

The Opal Express

American Opal Society
P.O. Box 4875
Garden Grove, CA 92842-4875



**Volume #38 Issue #1
January 2005**

TO:

Some Topics In This Issue:

- Scott Wilson on Opal Synthesis
- Gems Polish Because...
- A Dark Day on Red Mountain

Important Info:

**General Meeting
January 10th**

**General Meeting
January 13th**

AOS Officers Elections

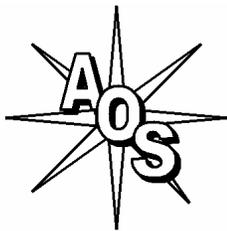
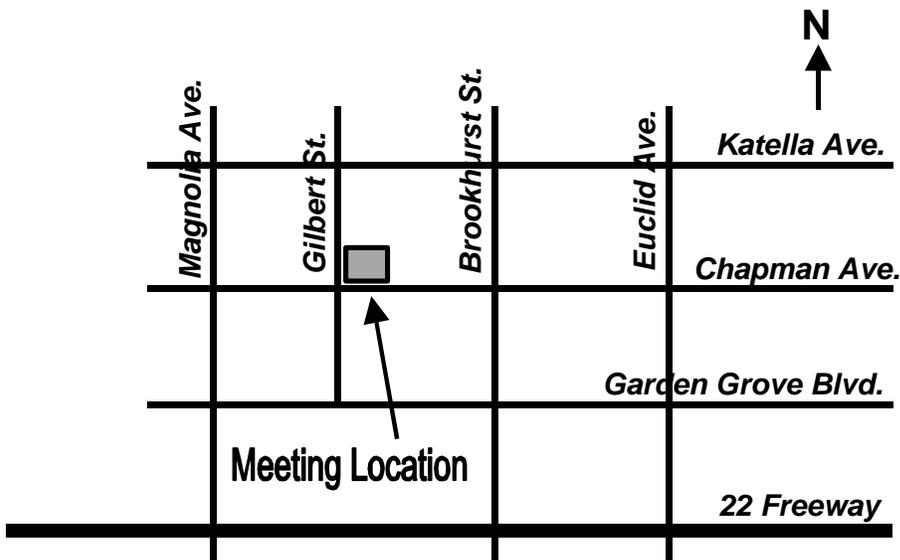
Jan. 13th Elections

— **GENERAL MEETINGS** —

2nd Thursday of the Month
7:00 pm - 9:00 PM
Garden Grove Civic Women's Club
9501 Chapman Ave.
(NE corner of Gilbert & Chapman)
Garden Grove, CA

MEETING ACTIVITIES

Opal Cutting Advice Guest Speakers
Slide Shows Videos Other Activities



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<http://opalsociety.org>

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Editor-Jim Pisani

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Are Your Dues Due Now?

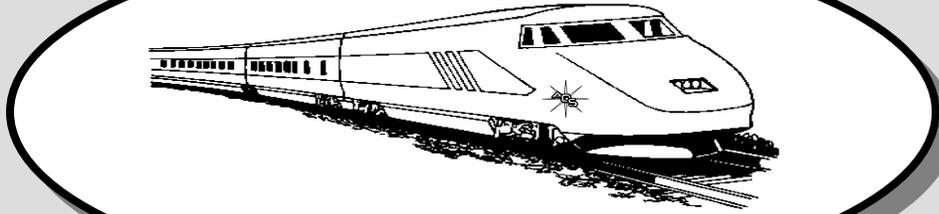
PLEASE CHECK YOUR ADDRESS LABEL. If your label shows the current month/year your dues are **DUE NOW**. If the date is older, your dues are overdue.

A Renewal Grace Period of two months will be provided. If your dues are due now you will receive two additional issues of the newsletter. Please note, however, that as the system is now set up, if your renewal is not received you will be **AUTOMATICALLY** dropped from membership thereafter. It is your responsibility to assure your dues are current.

Thank you,
The Editor

The Opal Express

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January 2005

Volume 38 Issue 1

Table of Contents:

President's Message	3
Christmas Potluck Dinner	3
AOS Elections for Officers	3
Opal Workshop	3
Members Only Website Password	3
To have your Newsletter e-mailed to you...	3
Scott Wilson on Opal Synthesis	4
Gems Polish Because...	5
Shady Tales: A Dark Day in Red Mountain	7
January Gem & Mineral Shows	8

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President's Message

By Pete Goetz

Hi Folks,

Well, it's that time, my term as President of the American Opal Society is up. I would like to thank all of you for allowing me the privilege of filling this office for the past two years... where did the time go??

Our 2004 OPAL SHOW went well. No major problems with the facility, vendors that I spoke with seemed to have done well and were generally happy to have been there. I meet a few members that I have not met and we a great time talking OPAL. Some of you traveled from afar, Thank you. Hope to see you all next year.

We did not grow as much as I would like to have seen, In act, some of our members seem to have lost the directions to the meeting hall. However, we did not fall behind. Two major developments were implemented that will increase our visibility. First, the ability to receive your monthly OPAL EXPRESS by e-mail. This will save the Society some needed dollars and will allow our editor to be more creative, not that Jim isn't mind you. It will also allow him to add new features which will make the OPAL EXPRESS a more outstanding newsletter. Those of you who have elected to receive your newsletter by e-mail, THANK YOU. I hope more of you will consider this option.

Secondly, The publication of the SPECIAL EDITION or SHOW EDITION of the OPAL EXPRESS was a giant leap forward in defining who the American Opal Society is and the direction we want to take our Society in the future. This piece will bring a new level of sophistication to our Society. I would like to thank Mike Kowalsky, Jim Pisani, and Russ Madsen for their extended time and effort in making this project a success.

Some parting thoughts: Our organization has a very focused agenda, mainly the study of OPAL as a gemstone. This being the case, we need to concentrate on building our organization. I think we can do this by developing a more aggressive membership campaign, finding more and varying venues through which we can tell our story, developing society generated seminars that can be

shared at a moments notice, and many other projects that I could name or you can suggest that also can be shared with other societies. These are not new ideas. These topics have been discussed on several occasions. What we need is some of our more knowledgeable members to work with some of the not so knowledgeable, and work on projects. I could go on for a bit, but save some of this for another time.

I do not know who the new officers will be, but I wish them well.

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Christmas Potluck Dinner

The annual holiday dinner was a success! At least 20 members attended, with a great feast of ham, chicken, pasta, baked beans, salads, cheese cakes, chocolate cakes, etc. etc. etc.

A good time was had by all!

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AOS Elections for Officers

The January General meeting will be our election meeting for new officers. Posts that will be voted on are:

- President
- Vice-President
- Secretary
- Treasurer

Please attend the meeting if you are planning on voting. The candidates will be announced at the meeting.

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Opal Workshop

The AOS opal workshop is at Ball Jr. High School on 1500 W. Ball Rd., Anaheim, CA. It can be open for members on Monday. Contact Stan McCall at (714) 220-9282.

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Members Only Website Password

To log onto the website's members only area at: http://opalsociety.org/aos_members_only_area.htm type: Name: "member" and Password: "opalshow".

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To have your Newsletter e-mailed to you...

About a third of the members responded positively to an e-mail asking if they wanted to receive the newsletter electronically. Thank you! You are helping your Society!

Since we don't have everyone's current e-mail address, we need to hear from you. A mass letter mailing will occur shortly, but if you want it e-mailed sooner, please e-mail the editor, Jim Pisani, at webmaster@opalsociety.org. Please indicate your name and e-mail address that you want it mailed to.

Thanks,
Jim Pisani, Editor, American Opal Society

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Scott Wilson on Opal Synthesis

The New Mexico Faceters Guild

By Nancy L. Attaway and Scott Wilson

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

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

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

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

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

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

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

To obtain the silica spheres, one might buy them from any of several suppliers of technical materials. Silica spheres are very expensive now, but they were much cheaper at one time. In the past, silica spheres were used in paints, cosmetics, food, and

juices. They are no longer widely available, due to a competing process (fumed silica) that forms irregular-shaped particles.

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

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

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

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

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

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

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

To improve the color, something must be done to increase the quality of the microsphere lattice. Many things can affect the quality of the lattice. A very important one involves electrostatic forces. The

spheres tend to charge negative, due to the disassociation of surface silanol groups or the absorption of hydroxyl ions. Charged particles rarely behave nicely. The surface charging tends to cause the microspheres to resist efficient packing in the lattice, thus forming lattice defects. This problem can be reduced by modifying the microsphere surfaces with a silane coupling agent (SCA), which reduces surface charging and allows the spheres to more easily form a high quality lattice arrangement.

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

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

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

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

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

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Gems Polish Because...

By Merrill O. Murphy

A Gem Cutter's Enigma

Colloidal silica and diamond powder are the two most nearly universal gem polishing agents. Colloidal silica will polish most gemstones in the Moh's hardness range between five and nine. Diamond will polish most gemstones in the hardness range between six and 10, and will polish many of the soft stones in the hardness range from two to four. Notice the modifiers "most" and "many."

Disclaimer - I cannot, of my own resources, prove the theory of polishing that I present here. I can only do two things: 1) present my ideas and 2) give my reasons for believing this theory is true. It will be up to those more learned than I to determine whether I have the correct interpretation of the facts or have just, like G. T. Beilby, distorted the facts to fit the theory.

History

Gems have been polished for ages. The Egyptians, Chinese, Persians and other ancient peoples polished gemstones by the simple process of rubbing them on sandstone, starting with coarse grained sandstone and ending with the finest grain obtainable. The degree of polish attained was, of course, limited by the largest silica grains present in the finest-grained sandstone. The results were no better than one would expect from such a crude process and was limited to gemstones no harder than quartz. Centuries later, the process was refined to use silica sand on wood for a final polish. The sand-covered wooden surface was wetted with water, and the gemstone was rubbed against it. In this case, the degree of polish was limited by the lapidary's ability to sort out the larger grains of silica.

Eventually, cutters found another polishing agent called emery. Emery is an impure granular mixture of corundum, magnetite, hematite, and spinel. Corundum, consisting of the gem minerals sapphire and ruby, is very hard and will cut or polish most minerals below it on the hardness scale. Spinel is ranked just below corundum in hardness while magnetite and hematite are much softer. With simple methods of particle size grading, emery replaced sand as a cutting/polishing agent in many areas of the world.

Later still, diamond was found in India and became the polishing agent of choice when working with the harder gemstones. Diamond particles could even be used to cut and polish the surfaces of gem-size diamonds.

The procedures for grading grit sizes improved slowly over the ages, but all information having to do with gem cutting and polishing was secretly held by lapidary groups called guilds. And this was the situation when Sir Isaac Newton, a 17th to 18th century scientist (working with Hooke and Hershel), looked into the matter. Polishing, Newton and company insisted, was an abrasive process. In polishing, they said, the gemstone was rubbed against particles of polishing agent and scratches resulted. As the polishing particle size was reduced, the scratches became smaller. Reducing particle size still more and more resulted, eventually, in scratches too small to see. At this point, Sir Isaac said, a stone is truly polished. And to this day, his findings still have some merit. There are, however, other factors to be considered. For example, certain cutter's guilds were aware, even then, that finely graded silica particles (Moh's hardness 7) could polish sapphire (Moh's hardness 9). I am surprised that a scientist as sharp as Newton did not unearth this fact.

The author has an acquaintance who works at the University of New Mexico. At one time, his job required him to polish large, flat synthetic sapphire slices. Since these slabs were for use in experimental optics, they were required to be both extremely flat and polished much better than jewelry use would have required. He succeeded by polishing without a lap. He simply suspended the sapphire blanks in a tank, then pumped a mixture of colloidal silica in water at high velocity across the sapphire surfaces. Remember these facts as we continue.

Beilby

In the period just before and after 1900, an Englishman named G. T. Beilby published what has become known as the Beilby Flow Theory of Polishing. His first paper was titled "The Minute Structure of Minerals." In 1903, he published a second paper, "Surface Flow

in Crystalline Solids Under Mechanical Disturbance." His third paper, titled "Aggregation and Flow of Solids," was published in 1921. As late as 1937, scientists F. P. Bowden and T. P. Hughes accepted Beilby's theory, and these ideas became known as the Beilby-Bowden Theory of Polishing. Other scientists were divided in their acceptance or rejection of the theory, mainly because there was no laboratory equipment yet available capable of proving or disproving the famous (infamous ?) theory.

Beilby's Theory

Beilby's famous theory, reduced to its essentials, claimed that (1) friction is involved in polishing, (2) friction generates heat at the surface being polished, (3) the heat generated is seen only by the surface molecules, (4) the heated surface molecules become molten, (5) the molten molecules are "pushed or flowed" from high spots and dumped into low spots, (6) the moved or flowed molecules remain in the low places, filling them and leveling the surface, (7) the flowed molecules, almost instantaneously, solidify in the low places, and (8) a smoothly polished surface is achieved. Unfortunately, Beilby forgot that the water, necessary to polishing, is one of the most perfect heat absorbers known to man.

Gemcutters, amateur and professional, generally accepted the Beilby theory because there was no alternative theory to explain the process. And, even today, there are many amateur cutters who will argue vehemently in favor of the idea of molecular surface heating and flow a-la-Beilby. Still, by the late 1940's, vastly improved instruments and techniques of examination led to less belief in Beilby-Bowden on the part of the scientific community. Scientists repeated all the original Beilby experiments over the following years and found little to support the old theory.

The Knockout Punch -

The final blow came in July 1981 with the publishing of "DEMISE OF THE BEILBY-BOWDEN THEORY OF POLISHING," by Peter J. Crowcroft, Ph.D., in The Journal of Gemology, Vol. 17 (7), July 1981, pp 459 - 465. Peter J. Crowcroft is an internationally known and respected gemologist. His article was published with 22 references. It thoroughly demolished the Beilby-Bowden theory and was reprinted in the Lapidary Journal in a revised article. Unfortunately, Crowcroft was unable to provide a new theory to replace the discredited one.

Somewhere in the same time period, the Lawrence Livermore National Laboratory became involved in polishing phenomena. One of their experiments involved the measurement of heat generated in polishing. A transparent lap charged with polishing agent in water was employed. By looking through the lap from beneath, instruments could monitor the contact surface of a synthetic sapphire blank while the lap was in operation. The maximum surface temperature rise noted was in the neighborhood of six degrees C. With adequate water on the lap, normal lap speed and hand pressure applied, there is, essentially, no gem surface heating.

Glass Research

The next and most important break-through came from Sandia National Laboratories in Albuquerque, New Mexico where Terry A. Michalske and Bruce C. Bunker were doing glass research. Their article, "The Fracturing of Glass," appeared in the December 1987 issue of Scientific American magazine. In their article, Michalske and Bunker described glass as one of the strongest of building materials and able to withstand tremendous stress - IF THERE IS NO WATER PRESENT in the surrounding atmosphere.

Glass, Michalske and Bunker said, has microscopic, shallow surface fractures. These fractures cause little trouble if there is no water present. In the presence of stress and water (or water vapor), things change. Because of surface tension, water cannot enter the

microscopic surface cracks - if there is no stress present. Under stress, water is forced in and moves to the very tips of the cracks. There, atoms of oxygen and hydrogen (water) bond with the silicon atoms of the glass. A one-molecule-thick layer of new material forms chemically. The new layer, called a hydroxyl, blocks further contact with water and prevents formation of thicker layers. Hydroxyls are both softer and weaker than the glass. Stress, concentrated at the crack tips, causes the hydroxyl layer to fracture, exposing the glass, again, to chemical change. A new hydroxyl layer forms, and the process repeats in a process called propagation. Propagation may be exceedingly slow or very fast depending on the amount of stress. Without stress, a hydroxyl layer forms very slowly.

Hydroxyls and Gem Polishing

Now, I'm not going to tell you that gem polishing is done by crack propagation, nor am I going to go through all the chemistry involved. (If you wish to follow the chemistry, crack the old chemistry book or "Mineralogy for Amateurs" by John Sinkankas, chapter 2. My copy of Sinkankas is the 1964 edition and is very good. I hope later issues still have the "Atoms and Minerals," chapter 2.) What I intend here is to show readers that a similar chemical/abrasive process is taking place as you polish a gemstone. And, yes, I did take my conclusions to Terry Michalske. He said my ideas sounded correct. That does not mean he sanctions everything I have said. To do that he would need to run a large number of experiments. He has neither the time nor a pressing need to know. It just means it seems in line with data received from stressed glass experiments he and Bruce Bunker have run.

Gemstones Versus Glass

Gemstones are chemically related to glass in that most of them are either oxides, silicates, or carbonates. All these minerals appear to be subject to hydroxyl formation in the same manner as glass. In the case of glass, stress forces water into the tiny fractures, then causes the hydroxyls to fracture. In gemstone polishing, water is present - even in oils, if you are using them as coolant/lubricant in place of water. Pressure speeds the formation of hydroxyls on a facet face just as it does within the tiny cracks in glass. (And the greater the hand pressure, the greater the lap speed, the greater the tendency for hydroxyls to form.) Therefore, it seems logical to think that very thin hydroxyl layers form on facet surfaces even as you cut them. If I am right, the polishing agent simply abrades away the soft hydroxyl layers. And, of course, a new layer forms even as the older layer is abraded off. When enough material has been "polished" off, no more pits and tiny scratches remain. You have a polish.

Other Factors

Several associated items remain to be explained away. There is that old problem of agglomeration. There is the hydroxyl formation on the polishing agent particles and the reasons why different gemstones require different polishing agents. Lastly, there is the question of how diamond particles polish gemstones.

Agglomeration

What is that old bugaboo called agglomeration? (Some people call it conglomeration, which it is not. Conglomeration is a rock building process wherein existing stones -- usually stream-smoothed stones, are included in a later geological formation.) Agglomeration is the process seen in polishing wherein polishing agent and lap debris form relatively large particles beneath the stone being polished. When such a particle forms between gem and lap, all the polishing pressure is suddenly concentrated on the single particle. The pounds per square inch pressure remains the

same, but the point pressure skyrockets. You get an ugly, ragged scratch.

Why does agglomeration occur? It probably results as particles tumble under the stone. Particles in contact become stuck together - glued - by thin hydroxyl layers and compacted by polishing pressure. The agglomerated particle(s) may become much larger than a single grain of polishing agent. With the exception of diamond particles, all gem polishing agents are oxides and usually (but not always) harder than the gemstones they will polish. As we have noted earlier, metal oxides are susceptible to formation of hydroxyls when water is present. Then, we would expect hydroxyl formation that would include bits of lap debris and adjacent other bits of polishing agent - agglomeration! Excess hand pressure on the stone and/or excess polishing speed compacts and strengthens the agglomerate particles.

What does one do to prevent agglomeration? Slower lap speeds and lighter hand pressure have been suggested. Also, it is obvious that reducing friction will reduce the tendency of particles to tumble on the lap. Two ways to reduce friction have been suggested. One way is to lightly grease the lap surface with a Teflon-based lubricant before applying a small amount of diamond powder or oxide type polishing agent. A drop of extender fluid may be added if the lap becomes too dry. Australian faceters extol this idea. I like better the use of a very thin layer of hard wax smoothed on the lap surface. Polishing or prepolishing, then, proceeds as described by the advocates of Teflon grease. I use a commercial hardwood floor wax trade-named TREWAX. TREWAX is a paste wax sold at hardware stores. In either case, friction is vastly decreased and polishing particles slightly embed in the very thin wax layer, which further inhibits tumbling. Any polishing lap is suitable for these procedures.

An Anomaly

Why do oxide polishing agents, also, develop molecule-thick hydroxyl films that may cement many small particles into agglomerates which cause scratching? The answer is simple. These polishing agents are chemically much like the gemstones we cut. In the presence of water and stress, they develop hydroxyl films over their surfaces just as readily as Michalske and Bunker found they do in the cracks in glass. Lap pressure bonds the coated surfaces together. I can only guess at why different gemstones may require different polishing agents. My best guess is that the hydroxyl films form more readily if the gemstone and polishing agent are in similar crystal systems or are chemically similar. Perhaps you have a better guess.

Diamond

How about polishing with diamond particles? Isn't that a totally abrasive process? I doubt it. Diamond is a crystalline form of carbon. In the presence of water and stress, hydroxyl carbonates probably form. In polishing with diamond, abrasion of the gem surface (exclusive of the thin hydroxyl layers) probably becomes more prominent. Do note the uses of the word "probably."

It's a wrap

Or, that is about all I have to say about that. I hope I have made some sense to each of you. If you totally disagree with me, that is okay. Perhaps you have information that I have not. Get on the Internet and tell me about it.

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The Eclectic Lapidary is seeking helpful lapidary tips, tales of adventure, pictures of jewelry and commentary on lapidary issues. If you have an article or an idea for an article you'd like to see in the pages of EL, please contact us at eclectic@bovagems.com.

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Shady Tales: A Dark Day in Red Mountain

By John Lightburn

I would rather have my head chopped off than fall down a 750-foot mine shaft. Very, very, sad to say that a very young man, 21 years old, plunged, unnecessarily so, down a large and deep mine shaft on a hill in Red Mountain on November 16, 2004. Michael Frey, from Mission Viejo, and a only-child, raced his dirt-bike up the steep slope of the mine's tailings pile and plummeted down a mine shaft measuring 20 some feet in diameter.

It was just another gorgeous Sunday afternoon on the Mojave several weeks ago when three dirt-bike riders arrived for lunch at the Silver Dollar Saloon in Red Mountain, three miles North of Atolia. Shortly after leaving the Silver Dollar Saloon, Michael Frey and his two companions sped away toward the foot of Red Mountain where a very large tailings pile exist. This benign looking, colorful mound of rocky debris is all that is left of a failed silver mine originally claimed and owned by the Rand Consolidated Silver Mining Company, founded in October of 1929.

What happened next to Michael and his friends was reported to me by gentleman named Stan. I met Stan Thanks Giving weekend in front of the Silver Dollar. Stan, a veteran bike rider, was still visibly shaken by the tragedy and what he had witnessed. Stan, who spoke at Michael Frey's funeral, had guided the three young dirt-bike riders to the Silver Dollar that fatal day. Stan, still in disbelief, never, ever expected what was soon to take place that day. Stan told me that he had watched the trio from the veranda of the Silver Dollar.

According to Stan, the first rider ascended the tailings pile with great speed, but turned off his course when he was unable to make it to the top. Frey, the second rider, reached the top of the tailings pile and flew into the abyss to a horrifying death. The third rider, and the luckiest fellow on the desert that afternoon, followed directly behind and to the left of Frey. This young man, unlike his friend, hit the north-side of the mine shaft, saving himself by hanging on to a



Mine Shaft on Red Mountain

bit of sage brush as he clawed his way to safety. Next to the edge of the shaft you could see the furrows made by his fingers as he struggled to save his life.

What is amazing to me is that tragic accidents like this don't happen more often. This was the first death of this kind in California this year. Earlier that weekend I met several families illegally camped in Atolia. Their kids, ranging from age 4 to 14, were riding without supervision all over the tailings piles in Atolia. Atolia, if you don't already know, has thousands of acres of mine shafts, pits, and trenches as dangerous as any to be found on the desert. I asked several of the Mothers whether they had heard about Michael Frey's death two weeks earlier. "Oh yes", they said, "wasn't that terrible". Even after I had advised them that their children were



Claw Marks on Shaft Opening

riding in an area more dangerous than Red Mountain, they said that they were not particularly concerned or worried. They just didn't seem to care. They just didn't get it! Oh well, so much for education and parenting.

The Desert is as dangerous as it is beautiful: A "tailings pile" is mostly unconsolidated dirt and rocky rubble and is most unstable at the edge of the mine shaft. It is always a good idea to stay a yard or so back from the rim, whether on foot or horseback. That Saturday morning Stan and I watched dozens of dirt-bike riders ride to the top of the mine shaft and peer over the rim to see where Frey had fallen. They didn't seem to get it either.

Earlier that weekend some one, perhaps a friend or relative, placed a little white cross in remembrance of Michael's dark day in Red Mountain.



Little Cross at Scene of Accident

JANUARY 2005

7-16 — QUARTZSITE, AZ: Show; Tyson Wells; Tyson Wells Show Grounds, 100 W. Kuehn St.; free admission; gems, rocks, minerals, jewelry, silversmithing, goldsmithing, faceting, precious metals, lapidary tools, equipment, supplies; contact Kym Scott, (928) 927-6364; Web site: www.tysonwells.com.

21-30 — QUARTZSITE, AZ: 27th annual Sell-A-Rama; Tyson Wells; Tyson Wells Show Grounds, 100 W. Kuehn St.; free admission; gems, rocks, minerals, jewelry, silversmithing, goldsmithing, faceting, precious metals, lapidary tools, equipment, supplies; contact Kym Scott, (928) 927-6364; Web site: www.tysonwells.com.

26-30 — QUARTZSITE, AZ: 39th annual show, "QIA Pow Wow" Quartzsite Improvement Association; 235 E. Ironwood Dr.; Wed. 9-5, Thu. 9-5, Fri. 9-5, Sat. 9-5, Sun. 9-5; free admission; more than 400 vendors of rocks, gems, minerals, beads, wire wrap supplies, jewelry, fossils, and lapidary, daily field trips, displays, demonstrations; contact Diane Abbott, P.O. Box 881, Quartzsite, AZ 85346-0881, (928) 927-6325; e-mail: qia@redrivernet.com; Web site: www.quartzsiteimprovementassoc.com.

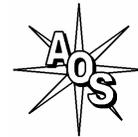
29-12 — TUCSON, AZ: Annual show; Martin Zinn Expositions; The InnSuites Hotel, 475 N. Granada; 10-6 daily; free admission; more than 400 dealers from all over the world; contact Martin Zinn Expositions, Box 999, Evergreen, CO 80437, (303) 674-2713; e-mail: mz0955@aol.com.

29-12 — TUCSON, AZ: Annual show; Martin Zinn Expositions; The Mineral & Fossil Marketplace, 1333 N. Oracle Rd.; 10-6 daily; free admission; more than 400 dealers from all over the world; contact Martin Zinn Expositions, Box 999, Evergreen, CO 80437, (303) 674-2713; e-mail: mz0955@aol.com.

29-12 — TUCSON, AZ: Annual show; Martin Zinn Expositions; Clarion Hotel-Randolph Park, 102 N. Alvernon Way; 10-6 daily; free admission; more than 400 dealers from all over the world; contact Martin Zinn Expositions, Box 999, Evergreen, CO 80437, (303) 674-2713; e-mail: mz0955@aol.com.

29-12 — TUCSON, AZ: Annual show; Martin Zinn Expositions; Smuggler's Inn, 6350 E. Speedway; 10-6 daily; free admission; more than 400 dealers from all over the world; contact Martin Zinn Expositions, Box 999, Evergreen, CO 80437, (303) 674-2713; e-mail: mz0955@aol.com.

29-12 — TUCSON, AZ: Annual show; Martin Zinn Expositions; Ramada Limited, 665 N. Freeway; 10-6 daily; free admission; more than 400 dealers from all over the world; contact Martin Zinn Expositions, Box 999, Evergreen, CO 80437, (303) 674-2713; e-mail: mz0955@aol.com.



January Gem & Mineral Shows

3-5 — SANTA BARBARA, CA: Gem Faire; Earl Warren Showgrounds, 3400 Calle Real; Fri. 12-7, Sat. 10-7, Sun. 10-5; admission \$5 (weekend pass); contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com;

4-5 — SAN BERNARDINO, CA: 58th annual show, "Rocks Galore in 2005" Orange Belt Mineralogical Society; San Bernardino Woman's Club, 503 W. 31st St.; Sat. 10-5, Sun. 10-5; free admission; dealers, exhibits, silent auction, door prizes, hourly prizes, raffle, wheel of fortune; contact Pat Wind, (909) 381-0089 or (909) 792-0668.

10-12 — COSTA MESA, CA: Gem Faire; Orange County Fairgrounds, Bldg. 10, 88 Fair Dr.; Fri. 12-7, Sat. 10-7, Sun. 10-5; admission \$5 (weekend pass); contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: www.gemfaire.com.

17-19 — SAN DIEGO, CA: Gem Faire; Scottish Rite Center, 1895 Camino del Rio S.; Fri. 12-7, Sat. 10-7, Sun. 10-5; admission \$5 (weekend pass); contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: www.gemfaire.com.

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