The New Mexico Facetor

Volume 16, No. 5, May-June, 1997

In This Issue

The Prez Sez:

by Moss Aubrey, Ph.D.

This marks the third and final installment of our series on the recent developments of mining and marketing Montana sapphire. We previously reviewed the history of this gem material and how it has fared in the international gem trade. Our final look will then be focused more towards the American Gem Corp. (AGC) of Montana. The development of this company, and their efforts to create a world market for Montana sapphire, have all been reported in numerous articles in the trade journals. Their efforts to promote sapphire material as a world class gem have been described by several noted authors. AGC has reproduced many of these trade articles and included some copies in their promotional materials and prospectus for investors. Their listed goals are: to control the majority of sapphire being mined in North America; to become one of the world's largest sapphire producers; and to maintain the highest quality standards in the industry.

These are all admirable goals, and at first glance, it appears that AGC may be meeting them. Further information provided by AGC includes that perhaps 70% of the mined sapphire material becomes suitable for cutting with the proper treatment. They estimate their holdings (that is, untapped reserves) to be over 62 million carats in three categories of quality. However, their own commissioned consultant reported an estimated 48 million carats in holdings. While both figures are impressive, there remains a substantial difference between the two sums. Although AGC states that a "high percentage" of the stones are of fine quality, they do not exactly specify the percentage of mined material that falls into each of the three categories. I find this all rather off-putting in a prospectus for possible investment.

AGC states that all stones are cut for brilliance. Most are also cut to calibrated sizes, except for the especially large stones. They state that Montana produces "on average" sapphire that may be the world's most flawless and brilliant, found in virtually every color known in sapphire. The literature that they distribute shows impressive stones, and the cutting does appear better than the typical overseas cuts. One journalist who viewed their inventory commented on the uniformity

of size, weight, and brilliance (Wise, 1996). Again, while AGC states that a "high percentage" of the stones are fine or very fine in terms of color (i.e., hue, saturation, and zoning), they do not specify the precise breakdown across the categories.

AGC has entered into marketing agreements with both Michael Anthony Jewelers and Landstrom's. The intent appears to be promoting Montana sapphire as a "home grown" world-class gem. They had trademarked the term "American Sapphire," which seems to fit the thrust of their marketing approach. However, this leaves me perplexed as to how I now can describe the sapphires that I sell. I can call them Montana sapphires, but, because the name "American Sapphire" is trademarked, I cannot call them American sapphires. Oh, maybe Montana seceded along with that guy in Texas.

I will admit to having envy of this company's position. As Jimmy Carter once said, I have lusted in my heart. Only in my case, it's those sapphires I want. But having acknowledged that, I still have one serious concern. The disparate figures AGC themselves have touted regarding their inventory bothers me. Their vice president of sales, Ken Erickson, declared their desire to hold a large inventory of good sapphire material before going public, which I consider to be admirable. He also stated that they counted about 300,000 carats of cut stones in inventory as of June, 1996 (Lurie, 1996). When other journalists toured the AGC facility shortly afterwards (Frazier, 1996), they noted two million carats of cut stones within the vaults. However, AGC's promotional material (see the March 1996 Issue of Colored Stone, page 36) claims to have counted an inventory of over six million carats. I am confused by this disparity.

I also read that AGC increased their rough production to one million carats per month, with a goal of an annual production of fifteen million carats within five years (Brockelbank, 1996). While I can understand that their inventory may be growing at a substantial pace, and that the more recent figures may show higher amounts than earlier figures, please note that the highest reported figure is from the earliest statement. Also, all of these figures appeared within several months of each other.

I am not the only one having some skepticism regarding AGC's sapphire holding claims. The Securities and Exchange Commission (SEC) turned down AGC's bid to be publicly traded, stating they required more information on the existing risks involved, as well as explanations in regard to the estimates of the actual reserves. Despite AGC's intention to respond to these points and to reapply to the SEC, AGC was not yet granted that status as of my last inquiry.

Well, it does seem that AGC has massive sapphire reserves, regardless of which figure you use. AGC also has demonstrated that they can produce exceptionally well cut stones in closely calibrated sizes, with production figures increasing each successive year. Still, it remains to be seen whether they can accomplish their marketing goal. Personally, I wish them luck, but I will stand back until all the dust has settled.

References.

Brockelbank, T. (1996). "American Gem poised to become a player in the world sapphire market." *The Northern Miner*, volume 82 (number 35), reprinted in AGC "Recent Publicity" materials.

Frazier, S. and Frazier, A. (1996). "Rainbow over Big Sky." *Lapidary Journal*, volume 50 (9), pages 44-47, 104-107.

Lurie, Mark. (1996). "Will new sapphire sources satisfy sapphire demand?" *Colored Stone*, volume 9 (2), pages 1, 38-39.

Wise, R. (1996). "Montana sapphire: The great American adventure." *National Jeweler*, volume 40 (19), page 46.

Minutes of the NMFG Meeting

May 8, 1997

by Nancy L. Attaway

President Moss Aubrey called the meeting to order at 7:20 p.m. and welcomed all members and visitors. Everyone introduced themselves, as several visitors attended the meeting. Moss reminded Guild members that Guild meetings should focus more on the exchange of ideas relating to gems and faceting, and not so much on Guild business items. Moss said that board meetings address both the business of the Guild and plan the programs. This allows more time at regular meetings for faceting discussions and for fun socializing.

Treasurer's Report

Treasurer **Bill Andrzejewski** reported:(This is a corrected report.)

Heading	*Total*
Previous Balance	$1,025.20
Expenses	305.90
Deposits	345.00
Balance Forwarded	$1,064.30

Old Business

The New Mexico Facetor, was not received by the membership before the May meeting. Therefore, the vote regarding the amendments that was scheduled during the May meeting has been rescheduled for the July meeting. Guild members must have the opportunity to read the proposed changes in the newsletter before casting their votes.

Due to jet lag and very little sleep, your Editor forgot that she had packed bundles of back issues of the New Mexico Facetor in her Suburban. These were promised at the May meeting, but will be available for the meeting in July. A small donation to our treasury for these back issues will be appreciated.

New Business

Vice-President Louie Natonek announced that Guild member Tom Martin moved to Colorado. Tom had placed orders for the special New Mexico Faceters Guild badges. Louie asked for a volunteer from the membership to assume Tom's place in ordering those badges. Please contact Louie if you want to do this.

Show and Tell

Scott Wilson found an interesting gray rock near Socorro, New Mexico and asked Merrill O. Murphy about it. The rock shows varying shades of gray with parallel streaks of blue and has a refractive index of 2.51. Paul Hlava determined it to be an orthorhombic variety of titania known as anatase. Merrill said that this rock represents a new anatase locality for New Mexico. He related that it seemed similar to the anatase found just west of Gunnison, Colorado along Beaver Creek.

Larry Plunkett presented a lovely square flux-grown emerald he cut at quartz angles. He mentioned that the quartz angles seemed to make the stone appear shallow.

Scott and Susan Wilson brought some flux-grown emerald crystals and some hydrothermal emerald crystals produced by the Russian company, the Wintra Corporation. Please contact Scott or Susan if you are interested in obtaining either of these two varieties of emerald.

While in Washington, D.C. visiting her mother and brother, Susan Wilson toured the Corcoran Gallery of Art. An exhibit at the Corcoran Gallery featured the "Jewels of the Romanovs". This historical jewelry collection, once worn by the Russian imperial court, showcased many exquisitely wrought gold jewelry pieces set with diamonds and colored gemstones of remarkable size and quality. The June 1997 Issue of Lapidary Journal published an article about the fabulous Romanov Jewels.

When they visited England, Scott and Susan Wilson viewed the fabulous collection of England's crown jewels housed in the Tower of London. This magnificent treasury of jewelry pieces and crowns possesses a rich history. The New Mexico Facetor plans to feature trip reports by Scott and Susan that describe their visitations of these wondrous jewelry collections.

Will Moats showed a greenish-blue Brazilian aquamarine he cut in a supernova oval. This impressive gem weighs over twenty-four carats. Will polished it with cerium oxide.

Elaine Weisman brought a pair of earrings she hand-wrought set with lapis and chrysocolla. She polished the lapis pieces, which had been shaped by her daughter. Elaine explained how she accomplished a reticulation of the different metals with careful applications of her torch. Elaine composed the earrings with .999 fine silver, .925 sterling silver, and .820 silver. She referenced an article published in the May 1997 (and also see the June 1997) Issue of Lapidary Journal that described the reticulation method.

Waylan (Dick) Tracy showed a large turtle pendant he cast in sterling silver. The centrifuge-cast pendant featured a large turtle carved from tigereye.

Russ Spiering, one of our visitors, displayed a variety of crystal opals he fashioned. Russ showed his hand-wrought gold and silver chains and his pendants set with black jade, African onyx, opal, and sapphires.

Nancy Attaway brought several mineral specimens containing garnets from the San Pedro Mountains near her home. Many exhibited the classic dodecahedron garnet shape, while a few featured an iridescent phenomenon on the surface.

Nancy also brought two crystals of the new kiwi quartz from an undisclosed location in Brazil. (Deal-

ers are keeping secret the exact location, so far.) This new quartz variety shows a chartreuse yellow hue that had been heat-treated from a muddy yellow. Nancy faceted a piece into a barion emerald cut weighing almost twelve carats. She made short sides (24 and 72) of the emerald cut steeper to eliminate a small gouge in the rough on one side. This seemed to diminish the windowing somewhat. She plans a vertical gold pendant with this kiwi quartz and will accent it with two Uruguayan amethysts.

Steve Attaway displayed several clear quartz pyramids with reverse intaglio carvings. Two showed winged fairies, and one featured a group of frogs. Steve also carved a frog in reverse intaglio in a Pakistani peridot tablet faceted by Nancy. Steve uses a small tapered diamond coated 600-grit point.

Field Trips

Scott Wilson is organizing a field trip to the Waldo Mine located close to the Kelly Mine near Magdalena, New Mexico for July 12 or 13. The New Mexico Institute of Mining and Technology will provide a tour of the Waldo Mine that weekend. This coincides with an "Old Timers Reunion" celebration. Scott plans to enter the fiddle contest. Please contact Scott if you are interested in participating in the mine tour.

The fabulous mineral museum on the campus of the New Mexico Institute of Mining and Technology in Socorro has a new display area. This new site allows more room for displays and uses an improved lighting for showcasing their excellent mineral collection. Dr. Virgil W. Lueth acts as the museum curator. Between the innovations from Dr. Lueth and the donations of money and mineral specimens from the Albuquerque Gem and Mineral Club, other clubs, and individuals, Socorro boasts a very fine mineral museum. Remember that Dr. Lueth also maintains a special collection in the museum of faceted gemstones from specific locales in New Mexico, all cut by New Mexico faceters.

Future Programs

Vice-President Susan Wilson said that when Scott and she recently visited England and viewed the marvelous crown jewels collection, they purchased the video featuring the collection. Susan plans to show the video during the Guild meeting in July. Since the video runs about thirty minutes, Scott Wilson and Steve Attaway will arrange a special gemstone photography session for Guild members to photograph their gemstones. Each member should bring a faceted stone or jewelry piece to be photographed. Equipment will be provided by Scott and Steve.

Susan Wilson scheduled several interesting programs for the remaining year. September's program will feature Ms. Jane R. Ward, who plans to address the Guild on the geochemical and physical aspects of diamonds from Ghana. Enrolled at the New Mexico Institute of Mining and Technology in Socorro, Jane is preparing her master's thesis on the diamonds from Akwatia and Tarkwa diamond fields in southern Ghana in West Africa. She will discuss the recent discovery of a highly altered kimberlite in the Akwatia diamond field and its geologic significance. Jane' interests also include taking GIA's graduate gemology program.

Will Moats plans to present significant geologic data from Yellowstone Park's hydrothermal regions for the November meeting. Paul Hlava may present his discourse on the aspects of phenomenon found in gemstones for January of 1998. Dr. Ralph Dawson may be slated for March of 1998 to continue his presentation on crystal growing and its impact on faceting. Herb Traulsen may prepare a slide presentation of his trip to Australia and New Zealand for spring of 1998.

NMFG Science Fair Award

Jacob Dawson received the New Mexico Faceters Guild sponsored savings bond recently awarded at the Regional Science and Engineering Fair. (I apologize for mis-typing Jacob's name as Jason.) Jacob brought his winning exhibit and explained it to the membership.

Jacob related that he measured with a protractor refracted light as focused through glycerine, water, alcohol, and karo syrup. He focused a beam of light through two coffee cans with slits cut on the lids. (Dick Ochsner used to dazzle us with his many uses for old coffee cans.) As he graphed the results, Jacob noticed that glycerine exhibited the highest refraction. Jacob checked his results against known values. He saw a little variation in the numbers, which he blamed on his light source and on human error. Thank you, Jacob, for a presentation well done.

Refreshments for the May meeting were provided by Waylan (Dick) Tracy, Susan Wilson, and Eileen Rossen. Thank you very much. Paul Hlava volunteered to bring refreshments to the July meeting, and Scott Wilson promised to bring his some of his home-made ice cream.

Program Speaker

By Drs. Scott and Susan Wilson

Dr. Ralph Dawson, who recently retired from Sandia National Laboratories as a crystal grower, spoke to the Guild about basic crystal classes and their unique crystal lattice arrangements.

For thirty years, Dr. Dawson grew crystals using a technique known as molecular beam epitaxy (MBE). Molecular beam epitaxy allows the crystal grower to precisely grow very thin layers of atoms (known as mono-layers) with controlled thicknesses. This technique permits highly advanced semiconductor structures to be grown, such as Vertical Cavity Emitting Lasers (VCELs).

The materials that Dr. Dawson works with are mainly III-V compounds. These are binary (2 component) chemical compounds formed from one element taken from the 3rd column of the periodic table, along with one element taken from the 5th column of the periodic table. Hence, the name "three-five compounds".

Examples of these types of compounds are Gallium-Arsenide (GaAs) and Indium-Phosphide (InP). These compounds are of great interest in the manufacturing of semiconductor lasers (your CD player has one).

In his introduction, Dr. Dawson described the three degrees of crystallization that a solid material may take: amorphous, polycrystalline, and a single crystal. The differences between these three types are based upon the size of an ordered region within the material.

An ordered region is a volume within where the atoms (or molecules) exhibit regular geometric or periodic arrangements (think of the regular spacing of boxes on graph paper). Amorphous material, such as glass, has order only on a length scale of a few atoms (very, very small). Polycrystalline material, such as agate, has order over many atoms (very small).

In both cases above, the ordered regions vary in size and orientation with respect to each other (rotated or displaced). Single crystal material, mainly what we faceters work with, has a high degree of order over a long range (several millimeters).

A single crystal region is called a grain. Adjacent crystal grains are separated by grain boundaries. These grain boundaries affect how well a material conducts electricity, and they may also influence the strength of the material.

The periodic arrangement of the atoms in the single crystal is called the "lattice" (remember the analogy of the stacked boxes). The 3D (three dimensional) lattice is a periodic repetition of a group of atoms. Since the lattice structure has repetition within, there must be some fundamental unit being repeated across the whole lattice. This fundamental unit is called the unit cell. By stacking unit cells above, below, and next to each other, we can build the full lattice structure to fill any given volume in the crystal.

There are seven crystal systems: triclinic, monoclinic, orthorhombic, tetragonal, cubic, hexagonal, and trigonal. Fourteen possible unit cells exist and are known collectively as the Bravais lattices. Two things need to be kept in mind: which crystal system (i.e. cubic or tetragonal, etc.) and which unit cell structure (i.e. body-centered, face-centered, primitive, or base-centered).

Dr. Dawson explained the symmetry found in a crystal. Since the crystal is formed with repeating unit cells, it logically follows that there will be some symmetry in the arrangement of the crystal lattice.

The crystal symmetry can be seen by rotating models of the different crystal lattice structures. For example, if the crystal structure is cubic, then the lattice will look like a box with an atom at each corner of the box. If we hold the box to look only at the front of the box, then we see only four atoms (one at each of the four corners). If we rotate the box to look at one of the other sides, it will appear exactly the same to us. There is no visible difference in the four sides of the box. This is an example of four-fold symmetry.

To satisfy the interests of the group, Dr. Dawson spoke about cleavage planes in material. Crystals will cleave (break apart along crystal planes) where the atomic bonds are weakest. Bond strength is a function of the distance between adjacent atoms. The closer the atoms are to each other, the stronger the bond.

Dr. Dawson mentioned that one must take into account the density of bonds on adjacent layers. For example, on a given crystal plane, the bond strength between the atoms on either side of the plane may be weak. However, many atoms may be connected together across the plane and prevent the crystal from cleaving along that plane. Those bonds may be weak, but there are a lot of them.

Conversely, on a different crystal plane we may have strong bonds, but very, very few atoms bonding

across the plane. It is possible that the crystal will cleave along this plane relatively easy.

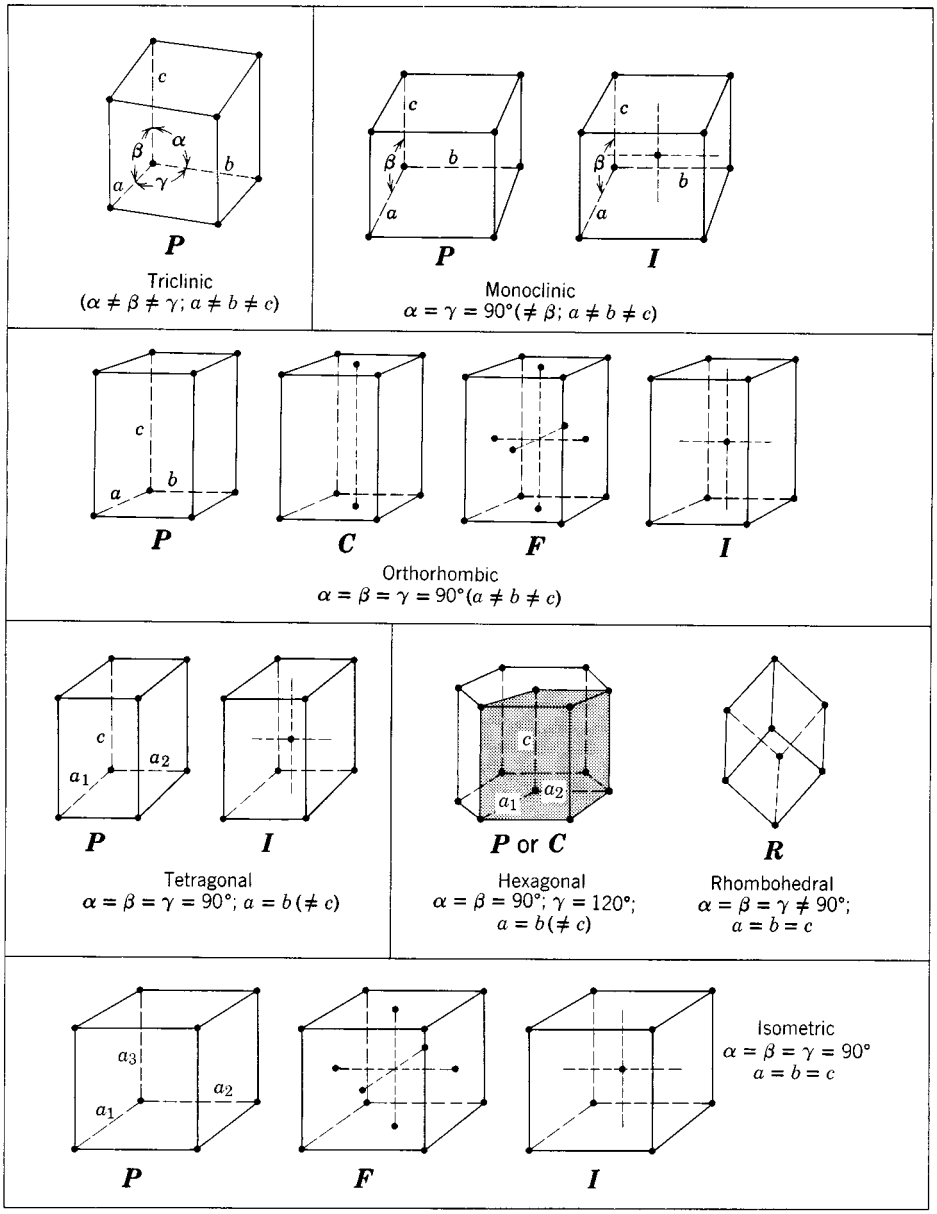
There is one crystal lattice arrangement that Dr. Dawson identified as THE most technologically important for mankind: the diamond structure. Clearly, the diamond structure is that exhibited by diamonds, with the lattice points being carbon atoms. Other materials may crystallize in the diamond structure, and among them is the element silicon. Silicon (pronounced sil-i-kun, NOT sil-i-cone) is used extensively in the semiconductor industry to make all the integrated circuits and transistors that run our computers, cars, phones, and our lives.

Diamond has carbon atoms that make up the lattice, while silicon has silicon atoms that make up the lattice. The crystal lattice arrangement is identical, but not so the atoms!

Instead of using only one type of atom in the diamond crystal lattice arrangement, we use two types of atoms, like gallium atoms and arsenic atoms, to make it interesting. We then obtain the zinc-blende crystal lattice. The overall structure is still that of diamond. However, by using two types of atoms, we give it a different name. Many of the crystals Dr. Dawson grows in his laboratory exhibit the zinc-blende structure.

Dr. Dawson merely began to scratch the surface of crystal structure and crystal growth. At the urging of many Guild members, Dr. Dawson graciously accepted to speak in more detail at a later date on work performed when he grew crystals using molecular beam epitaxy. Thank you, Dr. Dawson.

From the Editor: Dr. Ralph Dawson addressed the Guild on how growing crystals for the semi-conductor industry can provide insight into problems found in faceting. Dr. Dawson's well-explained concepts brought clarity into my mind and inspired Eureka! moments for me. Dr. Dawson's explanation of how crystal growth can be faster on some planes than on others helped me to understand how crystals often have a tubular shape, down the C axis.



One Eureka! moment arrived when Dr. Dawson explained two, three, and four-fold symmetry using visual aids to show the three types of symmetry three-dimensionally. These well-constructed visual aids represented various forms of crystals, both simple and complex.

Another Eureka! moment occurred when Dr. Dawson clarified the reasons for cleavage found in crystals. Using his crystal props again, Dr. Dawson showed how the directions for cleavage formed along the flat surfaces, where the individual atoms were at their greatest distance from one another. This leaves the atomic structure weak in that particular direction, and cleavage then occurs along the longest bond length. Thanks to Dr. Dawson, several concepts became crystal clear.

In the News

The Impact of QVC

From Modern Jeweler April 1997

Telephone sales orders taken by QVC's 5,300 order lines accounted for about $630 million in jewelry sales for 1996. Two 24-hour sales campaigns featured commemorative gold jewelry from both the gold rush of California and the Klondike (over one hundred years ago) and netted approximately $45 million in sales.

QVC promotions romance a gemstone's place of origin by airing film-clips of the mine sites. Hosts describe the areas with a documentary-type of style. This manner of promotion proved successful for selling many gems and accounted for many sales of 18 karat gold jewelry.

Montana Sapphire on HSN

From National Jeweler May 1, 1997

The Home Shopping Network aired an eleven-minute specially televised promotion of Montana sapphires to test the market for these gems. Jewelry shoppers purchased approximately 1,500 gold rings set with Montana sapphires. American Gem Corporation provided the stones. The total sales for this program netted about $225,000.00.

Tanzanite Mines Closed

From D & J Rare Gems, Ltd.

A tanzanite dealer who visited Tanzania during a trip in late March reported to John Rhoads of D & J Rare Gems, Ltd. that the Tanzanian government closed all the tanzanite mines. The dealer explained that the government intended to reduce the supply of tanzanite in hopes of reversing the drop in prices.This marks the third intervention by the Tanzanian government done on behalf of the tanzanite mines. The nines could reopen in six months.

Tanzanite in Graphite

From Gems and Gemology Spring 1997 Issue

A major graphite mining area in the Merelani region of Tanzania reports finding gem tanzanite that was uncovered as a by-product of the graphite. Mineralogical Record, Volume 28, Number 1, 1997 also reported this unusual occurrence.

Tanzanique and 10Kt. Gold

From National Jeweler June 1, 1997

OroAmerica, Inc. paid National Jeweler for two full page advertisements that featured a new line of faceted "tanzanique" set in 10 Kt. gold jewelry. (*From the Editor: I do not yet know what the composition of tanzanique is. However, one AGTA vendor during the February 1996 Tucson Gem and Mineral Show sold cut "tanzanation". This dealer had described tanzanation as a doublet composed of two layers of lab-grown spinel, one layer blue and the other purple. I now wonder if the name tanzanation was changed to tanzanique for a jazzier trade name that would enhance its marketability.)*

New Diamond Deal in Zaire

From The Economist May 3, 1997

Laurent Kabila, the rebel leader in Zaire, declared himself head of state and changed the name of Zaire to the Democratic Republic of Congo. He inherits a country bankrupted by the former rule under Mobutu Sese Seko. Kabila's rebels now control all of the vast diamond, gold, cobalt, zinc, manganese, and copper mining areas in Zaire. Since these all require cash for continued maintenance and operation, Zaire declared its mineral markets open to foreign investors.

Kabila announced that the people of Zaire now control the total production, the distribution, and the consumption of their land and all its mineral resources. This move follows one made by Zambia, where the government recently privatized its copper mines. To support free-marketeering and to discourage monopolies, the diamonds from Zaire will now be auctioned each month to the highest bidder. No longer will the diamonds be sold to De Beers at a guaranteed price.

The Great Borneo Gold Scam

From The Economist May 10, 1997

The remarkable story relating the discovery of the world's largest gold field claim (allegedly) in Busang, Borneo by the Canadian company Bre-x Minerals crumbled under closer scrutiny. An independent study found that the claims for the rich gold deposit were "based on tampering and falsification without precedent in the history of mining".

Bre-x Minerals of Calgary, British Columbia elatedly informed geologists and investors two years ago that they had discovered the gold strike of the century in the rain forest of eastern Borneo. When asked to perform an independent estimation of the gold deposit, Strathcona Mineral Services of Canada submitted a report that determined the potential in Borneo for gold not to be economically feasible. The report men-

tioned that thousands of geologic samples had been contaminated.

The investigation into the death of the chief geologist, who (allegedly) fell out of a helicopter, remains pending. An inquiry will determine whether the death was a suicide, a murder, or whether the corpse actually belonged to the chief geologist.

Canadian Gemstone Scam

From Colored Stone May/June 1997

A year long investigation of a telemarketing scam uncovered enough evidence to charge six Canadians and one American for fraud. The inquiry involved the joint cooperation between the Royal Canadian Mounted Police, the U.S. Federal Bureau of Investigation, and the U.S. Postal Service.

Doing business as Royal International Collectables of Toronto, con artists sold low-grade gemstones as "investment-grade" fine gemstones. They issued falsified certificates of authenticity and created the illusion of a secondary market for the stones to perpetuate sales. The gemstone scam lured over $11 million from unsuspecting gemstone buyers.

Mining Arizona Peridot

From Colored Stone May/June 1997

The May/June 1997 Issue of Colored Stone published a very informative article about mining peridot on San Carlos Apache Indian lands. The article described the mining history of the area, then and now. Charles Vargas, a leading player in the Apache Indian gem mining and sales, explained the impact felt by the tribe from mining and marketing peridot.

Recently, a red andradite garnet deposit was discovered on the Indian lands of San Carlos. The Spring 1997 Issue of Gems and Gemology on page 61 reported brownish-green gem andradites from a new locality on San Carlos. These were first seen at the February 1997 Tucson Show.

A Report on U.S. Mines

From Colored Stone May/June 1997

Kennecott, a subsidiary of the international metal and coal mining mega-operation, RTZ, decided to pull out of its commercial operations involving Utah red beryl and did not renew its lease option. The company also let go its interest in the benitoite mining area in San Benito, California. Apparently, Kennecott-RTZ believed that these two fine, rare gem materials would be commercially viable only for a small scale market and not be a large enough mining concern for their direct involvement.

The same report revealed that shares for American Gem Corporation fell on the Toronto and Vancouver stock exchange from a high of more than $5.00 per share Canadian down to under $0.50 per share Canadian. AGC President, Greg Dahl blames normal market fluctuations, as well as the initial high costs of mining and processing. He believes in the long-term value of his American sapphire commercial enterprise.

Date Change for AGTA

From National Jeweler May 16, 1997

The American Gem Trade Association announced a change in its Tucson Show schedule for February 1998. AGTA moved their new date to: February 4, 1998 through February 9, 1998. AGTA decided that it might be prudent to reschedule their show dates in accordance with the other shows at Tucson to better accommodate show customers.

Zambian Gemstone Exchange

From National Jeweler May 16, 1997

The Zambiam government plans to create a gemstone exchange to better promote and increase the dollar amount of its gemstone exports. The proposed exchange would organize the buying and selling of emeralds, aquamarines, tourmalines, garnets, and amethysts The Zambian government and certain private businesses would own and manage the gemstone exchange.

Black Pearls Featured

National Geographic June 1997

David Doubilet wrote an article describing his visit to the pearl farms of French Polynesia. His remarkable photographs accompanied his narration of the people and the science behind the pearl harvests that render the magnificent black pearls.

From E-Mail

Fred Ward e-mailed me a brief message about articles he authored that will be featured in the August and the September 1997 Issues of Lapidary Journal. These issues plan to cover his trip to the heretofore prohibited jade mines in Upper Burma, first allowable visit since 1962. The July/August 1997 Issue of Colord Stone also featured Fred's article on the Burmese jade mines.

After the February 1997 Tucson Show, Fred visited the opal fields in Australia and observed the pearl harvest in Indonesia. Fred also wrote an article describing the re-opening of the gem hall in the Smithsonian.

IN THE LAND OF WAX N' GLUE

By Merrill O. Murphy

I've checked the questions most asked the last several months during New Mexico Faceters Guild meetings. For a lesser time, I have been monitoring the questions posed by e-mail from the on-line Faceters' Digest. The most frequently asked question is: how do I dop and transfer my stones quickly and easily?

Every facetor will have his favorite method, and that is as it should be. Still, every facetor should be able to use all the better-known dopping and transfer methods. There are good reasons for this. Some gem minerals are downright fussy about their tolerance, or intolerance, to heat. Others are fragile or may have a tendency to cleave in any direction. A very few are attacked by solvents. One, salt (HCl), dissolves in water. If faceters have a hankering to facet a great many minerals, then they should be adept at handling all available dopping agents.

Actually, there is no great number of commonly used dopping agents. Let's see... there is dopping wax that melts at several temperatures and identified by color. There are stick shellacs, the cyanoacrylates (Super Glues in several forms), and the epoxies with several their setting times and bonding strengths. That's about it. I have found it useful to sometimes use two dopping agents to effectively dop one stone.

Now, let us see how to choose a dopping agent and how to properly use it. If you are cutting quartz, beryl, and topaz, stones that are neither particularly heat sensitive nor eight or greater in hardness, then I suggest wax, or shellac, or even both. Why? Because they are quick to apply, have adequate strength, and are both quick and easy to release from the dop. However, I know from experience that many faceters have trouble with wax. The problems with wax are heat and cleanliness. Before using ANY dopping agent, clean the stone and the dop thoroughly with alcohol.

Dopping With Wax And/or Shellac

Wax dopping evolved as a way of attaching a handle to stones being cut as cabochons. All kinds of ways were used to heat the wax and the stone. Early in the game, cutters heated wax in a pot held above a candle flame, and later Bunsen burners. The stone was heated above the same flame but on a small, isolated sheet of metal. The dop, made of wood doweling, required no heating. Hot wax was smeared on the dop end then pressed against the hot stone. While cooling, the wax set up and locked the dop in place.

Later, a torch was sometimes used to heat wax and stone. Some cutters used an electric hotplate. I have often used our gas-fired kitchen range. The stone was heated by placing it above the pilot light. The wax stick was heated above the burner flame and dabbed on the dop stick. The wax on the stick was then smoothed with wetted fingers, heated again over the flame, and pressed against the heated stone. Since dopping for faceting requires more precision and involves metal dops, slightly more sophisticated methods are required.

Make yourself a wax-dopping platform. On your workbench, set two bricks a few inches apart. Place a metal pie pan to span the opening between bricks. That's it. You then place your stone in the pie pan and heat the pan with a gas torch applied to the underside of the pan. Some stones can stand direct torch heating, but a flame always leaves a thin layer of residue on the stone that weakens the wax bond. We need no weakened bonds during dopping.

The metal dop must be heated using the flame applied to its midsection. Since it becomes uncomfortably hot to hold, we then need a dop handle. Make one by drilling a 1/4-inch hole an inch or so deep lengthwise of a piece of wooden dowel.

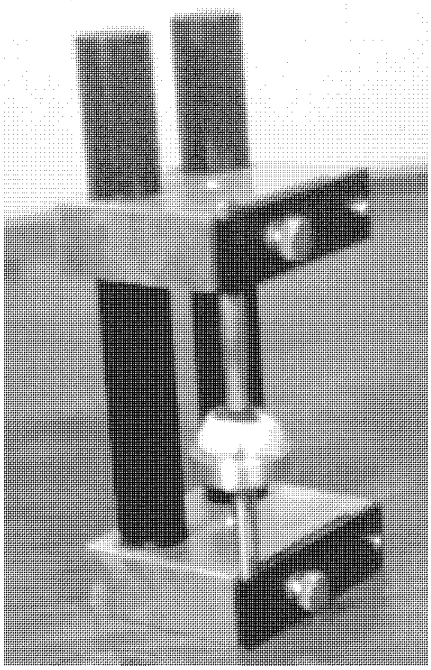
Use a medium-grit disc to grind a flat where the table will be on your stone. Heat the stone on the platform until a tiny flake of dop wax, placed on the stone, turns shiny. Place the chosen dop into the dop handle and play the gas flame on its mid-section until a flake of the wax melts on the dop. Next, heat the end of the wax stick in the flame and rub some of it on the hot dop. Press the waxed dop against the ground spot on the stone and invert the dop to leave the stone on top. Hold it all in that position until the wax sets.

At this point, I like to lock the dopped stone in the transfer jig with a flat dop in the opposing position. Press the dops together until the stone and opposing dop meet, then heat both dops until the wax again becomes shiny. Let the joint cool to room temperature before faceting. Note: The above sounds a bit confusing upon rereading. We are not attaching the opposing dop at this time, merely using it to apply pressure to have a minimum of wax between the attached dop and stone.

How much wax should be used? You will learn quickly by practice. You need enough to completely cover the meeting surfaces of dop

and stone, plus a tiny rim outside the joint. The tendency, however, is to use too much wax. With too much wax, one invariably finds himself cutting as much wax as stone in the girdle area. Wax can also foul a lap.

Stick shellac (available at lumber and hardware stores) can be used in exactly the same way as for wax. The Graves company recommended shellac dopping, probably, because the melting temperature was slightly higher. I highly recommend its use with wax if your stone is somewhat heat sensitive, like transparent red Mexican opal for example. Dip the end of the shellac stick in alcohol and rub the wetted area against the dop point on the stone. Repeat this two or three times. Use wax, as described above, to dop to the shellacked area, BUT WITHOUT HEATING THE STONE. The hot wax will adhere to the cool shellac surface. If your gemstone is small, you may wish to apply a light band of cyanoacrylate (Super Glue) at the wax/stone interface to increase the bond strength.



A lump of clay can be used to hold your stone on a target dop for the initial dop placement.

Cyanoacrylate (Super Glue) Initial Dopping

A number of the cyanoacrylate cements would seem ideal for dopping, but, like wax, there are drawbacks. When using cyanoacrylates, a flat should be fine ground at the future location of the table facet. The cyanoacrylates bond best to a clean, smooth surface, and a minimum of glue should be used. Place a tiny glob of the glue on the stone or dop and press the two together. Hold for about 20 seconds before mounting the dopped stone in the faceting machine. Wait ten minutes before beginning the cutting process.

There are several cautions to be observed when using cyanoacrylates:

1. Be very careful to avoid getting the stuff on your fingers. It can bond fingers together so tightly that a surgeon is required to free them.
2. Always use a minimum amount of the Super Glue. It is difficult to get too little.
3. Be aware that the Super Glues may lose bonding strength with age. If it does not stick well, then get a new tube.
4. All cyanoacrylates are not equal. Experiment until you find a brand that suits your purpose and stick with that brand. I like one called BONDINI EVERYTHING GEL. The gels make getting a minimum amount a little easier.

Here is a neat trick faceters sometimes use. Heat your stone on the dopping platform and apply hot dopping wax to the stone. Take the stone in gloved fingers and press an unheated dop hard against the waxed area. Hold until the wax solidifies and then lift the dop off. It will not bond to the wax, but an exact impression of the dop end will be left in the hardened wax. Now, place a little cyanoacrylate glue on the dop end and press it into the wax impression. Cyanoacrylates will bond readily to dopping wax. During later transfer, a little heat applied to the dop or stone will allow quick and easy release as the wax softens.

Dopping With Epoxy

The 5-MINUTE variety of Epoxy is useful as a dopping agent when a strong bond is required or when a bit more heating is expected during polishing. You will need the extra bond strength when cutting stones of very small size. The limited bonding area on tiny stones results in a much weaker bond than normal. Extra heat is often generated in polishing corundum. The Epoxy can withstand more heat than wax or cyanoacrylates. Some faceters use the slow-setting regular Epoxy, but I cannot see a good reason for its use.

Many of the same precautions apply to the use of epoxies as were enumerated for the cyanoacrylates. Epoxy will not so readily bond fingers together. It takes at least 15 minutes of steady, light pressure during early setup and needs about an hour or more of room temperature setup before cutting begins. Because of the slower beginning of epoxy setup, I use the transfer fixture with an opposing dop to apply the early light pressure needed for a strong bond. A clean dopping surface is required, although epoxy will bond to a rough

surface. Again, experiment with various brands and choose one you like. I have had good results with the DEVCON brand. Do be aware that epoxies age on the shelf, especially after opening the tubes.

The most important phase of epoxy dopping is the mixing of the epoxy and the hardener. Squeeze out Equal lengths of epoxy and hardener side by side on a hard, clean surface. (Or follow directions on the tubes.) Mix with a toothpick, pushing one substance into the other, lifting and FOLDING one element into the other. Conventional around-and-around stirring incorporates too many air bubbles that can reduce bond strength. Get a pastry cook to show you how various ingredients are "folded" one into another. The principle is the same. Mix for at least a minute before application.

Transfer Dopping

Transfer dopping must be done carefully to maintain perfect alignment of the stone. If the alignment shifts, the girdle thickness will vary around the stone. Facets that should meet perfectly will, consequently, not meet. The table facet may be off-center, or irregular in shape; like facets may differ in size, etc.

Transfer When Wax Or Shellac Dopping Has Been Used

When wax or shellac has been used for the initial dopping, I strongly suggest that transfer dopping be done with cyanoacrylate glues. It is easier and helps to avoid that disastrous alignment shift. Mount the initial dop and the partially cut stone in one transfer fixture clamp with a suitable, second concave dop in the opposing clamp. Using a toothpick, spread a thin layer of the Super Glue inside the concave dop, only about 2/3 of the way to the bottom. The reason: The sharply pointed end (culet) of the stone is weak. If Super Glue extends to the culet tip, the tip may fracture when slight stress is applied as the stone is separated from the dop.

With the stone bonded to two dops and still mounted in the fixture, a simple procedure is used to prevent more than minor heating of the second dopping, i.e., the dopping at the pavilion. Cut a strip of cotton cloth about 1 1/2-inches long by about 1/2-inch wide. Dip the bit of cloth in water and wrap it around the dop/stone juncture at the second dopping. That is the one you want to retain for cutting and polishing the crown. Water has the strange property of absorbing heat itself without showing much increase in temperature. The wet cloth absorbs heat traveling into the stone when the first dop is heated for removal.

Next, loosen the fixture clamp on the first dop only. Stick the sharply pointed tip of a scribe or ice pick slightly into the metal of the first dop at a point near the stone. Only VERY SLIGHT scribe penetration is required. Apply the torch flame to the center of the first dop, the one to be released from the stone, while applying a small pressure to the scribe. The pressure should be applied directly away from the stone. The first dop will quickly release. Gently clean off still-adhering wax or shellac and continue with crown cutting.

The steps leading to the actual removal of the original dop are far more difficult to describe than to accomplish. A practice run or two should ensure expertise. Note that scribe penetration into the dop is so slight that it does not harm the dop.

Transfer When Super Glue Or Epoxy Was Used Initially

In this case, we have two options: 1) Attack or similar strong solvent can be used, or 2) heat can be applied and the scribe or ice pick used as described above. Whichever option is chosen, the transfer dop must be attached as described above. The super glues and the epoxies are all suitable for transfer dopping.

If option #1 is chosen for removal of the initial dop, then a test tube or bottle must be used to hold the strong and somewhat noxious fluid. I find this method good for emeralds and opals. The fluid level in the tube or bottle must be just sufficient to reach slightly above the initial dop, leaving the transfer dop totally above the fluid. Also, it is best if the vapors from the solvent are blocked from reaching the second or the transfer dopping level. A small fan, played on the transfer dop, will remove the vapors before they can attack the transfer dopping. Wait 12 to 24 hours for the solvent to dissolve the initial dopping. The solvent works slowly at temperatures below 70 degrees F.

The solvent should be used in open air or in a well-ventilated garage at several yards from the flame of a gas-fired water heater or furnace. Care should be taken to assure that the vapors are not inhaled, nor the liquid spilled on the skin or gotten in the eyes. The solvent must be kept and used beyond the reach of children. All this sounds very serious, and it is; but Attack is probably no more dangerous than insect spray, gasoline or a number of other substances kept around for home use. I forgot to mention that Attack and similar substances make very efficient paint removers!

If option #2, application of heat is chosen to remove the initial dop, proceed as described for removal from wax dopping. However, be sure there is sufficient water-soaked cloth wrapped around the dop/stone junction of the transfer dopping. Then, apply heat as fast as possible. Get that initial dop off as soon as you possibly can!

Removal Of The Finished Gem

Any of the above options can be used to remove the finished gem from the dop. For the average run of stones, however, I prefer to place the dopped stone in a small cooking pan. Fill the pan half-full of cold water and add a squirt of liquid dish washing detergent. Bring the water to boiling and let it boil for a couple of minutes. Use forceps to lift stone and dop out of the pan. Apply modest finger pressure to unseat the stone. Still-adhering dopping material can be easily removed while the stone is still hot. I have never damaged a stone this way, probably because the heat rate-of-change is slow enough to cause little strain within the stone.

If your stone is quite heat sensitive, and the idea of raising its temperature to that of boiling water disturbs you, then you might consider an opposite course. Place the dopped stone in the freezer propped up a bit so the stone itself rests on nothing. After 15 minutes, apply modest finger pressure to free the stone. This seems to work well with Mexican opal and the somewhat heat sensitive gems. If your gem is really heat sensitive, use solvents.

And, that is the whole story, folks. I have probably told you more than you ever wanted to know about dopping and transfer. However, I know that some day you will remember and use some process that doesn't interest you at the moment. Most important, do not be afraid to modify and adapt these procedures to better serve your requirements. Thanks for reading.

More Dopping Tips

Stephen W. Attaway, Ph.D.

I want to share some more tips that may improve dopping. I like to use Super Glue for the initial dopping, then I transfer with two-part epoxy. I use a transfer block to hold the dop.

For the transfer, I have found two methods that work well for me. As Merrill said, mix your epoxies well. Only a small amount of epoxy is needed, but you will need to use a larger amount to get a good mix.

Be very careful to spread a uniform coat of epoxy around your stone. Epoxy shrinks as it cures. To realize how much force can be generated when epoxy sets, try putting some in a test tube. As the epoxy sets, the polymer will contract and initiate enough stress in the test tube to break it.

When we first began transferring our stones with epoxy, some of the stones would not be aligned correctly. The stones would tip during the transfer, and the girdle would not be level. At first, we thought that our transfer block was at fault, then we tried to blame the dops. We discovered that laying the transfer block on its side caused a small drop of epoxy to form on one side of the stone. The shrinkage of the epoxy was uneven, resulting in the stone being pulled to the side having the most glue. Now, we make sure that the glue is uniform all around the stone.

We all know how water can break things as it freezes. Epoxy can do the same thing. For bigger stones, the shrinkage forces become very large. In some cases, the culet is at risk of being 'pulled' off the stone. When transferring large stones, I always try to make sure that the culet is free of epoxy. You can use wax to protect the culet.

To remove the super glue, heat can be used. We place the transfer block in the oven and heat it to 200 degrees F. The heat will decompose the super glue and set the epoxy. Since the epoxy will be rubbery when hot, you must allow both the stone and the transfer block to cool at room temperature before removing it from the oven.

For stones that are heat sensitive, I let the epoxy set at room temperature overnight. I then coat the epoxy with wax and place the dops in a test tube half filled with acetone. The acetone is such a strong solvent for super glue that the stone does not need to be submerged. Just the vapors will dissolve the super glue in a matter of hours. You will have to be very careful to make sure that a good coating of wax covers the epoxy, otherwise it will soften.

Designer's Workshop

by Ernie Hawes

Very few faceters I know have ever tried cutting one of the checker designs, probably thinking that they are rather hard to cut. I would tend to agree. However, these designs are both attractive and very interesting and should be in any facetor's repertoire. The pavilions of the checker designs follow fairly traditional design concepts. However, the crowns consist entirely of a diamond or checker pattern. Meets may be hard to achieve and must be cut precisely to obtain the desired effect.

In February, Fred W. Van Sant created a round checker cut that promised to be fairly easy. In the attached design notes, Mr. Van Sant chose to be the person computing the design, but for my money, he is the designer. He refers to the design as simply **SRB CHECKER**.

Merrill Murphy contacted me regarding this design and suggested that I might want to put it in the newsletter. Merrill saw it published in the North York Faceters' Guild newsletter. I had already seen it in the April 1997 issue of ***FACETS***, as well as in the North York newsletter. I paid little attention to it then; my mistake.

Merrill pointed out two things about the design that impressed him. He admired how the facet edges run in perfectly straight lines with meets at the girdle facets, making the design much easier to cut than the earlier checker designs. Merrill also liked Fred W. Van Sant's notes on the reverse of the design sheet." Merrill is right. This is clearly an exceptional design, both from a designer's standpoint and as a good design for almost anyone to cut. Mr. Van Sant's design notes as originally published in ***FACETS*** are also included here. I admit that I have never attempted a checker cut, but I will definitely try this one!

In the March - June 1997 issue of the ***USFG NEWSLETTER***, Fred W. Van Sant wrote a very fine and comprehensive two-part article on oval checker designs with several illustrations, including designs with cutting instructions. It is well worth reading, and I have asked Steve and Nancy to include it as a reprint in the July/ August 1997 NMFG newsletter. I have selected one design from this article as our second design for this issue. It is by Robert W. Strickland and called **Diamond Checker Oval**.

The **Diamond Checker Oval** is a new design released by Strickland this past month, the latest of several checker cuts designed by Strickland. It is likely one of the easier checker patterns to cut, because the pavilion is a fairly straight forward barion design. The girdle facets should cut in with little difficulty, making the checker crown much easier to facet.

As I said in the beginning, most of us have never attempted to facet a checker design. With the two diagrams presented here, there should be no excuse left not to try one.

Happy faceting!

Notes on the SRB Checker

Computed by Fred W. Van Sant; Reprinted from Facets, April 1997

I computed this design as a way of checking some changes in my MacGem program. When working this problem, I was not thinking of other designs. I first tried it with a 96 index gear, but had no luck. I then went to a 120 index gear, same thing. I wanted a faceted girdle so the stone would be easy to align after cutting the first half and for transfer-dopping. Wouldn't you know it, I had to try all the other gears before I discovered that the design worked only with the 64 index gear. In fact, the 64 index gear is the **only** gear that will allow straight lines across the stone.

After completing the design, I located Sid Word's "Checkerboard Brilliant". Sid used a 96 index gear and a rolled, or rounded, girdle. Some lines are not straight in the center portion. To avoid crooked lines near the girdle, Sid used non-symmetrical break-facet indexing. These discrepancies could have been avoided had he chanced upon the correct index gear. When Sid published his versions in 1976, computer programs had not yet been written. It would have indeed been laborious to attempt cutting all of the various indexing arrangements on all gears.

I find it surprising that nobody found this version before now. This design marks the only one with perfect squares (or rectangles) and a faceted even-width girdle for easy alignment. The design should be available to faceters, and I think that, in the future, it will become the one cut most often. Whose name it is published under is not important.

There may be quite a few other older designs that could be much improved with computer-aided work. It becomes problematic regarding how many changes actually make a different version into a new design. On the SRB Checker, I added "computed by " instead of "designed by", even though it was designed from scratch.

Lets Talk Gemstones

By Edna B. Anthony, Gemologist

Opal (Second of Series)

The first article on opal described the definitions and provided explanations of the terms and the vocabulary peculiar to this gem species. Australia now stands as the world's major source of opal.

Early in 1997, Fred Ward's fascinating work on this subject was published. For everyone, especially the lay person interested in opal, Fred Ward's book is indispensable. He gives us a guided tour of the opal mines and introduces us to some of the extraordinary people involved in the unique methods of production. He also relates the unusual marketing practices of this beautiful gem. Fred weaves technical information and geological terms into the prose with consummate skill, and he illustrates with such clarity that one is hardly aware of having grasped sophisticated concepts. AND THE PHOTOGRAPHY IS SUPERB!

More than half of the eastern sector of Australia lay under the waters of the Great Artesian Basin during the Jurassic and the Cretaeceous Periods. As the sediments accumulated, many layers of sandstone, shales, and limestone were deposited. After the recession of the sea, the vast area became a desert. Tiny spheres of silica from saturated solutions seeping through these weathering deposits precipitated into cavities, sometimes replacing shell, wood, and bone. A regular alignment of these spheres, having a uniform size and shape caused by the constant slow rate of deposition and evaporation, produced precious opal. A variation in the size, shape, or alignment of these spheres resulted in the formation of common opal.

Australia's most famous opal mines lie on the periphery of this Great Artesian Basin. Mintabie, Coober Pedy, Andamooka, White Cliffs, and Lightning Ridge form an arc along its southern edge. Yowah, Quilpie, and Opalton project on a line north/northwest from Lightning Ridge. Some believe that untold riches, just waiting discovery, lie beneath the unexplored areas of this vast region. However, Dr. Joel Arem, (in the context that "worldwide demand is putting tremendous pressure on opal prices") states in his COLOR ENCYCLOPEDIA OF GEMSTONES that "opal deposits have been worked so intensely that they are becoming depleted" and that "new discoveries are rare."

Mintabie, not as well known as other mines, is unique for its good quality light, dark, and black opal. Sometimes, all of these colors are found together in the same pocket. About twenty percent of the production from Mintabie is black opal. Opal that is free of its matrix-sandstone is also recovered from there.

Some underground mining for opal does take place. However, the random distribution of opal material to a depth of 100 feet in hard sandstone dictates the exploration of an entire claim. Open cut or strip mining is the method used most frequently. Since restoration of "Precious Stone Fields" is not required by the Australian government, miners are free to walk away from the devastated land. Such shredded earth from exhausted claims has created a surreal moonscape on the abandoned area.

Horizontal seams of light opal, as well as some crystal opal, deposited in the soft clays of Coober Pedy make extraction by tunnel machines economically feasible. Blowers bring the material to the surface for further processing and sorting.

Coober Pedy was exploited in the 1960s by an American, George Manning. He had large quantities of light-colored opal material cut into calibrated cabochons in Hong Kong, then shipped them to eager buyers in America. Until recently, his was the opal most familiar to Americans.

Harsh conditions prevail at most opal mines. Some of the residents have constructed luxurious homes underground, especially at Coober Pedy, to make life more comfortable in these isolated sites. Tourism is now a secondary economic factor at Coober Pedy. Its residents enjoy urban amenities in a number of buildings erected above ground.

Andamooka remains a typical dusty "wild west" desert town. It was the world's largest producer of light-colored opal until the mid 1980s. Tunneling was the desired method of production during its most active period. Its famous vitreous transparent crystal opal is rivaled in beauty only by the more unstable variety found in Virgin Valley, Nevada.

The crystal opal produced in Oregon and Idaho, though of gem quality, is not comparable. The opal mined at Andamooka is considered by some to be the most stable in the world, because of its very low water content. Unique Andamooka opal matrix is often "smoked" or "sugar treated" to resemble black opal. The porous matrix absorbs sufficient carbon released by the processes to both darken its body tone and enhance its play of color.

Fred Ward describes this type of opal as having "a black peppery

appearance with a speckled play of color." This particular characteristic, along with its lighter weight, distinguishes this opal from black opal.

White Cliffs is the only place where the marvelous and very rare psuedomorphic "pineapple" opal has been found. The pineapple opal formed when a mineral crystal of a specie, now believed to have been ikalite rather than glauberite, was first replaced by calcite and then by opal. Despite their rarity, most pineapple opals have been destroyed by gem cutters, who were able to profit more from the opals cut from the psuedomorphs than from having the single pineapple opal specimen.

In his book *The Story Of Gems*, Herbert P. Whitlock, a former curator of Minerals and Gems of the American Museum of Natural History likens the light opal produced at White Cliffs to that found in Hungary, but with "broader flashes of color" and in "masses capable of furnishing larger stones." This text is in direct contrast to the statement by Dr. Joel Arem in *Color Encyclopedia Of Gemstones* that "the opal is usually small, with veinlets of precious opal within common opal."

Lightning Ridge, a "free-wheeling" town of about fifteen thousand people, now stands as the major source of the world's finest black opal. Here, the black opal is recovered from seams often more than forty feet below the surface. Heavy equipment is lowered through shafts, assembled below ground, and then used to work the seams in a fraction of the time it took to mine a claim with hand digging. The material is raised to the surface and washed in "co-op" agitators. This method permits faster and more economical sorting and allows easier identification of promising opal material.

Lightning Ridge maintains its own cutting center to retain control of the gems and maximize profits. Buyers deal with individual owners, who sell most of the best gems to customers from Japan and Asia. Sadly, less than eight percent of the finest opal reaches the United States.

Northwest of Lightning Ridge stand the ironstone formations of Queensland, the source of the brilliant boulder opals. These rock formations extend from and include the areas of Yowah, Quilpie and Opalton. A small area around Yowah yields the unique and very rare opal in matrix known as Yowah nuts. These expensive specimens are usually available to collectors only at gem shows and through auctions.

The Yowah nuts were once hollow ironstone concretions about the size of a walnut, and sometimes these contained brilliant opal cores. Some lie on or near the surface of the surrounding sandstone, but miners often use scraping equipment to expose the concretions. They may retain the name Yowah nuts only if a sizeable recognizable portion of the shell remains. If only a small portion of the shell is present, then they are properly called boulder opal. Complete removal of the shell changes the classification to solid opal. At Quilpie and Opalton, sandstone opal, which forms unattached to matrix and seams of boulder opal, lie within the surrounding sandstone.

When the opal is distributed throughout the ironstone matrix in a form not suitable for recovery, the material is often used for unusual decorator objects. It wasn't until the 1960s that heavy equipment and saws capable of handling the tough ironstone made extensive commercial development in the fields feasible. In the last few years, boulder opal has become well known and appreciated by gem enthusiasts all over the world. Its toughness, the brilliant colors, and a freeform style make it especially appealing to designers of unique fine jewelry.

Opal mining in Australia is probably the least regulated major industry in the world. For the most part, it is a rough and tumble, cash and carry, cards close to your vest, buyer beware, and a "you'd better know your opals" business!

While Australia overshadows all other countries in the production of most varieties of opal, Mexico produces fire opal that exhibits a special "it" quality almost always referred to as Mexican fire opal. This gem can show a play of color, but it is the body that color makes it so distinctive. The state of Queretaro is the major source today of Mexican opal.

Fire opal is found in the cavities of volcanic lava flows in Central and South America, as well as in Idaho, Oregon, and Nevada in the United States. Hand dug pits in Mexico still dominate the method of production there. It is a relativity inexpensive gemstone, and one that can have special faults. Opal formed in volcanic environments often crazes and cracks more frequently than that found in sedimentary deposits. The opal can also fade. Rhyolite spheres called "thunder eggs" sometimes contain such opal. It is interesting to note that much of the Mexican opal will craze within a period of less than an hour, although sometimes many months pass before crazing occurs.

Two new varieties have been recovered in Mexico recently. Opal deposited in rhyolite matrix, cut to retain some of its red, tan, pink, and cream-colored matrix, can superficially resemble Australian boulder

opal. The new Leopard opal made its appearance at the gem and mineral show in Tucson in 1996. It is recovered from vesicular basalt formations, where the vesicules were filled with light-colored opal. The play of color spots do remind one of a leopard skin.

A lovely blue translucent common opal called Andean or Peruvian opal is found in the Andes mountains near San Patricio, Peru. Copper may be the essential trace element that causes its soft distinctive color. It has been used by native South Americans for more than a thousand years. Recent commercial production is making more of this inexpensive material available to carvers and jewelry designers at mineral, gem, and jewelry shows. Sometimes, this aqua blue opal can dry out and lose its clarity.

There are many other lesser known sources of opal. Honduras produces a light-colored opal in a dark reddish to black matrix. Prase opal, colored by nickel, is found in Poland. Much of the Indonesian opal material resembles the water or jelly opal found in Mexico.

No two opals are ever identical. Opal is generally a soft and fragile gemstone that requires proper care to preserve its great beauty. Before purchasing any expensive gemstone, become familiar with all the proper methods of setting and caring for such a gem. This is especially true of the unique and very beautiful opal.

TABLE 1. Gemstone Properties

SPECIE	*Opal*
Composition:	SiO2nH2
Varieties:	refer to Jan/Feb 1997 Issue of NMFG newsletter
Colors:	all
Phenomena:	play of color and girasol effect
Streak:	
Crystal System	amorphous
Habit:	layers, veins, nodules, and psuedomorphs
Cleavage:	none
Fracture:	conchoidal and brittle
Fracture Lustre:	
Lustre:	vitreous, waxy, and pearly
Specific Gravity	variable 1.98 to 2.25
Hardness	5.5 to 6.5
Toughness:	poor
Refractive Index	variable 1.44 to 1.47; Mexican opal as low as 1.37, usually 1.42 to 1.43

TABLE 1. Gemstone Properties

SPECIE	*Opal*
Birefringence:	
Optic Character	isotropic
Dispersion:	very low
Pleochroism	none (please disregard info printed here Jan/Feb issue)
Ultraviolet Fluorescence	Variable. Strong white, medium blue, dull white, bright blue, pale yellow, brownish bright green (indicates U minerals). Fire opal often greenish brown. Black opal usually inert. Common opal often green. Phosphorescence sometimes strong.
Spectra	none
Color Filter	no information
Solubility	etched by HCL
Thermal Traits	VERY SENSITIVE TO HEAT and sudden temperature changes
Treatments	dyes, sugar cooking, and smoking

HORSESHOE MOUNTAIN OPAL

By Merrill O. Murphy

Once upon a time, a very long time ago, antelopes, coyotes, and the Chiricahua Apaches were about the only creatures roaming the Horseshoe Mountains. But, the hunger for gold soon spread upon the land and soon drew the prospectors to it.

In 1879 a group of gold-hungry American prospectors wandered northeast from the Mexican border. They, apparently, passed through Tombstone, Arizona and continued into New Mexico about thirty miles northwest of Lordsburg. Still, a few more miles brought them into a semicircular little range of mountains called the Horseshoes. These mountains appeared to be quite mineralized, but they found no gold there. However, legend insists that they did come upon a deposit of precious opal.

Opal wasn't gold, and it didn't cure gold fever. So, they traded the claim to some local prospectors for gold or groceries, or some such thing. Opal, it is said, is unlucky, except for those born under the sign of Libra in October. This prospecting pair must have been born under some lesser sign. They sent a small crew to develop the claim. The Chiricahuas, under the leadership of Cochise, promptly ran them off.

So, this pair gave their claim to a second local twosome in payment for wages owed for claim development. This second pair were working the claim in 1885 when Cochise's band arrived and killed both of them. Obviously, neither of these two men were born in October.

The claims were never worked again and became more or less forgotten. Finally, the Apaches were made peace. In 1902, newspapers in southern New Mexico and Arizona published what little was remembered about the opal of the Horseshoe Mountains. A prominent Arizona pioneer tried to revive the search, but for some reason, his plans fell through. Perhaps, in the nick of time, he remembered that he had been born in April or January or....

Anyway, near Lordsburg, New Mexico, a perfectly fine deposit of precious opal awaits a modern discoverer. I will tell you how to find it, but do beware. Don't go alooking unless you were born in October under the sign of Libra. Even then, don't leave until autumn. It is just too hot down in those Horseshoes.

Note Lordsburg on your road map. Paved U.S. Highway 70 runs northwest out of Lordsburg, crosses the Arizona border at Duncan, and continues on to Globe. A branch of the Southern Pacific Railroad, more or less, parallels Highway 70, then runs several miles to the south of it. Somewhere out there, before you reach the state line, there was once a tiny village called Summit. The Horseshoe Mountains lie shimmering in the sun a few miles to the southwest of Summit.

Summit doesn't appear on modern road maps and may no longer exist. However, my Gila National Forest map shows a few dirt roads that terminate at some sort of dwelling in the area northwest of Lordsburg and south of Highway 70. At one point, several of these dwellings are clustered together near the railroad, rather close to the Arizona border. My best guess would be that these are the old houses of Summit.

None of my maps show the Horseshoe Mountains, but I am sure that they are there, even if rather insignificant as mountains can appear. They are, no doubt, shown on USGS maps. However, they may not be revealed to me. You see, I wasn't born in October under the sign of Libra, either.

From the Editor: According to Fred Ward's wonderful book on opals, opals have been sadly associated with bad luck. One opal owned by a king brought very bad luck to the goldsmith who accidently broke it when setting it. An angry King Louis XI ordered his hands severed.

Another story about opals and bad luck involved a character in a Sir Walter Scott novel. Fred Ward again explained that many folks, who did not read the third volume of a series written by Sir Walter Scott in 1829, made a most unfortunate error in blaming opals for the death of the heroine, Anne of Geierstein.

One opal legend relates that opals emerged from the painting pallette of Mother Nature as she mixed all of her favorite colors together. Many gem lovers consider opal to be the queen of gems, because opals exhibit the pure essence of every colored gem. Jewelry designers surround precious opal and black opal with diamonds and colored stones to accent the particular colors shimmering from those magnificent opals.

Opal inspires many to an addiction. Just ask my opal-holic husband, Steve about his opal addiction. The amazing beauty of opal yields loyal followers and even compels some to search the globe for its existence. For those who appreciate them, opals are wondrous. Lucky are those who can claim opal as their own birthstone.

Update on Synthetic Diamonds

by Heidi Ruffner, Ph.D.

While attending the Tucson Gem and Mineral Show last February, I enrolled in two gemstone courses offered by the Gemological Institute of America (GIA): "Identifying Challenging Synthetics" and "Synthetic Diamonds". I found the information and hands-on identification work in both courses to be extremely helpful and well worth the modest registration fees ($79 for each course). This issue, I will relay some of the important information regarding synthetic diamonds.

Synthetic diamonds are now commercially available, albeit in limited quantities and colors. Nearly all of the synthetic diamonds that have reached the marketplace are either yellow or yellow-brown in color. Several dealers at the February 1997 Tucson Gem and Mineral Show offered such diamonds for sale. In addition, two Russian synthetic red diamonds (color-treated) have recently been submitted by independent dealers to the major gemological laboratories for identification and analysis (i.e. synthetic reds are out there too!).

Colorless synthetic diamonds are not yet commercially available, although DeBeers has manufactured some prototypes. Some of these prototypes have been sent to GIA for examination and will also serve as standards and educational aids. My diamond sources tell me that these "colorless" synthetics are actually light yellow in color (I, J, or K color on the GIA diamond color grading scale). Achieving a true "colorless" synthetic diamond (D, E, or F color) has not yet been achieved. True colorless synthetics will probably not be commercially available for quite some time.

Synthetic diamonds are, of course, crystallographically and chemically identical to their natural counterparts. Therefore, many of the standard tests for physical and optical properties yield the same results for both synthetic and natural diamonds. The growth processes, however, are significantly different, and the different growth features can establish the source. If these growth features are present in a cut diamond, then these features can serve to ascertain the stone's origin. The table below lists some properties that all diamonds have, regardless of origin, and also some growth characteristics that enable the identification of a diamond as either natural or synthetic.

Properties of Natural and Synthetic Diamonds

- Hardness = 10
- Refractive index = 2.42 (off the scale for most gem refractometers).
- Dispersion = 0.044
- Internal inclusions such as feathers, clouds, veils, pinpoints, etc.
- Thermal conductivity (standard test used to differentiate diamonds from other colorless, high refractive gemstones, such as cubic zirconia).

Natural Diamonds: Positive Identification Features

- Included crystals (also known as "carbon spots").
- Indented trigons (natural triangular shaped external features on diamond crystals). Note: raised trigons may be associated with either natural or synthetics.
- Blue fluorescence.
- Occurs in all colors, including colorless. Note: expect this to change as soon as the synthetic diamond technology matures!
- Mottled zoning that does not repeat every 90°.
- Usually octahedral crystal habit (uncut).

Synthetic Diamonds: Positive Identification Features

- Metallic inclusions.
- Hourglass-shaped and columnar internal color zoning. Repeats every 90° of rotation.
- Radiating octagonal surface pattern on table (raised external feature that remains after polishing).
- Geometric patterns (e.g. crosses) seen in fluorescence due to zoning of light emitting ions. Fluorescent pattern is usually green or yellowish green, sometimes orange, but never blue.
- Phosphorescence (up to 30 seconds) in near colorless stones.
- Cube octahedral crystals (uncut).

Because the supply of synthetic diamonds is still limited, and because the demand for them continues to increase (especially for use as teaching aids and novelty gemstones), their prices remain high. The synthetics currently sell for approximately 90% of the cost of a comparable natural diamond. This relative cost is much higher than that for any of the other synthetically grown gemstones, including rubies, sapphires, emeralds, and spinels. An investment in synthetic diamonds is especially risky, because of the artificially inflated natural diamond prices assigned by DeBeers. I plan to wait a few years before investing in my first synthetic diamond. In the meantime, I expect both quality and selection to increase, and the prices to decrease.

Another newcomer to the diamond market is moissanite, a diamond simulant composed of gem quality silicon carbide. The long-awaited commercial debut of this simulant will undoubtedly cause great consternation, as many of its physical properties are remarkably similar to those of diamond. In particular, moissanite will test "positive" (i.e. as a diamond) on standard "diamond testers" that measure the thermal conductivity of a stone. While current diamond testers will remain useful for differentiating between diamonds and some simulants, such as cubic zirconia, **the standard diamond testers will be unable to differentiate between diamonds and moissanite.**

More on moissanite and synthetic gemstones in the next issue!

Editor's Note: National Jeweler reported in the June 16, 1997 issue that a new diamond tester was nearly ready for market. The company C3 currently manufactures and markets synthetic moissanite, a new diamond simulant that dupes the thermal testing tool used for identifying natural diamonds. Because synthetic moissanite yields a false diamond reading, C3 also plans to sell a new tool for detecting synthetic moissanite. This would allow jewelers to positively identify synthetic moissanite and distinguish it from natural diamonds. The Gemological Institute of America reports cooperation from C3 on its product and testing. Both the new diamond simulant and the new testing device may be available this autumn. Prices for synthetic moissanite are estimated to run between 10% to 20% that of natural diamonds.

The Spring 1997 Issue of Gems and Gemology, pages 42-53, featured an article on the gemological properties of near-colorless synthetic diamonds.

A Costa Rican Adventure

By Nancy L. Attaway

An opportunity to visit Costa Rica in early May allowed Steve and I a close look at a Central American country. The 1997 International Conference on Computational Engineering Science invited Steve to present his latest work during a keynote address, as well as chair one of the committees. Two lovely hotels just outside San Jose, Costa Rica served as the conference centers. I filled in as the official spouse, trip organizer, and photographer.

Costa Rica lies north of Panama and south of Nicaragua. The ten degree latitude mark bisects Costa Rica. Many volcanoes dot the mountainous countryside, and a few of those volcanoes remain active. A wondrous variety of animals, birds, and insects inhabit the Costa Rican rain forests. Costa Rican beaches touch the Caribbean Sea with its eastern shores, and its sands meet the Pacific Ocean on its western section.

Like Hawaii, coffee grows well in the volcanic soil of Costa Rica. Pineapples, mangoes, papayas, and bananas all grow on large plantations near the rain forests. Costa Rica exports tropical fruit, coffee, and many ornamental flowers, such as orchids, ginger, and bird of paradise.

Costa Rica boasts of having the most stable political climate in Latin America and has held democratic elections since the 19th century. It also takes pride in its people having a 95% literacy rate. San Jose, situated in the central valley region at an elevation of 3795 feet, functions as the capital city and hub of Costa Rica.

The city of San Jose also houses two world-class museums, The Museum of Pre-Columbian Gold and the Jade Museum. The gold museum showcases an amazing collection of pre-Columbian gold adornments. The jade museum displays the world's largest collection of pre-Columbian works of carved jade.

The Museum of Pre-Columbian Gold (Museo del Oro Precolombino) displays over two thousand pieces of worked gold artifacts. The basement of the Plaza de la Cultura complex maintains the gold museum, owned by the Central Bank (Banco Central). Armed security guards watch over this fabulous gold collection arranged in an enormous bank vault.

Artisans worked the gold into jewelry, head and neck adornments, breastplates, and talismans. Hammering (repousse) and lost wax casting, using bee's wax, rendered gold into the remarkable likenesses of birds, frogs, lizards, butterflies, and jaguars. The museum interpretations relate certain theories and provide explanations for the golden objects. Some of the stories came from the records written by Catholic clergy and Spanish soldiers. However, not a lot is actually known about the cultures that produced these remarkable gold pieces.

The Jade Museum (Museo de Jade), (jade is pronounced as ha-day), exhibits the largest collection of American jade. The museum displays hundreds of jade tools, knives, beads, and carved ornaments. Most of the raw jade was obtained from Costa Rica. The museum cleverly mounted many jade pieces with a backlight to better view the translucent quality of the jade. Archaeological exhibits also include ceramic vases, stonework, and some worked gold pieces. The museum resides on

the eleventh floor of the National Security Institute (Instituto Nacional de Seguros). The eleventh floor also gives a bird's eye view of the city.

For a long time, the source of the jade was not known. However, a couple of years ago at Tucson, we were fortunate to find a dealer from Central America who sold jade from Guatemala. We purchased one fine slab of this white-green jade. Steve has since carved it. He thinks that it carves as well as any jade around.

Of all the Central American countries, Costa Rica stands as the one most influenced by the Spanish conquest. No large or rich Indian empire existed in Costa Rica when the Spanish arrived in the early 1500's. The Spanish merely settled Costa Rica. Hence, Costa Ricans speak a formal type of Spanish, even using some of the old Arabic phrases.

Costa Rica has earned a world-famous reputation for the excellence and far-sightedness of its national park system. Costa Rica's magnificent natural environment is, without a doubt, the country's feature attraction for tourism. Choices available include observing a diverse wildlife, white water rafting, hiking in the cloud forests, strolling on the beaches, snorkeling the coral reefs, viewing smoking volcanoes, soaking in the hot springs, sportfishing, and seeing cascading waterfalls.

Steve and I rented a car to give us flexibility and independence while touring the Costa Rican countryside. Little did we know what hazards would greet us on the open roads. Large trucks hauling bananas competed for space with small utility trucks and cars on roads barely wide enough for two vehicles. We dodged other traffic, pedestrians, and livestock, while trying to avoid falling into the deep rainsoaked potholes.

Navigating in Costa Rica presented some challenges. The road department saw no reason to erect very many road signs. Steve, ever the techno-gadget collector, used a combination of three different maps and a hand-held global positioning system (GPS) to help us navigate. Heavy rain and pea soup fog added to the confusion. Despite Steve's best orienteering efforts, we stopped often to ask directions. The very friendly Costa Rican people responded to my passable Spanish and graciously provided the necessary road directions. The rain fell so very hard sometimes that it obscured our visibility.

Unlike the usually arid state of New Mexico, downpours of rain hammered us with 110% humidity. Driving from rain cloud to rain cloud resulted in the windshield of our rental car to fog endlessly. The car defroster seemed to add to the problem. As the fog situation arrived at the point where we thought we would spend the night by the side of the road, waiting for the fog to clear, Nancy remembered she had packed an anti-fog cloth for her sunglasses. It worked miracles and allowed us to see through the windshield again.

Our road trips rewarded us with vistas of mountains covered with a lush, tropical plant life. The farther we climbed towards the mountain tops, the more the clouds diminished our views. Clouds blocked our views of volcanoes, but the rains fueled the waterfalls that cascaded over rough terrain. Exotic flowers decorated the landscape with vibrant colors and perfumed the air.

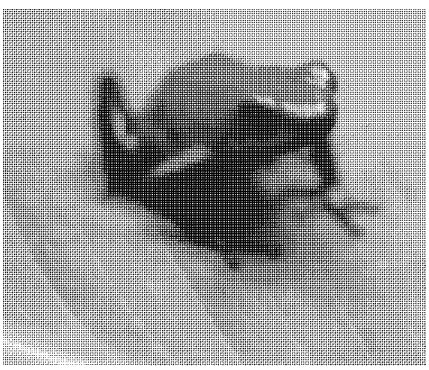
Steve has yet to see molten lava flowing down the sides of an active volcano. In Hawaii, steam could be

seen as lava slid into the Pacific Ocean off the southeastern coast of the big island. In Costa Rica, clouds obscured our view of Arenal, but we saw steam rolling down its sides. A clear night can provide some fantastic lava viewing. I guess Steve's quest for seeing fresh lava really stems from his desire to see the source of all those wonderful gems.

Our Costa Rican driving experience proved to be more than enough of an adventure. We returned it and arranged a guided trip to the rain forest east of San Jose. A seasoned jungle guide, Jungle Tomas "Tom" McGuinness revealed to us an exotic land filled with beauty and danger. We booked a flatboat tour near a 100,000 acre banana plantation and motored upon a jungle river.

Howler monkeys screeched at us from their treetop perches as they swung from branch to branch.Crocodiles and yellow-bellied turtles sunned themselves, while egrets and blue herons flew beside us. Basilik lizards (also known as Jesus Christ lizards) skipped across the water. Iguanas ran along the shore, and two-toed sloths napped in the trees.

Where the river met the Caribbean Sea, we turned left and soon docked for a mile and a half hike into the rain forest. Armed with the latest Deet Plus bug spray, we followed our intrepid guide into the jungle.



Jungle Tom pointed out spider monkeys and jaguar tracks while explaining the rain forest botany. The lush canopy made by the many trees left the forest floor in shadows. Since Steve has carved the likenesses of frogs in reverse intaglio into quartz pyramids and into tablets of peridot, he asked to see the poison arrow frogs. Jungle Tom obliged him and showed how many of them hopped allover the ground. These bright orange-red frogs have purple feet and measure about an inch long. Their skin secrets a neuro-toxin that forest dwellers used on their arrows and darts to hunt animals. Our guide assured me that I could allow one to sit in my hand if I had no open cuts, so I did. The frogs are so very tiny.

The most dangerous creature living in the rain forest, according to Jungle Tom, was the bullet ant. Longer than the poison arrow frogs, the poisonous bullet ant builds nests at the base of the trees. One bite from a bullet ant feels as if a bullet entered your body. Seven bites are usually fatal, and one ant can bite many times. Steve wondered if the poison arrow frogs fed upon the bullet ants and obtained poison from the ants. We then left the ants alone.

Among the wild banana trees, long leaf ferns, and umbrella leaves stood the strangest tree that I ever saw. Our guide said that it was a walking tree, and that it did, indeed, walk. In order to constantly adjust its upper branches to compete for sunlight, the walking tree walks the forest floor with its spoke-like roots. These long roots fan out in a circle from the trunk and 'walk" a distance of about two feet during a year. I learned, inadvertently, that the tree also has spines not to be touched.

We shared our Costa Rican adventure with several college friends who also attended the conference. The scenic beauty of Costa Rica impressed us all, and we wished that we had more time to explore the natural wonders of Costa Rica.

Anyone having questions about traveling in Costa Rica, may contact me by phone at 505-281-4163 or use e-mail: attaway@highfiber.com.

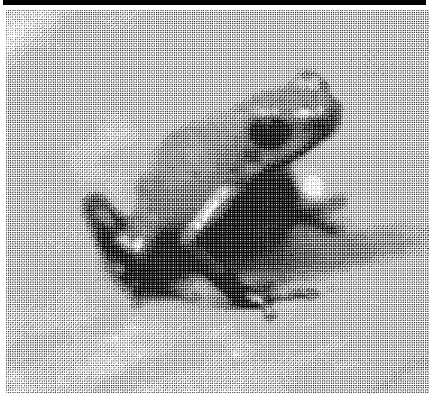
Next Meeting:

July 10, 1997.

Crown Jewels of England

Photo Workshop

Bring a stone for a portrait.



Wedding Bells

Mr. and Mrs. David Rosson announce the marriage between their daughter, Eileen Rosson and Troy Smith on September 28, 1997. Bride and groom currently reside in Albuquerque, New Mexico. Both are active members of the New Mexico Faceters Guild. Our best wishes of happiness go to Eileen and Troy as they begin their life together as husband and wife.

Advertisements

Faceting Machines for Sale

Al Tlush, master facetor, lists for sale two American Facetor faceting machines that have been stored in their original boxes and never used. Please contact Al at 505-864-2145 in Belen, New Mexico for details and prices. Al played a big part in the design and manufacture of the American Facetor faceting machine some years ago.

James Westcott lists for sale a nearly new faceting machine with all index gears and many supplies. The faceting machine set-up includes an electronic stop, all dops, some dyna laps, a transfer block, and four steel laps. Asking price is $1900.00. Please contact James in Tyrone, New Mexico at 505-534-0727.

Ernie Hawes lists for sale a used Facetron faceting machine acquired from an estate sale. Ernie, our local Facetron dealer, cleaned and refurbished the faceting machine himself. Please call Ernie in Albuquerque at 505-821-3201 for details and price.

TABLE 2. Shows of Special Interest

Name	*Location*	*Date*
Four Corners Gem and Mineral Club's Gem and Mineral Show	Durango, Colorado	July 11 -13
Ute Mountain Gem and Mineral Society's Rockhounders' Roundup	Cortez, Colorado	July 19 & 20
Colorado Gem and Mineral Society's 33rd Annual Pike's Peak Gem and Mineral Show	Colorado Springs, Colorado	July 19 & 20
Colorado Federation of Gem and Mineral Societies 14th Annual Show	Buena Vista, Colorado	Aug. 8 -10
"Ocean in the Desert"; Museum of Natural History and Old Town Merchants join the annual Gathering of the Society of Glass Beadmakers	Albuquerque, New Mexico	Aug. 21 -24
Atrium Productions Gem, Mineral, and Jewelry Show	Tucson, Arizona	Sept. 4 -7
Pacifica Trade Shows	Tucson, Arizona	Sept. 4 -7
Great American Gem, Jewelry, Mineral, and Fissil Show and Sale	Denver, Colorado	Sept. 9 -14
USGE Gem, Mineral, Fossil, and Jewelry Show	Denver, Colorado	Sept. 10 -14
Colorado Mineral and Fossil Show	Denver, Colorado	Sept. 10 -14
Gemfaire Show	Denver, Colorado	Sept. 10 -14
Gem and Mineral Show	Denver, Colorado	Sept. 12 -14