The New Mexico Faceters Guild

May/June 2003

The Official Newsletter of the New Mexico Faceters Guild

NMFG

Show and Tell

The picture on the left shows an amethyst faceted in the Apollo Cut design, a cushion cut triangle with cut corners, faceted by Aurelia Stone. Aurelia cut the gem from start to finish at the faceters workshop in June. This marks her third gemstone that she has faceted.

The picture on the right shows a large step cut citrine faceted by Guild President Scott Wilson. Scott cut the gem during his faceting demonstration at the Albuquerque Show last

The picture on the left shows three synthetic corundum color-change alexandrites faceted by Dylan Houtman.

On the Cover: A large faceted tablet in Bolivian amethyst cut by Nancy Attaway that measures 26.5 x 18.5mm and weighs 23.73 carats. Lilac flowers from the lilac bushes at the Attaway home are shown in the background.

The

New Mexico Faceters Guild

Guild Officers 2002-2003

President: Scott Wilson

Vice President/Programs: Paul Hlava

Secretary/Treasurer: Ina Swantner

Guild Gemologist: Edna Anthony

Guild Mineralogist: Paul Hlava

Workshop Chairman: Ernie Hawes

Newsletter Editors:

Nancy & Steve Attaway

Newsletter Production:

Wild Rice Press
P.O. Box 1355
Cedar Crest, NM 87008
(505) 286-2094

Purpose of the Guild: The purpose of the New Mexico Faceters Guild is to bring together persons who are interested in faceting or faceted stones. We promote the art and science of faceting and provide a means of education and improvement in faceting skills. Finally, we provide a means of communication between those persons involved in or interested in faceting as a hobby.

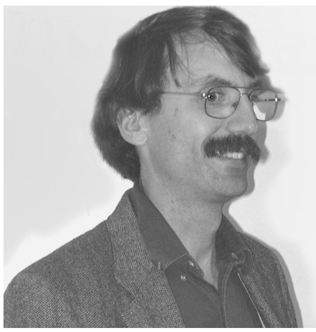
Guild Membership: Dues are $20.00 per calendar year (January through December) for newsletter issues sent by e-mail. Hard copies of newsletter issues sent by US mail are $30. Please see the membership application / renewal form on the last page of the newsletter.

Meetings are held the second Thursday of oddnumbered months at 7:00 p.m. at the New Mexico Museum of Natural History, 1801 Mountain Road N.W., Albuquerque, NM. Workshops are generally held in even-numbered months. Date, time, and place are given in newsletter. Also, any change in guild meeting times or dates will be listed in the newsletter.

The next meeting of the New Mexico Faceters Guild will be July 10, 2003.

The New Mexico Facetor

Volume 23, No. 3, May/June, 2003



NMFG President Scott Wilson

In This Issue:

The Prez Sez:

by Scott R. Wilson, Ph.D

American Gem Prospects

I recently had the pleasure of spending a week in Nevada, prospecting pegmatites for gem materials or whatever else could be found that was interesting. During transit from one locality to another, I got the opportunity to chat with a geophysics expert and dig in his pile of journals from various professional societies that dealt with geophysics and mineral exploration.

One of the journals had a complete breakdown of the expenditures made on mineral exploration, including gems, in the US. One particular analysis showed that the expenditures in the year 2002 for US mineral exploration were around 20% of the expenditures in 1997 for the same purpose. So, there has been an 80% fall in development of new mineral and gem resources in five years. That sounds bad, and it really is.

For gems specifically, there may be a hidden hope, though. The exploration expenditures are dominated by a few large firms who spend large sums looking for big gold, copper, silver, and diamond resources.

It appears that there are numerous, much smaller firms (and individuals) who are finding and developing new gem deposits, in spite of the massive regulations and costs laid upon them for that effort. Among the more exciting examples listed was a new precious opal locality being developed in the Snake River area of Idaho. I also heard of new sources of jade, dumortierite, quartz, and sapphires, all from Nevada.

It just may be that the lack of funding to search out large economic mineral deposits is refocusing the search into niche markets, namely gems, as a way to get some work in the door. We may be seeing the fruits of those efforts in the near future in the form of new American gem materials appearing on the market. That would certainly be a real treat for American faceters!

By the way, I did not find anything of particular gem value during my travels. I did truly enjoy the educational aspect of studying the geology and mineralogy of some quiet, windswept, and seemingly forgotten places in Nevada. Sore feet aside, it was a real treat, and I would do it again in a flash. I will be keeping my eyes wide open here in New Mexico, too. Many gem materials occur here. We just have to find them.

Minutes of the NMFG Meeting

May 8, 2003

by Nancy L. Attaway

President Scott Wilson called the meeting to order at 7:05 p.m. and welcomed all members and guests.

Old Business

President Scott Wilson reported that the Guild workshop held at his home on April 19 was a particularly good one. The stone-setting video was well received, and faceters enjoyed their time cutting stones.

Vice-President Paul Hlava declared the Albuquerque Gem**,** Jewelry, and Mineral Show, held March 21, 22, and 23 at the Fairgrounds in Albuquerque, a big success. Paul will serve as next year's show chairman.

President Scott Wilson said that many people gathered around the faceting demonstration table at the Albuquerque Gem and Mineral Club's show. The Guild signed new members from the handouts given at the show. One joined and even attended the last workshop. Scott thanked **Dylan Houtman** and **Pat Kirkpatrick** for helping him demonstrate faceting at the show.

New Business

Scott Wilson said that the next Guild workshop will be at the home of Steve and Nancy Attaway on June 14. Nancy Attaway will discuss cutting three faceting diagrams, the "Apollo Cut" triangle, the "Flasher Cut" twelve-sided round, and the "Square Barion".

Many of the barion designs have a very deep pavilion, but the pavilion for the "Square Barion" design is not that deep. The deeper the pavilion, the higher the stone needs to be set in the mounting. Stones with deep pavilions can sometimes pose setting problems. The three designs that Nancy selected for faceters to learn are easy to cut and easy to set in jewelry mountings.

The Guild Library is now at the home of Scott Wilson in Corrales. Ask Scott about checking out any books. The library is also available during workshops.

Ernie Hawes said that he has an Ultra Tec faceting machine with 52 dops, 4 index wheels, and 15 laps for sale. The machine has been redone and upgraded.

Steve Attaway reported that Nancy and he received a great tour of Rio Grande, given by Eddie Bell, through the American Society of Mechanical Engineers and the Society of Manufacturing Engineers. Another such tour may be available for Guild members.

Show and Tell

The Show and Tell Case tonight held many faceted stones and jewelry rendered by Guild members. **Moderator, Steve Attaway** used video and television equipment from Paul Hlava, Ernie Hawes, and the museum to better show the individual pieces.

Dylan Houtman displayed three color-change synthetic corundum alexandrites, two rounds and one cushion-cut triangle cut in his "Brilliant Tri" design. The gems ranged from a reddish-purple to a blueish-purple. He polished the stones on a ceramic lap with 50K diamond. Dylan faceted three Colombian emeralds, two emerald cuts and one round. He also showed a large red spinel crystal that he plans to facet soon.

Scott Wilson displayed an emerald cut citrine with cut corners and a deep pavilion. He cut the stone when he demonstrated faceting at the Albuquerque Gem and Mineral Club's Show in late March. He cut step facets both pavilion and crown to keep the design simple, while he discussed faceting and answered questions.

Paul Hlava showed his son-in-law's wedding ring, composed of 95% platinum and 5% ruthenium. Ruthenium is a grain refiner. When mixed with platinum, ruthenium makes the grain size small and allows platinum to be machinable on a lathe for cutting the outside surface. Ruthenium increases the melting temperature of platinum so platinum can be milled.

Nancy Attaway displayed a large amethyst tablet that resembled the shape of a church window. Steve will carve in reverse intaglio an angel in the back. She also showed a matched pair of large pearshape peridots from Pakistan that she cut, set in 14Kt. gold earrings.

Steve Attaway displayed a magnificent 70-carat pearshape black opal from Lightning Ridge that he carved. The huge gem exhibited deep blue and green tones. Steve and Nancy also showed a gorgeous, large chunk of fine quality rose quartz from Madagascar that they plan to carve and facet, along with a big chunk of golden citrine and a large piece of green-gold quartz.

Steve showed the 14Kt. gold ring that he designed in CAD, cast, and channel-set five princess-cut Yogo sapphires. He had rendered another one for a customer in platinum set with five princess-cut diamonds.

Refreshments

Elaine and **Marcus Price, Scott Wilson,** and **Nancy Attaway** brought refreshments to the May meeting, plus gourmet coffee. Thank you all very much. **Linda Vanya** and **Phil Callow** volunteered to bring refreshments to the meeting in July.

Future Programs

Vice-President/Programs Paul Hlava has arranged a talk that will address faceting problems. Paul asked **Nancy Attaway** to list several problems faceters may encounter during cutting and how to correct them. Nancy will discuss some real world problems that she encountered in faceting and how she addressed them. She will also explain how she recently re-cut the pavilion of a 10-carat tanzanite cushion-cut triangle to give the gem a lot of sparkle without removing much carat weight. Steve Attaway will also add to the faceting advice. Please feel free to ask questions.

Program Speaker

by Nancy L. Attaway

Paul Hlava presented his talk, "What's Hot and What's Not" in gemstones. Paul discussed the causes of color in gemstones from radiation-induced effects. Paul stated that radiation is normal, as it is found in nature. He said that radiation is found in potassium in the human body and in feldspar in granite. Radiation is beneficial in small doses but harmful in large doses. It is used to treat fast-growing cancer cells, where the radiation is aimed in three directions at the cancer site.

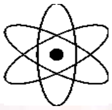
Here is Paul's talk as presented to the Guild

.

Will Moats, an accomplished facetor, shown here at the Guild meeting in May.

Facetor, Aurelia Stone, shown here at the faceters workshop in June.

Causes of Colors in Gemstones: Radiation Induced Effects




Paul F. Hlava
Sandia National Laboratories
Albuquerque, New Mexico

Purpose/Goals/Outline

- Define Gem, Jewel, and Gemstone
- Discuss Beauty in Gemstones
- Radiation Induced Beauty
- Discuss Light and Perception of Color
- Mechanism Involved - Color Centers
- Examples
- Commonly Irradiated Gem Materials
- Dangers?
- Recent Events



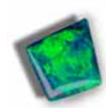

Definition - Gem

- Webster's -"An outstanding example of its kind." [A little gem of a book.] 
- A pearl or mineral that has been cut and polished for use as an ornament. 
- A beloved or highly prized person.
- A type of muffin or donut.



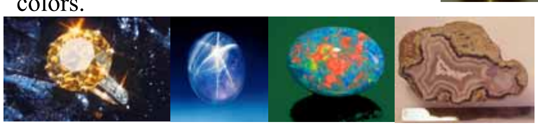

Definition - Jewel

- An ornament of dress, usually made of a precious metal, and having enamel or precious stones as part of its design.
- A gem or precious stone.
- A bearing for a pivot in a watch, made from a crystal or precious stone such as ruby.


Definition - Gemstone

- A naturally occurring material that is desirable for its beauty, valuable for its rarity, and sufficiently durable to give lasting pleasure.
- The beauty can be due to sparkle, luster, color, clarity, patterning, or phenomena such as iridescence, stars, and play of colors.

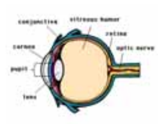
Radiation Induced/Enhanced Beauty/Ugliness

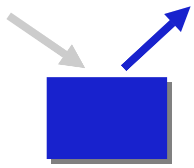
- " **Enhancement** is defined as any process other than cutting and polishing that improves the appearance, durability, and/or availability of a gemstone."
- (Ionizing or strong) Radiation can be used to enhance gemstones by inducing COLOR or altering the original COLOR.
- The Radiation may be NATURAL or man-made.
- Sometimes Radiation induces undesirable COLORS.
- Heat is often used to remove undesirable colors , modify desired colors , or change from one desired color to another.




The Color We Perceive

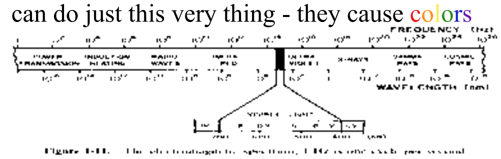
- Consequence of three factors
  - Spectrum of light source
  - Response of the object viewed
  - Response of our eyes





What Causes Color?

- Light is a form of (electromagnetic) ENERGY
- White Light is a balanced mixture of certain energies (colors)
- If something absorbs part of this energy, we see the colors that are left behind
- Electrons in the atomic shells of some elements can do just this very thing - they cause colors

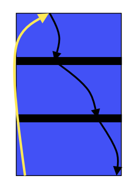


Color Centers

- In order for electrons to cause colors, they have to be unpaired
  - Radiation can remove electrons or atoms from some gem crystal structures
  - Electrons fill the atom hole
  - Electrons left behind are unpaired - excitable
  - They absorb some light energies and jump up into excited states
  - The unabsorbed energies produce the color we see

Transitions Up & Down

- **Excitable electrons**
  - can only absorb specific energy bands
  - move into favorable sites.
- **Some sites are "forbidden" .**
- **Absorption isn't canceled out**
  - relaxation of the electrons
  - paths back have smaller steps.



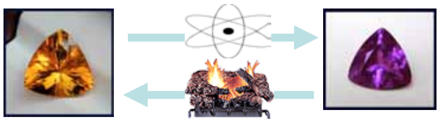
Smoky Quartz - Color Center

Color Centers

Smoky Quartz
Al, -lose O electron, other O electron
Amethyst
Fe^{3+}, -Fe^{4+}, ChrgTnsfr O^{2-} to Fe^{4+} , other O electron
Green Diamond
-C loss, unpaired electrons in C's next to hole
Blue Topaz (and Brown)
2 different, unknown processes - brown unstable
Maxixe Beryl
$(CO_3)^{2-}$, - $(CO_3)^{-}$, unpaired electron left behind
Amazonite
Pb^{2-} , - Pb^{3-}, $(OH)^{-}$ has to be present

Amethyst

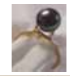
Fe^{3+} ions substitute for Si^{4+} in structure (produces yellow color)
radiation further ionizes Fe^{3+} to Fe^{4+} (unstable),
an O^{2-} ion gives one of its electrons to the Fe^{4+} changing it back to stable Fe^{3+}, other O electron is unpaired, stone now purple



Heat can relax the system and turn the stone back to yellow
This is completely reversible.
BTW - almost all citrine on the market is heat treated amethyst

Pearls

Radiation tends to make white pearls peach, gold, blue, purple, and/or gray to black

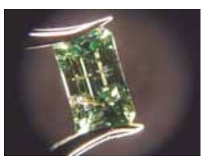



?

Diamonds

Yellow, orange, pink, hot pink, red, teal, green, blue, etc.




Zircon

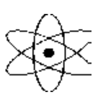
Sometimes the color due to natural irradiation is not desirable

As mined

Heat treated

What kind of Radiation?

- ***OK! Strong (ionizing) radiation causes the changes needed for color centers.***
- ***Which ones are used?***
- **Nature uses all**
- **We use beta rays, gamma rays, and neutrons**
- ***Why?***
- **Penetration and different rays for different effects/materials**




Any Dangers?

- Mostly NO
- Only neutrons cause gems to get hot
- Government checks imports
- US people are careful
- Problems early on with blue topaz
- More recently with cat's eyes


(Don't wear naturally radioactive stones)

Recent - Post Office Irradiation

- Plans to irradiate mail to kill anthrax
- Some gemstones at risk
  - pearls
  - kunzites
  - sapphires
  - quartz
  - tourmalines
  - others

That's All Folks!

- You may now applaud

- I'll be happy to answer questions during the panel session to begin shortly

From left to right: Ernie Hawes, Scott Wilson in the hat, Carsten Brandt behind Scott, Kevin Schwebel, and Elaine Weisman, all hard at work at the faceters workshop in June.

Faceters Guild Workshop

by Nancy L. Attaway

The New Mexico Faceters Guild held a faceters workshop on June 14 at the home of **Steve** and **Nancy Attaway** in the East Mountains. The workshop began at 9:00am and continued until 4:00pm, with a hour's break for lunch. **Moderator Ernie Hawes** was assisted by **Scott Wilson**, **Steve Attaway,** and **Nancy Attaway.**

Ernie Hawes began the morning session by describing some new items pertaining to faceting. First, he showed some laps made by Ameritool. These included a master lap made of a hard plastic/nylon composite that had been trued on a lathe and several bonded paste-on laps of different cutting grits. Ernie remarked that these new laps compared well with Nubond laps, as the Nubond laps glaze with time.

Second, Ernie showed a new lap, a Red Wing, the same manufacturers who make the Batt lap. The Red Wing is a copper lap with an outer circle for pre-polishing and a Batt lap inner circle for polishing. It allows a facetor more ease to go from pre-polish to polish.

Third, Ernie mentioned that he attended the faceters symposium in Ventura, California held in early June. He said that he enjoyed the proceedings, and he commented on the fine quality of the talks. There, Ernie was able to link noted faceting names with faces.

Fourth, Ernie showed several books on faceting and faceting diagrams. Facetor, Bob Johnson of San Marcos, California had two books of faceting diagrams published, and the faceters guild of Greensboro, North Carolina had a calendar with faceting diagrams published. Noted facetor, Ewing (Wing) Evans of Texas, who has won first place in the international faceting challenge for the last three years, now has a book on faceting tips with faceting diagrams. Ernie also showed a bottle of aluminum in 3/10 micron size in suspension, sold by Walker Gem Services. A bit of this liquid is rubbed on a polishing lap in addition to diamond.

Steve Attaway spoke about the new perforated laps for polishing large flat surfaces. Lew Wackler of Boulder, Colorado, widely regarded as the father of American gem carving, informed Steve of these laps and remarked on how quickly they polished large flat facets. Manufactured by Universal Photonics, these laps were originally designed for polishing computer wafers. Used with cerium oxide, they polish quartz. Steve said that he pasted one onto an old cerium oxide dyna lap. It polished fast a large flat on an ametrine.

Nancy Attaway wanted faceters to learn three cuts this summer that she hoped they would enjoy as much as she has. These included the "Apollo Cut" triangle, the "Flasher Cut" twelve-sided round, and the "Square Barion". These diagrams are fairly simple to render, and each faceting design allows the facetor to cut a sparkling gem. Printed copies of the three designs were given to those who attended the workshop. Copies will be provided for those who missed the workshop.

Nancy explained the "Apollo Cut" as a faceting diagram that promoted a lot of sparkle through its efficient placement of facets. Paul Smith designed this simple triangular design some years ago, and he based it on the light returning power of the standard retro reflector. The Apollo Cut was the diagram chosen by most of the faceters who attended the workshop.

Nancy then discussed the "Flasher Cut". The "Flasher Cut" is a twelve-sided round that was a variation of a design originally developed some years ago by Reg Thompson called "The Spectrabril". Nancy said that the Flasher Cut's pavilion facet arrangement resembled a flower petal design. She also remarked that what was divisible by three promotes a lot of sparkle. The "Standard Round Brilliant" is an eight-sided round, and the "Portuguese Cut" is a sixteen-sided round. Neither are divisible by three. A twelve-sided round and a nine-sided round show more sparkle.

Nancy finished by talking about the "Square Barion" design. She remarked that the barion designs incorporated different sets of complicated facet arrangements, but that the "Square Barion" design was not that difficult to render. She also said that barion designs usually have very deep pavilions that make the stones harder to set. The pavilion of the "Square Barion" is not that deep, making it easier to set.

Steve Attaway remarked that "Flasher Cut" rounds set easy in six-prong heads, as its facet arrangement corresponds well to six prongs. Because of this facet arrangement, the "Standard Round Brilliant" sets better in a four-prong head. Nancy remarked that the "Apollo Cut" triangular diagram used cut corners in its design, enabling jewelers to set such stones easier in jewelry than triangles with points. Likewise, the "Square Barion" used cut corners in its design that made setting such stones easier. Those points make a gem fragile and vulnerable to breaking or chipping when being set.

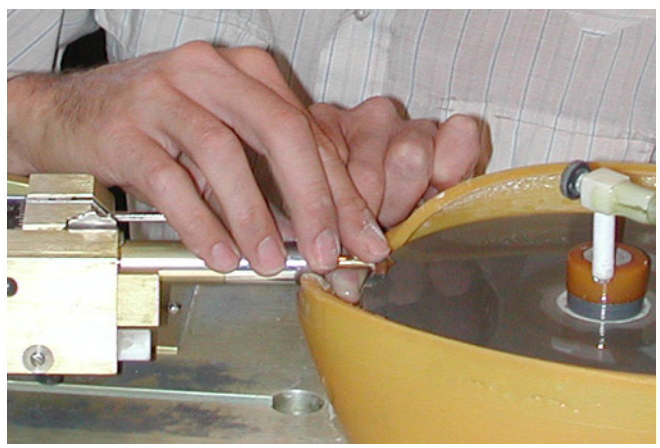
Faceters began cutting their stones during mid morning and continued until the lunch break. Pizza was bought for lunch. **Elaine Weisman** baked cupcakes. **Doug Stone** and his daughter, **Aurelia** brought doughnuts. **Scott Wilson** brought chips and salsa, and he made his special tomato/red onion/fresh basil salad with his secret "magic" dressing. **Nancy Attaway** baked a pineapple upsidedown cake. Iced tea and coffee were served. Thank you all for the goodies.

Faceters continued cutting gemstones during the afternoon session. **Elaine Weisman, Linda Vanya,** and **Doug Stone** all faceted citrines in the "Apollo Cut" and did quite well at it. **Aurelia Stone** faceted an amethyst in the "Apollo Cut" and finished it by the end of the day. **Scott Wilson** also took his turn faceting a citrine. **Carsten Brandt** faceted a stone we hope to see at the next meeting. **Dylan Houtman** finished polishing a small, absolutely lovely pink sapphire emerald cut.

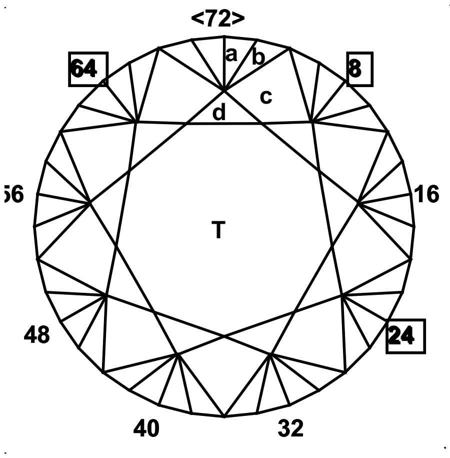
Thanks to all who participated in the Guild workshop. The next faceters workshop will be held August 23 at the home of Steve and Nancy Attaway.

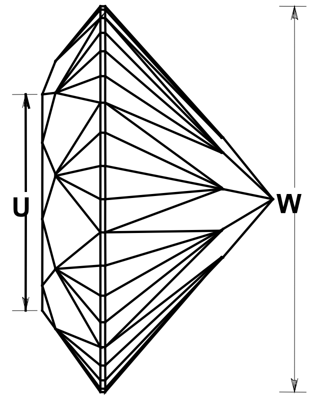
Scott Wilson and Kevin Schwebel cutting gems at the faceters workshop in June.

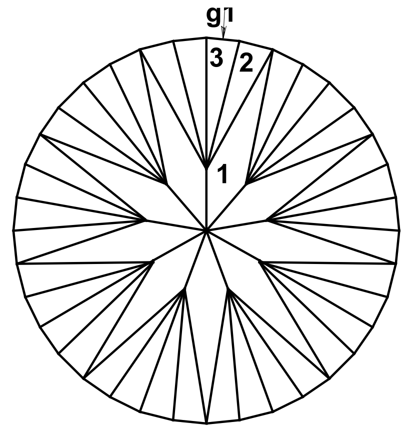
Dylan Houtman cutting a stone at the faceters workshop in June.

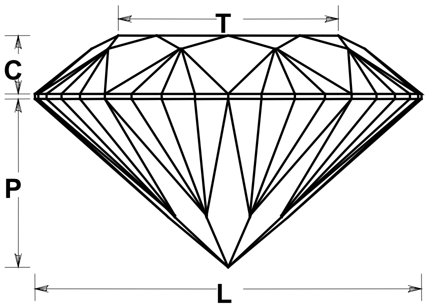


Scott Wilson demonstrates the proper way to hold a dopped stone and address it to the lap while cutting the girdle.





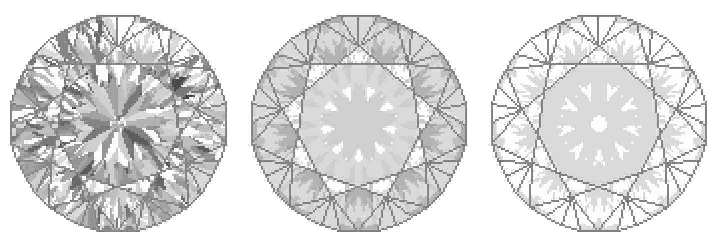




Cloud Nine II

By Ernie Hawes

Angles for R.I. = 1.760
100 + 36 girdles = 136 facets
9-fold, mirror-image symmetry
72 index
L/W = 1.000 T/W = 0.573 U/W = 0.564
P/W = 0.435 C/W = 0.152
Vol./W³ = 0.205
Average Brightness: COS = 85.8 %   ISO = 94.0 %



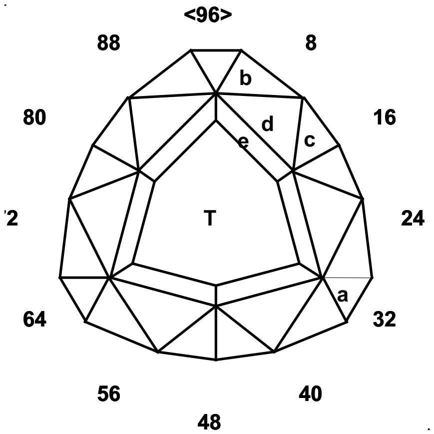
PAVILION

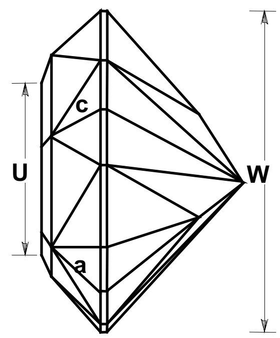
g1	90.00°	(36 total) Use index settings for both steps 2 & 3
1	41.00°	04-12-20-28-36-44-52-60-68
2	41.50°	03-05-11-13-19-21-27-29-35-37-43-45-51-53-59-61-67-69
3	41.90°	01-07-09-15-17-23-25-31-33-39-41-47-49-55-57-63-65-71

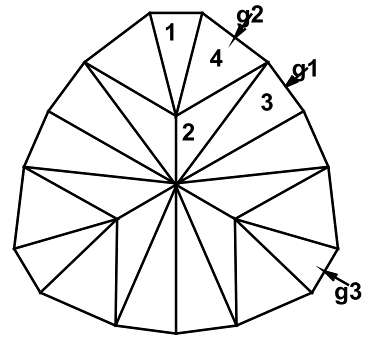
CROWN

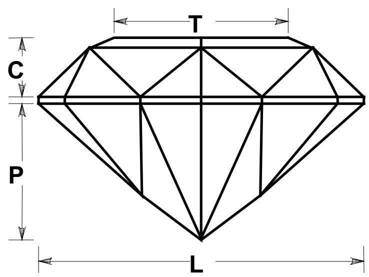
a	40.10°	01-07-09-15-17-23-25-31-33-39-41-47-49-55-57-63-65-71
b	38.00°	03-05-11-13-19-21-27-29-35-37-43-45-51-53-59-61-67-69
c	36.00°	04-12-20-28-36-44-52-60-68
d	21.70°	72-08-16-24-32-40-48-56-64
T	00.00°	Table

Note: The original design was a contest drawing without angles and index settings which I created in 1987. Angles and index settings were worked out by Louis Natonek, who thus was credited with the design and gave it it's name. Louie decided to use RI 2.15 for CZ. I lengthened the pavilion girdle facets by making them steeper and changed the angles to fit RI 1.76.





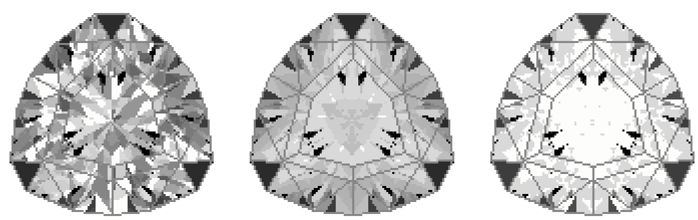




Himalaya Triangle

By Ernie Hawes

Angles for R.I. = 1.620
49 + 15 girdles = 64 facets
3-fold, mirror-image symmetry
96 index
L/W = 1.012 T/W = 0.537 U/W = 0.537
P/W = 0.424 C/W = 0.182
Vol./W³ = 0.213
Average Brightness: COS = 70.2 %   ISO = 84.8 %



PAVILION

1	41.70°	96-32-64
2	42.00°	12-20-44-52-76-84
3	42.80°	14-18-46-50-78-82
4	43.26°	10-22-42-54-74-86
g1	90.00°	14-18-46-50-78-82
g2	90.00°	10-22-42-54-74-86
g3	90.00°	96-32-64

CROWN

a	47.95°	96-32-64
b	43.80°	10-22-42-54-74-86
c	42.25°	14-18-46-50-78-82
d	39.00°	12-20-44-52-76-84
e	23.75°	12-20-44-52-76-84 Cut so e is approximtely 25% of total crown height
T	0.00°	Table

In the News

Australian Ruby

Source: Colored Stone May/June 2003

Cluff Resources of Australia has joined with Manning International of New York to mine ruby in Australia. Besides development, Manning's role is also to cut and market the ruby from Australia. Manning was very impressed with the mining potential. The deposit produces pink rubies in a color range that compares well to ruby from Vietnam. Mine reports estimate a possible 22 million carats of ruby, but sizes tend to be small.

Tanzanian Ruby

Source: Colored Stone May/June 2003

A mine in the province of Rukwa in the southern highlands of Tanzania now yields high quality ruby. The miners in the region are comparing their Tanzanian ruby favorably to Burmese ruby material. Most of the ruby is unearthed at Naende near the village of Chala, about 45 kilometers north of Sumbawanga, the capital of Rukwa. The mining area is quite large. The Naende mining area alone is estimated to be 10 square kilometers. Some sapphire is also being found with the ruby.

"Additive Free" Sapphires from Montana

Source: Colored Stone May/June 2003

Fine Gems International, the company that acquired a stockpile of Montana sapphires rumored to be in the millions of carats, currently markets their sapphires as "additive free". The company guarantees that all of its sapphire is "heated without the use of controversial additives". Robert Kane, President of Fine Gems, says that this sets sapphires from Fine Gems apart from the beryllium sapphire diffusion controversy. All of the heat-treatment of Fine Gems' sapphires was done with on site ovens set up by Dr. John Emmett and Troy Douthit of Crystal Chemistry. No additives were used in the heat-treatment. The entire inventory has been controlled since it was mined.

Gemstone Photomicrography

Source: Gems and Gemology Spring 2003

This latest issue features excellent photomicrographs and provides explanations of the methods used.

Huge Geode of Gypsum Crystals Found

Source: http://earthfiles.com June 30, 2003

The largest geode of gypsum, hydrous calcium sulfate crystals on record were discovered in an old Spanish silver mine near Almeria, Spain on the Mediterranean Sea. The geode measured 8 meters long, 1.8 meters wide, and 1.7 meters high; 26x6x6 feet. Geologist, Javier Garcia-Guinea said that the crystals were absolutely transparent and perfect, so clean that text could be read through them.

Symposium in Salida, Colorado

Source: D & J Rare Gems, Ltd.

Award-winning gemcutter, John Rhoads and his wife, Donna organized a gem and mineral symposium in Salida, Colorado for August 7, 8, 9, and 10. Salida is at an elevation of 7,000 feet, the Tail Gate Show sets at an elevation of 8,000 feet near Buena Vista, and the peridot collection site lies at an elevation of 9,600 feet. Lunch with beverages will be provided for all four days, and a barbecue dinner is planned for August 9. Speakers are also scheduled. The cost is $114 per person, and t-shirts will be available. Please contact John Rhoads at: raregems@amigo.net for more information.

24th Annual N.M. Mineral Symposium

The New Mexico Institute of Mining and Technology in Socorro, New Mexico will host its 24th annual New Mexico Mineral Symposium during November 8 and 9 at the Macey Center on campus. General registration is $25 per person and $16 per person for the dinner on Saturday. The symposium always features very interesting speakers from New Mexico and Colorado.

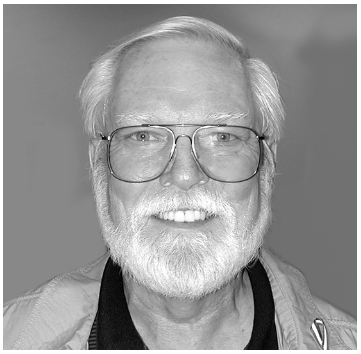
Montana Green Sapphires Are Evergreen

Source: Professional Jeweler July, 2003

Reports stated that demand for Montana sapphire steadily increased during the second half of 2002 and into early 2003. Much of the demand for U.S sapphire was in response to and against the bulk diffusion enhancement problem affecting the sapphire producers in Thailand. Robert Kane of Fine Gems International in Helena, Montana said that the supply of true green Montana sapphire, now marketed under the trade name "evergreen", is proving scarcer than originally believed. As a result, prices for the green sapphire have climbed to nearly that of Montana blue sapphire.

Facet Designer's Workshop

By Ernie Hawes



Designs Revisited and Lost Opportunities

Back in 1987, I ran a contest within the New Mexico Faceters Guild to see who could calculate angles and index settings for a particular design plan/view drawing that I had created. Whoever could translate some workable angles and settings could name the design and take credit for it. This was all done before GemCad was available, so figuring out this problem was not a simple task. One of the co-founders of the New Mexico Faceters Guild, Louis Natonek, accepted the challenge and calculated the index settings and angles for cubic zirconia. Louie proved the design by cutting it in a beautiful stone, of which I am pleased to be the owner. Consequently, Louie named the design ***Cloud Nine,*** and we published it in the August, 1987 issue of ***The New Mexico Facetor***. (Louie also solved a second design problem that he called ***Twelfth Night***, published in the July, 1988 issue.)

Recently, I took a another look at the ***Cloud Nine*** design. With the help of GemCad, which Louie did not have, I derived a modification suitable for corundum. I decided that I wanted steeper pavilion girdles, as I thought that aspect would increase scintillation and, hopefully, improve the overall appearance of the design. If you cut both versions, I think that you will see I was correct. With the help of GemCad and its associated programs, I was fortunate to be able to improve upon what was already a beautiful faceting design. I have named the revised design ***Cloud Nine II.*** There are a lot of facets in this design, thirty-two in the girdle alone. Obviously, it will work best in stones twelve *mm* in diameter or larger.

Our second design for this issue resulted from a lost opportunity that I had while at the Faceters Symposium sponsored by the Faceters' Guild of Southern California. The event was held at the fairgrounds in Ventura, California, in conjunction with the California Federation's annual show. One of the dealers there displayed a plate filled with an assortment of tourmaline rough that he had collected at the world-famous Himalaya mine. One piece stood out from the rest. It was an almost flawless, rose pink crystal section that weighed 19.5 carats. The price was right, but my budget was tight. I told the dealer that I would have to think about it. I went back twice, the third time having made up my mind to purchase it. Indecision has its price, and it is called regret. Another facetor also saw the stone and bought it before I returned for the third time. To inspire me to buy a nice piece of Himalaya tourmaline someday, I decided to create a design specifically for the stone I wanted. Now, when I am at shows or around gem rough dealers, I will be searching for that special piece of tourmaline rough. If the price is not too steep, I will not be indecisive, like I was in Ventura.

The design shape and name, ***Himalaya Triangle***, was chosen for obvious reasons. First of all, I have to find another really nice piece of Himalaya mine tourmaline to cut the design. Secondly, because really good Himalaya tourmaline is not cheap, I want to recover as much of the rough as possible, while cutting for the best color, usually found down the C axis. Of course, any tourmaline can be used, and I do not suggest that everyone look just for Himalaya mine rough. You do not even have to cut down the C axis. However, I would not cut this design in tourmaline that is too dark down the C axis. You will note that the corner facets are quite a bit darker than the rest of the stone, which is unfortunate. However, pointed corners are much more fragile, and any jeweler will tell you they are a pain to set. This compromise may save a lot of disappointment later, and, possibly, may not be too noticeable when partially covered by prongs in a jewelry setting. The overall brightness and scintillation is good. The design should yield a beautiful stone. It should also work well in other materials with a similar refractive index to tourmaline.

Next Faceters Workshop

The next faceters workshop is scheduled for August 23 at the home of Steve and Nancy Attaway.

LET'S TALK GEMSTONES

Edna B. Anthony, Gemologist

P.0. BOX # 49371
Colorado Springs Co 80949-9371,
eba@bwn.net

[INOSILICATES]

The Pyroxenes

The Enstatite-Orthoferrosilite Solid Solution Series

Enstatite

Enstatite [$MgSiO_3$] is the magnesium-rich end member of the magnesium-orthoferrosilite solid solution series. Pure magnesium silicate crystals are known to occur only in iron meteorites. Such pure meteoritic crystals are designated as **chladnite**. At a content of more than 12% orthoferrosilite, a change of the optic sign from positive (+) to negative (-) occurs as enstatite grades into bronzite, an intermediate member of the series. The orthorhombic, short prismatic, and frequently twinned enstatite crystals sometimes exhibit such twinning as lamellae. Exsolved calcium rich clinopyroxene lamellae are also frequently present.

Enstatite occurs in basic and ultra basic, as well as prograde metamorphic and regionally metamorphosed formations. Major sources of gem enstatite are Arizona, California, Germany, India, Kenya, Myanmar, Norway, South Africa, Sri Lanka, and Tanzania. Gemmy green crystals are produced in Kimberly, South Africa. The yellowish-green material from Mairimba Hill in Kenya exhibits a density of 3.23 and refractive indices that vary from 1.652 to 1.662, with the birefringence of 0.01.

Chatoyant enstatite and star gems of more than 50 carats are found in India, but crystals that yield faceted gemstones larger than 10 carats are rare. Quartz inclusions often mark the colorless crystals produced at Embilipitiya, Sri Lanka, from which gems as large as 20 carats can be cut. This material exhibits a specific gravity of 3.25, with refractive indices of 1.658-1.668, with the birefringence of 0.01. Refractive indices of 1.665-1.675, with a birefringence of 0.01 and a density of 3.23, are typical of the brown and green crystals from Ratnapura, Sri Lanka. Chatoyant material there is not uncommon.

In the *Color Encyclopedia of Gemstones*, Arem mentions deposits of an opaque altered enstatite called **bastite** used to fashion cabochons. The name originates from its chemical composition that includes barium, silicone, and titanium. Schumann refers to it in *Gemstones of the World* as "psuedomorphs of serpentine after bronzite with a silky sheen." The American Institute's *Glossary of Geology* states that this schiller occurs on the "chief cleavage face of the pyroxene," and it is often called schiller spar. Bastite deposits are located in the Harz Mountains in Germany and in Myanmar. Bastite has a lower specific gravity, 2.6, than is common in enstatite. The hardness of 3.5-4.0 renders such cabochons more delicate than usual.

Opaque to transparent enstatites occur in gray, colorless, yellow, green, and brown. Even in small sizes, the colors tend to be dark and lifeless in faceted gems. Dispersion is low to none. The luster is vitreous. A refractive index range of 1.663-1.673, with a birefringence of 0.01, is the norm. Pleochroism, as shown by Arem, is characteristic for the series:

a = pale red-brown/purplish/brown pink

b =pale/greenish brown/pale reddish yellow/pale brown-yellow

y = pale green/smoky green/green.

Strong lines are exhibited at 5060 and frequently at 5475 in the spectrum. The appearance of diffuse lines at several specific points throughout the spectrum may help to identify the origin of the material. This information appears in the *Color Encyclopedia of Gemstones.* The iron content masks fluorescence. Specific gravity can vary from 3.20 to 3.30. In *Gemstones of the World*, Walter Schumann states that the streak is white, the hardness is 5.5, and a "lamellar to scaly" fracture with one direction of perfect cleavage causes a slight brittleness. Although a slight roundness of thin edges may develop, it is almost infusible. This characteristic accounts for its name from the Greek word *enstates,* meaning resistor or opponent. Increases in the iron content facilitate fusing. Large clean enstatite gems over two carats are uncommon. Four-rayed stars are abundant and inexpensive. It is considered a collector gemstone for the difficulty in faceting, and its normally unattractive appearance limits its use in jewelry.

Bronzite

Bronzite [(Mg,Fe)SiO_3], usually greenish-brown, gets it name for the unusual golden vitreous to submetallic luster that sets it apart from other members of the enstatite-orthoferrosilite solid solution series. It always occurs in massive form, and the streak is white. Orthoferrosilite molecules make up from 10% to 30% of its chemical composition. This slightly greater iron content facilitates fusion to a slight degree. A specific gravity variation of 3.30-3.43 is a bit above that of enstatite. The refractive indices reach 1.703 from a low of 1.665, with a slightly increased birefringence of 0.015. Unlike enstatite, bronzite exhibits a biaxial negative characteristic. The dispersion is low to none. The pleochroism is common to all members of the series:

a = pale red-brown/purplish/brown pink

b = pale/greenish brown/pale reddish yellow/pale brown-yellow

y = pale green/smoky green/green.

The spectrum is typical with a strong line at 5060, sometimes one at 5475, and with diffuse lines possible elsewhere in the spectrum. Bronzite is recovered from serpentine deposits at Kraubat in Styria, Austria and in Mysore, India. Some material exhibits six-rayed stars. The hardness of 5-6 is low, but the unusual pearly submetallic luster makes bronzite cabochons striking gems for use in jewelry.

Hypersthene

Hypersthene [(Fe,Mg)SiO_3] exhibits an increase in the percentage of orthoferrosilite molecules in its chemical composition to a range of 30% to 50% of its make-up. With this greater iron content, fusion occurs more easily than with enstatite or bronzite. The other species of the series [ferrohypersthene, eulite, and orthoferrosilite] that contain even higher percentages of the orthoferrosilite molecules are not a factor in the gem trade. Hypersthene usually occurs in a cleavable granular leaf-like form. Crystals are almost always small, dark green, brown, or black, with a vitreous, pearly, or silky luster, and are seldom attractive. Bright clean gems between 5-10 carats are extremely rare. Arem mentions a 4.5-carat brown gem from Africa that is held in a private collection. The primary hypersthene gem material sources are in Mexico and Baja, California. Sites in Germany, Greenland, and Norway also produce the mineral. Crystals found in basic igneous formations called norites are sometimes designated as the norite variety or hypersthenite. The hypersthene density ranges from 3.43 to 3.90. A hardness of 6 is the norm. Refractive index readings from 1.686 to 1.772 of the biaxial gems exhibit a birefringence of 0.017 and are the highest of the series. The optic sign can change from negative to positive as the orthoferrosilite content increases. Dispersion is low or non-existent. Hypersthene exhibits the pleochroism common to all species of the series:

a = pale red-brown/purplish/brown pink

b = pale/greenish brown/pale reddish yellow/pale brown-yellow

y = pale green/smoky green/green.

A hardness of 6 is the norm. Goethite and flakes of hematite sometimes appear as inclusions in hypersthene crystals.

The Diopside-Hedenbergite Solid Solution Series

As the chemical composition of this series of the pyroxene group changes, and the replacement of magnesium by iron increases from **diopside** [$CaMgSi_2O_6$] to **hedenbergite** [$CaFeSi_2O_6$], higher properties of the intermediate members **salite** and **ferrosalite** reflect the increase of the iron content. Of these two intermediate members, only **jeffersonite**, a variety of ferrosalite, is of interest to gem enthusiasts. All members develop in the monoclinic crystal system. Frequently twinned, well-formed, short, stout prismatic crystals exhibit eight-sided or square cross-sections and are found in contact metamorphic formations. Columnar, lamellar, and granular massive forms also occur. Crystals exhibit a white streak, perfect cleavage in one direction, frequent parting, and a rough or conchoidal fracture. Fusion occurs at 4, forming a green glass. The species are insoluble in acids. Hardness can vary from 5.5 to 6.5. A vitreous luster is characteristic of all the members of the series.

Arem lists SW fluorescence colors to include an orange yellow, cream white, and blue while "mauve" may occur in LW. A peach phosphorescence may be exhibited in some specimens. Orlando Paddock and Malcolm Heuser in the *Gemology for the Jeweler* course work and Walter Schumann in *Gemstones of the World* state that "a strong dark violet" is apparent in both LW and SW. The intermediate members of the series and hedenbergite occur as dark and opaque crystals, so they are very rarely faceted as gemstones. Gray-green to black **salite** [$Ca(Mg,Fe)Si_2O_6$] contains a larger percentage of magnesium than iron. Its name is sometimes spelled *sahlite*. In thin flakes, it exhibits light-green/blue-green/yellow-green pleochroism.

Diopside

Diopside [$CaMgSi_2O_6$] is the magnesium-bearing end member of this series. A specific gravity range of 3.22-3.38 is the norm for diopside. Pleochroism is weak, if it exists. As shown by Arem, the following refractive indices can cause the birefringence to fall in the range of 0.024-0.031; a = 1.664 - 1.695 b = 1.672 - 1.701 y = 1.695 - 1.721.

Varieties of diopside with slight variations in chemical composition and properties occur. These, with their properties, are listed following the information specific to diopside. Diopside is found in a number of shades of green (from pale to dark blackish-green), brown (including yellowish and reddish-brown), colorless, white, gray, and purple. A blue diopside is very rare. Asterated and chatoyant materials, as well as dark green crystals, are produced in Nammakal, India. Sri Lanka is a source of pebbles that can be faceted. Chatoyant, yellow, and light green materials suitable for faceting are found in Myanmar (Burma). Popular star diopside originates in India. Gems of up to 20 carats can be cut from the less attractive dark green crystals from Madagascar. Some excellent, but generally small, green crystals occur in a deposit near Zillerthal, Austria.

Deposits of lovely transparent green crystals of exceptional length (some as much as several inches) occur near DeKalb, New York. Another source of green material is located in the United States near Georgetown, California. Various names indicating color or area of source have been applied to some diopsides. An area near Lake Baikal in Siberia is the source of *baikalite*, a second dark green diopside. The *Glossary of Geology* states that the translucent pale green and yellow crystals from Sweden were originally designated as *malacolite.* The light, fine green material produced at Ala, Piedmont, Italy is called *alalite*. Nearby, at St. Marcel, the violet variety, *violane,* can be found. The Glossary of Geology describes it as "a translucent, massive, fine-blue or bluish-violet variety of diopside." The *Manual of Mineralogy* attributes diopside's name to "two Greek words meaning *double* and *appearance*, because the vertical prism zone can apparently be oriented in two ways."

Chrome Diopside

The presence of chrome is the origin of the pure, intense green of chrome diopside. It exhibits a yellow/green pleochroism, and most of its properties range a bit higher than diopside. The density varies with the content of iron from 3.17 to 3.32. Arem lists the following refractive indices: a =1.668-1.674 b=1.680 y=1.698 - 1.702. Although some 10 to 15 carat faceted chrome diopsides are known to exist, gems greater than 3 to 4 carats in size are very rare. Sources in the former USSR, including Slyudyanka, now produce commercial quantities of excellent faceting material. Arem states that the chrome content is "about 0.5% by weight. Chrome diopside is found in Kenya, and the deposits in Outokummpu, Finland are noted for fine, intense green crystals.

Shefferite

This usually opaque variety of diopside is rich in manganese. When zinc appears in its chemical composition, it is designated as *zinc shefferite*. A specific gravity of 3.39 reflects its greater content of iron. In very thin sections, dark brown/light brown are the pleochroic colors revealed by the dichroscope. A density of 3.39 is the norm. A birefringence of 0.031 results from refractive indices readings of: a =1.676 b =1.683 y =1.705. Both shefferite and zinc shefferite are found in deposits in Franklin, New Jersey and Langban, Sweden.

Jeffersonite

Jeffersonite [$Ca(Mn,Zn,Fe)Si_2O_6$] is the manganese- and zinc-rich variety of intermediate member ferrosalite of the *diopside-hedenbergite* solid solution series. Like shefferite, **jeffersonite** occurs in deposits in Franklin, New Jersey and Langban, Sweden. Its refractive index readings of: *a* = 1.713 *b* =1.722 *y* = 1.745 give a birefringence of 0.032. It exhibits pleochroic colors of dark brown/light brown. Only in very thin specimens can these properties be observed, since the material is usually opaque. The greater iron content increases the specific gravity to 3.55. Jeffersonite is of little consequence as gem material except to collectors.

Hedenbergite

Hedenbergite [$CaFe^{2+}Si_2O_6$] is the very dark green or black, normally opaque, iron bearing end member of the series. Its pleochroism colors of light green/greenish-brown are difficult to ascertain except in extremely thin material. The density readings can vary from 3.50 to 3.56. Arem lists refractive indices as *a* =1.716-1.726 *b* =1.723-1.730 *y*=1.741-1.751, with a birefringence range of 0.025 to 0.029. Faceted hedenbergite is rare and is of interest only to collectors of unusual gems.

The Sodium Pyroxenes

Spodumene

Spodumene [$LiAlSi_2O_6$], a lithium ore in its cleavable massive form, crystallizes in the monoclinic system in frequently twinned prismatic and tabular habits. In some material, sodium may replace lithium in very small amounts. This relationship causes it to be classified with the sodium pyroxenes at times. Huge, non-gem, gray, and white crystals of spodumene, some up to forty feet in length, have been found at the Etta Mine in South Dakota. Alteration to any of several minerals, including microcline, is common. With the exception of **hiddenite**, gem crystals are often large, with deep vertical striations. A streak plate test produces a white residue. After ejecting fine tentacles, fusion to a clear glass takes place at 3.5. Spodumene is unaffected by acids. The presence of lithium in its chemical composition causes a crimson blowpipe flame. Parting and extremely pressure-sensitive planes of perfect cleavage make faceting a difficult process. Mohs hardness varies from 6.5 to 7.5. A specific gravity range of 3.0-3.20 is the norm, with 3.18 usual for gemstones. Spodumene exhibits a conchoidal fracture and a vitreous luster. It is biaxial (+) and a birefringence range of 0.014-0.027 is caused by refractive indices of *a* = 1.653-1.670 *b* = 1.660-1.669 *y* = 1.665-1.682.

The gray, colorless, light to deep yellow, pink, violet, blue, blue-green, or pale to deep green crystals occur almost exclusively in granitic lithium-rich pegmatites. Translucent and transparent gem quality material is found in deposits in the United States in Connecticut, Massachusetts, Maine, in North Carolina at Stony Point, Hidden and King's Mountain, and in the Pala district in California, as well as Madagascar, Afghanistan, Myanmar (Burma), and Minas Novas and Minas Gerais in Brazil. In Volume 2 of *Precious Stones*, Max Bauer tells of a few beautiful, blue transparent pebbles, believed to be lazulite, that were retrieved from the Rio de San Francisco near Diamantina in Minas Gerais. Quite some time elapsed before they were identified as spodumene. The rich, intense yellow crystals found in Afghanistan are darker than the lighter yellow material from Brazil. Some Brazilian material has been extensively marketed as chrysoberyl.

In yellow-green spodumene, a definite band at 4375 and a fainter band at 4330 appears in the spectrum. It fluoresces orange-yellow in LW, with a weaker fluorescence in SW ultra-violet light. Green crystals exhibit a distinct pleochroism of green/blue-green/colorless to light green when observed through the dichroscope. The chemical make-up of the green material from Brazil lacks the chrome element essential to hiddenite's composition.

Until yellow gem quality crystals of spodumene were discovered at Minas Gerais in Brazil and reported by Pisani in the *Comptes Rendus* for 1877, it was known only as an ash-colored, non-transparent mineral. This accounts for its name, derived from the Greek word *spodios,* meaning *ash-colored* or *burnt to ashes*. Another name, **triphane**, from the Greek for "*three aspects*", refers to spodumene's distinct trichroism. This term is seldom used today. Although the other transparent color varieties of spodumene are faceted and sometimes available, **kunzite** and **hiddenite** provide the best-known and most desirable gems. Kunzite can be imitated by pale pink corundum, but imitation and synthesis of spodumene is not known to occur commercially.

Hiddenite is the characteristically transparent, chrome-bearing, intense green spodumene variety discovered at Stony Point in North Carolina. In his work, *The Story of the Gems*, published in 1940, Herbert P. Whitlock, author and curator of Minerals and Gems, American Museum of Natural History, refers to it as *lithia emerald* and gives the date of discovery as 1881. Most sources accept the date of discovery as 1879. This confusion may be the result of conflicting information in the book, *Gems and Precious Stones of North America*, by George Frederick Kunz. He states that in the early 1870's, a Mr. J. A. D. Stephenson realized the area surrounding Stony Point might be a source of beryl. He was particularly interested in proving it to be a source of emerald, and he encouraged the farmers of the area to search for and bring to him these "green rocks or bolts." In this way, he acquired a number of various mineral crystals, including emerald, but none of gem quality. He sent a number of the best crystals, thought to be diopside, to Norman Spang of Pittsburgh, Pennsylvania. After the incorporation of the Emerald and Hiddenite Company to further explore the possibility of commercial production of gem material, Mr. Stephenson called these crystals to the attention of the mine superintendent and gem enthusiast, W. E. Hidden. Mr. Hidden submitted specimens to Dr. J. Lawrence Smith, who identified the crystals as a transparent form of spodumene. Mr. Hidden was honored to have the new variety named hiddenite.

Unlike other spodumene, hiddenite's small crystals are very rare and highly prized. Arem makes the point that the green spodumene found in Brazil lacks the chrome element and is not hiddenite. Gems larger than three carats are unknown. Walter Schumann in *Gemstones of the World* lists the dispersion as 0.017. Luminescence can be a weak reddish-yellow. When exposed to x-rays, it phosphoresces after emitting a strong orange glow. A distinct chrome line in the spectrum is present, and definite yellow-green/green/blue-green pleochroism colors are seen when specimens are examined with the dichroscope. To obtain the best color, the table of a gem must be oriented perpendicular to the main axis. A hardness of 6.5 on prism faces to 7.5 in the direction perpendicular to the faces, the easy parting, and perfect cleavage in two directions make hiddenite very difficult to cut and a fragile gemstone. Great care must be exercised when used and worn as a gem in any jewelry.

Kunzite is the manganese-bearing, violet-pink variety of spodumene, discovered in California near Pala, San Diego County in 1902. George F. Kunz, the renowned gemologist associated with Tiffany at that time, vigorously promoted the new find. Unlike hiddenite, kunzite gem crystals can occur in very large sizes of excellent quality. Several museums house faceted gems of 200 to 300 carats. Afghanistan, a mine at Antsirabe, Madagascar, and Minas Gerais, Brazil are major sources of large, fine colored material today. The color can be quite intense and may fade with time, especially if exposed to sunlight. For this reason and its delicate nature, kunzite is sometimes called an "evening stone."

Jaroslav Bauer and Vladimir Bouska state in *A Guide in Color to Precious & Semiprecious Stones* that exposure to x-rays can change the color to green, and then "annealing at 200 degrees centigrade" will restore the "original hue." Arem indicates restoration of the color can take place with exposure to sunlight. An orange glow, followed by phosphorescence, occurs with x-irradiation. Under LW ultraviolet rays, "golden pink to orange" fluorescence is seen, with a weaker fluorescence exhibited under SW. Treatments of kunzite are not common, but Walter Schumann states in *Gemstones of the World* that "brown and green-violet colors can be improved with heat-treatment." In large, fine gems, kunzite's pleochroism of two tones of the body color, plus a very pale or colorless hue, is so pronounced that it can be observed with the naked eye. The table facet of gems should be oriented to display the best color.

Simon & Schuster's *Guide to Gems and Precious Stones* makes the observation that the detection of an oily or soapy feel when rubbing the less acute facet edges of a gem between the thumb and forefinger is an indication of the lesser hardness of kunzite, when compared to other spodumene gems. Although kunzite is abundant and inexpensive enough to create striking jewelry, it is best set in a protective mounting in jewelry pieces that will avoid exposure to ordinary wear and tear. It is well advised that kunzite gems should avoid exposure to bright light for any length of time.

Kosmochlor--- [Ureyite] [Hmaw-Sit-Sit] [Maw-Sit-Sit]

Kosmochlor [$NaCr^3Si_2O_6$] made its appearance at gem and mineral shows only a few years ago. Little information about this material has been available to the public. Arem uses the name *Hmaw-Sit-Sit,* and he mentions that it was presumed to be an aggregate of jadeite and albite from Myanmar, until recent analysis revealed it to be the monoclinic pyroxene mineral *ureyite* in natrolite.

The American Geological Institute's publication, *Glossary of Geology*, defines ureyite as "a meteorite mineral of the pyroxene group – Syn. *kosmochlore; cosmochlore*." In *The Glossary of Minerals Species* 1995, Michael Fleisher and Joseph A Mandarino note the 1984 decision of the IMA Commission on New Minerals and Mineral Names to designate *ureyite* as *kosmochlor.* The vendors at trade shows label it as *maw-sit-sit* or the misnomer "chrome jade." Its chemical composition and monoclinic crystal structure has caused the author to place it with the sodium pyroxenes. No more descriptions of its physical and optical properties occur in the available references. It is a chrome-bearing, bright green, opaque mineral that contains black inclusions and veining. The primary source is located at Maw Sit in northwest Myanmar [Burma]. A picture of a specimen, in connection with an article on jade mining in Myanmar, appears on page 154 of the January 1997 edition of the Jeweler's Circular Keystone publication.

The monoclinic sorosilicate chrome-bearing epidote, *tawmawite*, is found at Tawmaw in the same area. It exhibits a distinct cleavage and a refractive index range of 1.72 to 1.76. The close resemblance of the three minerals, kosmochlor, tawmawite, and jade, could cause confusion in identification. It seems that extensive commercial use has not been made of kosmochlore, but cabochons of ***maw-sit-sit*** are available at gem and mineral shows. They present a number of interesting possibilities for designer jewelry.

Jadeite

Jadeite [$NaAlSi_2O_6$] has been treasured in China since it was taken there about two hundred twenty five years ago from Burma. Despite the similar appearance, imperial lapidarists and carvers immediately recognized the difference of this Burmese green stone, *kyauksein*, from the material nephrite. Before then, nephrite had been used for seven thousand years by many cultures worldwide for tools, weapons, ornaments, religious artifacts, and musical instruments. To the Chinese artisans, the name of the brilliant green kingfisher, *fei-ts'ui*, was more appropriate for the new material from Burma.

In *The Handbook of Jade*, Gerald I. Hemrich relates that the Chinese generally referred to the material used for centuries, nephrite, as *yu* and the newer substance, jadeite, as *ynu-nan-yu*. The term *ynu-nan-yu* may be a corrupted form of *Yunan jade*.

Richard Gump tells us in *Jade Stone of Heaven* that the jadeite was brought from Burma by mule to China through the Chinese Yunan Province, causing some to believe that area to be the source. These Chinese words for total spiritual and physical beauty were not adopted for worldwide use. The most common term used today for both jadeite and nephrite is jade. This has caused much confusion. Kachin tribesmen in Burma had traded jadeite pebbles and boulders retrieved from gravel beds of the Chindwin and Mogung rivers with the Chinese across the border for decades. However, it has been established that this vivid, translucent material did not become readily available in China until about 1780. [A jadeite boulder, weighing an estimated 36 tons with an approximate circumference of 29 feet, said to be the largest ever recovered, is displayed at the Myanmar Gems Enterprise headquarters in Yangon, Myanmar. Its origin is the Khy-Siu mine in the Mogaung area.] The Manchu emperor, Chi'en-lung (1711-1799) was fascinated by and paid well for the "imperial" green material brought to him.

Although the use of this new material for treasured carved objects began to flourish, one must be extremely skeptical of claims that an object of jade executed by Chinese lapidarists before this time is jadeite rather than nephrite. In his book, *Jade*, Louis Zara, an authority on jade, gives us the most comprehensive explanation of the continuing confusion surrounding the names. Writing in his book *Discovery of Guiana* the explorer, Sir Walter Raleigh (1552?-1618), referred to "stone for the loin." This Spanish term "*piedra de ijada*" translated to the French as the feminine gender word *l'ejade*. A printer erred in a publication and used the masculine noun *le jade,* which entered the English language as ***jade***. Others used the Spanish term "*piedra de rinones*" meaning "*stone for the kidneys*" for the precious green material and its many artifacts flowing to Europe from the conquered Aztec and Mayan cultures of the new world. The conquerors ignored the Aztec name *chalchiuitl* for the stone.

In 1789, not aware that the familiar green tool material and the jade being brought from the new world by the conquistadors were different minerals, the German mineralogist A. G. Werner used the Latin translation "*lapis nephriticus*" (kidney stone) to derive the name ***nephrite***. Nearly a century later, during the looting of the Summer Palace in Peking in 1860, the French Comte Klaczkowsky acquired several "imperial" green jades that were referred to as "jade imperial" by the French ceramics expert, Albert Jules Jacquemart. Its color and translucence resembled the finest Imperial porcelains of France.

In 1863, the French chemist, Alexis Damour, proved the distinction between the pyroxene and the amphibole minerals that had been called nephrite for more than sixty years. He bestowed the name "***jadeite***" on the highly prized pyroxene mineral that had been brought to Europe as plunder from both the new and the old worlds. The amphibole material retained the appellation "***nephrite***." Perhaps, it is unfortunate that both materials are still commonly called jade in the jewelry industry when the value can differ so greatly, while their physical properties and appearance can be so similar.

It is not well known that artisans in the Middle Americas were working with jadeite long before it was introduced to the Chinese. Although in situ jadeite was found in Guatemala in the 1950s near the Motagua and Palmilla Rivers, it is not certain that this is the source of the artifacts created by the artisans of the Americas. Broad (2002) reports that flooding and landslides, caused by the major hurricane in this area in 1998, dislodged and deposited "bus-sized" boulders of blue and blue-green jadeite in the river-bed and exposed veins of the material in the surrounding bedrock. Numerous colors of jadeite were available to the Mesoamerican lapidarists. The finest emerald green material rivals that of the jadeite produced in Burma. Its name, *quetzalitzli*, was derived from the brilliant plumage of the sacred quetzal bird.

The Mayas (2000 B.C.- A.D. 1697) carved ornamental tubes, beads, plaques, and pendants for use in rituals by their priests and princes. The Olmecs of Mexico (800 B.C. – A.D. 600) created large figures and masks. Their incredibly skilled artisans created and fitted dental inlays of jadeite in the teeth of prominent leaders. The fierce Aztec warrior-sculptors exacted tribute in jadeite from those cultures they conquered. Their creations emphasized the boldly dramatic and terrifying aspects of life and nature. With continued scientific exploration of the archeological sites, perhaps, the source of the material for these treasures may eventually be found. However, Louis Zara states "even if great veins should be discovered, their value would be commercial rather than artistic. For no men today can equal the skill of the lapidaries of pre-Columbian times."

James L. Kraft stated: "The endless colors of jade are the result of each stone's experience in the earth." This is true of all the properties of each mineral that develops in the earth. No two environments or mixtures of elements are the same. Man can formulate exact chemical compositions, but one seldom sees "pure" specimens of any natural mineral. Therefore, marked differences occur in jadeite from different localities.

In *The Handbook of Jade*, Mr. Hemrich lists three types of jadeite. The purest form of jadeite comes from the deposits in Burma. Calcium is present in the jadeite found in the western hemisphere. He refers to this second type as *diopside jadeite*, an intermediate member between jadeite and diopside. The deep green or black *chloromelanite*, usually used for carvings, contains iron and lies between jadeite and acmite or "even jadeite, acmite and diopside." He cautions that the term "chloromelanite" should never be applied to black nephrite.

The following statements are quoted from page 467 of Volume II of *Precious Stones* by Max Bauer: "Objects of chloromelanite accompany jadeite articles (in archeological sites) in France, Switzerland, Mexico, and Colombia, while a large axe of the same material has been found at Humboldt Bay in New Guinea. Chloromelanite in the rough condition has never yet been met with; the articles which are found fashioned out of it all date back to remote antiquity and are rarer than either nephrite or jadeite objects. Its existence as a distinct mineral was first recognized in an axe-head found in France."

Jadeite forms in high pressure, low thermal metamorphic environments along "lithospheric plate boundaries, where subduction and obduction are active." Peter C. Keller, in *Gemstones and Their Origins* explains that, "When the ocean floor slides under the edge of a continent, it is subjected to very high pressure, but the temperatures remain low because the ocean floor starts out quite cool. During the process, which occurs over millions of years, the basalts of the ocean floor are broken off and pushed back to the earth's surface, forming high-pressure recrystallization."

Jadeite's monoclinic crystals are usually of microscopic size. Very few collectors have specimens that do not require observation through a lens. In 1949, the discovery of jadeite crystals visible to the naked eye caused quite a stir in mineralogy circles. Dr. John Peoples of Petaluma, California collected glaucophane boulders from the Russian River near Cloverdale, California. Their point of origin has not been determined. The boulders contained thin veins of transparent, pale-green-tipped, colorless, and gray-green crystals that housed partially embedded quartz crystals in association with diopside. They were determined to be jadeite by Dr. C. W. Wolfe of Boston University. A picture of such crystals is shown on page 8 of *The Handbook of Jade.* Jadeite's aggregate structure consists of the compaction of numerous, tiny, inter-locking granular crystals. According to Jaroslav Bauer and Vladimir Bouska, this "perfect natural laminate" can "withstand pressures of up to 8000 kg cm^{-2} without any damage" and is "more elastic than steel."

In the *Handbook of Gem Identification*, Richard T. Liddicoat, Jr. informs us that "two directions of easy perfect cleavage (at angles of 93^o and 87^o)" are concealed by this closely compacted structure. This extreme toughness, combined with a hardness of 6.5-7.0 and an almost vitreous or pearly luster, makes jadeite an ideal material for carving. Specific gravity can vary from 3.3-3.5, with a norm of 3.33. It fuses easily at 2.5, and a streak plate test leaves a white residue. Refractive indices of a = 1.640 b = 1.645 y = 1.652-1.667 reveal jadeite to be optically biaxial with a positive sign. References list a birefringence range from 0.0 to 0.02, with no dispersion or pleochroism. According to Arem, a strong line at 4375 in the spectrum, which may not be observed in chrome-bearing jadeite, is diagnostic for jadeite. Weak bands at 4500 and 4330, a strong line at 6915, and weak lines at 6550 and 6300 make the spectrum distinctive. Jadeite is inert when subjected to SW ultraviolet light, but a weak gray-blue or white luminescence may be exhibited in pale hues in LW.

Hemrich mentions that actinolite and specks of carbon and iron are harbored in jadeite, but no other inclusions specific to jadeite are named. He makes no distinction between jadeite and nephrite when he states that "chatoyant jade usually refers to the type having a silvery sheen over the whole surface." The term cat's-eye applies when a gemstone exhibits a "single bright line of light." Only a few collectors possess such a rare gem.

Trace elements cause the myriad colors in jadeite, as well as in nephrite. Pure jadeite would be colorless. The descriptive names, derived from the animal, vegetable, and mineral kingdoms and the natural world around us, are verbal attempts to induce visual color images. The Chinese were especially adept at using such visual images to express the "feel" for jadeite colors. These descriptive terms can apply to both jadeite and nephrite. A pure milk-white jadeite seldom exists. Some of the "off-white" jadeites have been described variously as mutton-fat, camphor, curds and whey, ivory, oatmeal, beige, chicken-bone, and duck-bone tones. Blue shades are referred to as sapphire and sky blues. Delicate pink or violet hues that may indicate the presence of traces of vanadium or manganese are called peach, pink, purple, lavender, and mauve. Yellow tones can range from butter-yellow, egg-yolk, saffron, orange, and amber to rust, carnelian, blood, and tomato-red. Traces of titanium and vanadium may cause the pale yellows and hues of lavender and blue. Gray and black jadeite may be the result of an extremely fine dispersion of tiny particles of chromium throughout the material, as well as the presence of iron. Variations of iron content influence the green tones. The "imperial green" jadeite is the result of the replacement of some of the aluminum by an unknown quantity of chromium. Shades of blue, green, yellow, red, and white intermingle in the extremely rare "five-color" jadeite. "Moss-in-snow" describes the treasured white material spotted with patches of spring green. Arem lists the following interchangeable Oriental and English terms for only six of the hues of green jadeite:

Orient	**United States**
Old Mine	Imperial
Canary	Glassy
New Mine	Apple Green
Oily	Spinach
Pea Green	Moss-in Snow
Flower Green	Apple Green

Hte long Sein is not as well known as other designations for the luminous green jadeite from northern Myanmar. Kimpi is an appellation for red or brown material. In Guatemala, an unusual black jadeite that contains bright inclusions of a metal (perhaps pyrite) is called Galactic Gold in the marketplace [Fred Ward, 1999]. It seems that only one's imagination limits the number of terms used as names for jadeite and nephrite.

Adding to the confusion surrounding the identity and names for "jade" is that many other substances, both natural and manufactured, can resemble jadeite and nephrite. Using a proprietary process involving extremely high pressure, General Electric Gem Technology has manufactured and submitted samples of synthetic jadeite to GIA for testing. {Chatham Created Gems displayed pieces of their new synthetic green jade at the 2003 AGTA Show in Tucson.} The physical and optical properties overlap those of natural jadeite. This material is not yet widely available. Doublets and triplets are constructed of various materials including jadeite. Dyed jadeite and many other substances colored to resemble it are readily available in the market.

Of the many simulants and imitations, only emerald and glass can closely approximate the color of fine green "imperial jadeite." Hemrich devotes a full chapter in *The Handbook of Jade* to the pseudo-jades. The following information was gleaned from that source.

Pseudo-jades: natural minerals used to imitate the jades

Amazonite – [Microcline] - The specific gravity range of 2.54 to 2.57 is helpful in determining that this green to blue-green *Colorado jade* is not jade. The very attractive, dark green material, found in Baja, California, a nephrite look-alike, is seldom available on the market.

Calcite – [Calcite onyx, Travertine] – "Only those who are totally unfamiliar with jade" are duped when this usually dyed material is represented as jade. Calcite deposits occur worldwide, but Mexico is the major source for that which is offered as jade.

Chromepidote -- [Tawmawite] – The opaque monoclinic sorosilicate chrome-bearing epidote, *tawmawite*, is found near the jadeite mines at Tawmaw, Myanmar. It exhibits a distinct cleavage and a refractive index range of 1.72 to 1.76.

Diopside – This component of most western hemisphere jadeite can easily be mistaken for jadeite. Its usually chrome-green-streaked white or cream Burmese counterpart is found in association with jadeite in Myanmar. Rough material can usually be readily identified by the presence of distinct cleavages, a conchoidal fracture, and a 5 to 6 hardness.

Fluorite – Carving this "soft, brittle, heat-sensitive" mineral, laced with planes of easy cleavages, presents monumental challenges to an artisan. Despite these obstacles, fluorite is widely used as a carving medium. Although the planes of cleavage can be less pronounced in massive material, its softness can help to reveal its identity.

Massive grossular garnet – The green variety of massive grossular from Africa is called *Transvaal jade* or *African jade*. Brown, pink, red, white, and yellow are its other colors. It more closely resembles nephrite than jadeite. Once believed to be nephrite, *Oregon jade* is the misnomer used for the massive grossular material found in northwestern United States. It is said that Chinese gold seekers exported large amounts to artisans in China, where it was accepted, carved, and sold as jade by the Chinese. However, no proof exists of this claim. Objects carved from this scarce garnet mineral do make lovely additions to a collection.

Idocrase – [*Vesuvianite*] The toughness, a 6.5 hardness, and the many and varied colors of this mineral are properties that closely resemble jadeite. Excellent rare blue idocrase, *cyprine*, can closely resemble blue jade. The massive green *californite* known as *California jade*, *Feather River jade*, *Happy Camp jade,* and *Pulga jade* is the best-known and most desired idocrase substitute for jadeite. Its development, in association with grossular, can complicate identification, but the conchoidal fracture and the difference in density help to differentiate idocrase from jade

Kosmochlore – [Ureyite, Hmaw sit sit, Maw sit sit] – This monoclinic pyroxene mineral *ureyite*, like jadeite and tawmawite, is found in northwestern Myanmar. Although they can appear so alike, they differ entirely in their chemical, physical, and optical properties. Vendors usually label this opaque mineral *Maw sit sit*. Its bright green color, with black markings and veining, make it a convincing substitute for jade. Arem uses the alternate spelling *Hmaw sit sit.*

Obsidian – [natural glass] – This singly-refractive, dark, usually black, amorphous substance represented as "Mexican jade" is easily recognized by those who have even a minimal knowledge of the jade properties.

Pseudophite – A relative of serpentine, *Styrian jade* ranges in color from "gray-green to black", with a greasy luster and frequent mossy inclusions. It lacks the hardness and luster of serpentine and jade and is generally carved as bowls and other ornamental objects.

Serpentine – The tougher varieties of serpentine are the most suitable as substitutes for jade. Its wide range of colors mimics the many colors of jadeite. The yellow to yellow-green translucent r*etinalite* exhibits a resinous luster. Translucent to opaque *bowenite*, also known as *new jade*, *Soochow jade*, and *Korean jade*, occurs in various colors. The rare almost transparent to translucent *williamsite* is a convincing substitute in its deep green to "true emerald-green" color range. *Verde antique* is a name applied to an "ancient green" serpentine, as well as to several materials used as decorative building products, including travertine, marble, and calcite. Deposits of *ricolite* near Rico, New Mexico yield a "banded variety" of serpentine that exhibits unusual patterns and colors. The differentiation of all these materials from jadeite can be achieved with a specific gravity test.

Sillimanite – [Fibrolite] – Carvings of this fibrous aluminum silicate often present more of a problem of identification than the other materials listed among these pseudo-jades. In dealing with the physical and optical properties so similar to the jades, some situations may justify an examination by an expert.

Talc –Despite its low hardness, 1.0-1.5 on the Mohs scale, *steatite* or *soapstone* has been for centuries, and still is, a favorite carving material for Chinese, as well as Eskimo lapidarists. It dyes well, and numerous ornate ornamental, as well as some utilitarian objects, have been fashioned from this easily worked mineral. Material and carvings from Mexico are often called *Mexican jade*. Differentiation from jade should present no problem.

Zoisite – The hardness [6.0-6.5] and specific gravity [3.25-3.57] fall within the range of jade's properties, and positive identification, hence, could be rather difficult. Opaque pink *thulite* and the pink and dark green *sausserite* are readily available from vendors.

Agate – *Agate* can be dyed to produce a more appealing gemstone than dyed jade. It is the "most attractive of the dyed pseudo-jades." Only routine gemological tests are required to make the distinction that it is a quartz mineral in actuality.

Aventurine – The Chinese have used this quartz-family material extensively for some extremely fine carvings. A photograph of an exquisite figurine executed in blue-green aventurine is shown on page 202 of Simon & Schuster's *Guide to Gems and Precious Stones.* India is the source of an excellent yellowish aventurine sometimes called *Indian jade*. Wyoming and Brazil produce pale green and gray varieties. Several locations in the United State are sources for a reddish variety. It is sometimes called *Mexican jade,* especially if the source is Mexico or the surrounding region.

Carnelian – The finest quality of this cryptocrystalline chalcedony can resemble reddish-brown Burmese jadeite. Again, tests for specific gravity and refractive indices will correctly identify it as a member of the quartz family.

Chrysoprase – This yellowish-green, nickel-bearing chalcedony can resemble the higher quality jades. Again, the tests for properties of cryptocrystalline quartz separate it from them.

Jasper – Some of the best forms of jasper, especially some of the greens, may be as rare as the jade it resembles. The reddish colors are more likely to bear a resemblance to the rusty colors of nephrite. Sites in the Ural Mountains are sources of "yellow moss jasper" that was exported to the Chinese artisans during the Ming dynasty. This member of the quartz family can be identified by the usual tests.

Plasma – *Nevada jade* is a deep green chalcedony found near Tonopah, Nevada. Care must be taken to accurately identify this material. The hardness is 7, but a conchoidal fracture and the density range of 2.58 to 2.68 helps to distinguish it from Covello jade.

The minerals named above are only a partial list of the many materials frequently carved and used as substitutes for the jades. Many can be, and are, both dyed and treated to enhance their resemblance to the ancient fascinating materials called jades. Of course, man-made plastics and glass are also substances purported to be jade and found in the market. Great care should be exercised when any jade purchase is contemplated.

E-Mail Addresses:

Edna Anthony .... eba@bwn.net
Bill Andrzejewski .... sierragm@uswest.net
Nancy and Steve Attaway.... attaway@highfiber.com
Moss Aubrey .... drsaubrey@aol.com
Charles Bryant .... crbryan@swcp.com
Ernie Hawes......................... ehawes7@comcast.net
Paul Hlava............................ hpf1@qwest.net
Dylan Houtman....................dhoutman9@aol.com
Mariani Luigi .... ENVMA@IOL.IT
Will Moats .... gemstone@flash.net
Merrill O. Murphy .... momurphy2@juno.com
Gary Peters .... albpet@msn.com
Russ Spiering .... DesignsByRKS@email.msn.com
Jim Summers: .... commish1@worldnet.att.net
Bill Swantner.....................WSwantner@Comcast.net
Herb and Maria Traulsen ..... htraulsen@mycidco.com
Stephen and Linda Vayna .... Vayna@transatlantic.com
Elaine and Al Weisman........ almgtcons@aol.com
Scott Wilson......................... swilson@copper.net