformity of the lattice is sufficient to diffract electromagnetic radiation (in precious opal, this is light) in accordance with Bragg’s Law. The packing of the lattice is face-centered, cubic, with faults, twins, and dislocations (Sanders, 1964), just as you might see in an actual crystal.

Scott explained that hydrated silica is nearly pure SiO2 with water entrapped at the molecular level, usually as hydroxyl ions. Natural opal shows trace elements of sodium, calcium, potassium, and aluminum. Synthetic opal may also show Ti and other metals.

Opal is active in the optical wavelength region from 400 nanometers to 700 nanometers. From Bragg’s Law, the diameter of the spheres may be calculated, something like 250-350 nanometers for red-green opal flash, and 150-250 nanometers for green-blue flash.

Opal formation in nature is an area subject to much conjecture and study. Darragh gave a description of opal formation in 1966, and it still holds true to a great extent, even in light of very recent work. Darragh described a 100 parts per million silica solution, dissolved from host rocks at about 25 degrees C in slightly acid waters. Slow evaporation of the solution over a period of about 1 million years is followed by condensation to form about 30 nanometer spheres in colloidal form. Aggregation forms about 300 nanometer spheres of uniform size, followed by sedimentation (settling) that forms the opal lattice. Hardening occurs by dessication and partial fusing by silica gel. Only high quality lattices yield precious opal. The lattice quality is controlled in later stages by the geologic stability of the growth environment.

Opal growth in the lab follows a similar trail. In general, silica spheres of the correct size must be procured that have very narrow size distribution. Sedimentation is used to form a lattice. Void filling is done, often to a partial degree, with a silica gel (although some folks have done it with epoxy), all followed by a hardening process. The trick is to try to get this done in less than a year’s time!

To obtain the silica spheres, one might buy them from any of several suppliers of technical materials. Silica spheres are very expensive now, but they were much cheaper at one time. In the past, silica spheres were used in paints, cosmetics, food, and juices. They are no longer widely available, due to a competing process (fumed silica) that forms irregular-shaped particles.

Another possibility might be to try to “mine” such particles. It may be possible to separate silica spheres from suitable soils, like those found in Australia. There is no actual evidence of this method being used in the literature, but Cram implies that it could be done (“only pennies for the raw materials”. Sounds “dirt” cheap!).

Silica spheres can be made, and there are many ways to this. All involve some process that takes place under significant acid or base conditions that usually involve a combination of nucleation, growth, and aggregation. Aggregation should probably be avoided, due to its tendency to produce non-uniform-sized particles. The most common approaches are sodium silicate ion exchange and condensation from silicic acid. Both create “sols”. Hopefully, they don’t “gel” until the end, or you would end up with “potch”. Temperature, ph, motion, and chemistry are all factors that must be carefully controlled in order to obtain particles suitable for opal synthesis.

The Stober-Fink method (1968) is a condensation approach that makes use of ammonia as a catalyst to condense silicic acid from hydrolytic breakdown of TEOS in water-ethanol solution. The sphere size is controlled by ammonia/water ratio, which is something that requires only careful measurement. This process is done at room temperature, which makes is relatively convenient.

TEOS, tetraethylorthosiloxane or tetra-ester of silicic acid, is a chemical used in large quantities in semiconductor fabrication to make high quality SiO2 (glass) for integrated circuits. TEOS can be considered to be ethyl alcohol with silicic acid bonded in a molecular structure. It is highly flammable and "burns" to form glass, so it absolutely must be handled carefully using the proper equipment, alway being mindful of the safety precautions.

Scott's procedure for opal synthesis is, first, select the ammonia/water ratio to get desired sphere size. After scaling to the size of the "batch", mix the TEOS and ethanol. Mix ammonia and water. Rapidly add ammonia/water mixture to TEOS/ethanol while stirring rapidly (rapid stirring helps to maintain a narrow size distribution). Stir for an hour and cover to keep dust out and also to reduce evaporation. This results in production of a milky colloidal suspension of the silica spheres. To centrifuge and separate the spheres, pour off the excess liquid. Re-disperse in ethanol (wash). Centrifuge again. Re-disperse to the desired density in ethanol. The trick to the re-dispersal is to partially submerge the solution container in an ultrasonic cleaner, as the acoustic cavitation helps break up any aggregates that may have formed.

The sedimentation process follows next. The cake produced during centrifuge processing shows definite color, but it is not good enough yet. It is still weak and diffuse, so a slow and controlled sedimentation process must be carried out. Gravitational sedimentation takes a very long time (It is suspected that Gilson does it this way). The trick to doing this quickly is to perform the sedimentation under silicone oil (Philipse, 1989). This procedure involves adjusting the specific gravity of the solution to match the oil, then pouring the solution on top of the oil and covering it with a plastic membrane to keep out dirt and dust. Store for about four weeks in a quite, draft-free, constant-temperature location. The solution slowly loses the ethanol by evaporation through the oil. It sinks to the bottom of the oil as a "blob". Good opal color shows as the blob shrinks.

The results are good pinfire color, but the material is very soft. Better results are often obtained if a 10% methanol in ethanol solution is used during sedimentation, due to chemical reasons and electrochemical forces. Even with all of this work, the awesome color saturation that you look for in opal is just not quite there.

To improve the color, something must be done to increase the quality of the microsphere lattice. Many things can affect the quality of the lattice. A very important one involves electrostatic forces. The spheres tend to charge negative, due to the disassociation of surface silanol groups or the absorption of hydroxyl ions. Charged particles rarely behave nicely. The surface charging tends to cause the microspheres to resist efficient packing in the lattice, thus forming lattice defects. This problem can be reduced by modifying the microsphere surfaces with a silane coupling agent (SCA), which reduces surface charging and allows the spheres to more easily form a high quality lattice arrangement.

It is interesting to look at the costs of doing this work. The cost for one gram of silica, produced by the above process is: TEOS $3; ammonia $0.50; EtoH $3; and TPM (SCA) $10, for a total of $26.50 per gram. The silicon oil can be reused many times. Silicone brake fluid appears to work well, too, but it may produce a discolored opal.

The synthesized opal needs to be hardened. This can be done in lots of ways. Heating is an obvious approach, but Scott found that furnace-fusing at between 200 degrees C to 600 degrees C caused the opal to lose color and mechanical strength, possibly due to thermal breakdown of the silicon oil. Scott is experimenting with solutions to wash the oil out of the opal. Adding some weak silica solution to the soft opal (by soaking) may assist in fusing the microspheres during heating.

Scott reported that the current state of this process takes about three hours for preparation of the microspheres and the initial solution and about six weeks for sedimentation, a scalable but expensive approach. Work needs to be done to find a cheaper SCA. It will certainly be worthwhile looking at the silicate route to microsphere preparation. More work on hardening also remains to be done.

There are areas of optical technology that are related to the growth and synthesis of opal. Optical bandgap materials are specially constructed opals, just a few lattice layers thick. These materials typically have multiple sphere types in the opal and are arranged in a complex, computer-designed array. These materials exhibit special optical properties, much like a semiconductor for electrons but for photons (light). They can exhibit complex (and possibly useful) wavelength dependent behavior. The technology of optical bandgap materials is currently where semiconductor technology was about 40 years ago. Perhaps, one day we will be using what amounts to a computer built with optical transistors to surf the Internet.

Scott closed with a word on safety. These chemicals represent a most serious fire danger due to their flammability and combustion by-products. The chemicals and vapors can and will cause serious burns, eye damage, respiratory problems, etc. Special equipment and a thorough understanding of the hazards is required by a person who handles these materials. Serious ventilation is required. Scott concluded with the recommendation that you “Don’t Try This At Home,” which spoiled all the fun! Thank you, Scott.

In the News

John Rhoads Wins Two Cutting Edge Awards

Source: D & J Rare Gems, Ltd. Newsletter Dec. 2001

On October 29, 2001, the American Gem Trade Association (AGTA) notified those who had submitted entries and were honored with awards from AGTA’s 2002 Cutting Edge Competition. John Rhoads won a first place Cutting Edge Award with a 15.89-carat orangish-pink tourmaline from Mozambique that he cut in a round flower brilliant cut. He also won a third place Cutting Edge Award with a 58.33-carat light pink morganite from Brazil that he cut in an original cushion brilliant design. Congratulations!

Steve and Carsten hard at work.

Faceters Guild Workshop

by Nancy L. Attaway

The New Mexico Faceters Guild held a workshop at the home of **Steve** and **Nancy Attaway** on **December 8** that lasted all day. **Ernie Hawes** organized the workshop and served as its moderator. **Ernie Hawes, Steve Attaway,** and **Nancy Attaway** instructed the beginner faceters.

Gary Peters brought his Facetron faceting machine and cut part of his second stone, a peridot from Pakistan that he cut in a modified marquis with blunted ends with a step cut pavilion and crown. Nancy assisted Gary with his cutting. After Gary completed the polish of the pavilion and transferred the stone, he began on a long and slender peridot emerald cut, where Nancy outlined the pavilion angles and facets. In faceting the first peridot, Gary discovered that working with natural gem materials can sometimes present faceting challenges. In order to eliminate a crack on one end, he needed to blunt both ends of the marquis shape a bit more than he had originally intended to do. He was successful in eliminating the internal damage and will have a very nice design rendered when he finishes.

Bill and **Ina Swantner** took turns faceting that large smoky quartz on the Facetron faceting machine that Ernie brought. They finally finished a nice pre-polish on the pavilion and transferred the stone. A slight discrepancy was detected in using one Facetron head to pre-polish the quartz and another facetron head to polish it. Ernie helped Bill and Ina. Ernie also had Bill work on cutting the pavilion of a cubic zirconia on the coarser grits, as Bill wanted to become familiar with cutting cubic zirconia.

Nancy helped **Linda Vayna** with her large synthetic blue spinel on her Graves faceting machine. She finished polishing the last row on the pavilion, transferred the stone, and stopped for the day.

Carsten Brandt had chipped the culet of the amethyst that he cut during the last workshop. Steve and Nancy Attaway assisted him in repairing the pavilion on his Ray Tech faceting machine. Stone repair is a difficult endeavor, especially for a beginner facetor. Carsten re-cut the pavilion angles at a shallower angle to eliminate most of the culet damage. A small flat culet facet completed the repair.

Mark Price worked with his UltraTec on several stones. **Steve Vayna, Rainy Peters, Elaine Price,** and **Magail Medina** observed the proceedings.

Pizza was ordered for lunch. Rainy Peters baked an apple crisp coffee cake. Nancy prepared coffee, iced tea, and baked a lemon cake with lemon icing.

Ernie wanted to cover glues and epoxies, the selection of gem rough, the orientation of gem rough on a dop stick, the transfer of a stone from pavilion to crown, and the use of GemCad. Folks wanted to facet most of the day, so the other related topics were saved for the next workshop.

The beginner faceters were becoming more familiar with grinding and polishing and how the diagram is translated to the gemstone. The instructors again explained the importance of eliminating the damage from the previous grinding lap and how to work through the different grinding laps to a finer and finer grit before polishing. The workshop session was an intense learning experience, but a tremendous amount of fun and excitement was again enjoyed by all. Thanks to all who participated.

Mark Price hard at work

Nancy and Ernie fixing problems.

LET'S TALK GEMSTONES

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Garnet Group
[A NESOSILICATE]
The Ugrandites
Grossular

A greater variety of colors occurs in grossular garnet [calcium aluminum silicate – $Ca_3Al_2(SiO_4)_3$] than in any of the other garnet species. Grossular forms series with andradite and uvarovite. Its name is derived from the botanical name of the gooseberry (Ribes grossularia) that it resembles in form and color. The diaphaneity ranges from transparent to opaque. Under the microscope, transparent grossular exhibits a distinctive characteristic described by Richard T. Liddicoat in his *Handbook of Gem Identification* as "it looks like a saturated sugar solution with light passing through it." In the *Color Encyclopedia of Gemstones,* Joel Arem attributes this swirled effect to "included diopside crystals and irregular streaks at grain boundaries." Pure grossular is colorless and rare. The presence of small amounts of trace elements, iron, manganese, chrome, or vanadium, produces its various shades of yellow, brown, green, black, orange-brown, red, pink, gray, and white. [It is interesting to note that a purple-red grossularite is mentioned by Liddicoat that can be "almost semi-transparent." It "usually transmits much more light than rhodolite"; and "is recognized by a refractive index between 1.70 and 1.73 and a specific gravity from approximately 3.25 to 3.5."] A content of more than 2% iron produces the deeper tones of yellows, browns, and greens. Typical environments for this common mineral are regional and contact-metamorphosed zones of impure calcareous rocks (calcium carbonate rocks, i.e. limestones, shales, and mica schists). Less frequently, serpentines and metamorphosed basaltic lavas are sources of the isometric dodecahedral or trapezohedral crystals. A refractive index of 1.74 is the norm for grossular. Its luster can vary from vitreous to resinous. The lighter colors do not mask grossular's high dispersion (0.027), and well cut stones make exceptional gems. Like other garnets, grossular exhibits no cleavage, but brittleness is a characteristic. Its hardness (6.5 to 7.0+) and the density (3.4 to 3.71) are variable. Joel Arem's *Color Encyclopedia of Gemstones* states that grossular seldom exhibits luminescence in ultraviolet light, but exposure to x-rays reveals an orange glow in all massive material and in many faceted gemstones. In *A Guide in Color to Precious and Semiprecious Stones*, Jaroslav Bauer and Vladimir Bouska state that, "In contrast to other garnets, grossular strongly luminesces in ultraviolet light." Since the refractive indices of grossular and synthetic spinel are similar and both frequently house rod and acicular inclusions, Dr. Liddicoat advises that grossular's "weak green fluorescence to shortwave" and "weak orange to longwave" may be helpful in identification. Other inclusions common to the varieties of grossular include actinolite, short, stubby low relief crystals of diopside, and crystals of zircon and apatite. Uncommon variations of the physical and optical properties of the grossular varieties from the normal characteristics of the garnet group are presented in the paragraphs devoted to the various varieties.

Massive grossulars

The important sources of the massive varieties of grossular are located in South Africa, China, and Myranmar (Burma). Green chrome-bearing masses (R.I.=1.738 to 1.742 and S.G.=3.63) are found in Pakistan. Similar material found in Tanzania exhibits a density of 3.68 with a refractive index range of 1.742 to 1.744.

Hydrogrossular

Hydrogrossular [$Ca_3Al_2(SiO_4)_3(OH)_4$], a crystalline component of massive grossulars, occurs in numerous locations and several colors. Quite large cabochons can be fashioned from this translucent material. New Zealand hydrogrossular is known as rodingite. The Transvaal region in South Africa produces manganese-bearing pink material (R.I.=1.675 to 1.705 and S.G.=3.27), gray containing zoisite, and green material, resembling jade, which is often called Transvaal or South African jade. The presence of visible small black inclusions in this cryptocrystalline material can help to distinguish high quality "Transvaal jade" from jadeite. A waxy luster and a splintery fracture can be characteristics of the compact homogenous material.

Leuco [white] garnet

The rare crystalline grossular called **leuco** or **white garnet** found in Italy (Cantanzaro), Norway (Telemarken), and at Jordansmuhl, Poland is seldom faceted and used as a gemstone. No other gem mineral of its color range exhibits a singly refractive index of 1.725. Colorless crystals with a refractive index of 1.733 are found at the Jeffrey Mine near Asbestos, Quebec, Canada. A source near Georgetown, California produces material with a refractive index of 1.737 and a density of 3.506. White crystals are frequently associated with the greenish and pink material from Lake Jaco, Chihuahua, Mexico. Myanmar and China produce white garnet that is frequently carved by Chinese artists.

Rosolite [xalostocite, landerite]

Marble deposits in Lake Jaco, Chihuahua, Mexico yield pink grossular known as rosolite. The manganese-bearing commonly opaque concentrically zoned crystals can have a diameter of up to 5 inches. Material from this locale has been known and used for years by the inhabitants of the southwestern part of the U.S. Lesser known is the sometimes-transparent rose-pink material from Xalostoc, Morelos, Mexico, where large well-developed crystals associated with vesuvianite are extracted from the granular limestone formations. Well-cut stones from these crystals are beautiful gems. Fine pinkish grossular crystals are found at the Jeffrey Mine in Quebec, Canada.

Green grossular

The incorporation of iron into its chemical composition accounts for the colors of most of the green grossular garnets. Greater amounts of the element create the dull turbid tones often associated with this material. Concentrations of less than 2% iron permit the development of very attractive lighter hues. Although singly refractive with a luster that is not as strong, it is frequently confused with green zircon and green tourmaline. Gem quality crystals are found in the gem gravels of Sri Lanka, Tanzania, and Pakistan.

Tsavorite [tsavolite]

Since its discovery several decades ago in southern Africa near the Tsavo National Park, Kenya, this bright green grossular has rapidly gained favor with the public. Original analysis disclosed traces of chrome to which its intense color was attributed. More recent examinations have determined that, although chrome is present, vanadium is responsible for its brilliant hue. The rare crystals seldom exceed a size of more than a carat. In addition to the original source from the Lualenyi, Kenya mine, deposits have been found in Tanzania and Pakistan. Tsavorite exhibits a refractive index of 1.743 and a density of 3.61. According to Joel Arem, exposure to ultraviolet light elicits no reaction. In his *Handbook of Gem Identification*, Richard T. Liddicoat, Jr. states that, "The transparent green material may show a weak-to-moderate red fluorescence under both short- and longwave ultraviolet light." [Upon exposure to shortwave ultraviolet light, only one of several tsavorite gems made available to the author from private sources exhibited a weak dull red fluorescence.] Examination under the microscope often reveals tiny white crystals in healed fractures. Acicular actinolite crystals and mirror-like plates of hematite are seen less frequently.

Hessonite [essonite, cinnamon stone, yellow garnet]

An extensive essay on this transparent to translucent variety of grossular garnet appears in *Precious Stones, Volume 2*, by Max Bauer. Several of his observations were found nowhere else. Collectors of antique jewelry may be surprised to learn that as late as 1904 hessonite gems were "usually mounted upon a burnished foil, rarely set *`a jour*". It was not until the close of the eighteenth century that this gem was identified as a garnet. Until then, it was believed to be zircon (hyacinth, jacinth). The gem gravels of Sri Lanka, especially those in the Matura district, are major sources of hessonite and zircon. The water-worn pebbles found there, some weighing as much as five pounds, yield the finest hessonite gem material. Hessonite's resemblance to zircon is uncanny and the confusion of the gems and the terms persists even today. [Such confusion with identification would seem more likely when confronted with spinel of similar color.] Both iron and manganese are constituents of hessonite. Differences in the amounts account for the variations in color from a rich reddish brown to orange to pinkish-orange to pale honey-yellow. Bauer states, "The color varies somewhat according to the distance at which the stone is held from the eye. It appears distinctly red only when held some distance away; close to the eye it often appears nearly pure yellow. Hessonite is also remarkable in that its color by lamp-light is considerably more brilliant and fiery than by day." Bauer also tells of gem quality pea-sized crystals of hessonite, each usually enclosing a grain of quartz, that are found in the Alp-Lolen near Grisons, Switzerland. He mentions that a locale in the Ala valley in Piedmont is the source of hessonite druses found in crevices of the serpentine formations. Dark green chlorite and pale green diopside are frequently associated with these druses. Brazil, Greece, and the Harts Range in Australia's Northern Territory produce gem quality hessonite.

The Greek word *esson*, meaning *inferior* or *less*, is the root for hessonite's name. In spite of the fiery brilliance of well-cut stones, yellow-brown gems were regarded as the least valuable of this material. At times, hessonite exhibits a highly vitreous luster that can incline to resinous, and an anomalous double refraction is known. Because its refractive index (1.74) is so close to that of methylene iodide, it becomes almost invisible when immersed in the fluid. The diagnostic "treacly" appearance of the interior of the crystals has been described as: "scotch in water", "heat waves over hot pavement", "roiled", "sugar candy", "syrupy", "swirled", and "granular." The specific gravity of hessonite ranges from 3.6 to 3.7, and it fuses easily to a greenish glass. Though the iron content is minimal, a slight reaction to a magnet can be present.

The large size of some crystals and a hardness of 6.0 permit the economic use of this gemstone for carvings, engraved cameos, and intaglios. The collection in the American Museum of Natural History includes a 61.5 carat cameo head of Christ.

New Mexico Faceters Guild Website

The New Mexico Faceters Guild has a website that may be accessed at: www.attawaygems.com/NMFG. The site contains many interesting articles written by Guild members, informative reports on some of our noted guest speakers, and gemological articles composed by Guild Gemologist, Edna Anthony.

Facet Designer's Workshop

By Ernie Hawes

Dylan Houtman is a talented lapidary artist, as the pictures of some of his work in our last newsletter easily prove. Dylan is also a skilled facetor who has an interest in cutting small stones. At the first workshop held at Steve and Nancy Attaway's, Dylan showed us a couple of rather small, light colored garnets that he had cut in an interesting oval pattern of his own creation. Dylan had sketched the design on paper and listed the cutting instructions. I was amazed at the complexity of the design in light of the small size of the stones Dylan had cut. There are 93 facets, including 16 girdle facets in this design. Neither of the gems Dylan showed us was over about 7 mm in length, if that. While not a particularly difficult design to cut in larger material, Dylan obviously had to have a quick and light touch in order to accomplish this design in such small gems. Dylan has yet to work in GemCad, so I entered his design in the computer for him. More into cutting than naming designs, Dylan agreed to simply calling his new pattern, ***Houtman's Oval***.

Our second design is a new shield pattern created by Nancy Attaway. We have not published many shield designs, so this new design of Nancy's is a really welcome addition to our design collection. Here are Nancy's comments.

"The ***Flared Shield*** evolved in this manner. I dopped many stones this fall in preparation for two gem shows, and Steve dopped a few for me as well. One piece of rough that he dopped for me was an odd-shaped aquamarine that resembled an isosceles triangle, having two long sides and one short side. The rough showed a very narrow profile. I did not really want to render a regular kind of triangle, so I began with doing facets at 90 degrees by flaring the long sides outward some. The shape resulted in a neat triangular shield, and I carried the design from the girdle facets to the pavilion. The pavilion facets are a simple arrangement, and the crown uses step cuts. The result was a very sparkling aquamarine. I did the same design for a piece of peridot that was as odd-shaped as the aquamarine had been. As I look at this design and others that I have done recently, I think that I am searching for some way to combine an antique appearance with a modern look, melding the old with the new."

As most of us know, the shield is one of the less common design shapes. Only 52 shield designs are in the current DataVue2 database or just over one percent of all the designs published. While the shield shape can stand well on its own in a piece of jewelry, it is also very useful when cut in small pairs to be set as side stones in a ring or brooch. Used this way, the side stones do not need to be the very small melee sizes so often seen as either rounds or baguettes. Nancy Attaway was not planning for side stones when she came up with her newest design, but it is worth mentioning as you consider cutting this very attractive pattern. Imagine two matching shields for dangle earrings.

NMFG FACETING WORKSHOP JANUARY 12, 2002

The next faceting workshop is scheduled for **Saturday, January 12** from 9:00 am to 4:00 pm at the home of **Scott Wilson** in **Corrales.** A detailed map will be provided at the next Guild meeting on Thursday, January 10. At the request of several members, the first portion of the workshop will be devoted to a discussion of selecting and buying rough. Ernie will cover the orientation of rough for cutting. Some hands-on practice will also be available to help hone your skills in identifying gem material that is truly worth your time and money to buy and cut. This should be very helpful to those members headed to Tucson in February. The rest of the day will be spent in faceting instruction and practice. As usual, there will be a $5 fee per person to cover the cost of pizza, beverages, and to help pay for materials and handouts. Any treats brought for the morning will certainly be appreciated. Thank you very much. See you there.

E-Mail Addresses

FireScope Used for Re-Cutting Diamonds

Source: JCK Monday on the Net 12/10/01

Richard von Sternberg, President of EightStar Diamond Company in Santa Rosa, California, proved that even the most beautiful diamond cut by conventional methods can benefit from his company's scientific approach to diamond cutting. He paid in excess of $1 million for a 14.89-carat D-color, internally flawless diamond with a very good polish and excellent symmetry, according to GIA's Diamond Grading Report. Then, he re-cut the stone. The result was the "American Star", a D-color, internally flawless, 13.41-carat EightStar round brilliant with excellent polish and symmetry and a 57% table, according to another GIA report. To re-cut the stone, a device called a FireScope was used that showed the cutters where to place every facet to eliminate light leakage and maximize brilliance and fire. EightStar Diamond Company claims to cut every diamond for maximum light performance with specially-designed equipment to render an intense study of the crystal's growth pattern. The project took ten months of preparation, but the actual re-cutting took only six weeks. For more information, call 707-939-7960 or e-mail: eightstar@aol.com