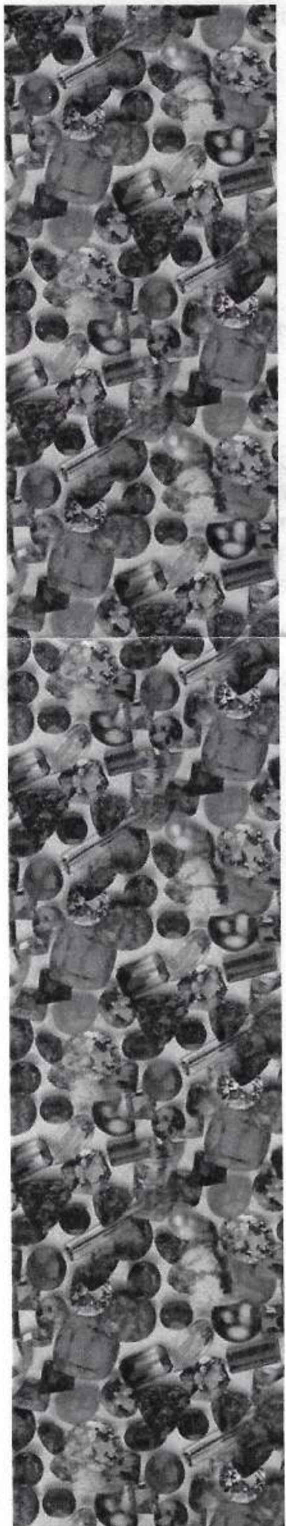
The Midwest Faceter



A Publication of The Midwest Faceters' Guild, October 2010

From The Presidents' Pen

By Tyler Miller

Dear fellow Faceters,

This will be my last letter to you as President. The next one will be from the new president that you will elect at the Annual Meeting in November.

Barb Yost has finalized the plans with Larry Kelly at the Shelby Gem Factory in Shelby Michigan. Details are elsewhere in the news letter. Please plan to attend the Factory Tour and also our annual meeting and election of Officers for the coming year, that will be held in the Tallmadge Hall in Tallmadge Township Michigan following the Shelby trip.

Barb Yost has made arrangements for the Tallmadge Hall for a Frat in conjunction with the annual meeting and the Shelby Trip.
We have asked Larry if he could possibly have a furnace in operation during our visit, he promised he would try. We told him that if he didn't we would understand. I have been to Shelby many times and have always enjoyed myself as Larry is a special host. If anyone wishes to purchase any rough there, it will be available.

Barbara and I will be demonstrating at the Indiana State Museum in Indianapolis 22-24 October for GeoFest. If any one wishes to drive to Indianapolis we would love to see and visit with you.

Summer has come and gone, it seems that the older we get the faster the time passes and the more we have to do.

As the new slate of members assumes their duties for the next year, members should show their interest in the guild and take part (volunteer) to help out. Most of the extra things that need to be done can be handled by a phone call, it takes very little time and effort. It will give you a good feeling about yourself and make things a little easier for those that you have elected.

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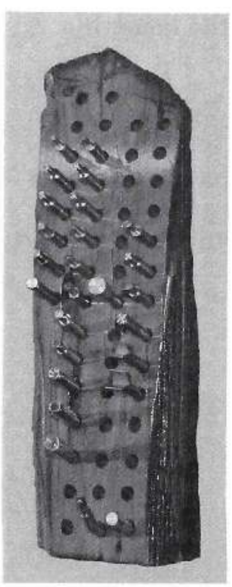


The Midwest Faceters' Guild

http://midwestfacetersguild.org/

The Midwest Faceters' Guild was established July 14, 1979 and chartered in October of that year. The MFG is a member of the American Federation of Mineralogical and Geological Societies and the Midwest Federation of Mineralogical and Geological Societies. Our purpose is:

- To promote education and recreation.
- To develop the art of faceting.
- To exchange information related to faceting.
- To provide meetings for those of like interests.
- To promote the achievement of individuals.

The official publication of the Midwest Faceters' Guild is *The Midwest Faceter,* published five times per year.

Membership in the Midwest Faceters' Guild is open to anyone with an interest in The Art of Faceting, regardless of geographical location. Membership applications are available on the website or by contacting the Membership Chairperson. Membership is \$20 single and \$30 family and includes a subscription to *The Midwest Faceter* and enables you to participate in Guild activities such as our Faceter Frats and gemstone competitions.

Calendar of Events

November 5	Faceters' Frat Tallmadge Township Hall 0-1451 Leonard NW Grand Rapids, MI 49534
November 6, 11am	Shelby Gem Factory Trip Shelby, Michigan
November 6, 5pm	Annual Meeting Tallmadge Township Hall
November 7	Faceters' Frat Tallmadge Township Hall 0-1451 Leonard NW Grand Rapids, MI 49534

Shelby Gem Factory Trip

By Barb Yost

Dear members,

Several things we would like you to be advised of and trust you will take advantage of these opportunities.

Trip to Shelby Gem Factory:

Date: Saturday November 6th, 2010
Time: 11:00 am
Place: Shelby Gem Factory, Shelby Michigan
Factory Tour and History, opportunity to purchase rough

If interested in car pooling from the Grand Rapids area, please contact Barb Yost. 616-254-9777

Annual Meeting:

Date Saturday November 6th, 2010
Time: 5:00 pm
Place: Tallmadge Township Hall,
O-1451 Leonard St NW
Grand Rapids MI 49534

Election of Officers will take place.. The nominations are:

Treasurer: Melvin Lehner
Secretary: RuthAnn Lehner
Vice President: Tyler Miller
President: Barb Yost

If you wish to nominate another member please contact Tyler Miller 910-409-7416

Nominations are being accepted for the Murray Award to be presented at this meeting, please contact Tyler Miller with your nominations.

Faceters Frat:

Dates: Friday November 5th, Saturday November 6th, Sunday November 7th, 2010
Time: 8:00 am Friday to 6:00 pm Sunday
Place: Tallmadge Township Hall
O-1451 Leonard St. NW
Grand Rapids MI 49534
Cost: $10.00
Bring your machine and have a great time of faceting, learning, & fellowship
We have use of a full kitchen and encourage you to bring food items for Potluck type meals.

Please RSVP the trip to Shelby Gem Factory and the Faceter's Frat
Barb Yost 616-254-9777 or barbandben@gmail.com
Ruth Ann Lehner 517-643-4406 or ruthie48@netzero,com

A Gem Cutters Enigma

By Merrill O. Murphy

Reprinted from the March 1999 issue of The Midwest Faceter

Colloidal silica and diamond powder are the two most nearly universal gem-polishing agents. Colloidal silica will polish most gemstones in the Mohs hardness range between 5 and 9. Diamond will polish most gemstones in the hardness range between 6 and 10, and will polish many of the softer stones in the hardness range from 2 to 4. 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 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 course-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 of 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 materials 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.

Still later, diamond was found in India and became the polishing agent of choice when working with harder stones. 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. 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 agents 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. 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 a finely graded silica particle (Mohs hardness 7) could polish sapphire (Mohs 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 of the theory, mainly because there was no laboratory equipment yet available capable of proving or disproving the famous (infamous) 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.

Gem cutters, both amateur and professional, generally accepted the Beilby theory because there was no alternative theory to explain the process. Even today, there are many amateur cutters who will argue vehemently in favor of the idea of molecular surface heating and flow a-la-Bielby. Still, by the late 1940s, vastly improved instruments and techniques of examination led to less belief in Bielby-Bowden on the part of the scientific community. Scientists repeated all the original Bielby 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, Volume 17 (7), July 1981, pages 459-465. Peter J. Crowcraft 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, Crowcraft 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 a 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 celsius. With adequate water on the lap, normal speed and hand pressure applied, there is, essentially no surface heating.

GLASS RESEARCH

The next and most important break-through came form 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 America 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 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 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 an weaker than 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 progress 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 that it seems in line with data received from stressed glass experiments Bruce Bunker and he have run.

GEMSTONES VERSUS GLASS

Gemstones are chemically related to glass in that most of them are either oxides, silicates, or carbonates. All these materials 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 the 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 the 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 banded 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. There is the 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 a 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 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, or glued, by thin hydroxyl layers and compacted by polishing pressure. The agglomerated particles 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 agglomeration 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 of 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 pre-polishing, 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

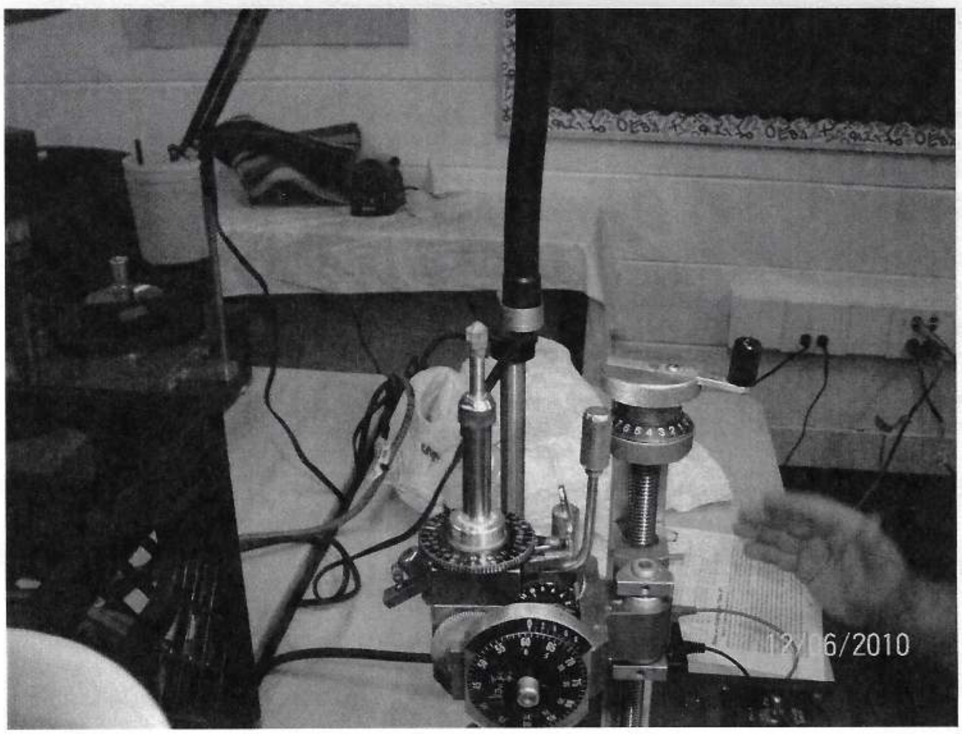
Why do oxide-polishing agents, also, develop molecule-thick hydroxyl films that may cement many small particles into agglomerates which cause scratching? The answer is simple. These polishing agents are chemically much like the gemstones we cut. In the presence of water and stress, they develop hydroxyl films over their surface just as readily as Michalske and Bunker found they do in the cracks in glass. Lap pressure bond 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 use of the word "probably".

IT'S A WRAP

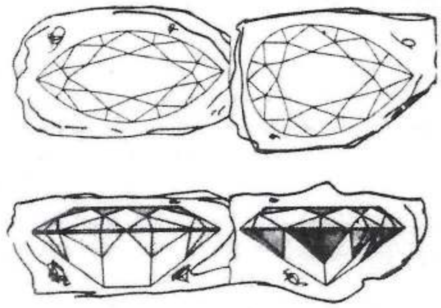
Or, that is about all I have to say about that. I hope I have made some sense to each of you. If you totally disagree with me, that is okay. Perhaps, you have information that I have not. Get on the internet and tell me about it.



One of the Guilds' UltraTecs being put to good use at the Webberville Seminar June 2010

Photo by Barb Yost

"GETTING THE BEST YIELD"



You increase the value by getting the largest possible stone from a piece of rough. This method requires an additional dopping transfer, but it is well worth the effort. I look over the rough to decide where best to locate the table. After deciding, I grind by hand-holding, a small flat at that surface. The rough is then dopped table toward the dop. It is located so that the highest point of the pavilion end of the rough is near the center of the dop. I then rotate the dop in the machine so that the thinnest side of the rough will coincide with a main pavilion facet. The mains are then rough ground. If you can clean up the mains by heating up the wax and moving the stone to one side . . . do it. You might even want to rotate the stone slightly, moving the stone around is where you gain in stone size.

The pavilion mains are now roughed in, and regardless of what you may encounter on the crown, you are assured of having material to finish the stone with correct pavilion angles. Now transfer the stone and rough out the crown mains, leaving enough material to finish the table to the correct size. Next, cut your girdle just a little thick. Then comes the table; cut and polish. After that, finish the crown, redop, and finish the pavilion. The point to all this extra work is that you have, by shifting your stone, cut all your main facets by just barely cleaning up the rough.

The method also works well if you run into a flaw or inclusion. Just move away from the flaw on the pavilion side, or cut out the flaw on the crown side. In cutting step cuts, rough out both culet facets and girdle facets on your pavilion as your first step. Then go through the steps as I have described.

Keep in mind, no type of material, whether made by man or by nature, is entirely free from occasional inclusions or flaws. Some may be quite beautiful or quite invisible to the eye, not lessening the gem stones value ... perhaps even increasing it. Other inclusions may be so large or so ugly as to place the stone in the non-gem quality class, until they are cut out.

An Inclusion is a foreign body, gaseous, liquid, or solid, enclosed in the mass of a mineral. In the study of gems it is necessary to include cleavage, cracks, fractures, growth lines, color zoning, and even included crystals of the same composition if they are differently oriented.

Do not confuse the term 'inclusion' with the derogatory terms 'imperfection' or flaws', which are used in describing diamonds, but seldom applied to 'colored stones'. Colored stones are any gemstones, colored or colorless, other than diamonds.

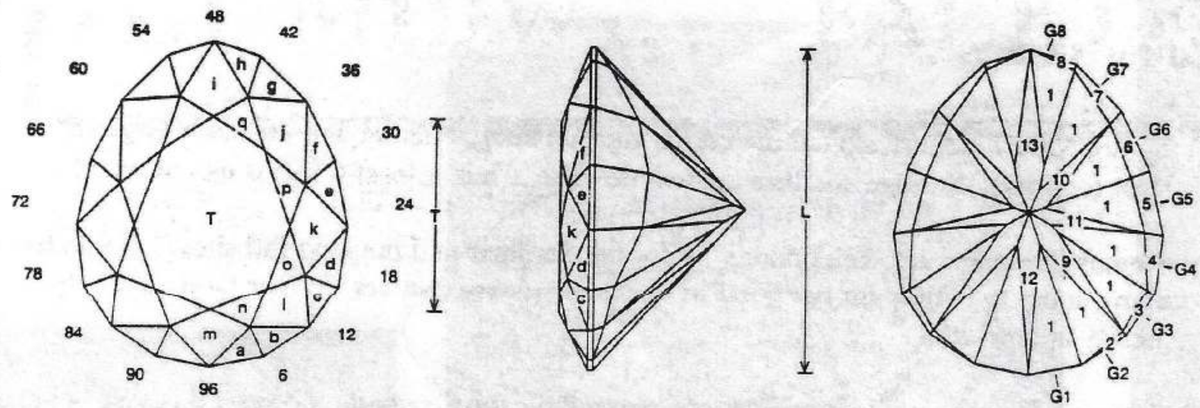
The choices on handling an inclusion or flaw are:

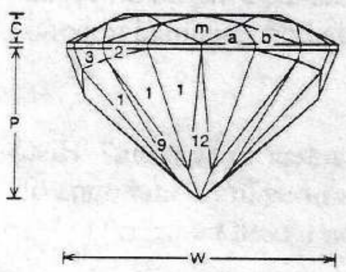
1. Can it add to the beauty of the gem by displaying it.
2. Should we cut it, to hide it on the side of the crown or in dark material, can it be better positioned in the pavilion.
3. Should it be cut out completely even though it will affect the yield.

Your judgement will have to come into play on what choice to make because there are no two gemstones the same. As a result the best rule is to try to cut for the ultimate in beauty without sacrificing too much of the yield.

We owe our thanks for a major portion of this article to Mr. Merlin Neis, Richland, Washington.

Originally published in the September 1973 issue of The Facetier





OMNI Egg Brilliant
by Robert W. Strickland 4/2/98
Redrawn by J. W. Carroll
Angles for R. I. = 1.54
71 facets + 16 facets on girdle = 87
1-fold, mirror-image symmetry
96 index
L/W = 1.241 T/W = 0.739 T/L = 0.595
P/W = 0.562 C/W = 0.106
H/W = (P+C) / W+0.02 = 0.688
P/H = 0.817 C/H = 0.154
Vol./W ^ 3 = 0.293

PAVILION

1	43.00	03-07-13-17-79-83-89-93	Meet TCP
1	43.00	26-33-41-55-63-70	
1	43.00	46-50	
G1	90.00	03-93	Set size
G2	90.00	09-87	Meet 1-1-G1
G3	90.00	15-81	Chain rest
G4	90.00	22-74	
G5	90.00	27-69	
G6	90.00	31-65	
G7	90.00	36-60	
G8	90.00	43-53	
2	65.46	09-87	
3	66.57	15-81	
4	68.76	22-74	
5	70.00	27-69	
6	69.84	31-65	
7	68.37	36-60	
8	65.80	43-53	
9	41.94	10-86	
10	41.36	37-59	
11	41.07	21-75	
12	41.98	96	
13	42.29	48	

CROWN

a	32.10	03-93
b	31.83	09-87
c	30.91	15-81
d	30.88	22-74
e	32.63	27-69
f	30.17	31-65
g	29.09	36-60
h	25.90	43-53
i	20.23	48
j	24.83	33-63
k	26.50	24-72
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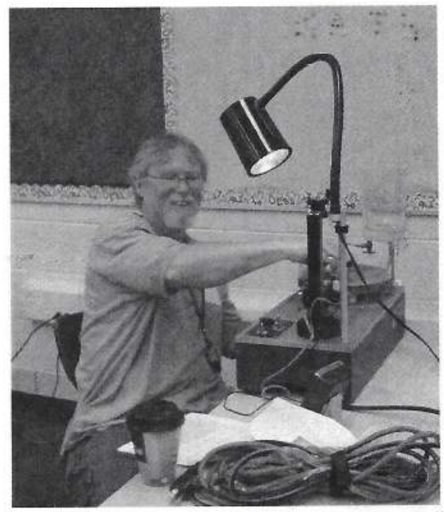

More Seminar Action From The Webberville Seminar June 2010

Photos by Barb Yost

If you would prefer to receive the newsletter via email please email the editor at d-root@sbcglobal.net with your request. If you get it via email the Guild saves money on printing and postage costs and you get the pictures in color.

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