TECHNICAL ISSUE

fusion

The Journal of the International PMC Guild

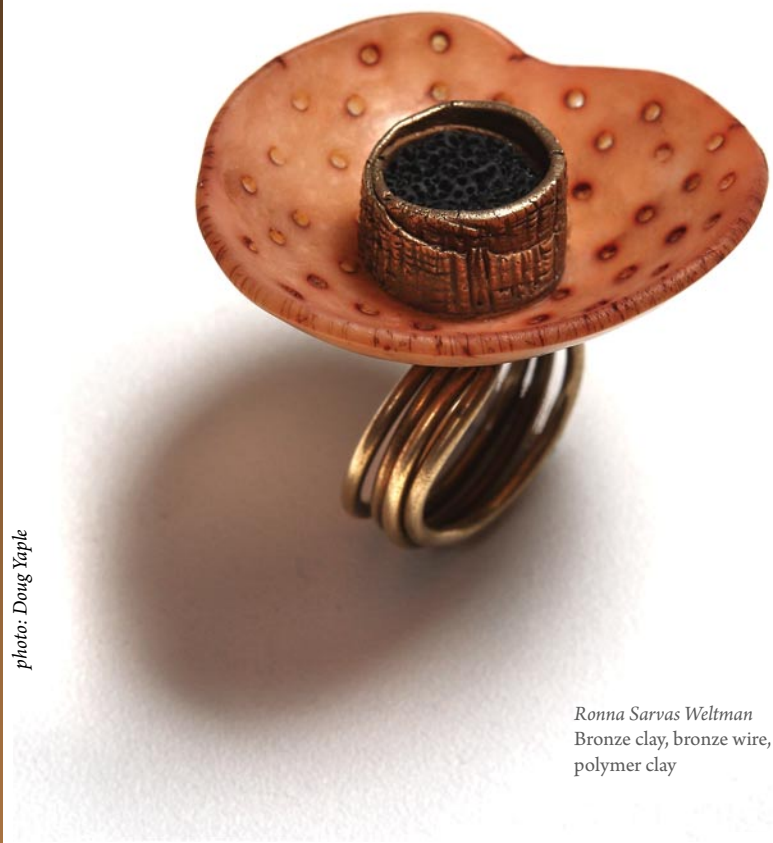


photo: Doug Yaple

Ronna Sarvas Weltman
Bronze clay, bronze wire, polymer clay

THE BRONZE CLAY ISSUE

8
2009/2

left, Lorena Angulo
above, Chris Darway

Introduction to Bronze Clay

Silver clay was introduced to the American public at the Manufacturing Jewelers and Silversmiths of America (MJSA) show in April of 1996. Bronze clay had its coming out party last July at the PMC conference in Indiana, where each of the 400 people in attendance was offered a free sample. Comparing those two releases provides a capsule view of the materials and the world into which each was born. PMC and Art Clay were developed by large foreign corporations using precious metal. They were launched—or dropped—into a jewelry industry with a 5000 year history. Bronze clay, by comparison, arrived to find an active metal clay community and a host of knowledgeable vendors who serve them. Unlike the precious metal clays, bronze clay was developed independently by individuals who spent several years and personal resources in research and experimentation.

Since its release, bronze clay has won many enthusiastic fans. And it has generated lots of questions. This issue of *Fusion* aims to summarize the current state the art of bronze clay, but before we get started, a few caveats are needed.

1. Things change. The information that follows was gathered from knowledgeable people who have worked extensively with bronze clay, but be prepared to adapt to the expanding knowledge base as new discoveries are made.

2. Experience differs. Anyone who has tuned in to the bronze clay chatter on Internet discussion boards is aware of apparent contradictions. No sooner will one person report success with a process than someone else

PMC GUILD
International

The PMC Guild is a members organization with the mission of providing support, education, and exposure for artists working in Precious Metal Clay.

PMC Guild
1921 Cliffview Lane
Florence, KY 41042

Executive Director
Jeanette Landenwitch
Director@PMCguild.com

Treasurer
Darnall Burks
Treasurer@PMCguild.com

Communications
Tim McCreight
Tech@PMCguild.com

Journal Editor
Bob Keyes
Journal@PMCguild.com

Web Manager
Sadelle Wiltshire
Web@PMCguild.com

To Join, Renew, or Edit Info Online
www.PMCguild.com

Membership Questions (toll-free)
866–315–6487

Speak with the Director
859–586–0595

Hadar Jacobson

will say that the same technique did not work for them. Someday we might understand these conundrums but for now we will offer various opinions when the data conflicts. Those who have come to metal clay in the last five years may not be aware that the early years of silver clay saw similar confusion.

There is enough information about bronze clay to fill a book, and fortunately for us, there are several books either available or in production. This issue of *Fusion* offers a summary that is divided into these five sections: Science, Handling, Firing, Finishing, and Miscellaneous.

SCIENCE

Silver and gold are elements, so by definition most precious metal clays consist of a single kind of metal that is mixed with a binder and water (the exception is gold PMC, which is a combination of two elemental metals). Bronze is an alloy of copper and tin, and in the case of metal clay, these two ingredients in powder form are blended and mixed with binder and water. In the case of precious metals, crystals of more or less identical size and shape join together at the relatively high temperatures needed to make their

surfaces active. In the case of the bronze alloy, the relatively low melting point of tin (450˚F/232˚C) triggers a combination of the two parts to make an alloy that is unique from either of its constituent parts. In a general way, we can assert that alloying is more dependent on time than temperature, which is the reverse of the fusion of precious metals. See the associated article in this issue called "How to Read a Phase Diagram."

Nisa Smiley

HANDLING

Most of the people we spoke with agree that bronze clay feels pretty similar to silver clay, though there are some who maintain that it is a little sticky. It has been suggested that kneading the clay before starting to work with it softens the clay. Polymer clay artists will recognize this a process they call conditioning; potters call this wedging.

Bronze clay can be rolled, sliced, layered, and pressed into molds. It can be given shape by drying over forms and, like silver clay, bronze clay can be air dried or rapidly dried with heat or air. Bronze clay can be worked in the green state (i.e. dry but not fired), for instance with files, burs, and drills. It carves as well or better than dry silver clay.

Most people will agree that bronze clay is messier than its silver sibling. As with silver clay, a thin layer of olive oil on the hands is recommended. Dry bronze is easy to file, but be prepared for the quantity of fine brown dust that will result. It is best to keep separate sanding boards for the two materials, and to develop a working space that keeps the bronze and silver separate from each other. Some people insist on totally separate tools, but others report that casual cleaning when moving a tool from one material to the other is sufficient.

Joining parts is not quite as easy in bronze as it is in silver clay and it is not uncommon for casually made joints to separate during firing. So far there is no commercially available bronze slip, and homemade versions are often too thin for good bonding. Consensus recommendation is to handle bronze clay in the way that potters join parts in traditional earthen clay. Start by moistening the joint area, then press the parts together with a slight twist, holding them firmly in position for about a minute. Moisture helps to soften the clay at the joint, but pressure is the most important factor.

FIRING

As with silver clay, it is important that bronze clay dries completely before firing. Because bronze clay is denser than the precious metal clays, this usually takes a little longer, especially with thick pieces.

When a sample of bronze clay is heated, two things are happening. OK, metallurgists would tell us that all sorts of things are happening, but to render this into an image we nonscientists can understand, let's stick with the simple image. One thing that happens with the addition of heat is that the copper powder starts to oxidize, i.e., to develop a black film on its surface. That's bad, at least in terms of getting the particles to join together. The other thing is that the tin starts to melt and flow into the copper where it joins to make a new material altogether. That's good; this alloy of the two powders is the tough yellow metal we know as bronze. So the trick is to create a situation that limits oxidation while it encourages the diffusion of tin into copper. The solution is to bury the bronze clay in something called activated carbon. This black granular material is used in filters and can be purchased at pet supply stores (it is used in fish tanks), pool supply stores, and usually from vendors who sell bronze clay. Wikipedia describes activated carbon as "a form of carbon that has been processed to make it extremely porous, giving it a large surface area that is available for chemical reactions." The role of the activated carbon is to absorb oxygen in the firing environment before it can attack the copper and tin powders.

Activated carbon can be made from many things, the two most common outside of industrial uses being coal and coconut shells. Either will work, but the coconut shell variety seems to be the more popular. It is a bit cleaner to use and leaves less carbon residue on the fired bronze. With each firing a thin outer layer of the carbon particles turns to ash, but this does not prevent the carbon from being used for many firings. Some people report a change in results between first firings and later firings, perhaps because the carbon granules become slightly less absorbent with each use.

The firing arrangement typically consists of a lidded container that will hold the activated carbon and limit the amount of atmosphere that gets in. Stainless steel seems to be the vessel of choice, though steel and high-fire ceramic will also work. Bronze clay pieces can be grouped in a firing vessel as long as there is space between them. Small pieces need at least a half-inch of carbon between them, but larger pieces need a thicker cushion of carbon to match the larger mass of bronze being protected from oxidation.

When it comes to firing schedules, there is considerable difference of opinion. Everyone seems to agree that thicker pieces require a longer firing than thinner ones, but beyond that there are several approaches. One

school of thought is a slow heating to 1550˚F (843˚C) degrees, which is then held for two hours. Pieces the size of a coin will probably do well at any schedule that even approximates this. Thicker pieces, say more than in inch wide and larger than 5 millimeters thick, require extra care. It appears that early in the process the bronze starts to coalesce on the outside of a piece, in effect creating a dense metal shell. In thin pieces, the shell meets in the middle to form a solid metal object. Thicker pieces that have been cut open often reveal a brown powder that is most likely a mixture of copper and tin powder that did not sinter. This hollow core is not itself a problem as long as the outer shell is thick enough to provide the strength required for the piece.

FINISHING

One thing that becomes instantly apparent when working with a fired piece of bronze clay is that this stuff is hard! A scratch that can be sanded out of a silver object in a few minutes will take a lot longer and require coarser tools to be sanded away in bronze. A lesson quickly learned is the importance of refining forms as much as possible before firing. Some people are rigorous about keeping separate tools to work on bronze, but others say it is enough to keep separate sanding sticks and abrasive pads. Their rule is "If you can see brown dust on the tool, keep it aside for use only on bronze. If it looks clean (like a file for instance), it can be used on silver too."

If you take the time, bronze clay can achieve a mirror finish through sanding and polishing papers or by machine polishing with a compound like tripoli or white diamond. Tumbling will develop a matte surface easily but requires many hours in the machine to yield a shine.

Few topics have generated as much discussion as the color that appears on bronze clay during firing. The rich blues, deep vermilions, and icy greens are seductive and in pieces that come from the kiln ready to wear, these colors are a wonderful bonus. Be careful, though, that they do not shortchange proper finishing. Some objects need sanding, bending, or soldering—all techniques that will disturb the color. In those cases, do whatever is needed to properly complete the piece, then turn your attention to creating a patina color.

And what a range of colors you will have! Space allows only a brief survey of the possibilities, but they include heat colors achieved with a torch, in a kiln, and on a kitchen stove. Once a piece is finished, try burying it in hot activated carbon when the next batch comes out of the kiln—brilliant colors have been reported. Chemical patinas can be sprayed, dipped, fumed, and applied through an absorbent medium like sawdust.

Patina colors on bronze are generally more resilient than patina colors on silver. Colors will include a wide range of greens, some rich blues, and warm nutty browns.

SHRINKAGE

We all understand shrinkage in a general way, and for all metal clays, that's probably the best way to leave it. Attempts to calculate precise numbers quickly get into volume versus density, axes of shrinkage, effects of friction or resistance, and similar fine points that make scientists reach for their calculators and the rest of us run for the doors. Perhaps it is enough to say that bronze clay generally shrinks in the 25% range, with larger pieces showing a slightly greater degree of shrinkage than smaller ones. See page 9 for side-by-side examples.

MISCELLANEOUS

Combining Silver and Bronze Clay

Almost everyone we spoke with has had some success in firing bronze clay with silver clay, but they also report disastrous results. The metallurgy of tin and silver is the stuff of doctoral theses, but for us it is sufficient to know that there is a high potential for weirdness. Temperature and the relative surface areas of the two materials play a role, but most people agree that it is best to combine fired bronze components to fired silver components with cold connections or by soldering.

Setting Stones in Bronze Clay

It will come as no surprise that the information about gems carries over easily from silver to the bronze clay because the firing temperatures are similar. Cubic zirconia can be fired in place in bronze clay, as can most of the natural stones that will withstand PMC firing. A list of gems that can be considered is available at many websites, including PMCguild.com.

As mentioned earlier, bronze is a tough material, so it is not a natural choice for bezels that need to be closed after firing. These are possible, but they should be kept thin and probably even then, bezels will require hammer-setting techniques. When adding a bezel after firing, it is probably best to solder on a commercial fine silver bezel or to make a setting from PMC that can be soldered or cold-connected to the bronze piece.

Copper Clay

Bill Struve, inventor and manufacturer of bronze clay, reports that he is currently developing a copper clay that might be available to the public as soon as this spring. Consultants who have used the copper clay report

that it looks and works very much like the bronze. The color after firing is a normal orange-brown copper color and the strength seems to be greater than traditional wrought copper. It appears to take patina and enameling well. Firing is done in activated carbon and uses a slightly shorter firing schedule (two hours for small pieces).

Thanks to the following people for their contributions to this article: Bill Struve, Celie Fago, Barbara Becker Simon, Hadar Jacobson, Tonya Davidson, Jeanette Landenwitch, and Kevin Whitmore.

Web Resources
www.bronzclay.com
www.cooltools.us
www.wholelottawhimsy.com
www.creativetexturetools.com

Introduction to Copper Alloys

Historically, bronze is an alloy of copper and tin, with copper dominating, usually in the neighborhood of 90%. That metal was so important that it gave its name to an entire age (3300BC – 600BC, depending on location). That metal has a rich golden color and the word "bronze" has found its way into our vocabulary, from copper-plated baby shoes to a desireable suntan. Here are a few common misunderstandings:

Jewelers Bronze (CDA* 226)– a brass alloy of 88% copper and 12% zinc. Also known as NuGold, Merlin's Gold.

Yellow Brass (CDA 260) This is an alloy of 70% copper and 30% zinc. Also known as cartridge brass because it is used for bullet casings.

Red Brass (CDA 220) – a brownish brass of 90% copper, 10% zinc. Naval brass because it resists oxidation.

Bell Metal – a strong bronze of at least 25% tin used for… you guessed it.

Naval Brass – several alloys, but typically containing a mixture of zinc and tin to resist oxidation.

By far the largest category are complex copper-based alloys that may contain zinc, tin, aluminum, beryllium, manganese, or many other metals. These are used in industry but have little application for artists.

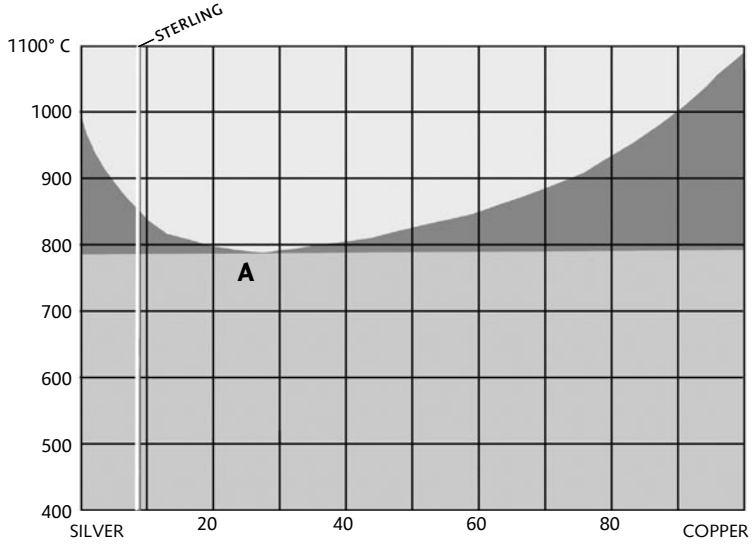
** Copper Development Association, a trade organization that establishes and oversees standards. More at www.copper.org.*

Metal Clay Comparison

TOPIC	BRONZE CLAY	SILVER CLAY	NOTES
Metal Content	89%Cu 11%Sn	99.9%Ag	
Hydration	yes, with time	yes, with time	
Handling	solt, moldable	soft, moldable	very similar
Water soluble	yes	yes	
Olive oil	recommended for handling	recommended for handling	organic lotions OK
Lavender oil	reduces oxidation	increases joint strength	
Safety	do not ingest	do not ingest	
Fumes	not harmful	not harmful	
Firing	in activated carbon	in atmosphere	ventilation recommended
Pickling	as needed	not necessary	
Patinas	many options	liver of sulfur	
Recycled	copper is recycled	partial	about 40% of silver is recycled
Reclamation	not economical	yes	

How to Read a Phase Diagram
(and why you might want to…)

Phase diagrams provide a visual shorthand for the complicated changes and states of metals and alloys as they are heated. In this chart, the left edge represents 100% silver and the right edge is pure copper. A line exactly in the center is a 50/50 mixture. The bottom edge in this case is 400° Celsius, rising as we move up the chart to 1100°C. Each phase diagram will use different temperature ranges, depending on the alloy being displayed.

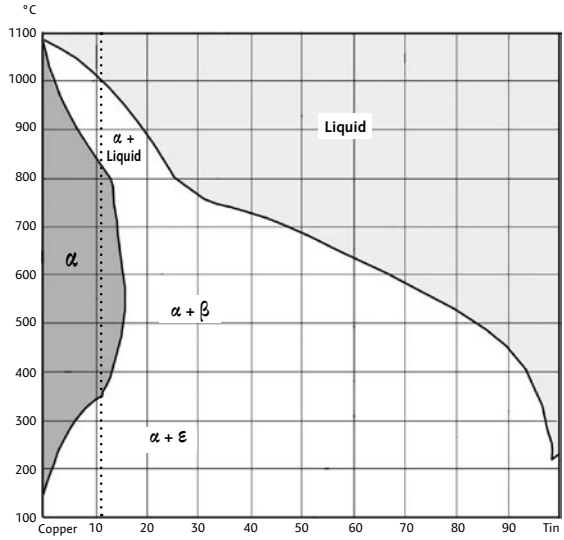


Silver/Copper Phase Diagram

To fill in the graph, laboratory tests are made for many alloys, first a mixture of 99 parts silver to 1 part copper (99:1), then 98:2, 97:3, and so forth. These tests determine the temperature at which the alloy is no longer solid (the darkest gray here) and the temperature at which it is totally liquid (the lightest shade of gray on the chart). These are plotted on the graph and yield the freezing curve, which dips down to nothing at the point marked A. This tells us that of all possible mixtures of these two metals, a combination of 71.9% silver and 28.1% copper has the lowest freezing point (1438°F, 781°C). Sterling, an alloy of 7.5% copper and 92.5% silver, is indicated on the diagram by the vertical white line near the left edge; the graph shows that its melting point is 1640° F (893° C). If we trace that line from bottom to top, we see a metal that is solid up to just under 800°C, then becomes semi-solid up to about 860°C, at which point it becomes liquid.

From Complete Metalsmith *by Tim McCreight, used with permission.*

Simplified Copper/Tin Phase Diagram



The phase diagram for bronze is wickedly complicated, and this simplified version only begins to hint at the complicated transformations that take place as the alloy moves through various states. This diagram omits a lot of information that is important to metallurgists to simplify the picture for nonscientists. The left edge represents pure copper; the right is pure tin. The dotted line shows an alloy of 89% copper and 11% tin, which is roughly the formulation of bronze clay. Reading from the bottom of the chart upwards, you will trace what happens as a sample is heated. At room temperature and slightly above, the alloy is a mix of two crystalline states (identified at alpha and epsilon by metallurgists). Because this is an intermetallic compound of two different types of crystal, the metal is strong. As we read upwards, the alloy changes to a single alpha phase (dark gray), which is also strong. At about 1500°F (820°C) the metal starts to melt, forming a slushy mixture of crystals in liquid (think crushed ice in water). At just over 1830°F (1000°C) the alloy becomes totally liquid, indicated here by the lighter gray. The shape of the light gray field shows that as the proportion of tin goes up, the melting point is lowered.

A full phase diagram can be found in the Members section at www.PMCguild.com.

Launching a New Product

The evolution of bronze clay has an interesting history, much of it centers on its inventor, Bill Struve (profiled in *Fusion 5*). But the story would not be complete if not for Struve's relationship with Rio Grande, the largest supplier in the jewelry industry. It's one thing to invent a product. It's another to market it and make it available to consumers.

The man responsible for introducing BRONZclay to consumers is Rio Grande's product manager Kevin Whitmore. Among other duties, his job involves bringing the product out of the lab and into the world of retail. He began working on BRONZclay in the summer of 2007, when he met Struve and his wife, LaceyAnn, at the Bead & Button show in Milwaukee. Whitmore attends trade shows and other events to seek out new ideas and also gather feedback about Rio Grande.

At that point, Struve had shown his bronze clay experiments to a number of instructors and made many adjustments to the formula that produced the product. Struve was ready to transform bronze clay—a grand experiment—into BRONZclay, a new material with the potential to reach a wide consumer audience.

"They make it in bulk, and Rio Grande does the packaging and distribution," Whitmore said. "I left the technical testing to Bill, who did an admirable job of gathering some of the top names in the metal clay community as Alpha and Beta testers. Bill listened to their feedback and made adjustments to the formula. Simultaneously, I was working to ensure that Rio would be ready with a professional package once the final formula was confirmed. After a few months, we felt we were ready to move forward."

The goal was to introduce the new material at the PMC Conference last July. By then, word had gotten out that Struve was going to be speaking about bronze clay at the conference. Rio fed some BRONZclay to editors at key magazines, who wrote about it. The internet was buzzing, and it seemed that everybody was eager to try out this new product.

"My initial worry was whether we could provide enough to meet the demand," Whitmore said. "This was tricky because we had no real way to measure the demand. Would a customer buy one pack or 10? We packaged several kilos of material prior to the conference, thinking it might last a couple months, but as it turned out, we nearly ran through the entire stock in four days."

The Struves had planned a vacation after the conference, but instead went home to North Carolina, shortening their vacation so they could make more material.

Whitmore and Rio devoted the autumn of 2008 to shoring up production capabilities and opening a worldwide sales network. The sales network is still being formed, and will grow in size and reach over time.

Looking back, Whitmore says the launch of BRONZclay went remarkably well. Barely a year after first contemplating the product, it was available to consumers. And now, less than two years later, it is established as a hot new product with widespread recognition.

"We did not have any formal focus groups, but Bill put BRONZclay in the hands of several artists, and the product was improved by their feedback. Prior to launch, Rio Grande provided BRONZclay to our entire PMC teaching staff. In addition, we hosted a visit from Bill and LaceyAnn to Rio so they could introduce the product to our technical department," Whitmore said.

Rio is selling 100-gram and 200-gram packages of BRONZclay, for $19.98 and $34.48, respectively. During the time that Struve and Rio were developing BRONZclay, silver was topping out at $20 an ounce. "I knew this was affecting Rio Grande's customers. Since BRONZclay also requires a kiln, it seemed BRONZclay would offer some economic relief to those who were distressed by the relatively high price of silver," Whitmore said.

With the calendar now opened to 2009, Whitmore and his staff at Rio

Grande are moving beyond the introduction phase, gauging interest and feedback. He said he has spent more energy on BRONZclay than any other product he has managed for Rio, and the rewards have been great.

"BRONZclay has been embraced by lots of artists, I've helped Bill and Lacey Ann with their young business, and I know BRONZclay has helped Rio Grande and the dealers who offer it for sale. I also believe BRONZclay will help the silver clay community. School children can learn important skills in BRONZclay, and they will aspire to work in silver clay when they can afford it. I believe BRONZclay will help pave the way for our entire metal clay segment."

BRONZclay™

BRONZclay is a trademark name created by Rio Grande for Bill Struve's Metal Adventures bronze clay.

The New Fusion Visual Trigger Challenge

This issue of Fusion contains the fifth installment of a feature we call the Visual Trigger Challenge. As you see elsewhere in the journal, our creative members have made work that responds to a particular image. We will select a first-place winner and runners-up to be included in the following issue. In addition to this international exposure, the first-place winner will receive $100 worth of PMC.

Submitted work can be wearable, sculptural, or functional, and can include additional materials besides PMC. The winners will demonstrate creativity, craftsmanship, and a clear reference to the target image. Send a digital image to Tech@PMCguild.com any time before March 20, 2009. Sorry for the short deadline, which results from transition to a new publication schedule. Don't just sit there…

Ask Sol

This isn't so much a question as a warning to your readers so they can avoid the awful mistake I made. I was checking my email late one night when I got a note that hurt my feelings. I replied ("lashed out" might be a better phrase) and I wish I hadn't. What could have been a small bruise to my ego turned into a huge and hurtful mess. I hope others can learn from my experience.

— Sorry Sue in Seattle

Hello Sue,
I'm happy to print your note because I think many of us are familiar with the phenomenon. Did you know that Abraham Lincoln wrote hundreds of letters that he never intended to mail? Historians have uncovered angry notes written to political rivals, reluctant generals, and disappointing family members. And though he kept each one, he wrote across the bottom, "Do not Send." Wise man, that Lincoln.

Our Internet age makes communication easier than it has ever been, but easy is not always good. The Send button is way too close sometimes and it takes a special kind of maturity to know when to resist it. Maybe somebody should invent a keyboard with a Go Have a Cup of Tea button. Playing into the problem is our lust for instant resolution. We have gotten used to the idea that an instant reply is somehow better than one that comes a day or two later. That's an assumption worth reconsidering, especially when emotions are running hot.

Thanks for your warning, Sue, and may we all take a moment to heed your warning. Here is a suggestion that might be taped onto all our computer monitors: If you're writing about more than everyday matters, send the email to yourself first. Get up from the computer, even if just for a few minutes, to clear your head. Read what you wrote, imagining how it will sound to the recipient. If it is an accurate description of your feelings, and if there is really some reason the person needs to know this, then send it. But remember Mr. Lincoln—a leader remembered for his wisdom rather than his expediency.

Send your philosophical quandaries to *Ask Sol, c/o Journal@PMCguild.com.*

Editorial

— Bob Keyes

Lurking a few weeks ago on a popular online metal clay discussion forum, I came across what I thought was an interesting exchange about the acceptance of metal clay among the traditional metalsmithing community. A metal clay artist was complaining about metalsmiths looking down their noses at PMC, and dismissing metal clay as second-rate art form.

It's an interesting discussion, because it helps frame the context of metal clay in the larger art world. Metalsmithing and other traditional forms have been around – what – thousands of years? Metal clay, on the other hand, is barely a decade old. But look how far metal clay has come since its introduction in the mid-1990s. Let's not forget, folks, that we are newbies, and that the metal clay community is bound to meet resistance for a long time to come. I suggest we not worry about what other people think, and instead concentrate on doing what we love, improving our craft and making good work with the goal of making better work tomorrow.

Chiming in on the discussion, Linda Kaye-Moses said it best. "The work being made in metal clay just keeps getting more interesting and beautiful. Every day I am challenged (and) inspired by the pieces I see."

In addition, let's also not forget that metal clay is accepted by many mainstream artists and arts organizations, and that the perceived resistance comes from an increasingly small camp, and may be best summed up with one word: Fear. Fear of change; fear of the unfamiliar; fear of the unknown.

The Society of North American Goldsmiths, an professional organization with a lifetime of credibility, has begun recognizing metal clay as a legitimate and teachable art form, and it's no longer unusual or surprising to see metal clay pieces show up in jewelry magazines and other art journals.

By nature, people are resistant to change. Metal clay may still be seen by some as a fad or a passing fancy. That's OK. Let them have their doubts. If we stay our path, we will prove the doubters wrong with time. We're on a journey. Rather than worry about what other people think, let's concentrate instead on presenting ourselves in the best possible light, with dignity, class, and a commitment to artistic excellence.

Firing Garnets

— Mary Ellin D'Agostino

Garnets are one of the natural stones that can be fired in place, but some people have reported a metallic sheen on garnets after firing. The first reports were in conjunction with fired cork clay, but tests show a greater instability in these types of garnet than previously thought. The exact composition of individual stones may be the dominant factor whether the stones remain clear or gain a metallic sheen when fired.

Discussion on the Yahoo MetalClay list revealed that the problem has more to do with the chemical composition of pyrope-almandine garnets [$(Fe,Mg)3Al_2Si_30_{12}$]. While pyrope garnets contain magnesium, garnets of the almandine family contain iron. Rhodolite garnet is an intermediate form of garnet in the pyrope-almandine series and contains varying amounts of iron.

Zora Monster hypothesizes that the iron content of the stone is the culprit. When heated, the chemical bonds may weaken and break, allowing the iron to form bonds with oxygen and create hematite (Fe_2O_3) on the surface of the stone. This suggests that torch firing or firing in a kiln with a reduction atmosphere (i.e., without oxygen) may reduce the likelihood of this happening.

In recent tests, I have found that temperatures up to 1200°F for 30 minutes in a kiln seem be acceptable when firing garnets that have this problem at higher temperatures. I also found that the stones I tested at this temperature didn't have a noticeable color shift either.

On a happier note, spessartite, grossular, and andradite garnets (including yellow, gold, green, tsavorite, hessonite, and demantoid garnets) don't contain iron in their chemical composition (unless it is an impurity) and shouldn't have this problem. However, I did once have a gold garnet become muddy when fired for an extended time at 1650 (an iron contaminated burnable core may have been a factor), so it is probably a good idea to fire all garnets at the lowest practical temperature and test them before firing them in place in silver clay.

This article draws from a thread at http://groups.yahoo.com/group/MetalClay
Additional Source: Simon & Schuster's Guide to Gems and Precious Stones, *New York, 1986.*

Profile: Donna Penoyer

Donna Penoyer may well have the most unique career combinations of anyone working in PMC. Penoyer, who lives in the Lawrenceville neighborhood of Pittsburgh, is a Rio-certified PMC instructor, and has been teaching PMC for four years. In June, she will lead a series of workshops at the prestigious Bead & Button show in Milwaukee. She's also a stilt-walker. When she's not making things in PMC or teaching, she works as entertainer, providing laughs while towering above the party on stilts.

"My husband bought me a pair of stilts for Christmas one year, and I took to it right away. I developed characters and a routine. I approach stilt-walking as an actor, not an acrobat. I don't juggle, or do anything like that," she says. "I haven't had a day job since July 1998. I just celebrated my 10-year anniversary as a stilt-walker. I do corporate events, trade shows, grand openings, things like that. And I travel quite a bit."

Penoyer became a PMC artist in January 2005, although she was familiar with the material for years prior. She began reading about and researching PMC soon after it arrived in the United States in the mid-1990s. As she says, "I became obsessed with it, and I knew it was something I wanted to do." It just took her awhile to get to it.

Penoyer was raised by creative parents near Rochester, N.Y. Her father was hobbyist blacksmith, and her mom was, and still is, a weaver. Penoyer is a writer by training, and became a maker of three-dimensional objects while writing her master's thesis, which involved a book of poetry. She began making things with her hands as a diversion during her thesis work.

"A light bulb went off, and I said, 'I'm going to be a lot happier if I

make stuff,'" she said. Her creative expression started with silk painting. She enjoyed it very much, but wasn't very good at it. That led her to make silk scarves. With leftover fabric, she created silk jewelry, and began a line of jewelry that was loosely based on the design principles of origami. Eventually, she found a place in her life for bead work, metalsmithing and polymer clay. While making things with polymer clay, she began hearing about PMC. The very idea of PMC fascinated her, and she spent several years reading about it before ever trying her hand. By 2005, she was ready, and she jumped right in. So confident was she in her knowledge of PMC, the first PMC class she took was a certification class, in January 2005.

A quick learner, she began making an item that has become her signature piece. It's a little whistle, shaped somewhat like a canoe, that hangs from a chain. She enjoyed making the whistle because of the challenge. In the beginning, she made the whistle in one-piece, and tried to poke holes in the clay for the whistle opening. But that didn't work well, and she eventually learned, by trial and error, that the best way to make the whistle was in two parts. "I learned the rules as I experimented," she said. She loves the malleable nature of PMC, and believes that the flexibility of the material is its greatest attribute.

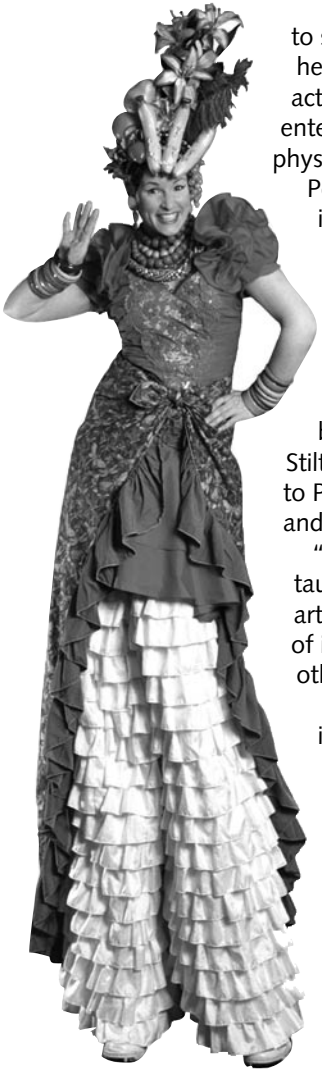
"I like the fact that it is water-based. You can do some basic forming and then really refine it with water and brushes and tools, and take advantage of it, so you can dry it and it becomes hard, and then it can become soft again.

"The real crux of what I love about metal clay is that is has the best of both worlds. It has that immediacy of being able to shape it in a very spontaneous way, and you get an immediate response from it. You learn from it, you get some feedback from it, so you can enter into a dialogue with the material right off the bat. But then you can refine that dialogue."

Penoyer teaches PMC classes several times a month across Pittsburgh, and lately has begun traveling nationally to teach, as well. She is serious about PMC, and is committed to establishing herself as a commercial artist.

"I can't be a stilt-walker forever," she said.

Stilt-walking is an attraction left over from her college days. She studied acting in college, but suffered stage freight – so much so, she had



to stop performing altogether. But then she met her husband, who is a physical comedian and actor. He does what is known as walk-around entertainment – juggling, globe-walking and physical interactions with small groups of people.

Penoyer was intrigued by the idea of entertaining for small groups of people, so she decided to give it try.

"I thought, maybe if I could entertain just a few people at a time, I wouldn't have stage freight. And you know what? I blossomed. I quit my day job and decided to contact my husband's agent, and immediately began getting work."

Stilt-walking and PMC make perfectly good sense to Penoyer, who has always trusted her instincts and followed her heart.

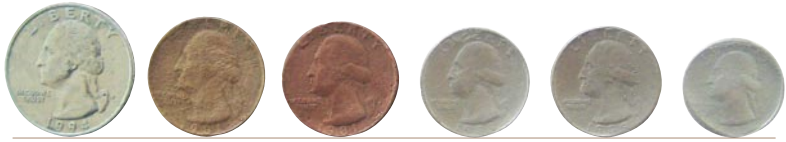
"I see a progression through my life. Poetry taught me how to see the world through an artist's eyes, and I was forever changed because of it. Everything has been one foot in front of the other, and trusting my inner voice.

"I would have never guessed that this is where I would have ended up. But that is what you do when you head out on a journey. You never know where you are going to end up, but you learn to enjoy where it takes you."

Donna Penoyer as Carmen Banana

Shrinkage

Shrinkage is a little bit like shoe sizes… the numbers are a good place to start, but you should not expect scientific precision. Or more accurately, the precision needed to understand with absolute certainty exactly how a piece will look after firing is very complicated. Size, shape, firing, and other factors will each impact shrinkage in subtle ways, so it is best to trust your eye rather than your ruler.



real quarter | *bronze clay* | *copper clay* | *PMC3* | *PMC+* | *Original PMC*

All PMC samples fired 1650˚F for two hours.

PMC GUILD Annual

PMC Guild Permits Bronze Clay in its Annual Publication

In 2007 the Guild started publishing a juried collection of the year's most exciting new work in metal clay. At the time, "metal clay" meant silver, but if you're read this far, you know that's no longer the case. The goal of the *Annual* is to foster creativity in its broadest forms while remaining true to the mission of the Guild. While it is assumed that PMC will play a role in the work being submitted, artists are invited to use bronze, copper, or any other new clay that comes along.

Deadline for the 2009 Annual is May 16, 2009. For a full prospectus and advice about photo parameters, please visit the *PMC in Print* tab at www.PMCguild.com.

Bronze Clay Gallery

More work at *www.pmcguild.com/members*

Lorena Angulo

Jen Kahn, Brass Knuckles
Silver and bronze,
photo by R. Diamante

Hadar Jacobson, Runover Beads
Silver, bronze, and copper clay

All photos by the artists unless noted.

Donna Penoyer
Whistle

Janet Harriman
photo by Rick Doble

Visual Trigger Challenge

Our wintry image of ice on grass drew many creative responses. Top prize goes to Louise Shadonix for her elegant entry. Tina Christie covered her polished silver with polymer to mimic the icy layer, and Patricia Weikersheimer was able to take a rubber mold of ice crystals.

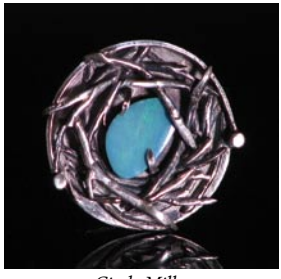
Louise Shadonix

Honorable Mention

Tina Christie

Jackie Freiburger

Runners Up



Cindy Miller

Patricia Weikersheimer

Julie Sanford

PMC Guild
1921 Cliffview Lane
Florence, KY 41042

Fusion Visual Trigger Challenge: See inside for details