

Special Web Edition

The first six pages are the original paper. The final eight pages are selected bonus pictures showing pattern development in greater detail. While this workshop was centered on Argentium the techniques are universal to mokumé-gane.



Argentium Mokumé Workshop

Rio Grande • Albuquerque, June 16 & 17, 2008

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Photography by Bill Seeley



Mokumé-gane (or mokume) is a multilayered, non-homogenous metal that can be manipulated to form striking, decorative patterns that are inherent to the structure of the work. Mokume can be made from a wide combination of metals. The workshop at Rio explored the possibilities of their new Argentium Sterling/Copper (AS/Cu) mokumé-gane.

In the middle of June a two-day workshop on the subject of pattern development and surface treatment in Argentium Sterling mokumé-gane was held at the excellent teaching facility of Rio Grande in Albuquerque, NM, USA. The workshop was taught by Phillip Baldwin and the participants were technical and educational staff at Rio, plus Bill Seeley, who photographed the event.



Educational Studio at Rio Grande.

The purpose of the workshop was to familiarize the Rio personnel with the possibilities and processes associated with mokume and AS/Cu mokumé in particular. As it turned out, it also became a materials testing event for the line with emphasis on severe to the point of abusive, working of the material.

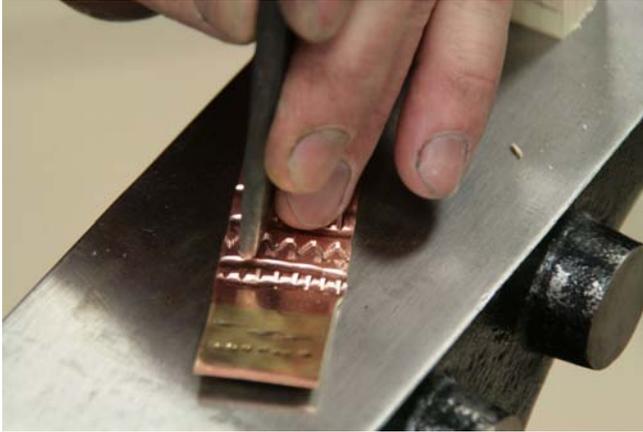
The workshop was divided into two parts, pattern development and surface treatment. In pattern development, un-patterned plate and rod are manipulated to create the decorative surface that is characteristic of the material. For the workshop, three different configurations were used, brass/copper in 27 layers, both rod and sheet, and AS/Cu sheet with 21 layers on a heavy AS back and 26-layer rod. The workshop did not use the 14K Pd White/AS patterned sheet due to cost considerations.



Cutting the pattern.



Repoussé.



Repoussé.



Twisting.



Patterning w/ a flexshaft.



Filing punched "Egg & Dart" bracelet.



Reverse twist AS/Cu Rod.



To begin, pattern samples were developed in brass/copper mokumé. Three types of incised patterns (patterns formed by cutting) were made in sheet and twist patterns in rod. Incised patterns were formed by cutting hollows into the sheet and flattening, repoussé and filing on the front, and by punching and filing flat. The results of the various processes were compared, each producing a different result. Incised patterns tend to produce designs that look like a topographic map, while twist patterns look like anything from a rope to snake skins.

Of particular interest were the twist patterns. The AS/Cu rod was twisted to a pitch of at least 60° to produce a tight pattern, usually requiring two annealing cycles for 1/4" rod. One participant did the most abusive twist of all, 270° reverse twists. In no case was any layer separation observed. The participants noted the great malleability of the material; more easily formed than standard sterling and equal in malleability to straight AS.

Next, each participant chose a particular project; belt-buckles, bracelets or earrings and made patterned stock for that piece in AS/Cu mokume. Bracelets were made using twist and incised patterns. A belt buckle was made by punching and a set of earrings used the repoussé method. Stock removal, a part of the patterning process, was aided by the use of very coarse wax files and

burrs followed by coarse and fine Scotch-brite wheels to remove “drag over” left by the files and burrs.

Soldering and annealing was done with an air-acetylene torch. All the twist-patterned bracelets required a silver back to be soldered on, giving the workshop the opportunity to test flux and solders. As the soldered elements were fairly large, a thick flux was needed. Fluoride-free GriffFlux #1 worked very well. Using the flux as a temperature indicator was found to not work as it became liquid before the AS was fully softened. Heating to a dull red in a dim light proved to be very satisfactory, followed by a quench in water after the color had disappeared. Pickling was in cold “RioPickle”.



Sweat soldering using easy.



Forging “Egg & Dart” bracelet.

Two very different types of Argentium solder were tried. The first was a hard paste solder. It did not flow completely before the AS/Cu mokume element started to melt. The second type tried was easy Argentium wire solder and this worked very well for all types of solder joints, with very good flow, leaving no ghost and excellent malleability.



A hardening experiment was conducted on a belt-buckle that had been softened by soldering on the loop and post. It was heated for one and half hours at 580°F (304°C) and cooled. The belt-buckle had become quite hard and could not be bent by hand.



A well soldered joint.

Quite rapidly, finished pieces began to emerge. Some of Rio’s excellent tooling came into play; most impressive was the bracelet bender, which could bend a full hard band into a bracelet, with no need for annealing.

Finishing was done by conventional techniques, such as sanding and buffing aided by use of the Scotch-brite wheels. An incredible aid to finishing was the **no firescale** characteristic of Argentium.



Finishing.



Copper Rokusho pot, hot plate, copper wire & daikon radish.

After lunch on the second day the pieces were ready for the second stage of the workshop, surface treatment and patina. The appearance and contrast of the Argentium and copper can be enhanced by etching and patination. Etching creates an actual topography on the surface by selectively removing the copper, sometimes making a diffraction grating or “spirit” pattern. Patina can darken and/or color one of the metals and in the case of AS/Cu mokume create a striking contrast between the bright silver and dark copper that is visible across the room.



Lightly etched sample.



AS/Cu mokume w/Rokusho.

For etching, Rio’s Silver Etching Mordant was used, diluted to 4 parts mordant to one part water, though it can be used straight. Etching can also be done by immersing the work overnight (or longer) in clear ammonia cleanser or sulfuric acid pickle. The two most important aspects of etching are a clean, finished surface and not over-etching. In this workshop, everyone was watching their work like a hawk so no accidents occurred. Generally slow etches are cleaner than fast ones. We found that some very light etching occurred on the AS backed works, but the frosting disappeared with a light buff. The acid on the work was

neutralized with a baking soda solution, dried and given a light post-etch finishing with a nylon brush or buff with red or white rouge. The pieces were cleaned again and ready for patina.

Two types of patina were tried: Baldwin's Patina, a cold rub-on solution and Rokusho, the classic Japanese boiling patina. The BP was found to be the easiest to use by far, it was simply rubbed on a clean piece with a paper towel or brush until the copper turned brown and rinsed off with cold water. A light polish with a rouge cloth and the piece was finished.



Phil's "Egg & Dart" pattern bracelet w/ Baldwin's Patina.

The Rokusho was more work. The Rokusho powder was combined and simmered in a copper pot with distilled H₂O and grated daikon radish. The cleaned piece was rubbed with the radish (to keep the silver from turning yellow) and immersed in the solution for about 10 minutes. The copper turned a dark leathery brown, somewhat different from the BP, with a very even color.



Bill's reverse twist pattern bracelet w/ Baldwin's Patina.

Every workshop participant was able to make at least one finished work. For some this was their first experience in working metal and for some it was an introduction to heavy metalsmithing techniques. Everyone worked very diligently, greatly aided by the excellently equipped (no surprise there!) and well-organized teaching facility at Rio. One of the best things about the workshop was treating a precious metal less preciously and enjoying the search. Many thanks to the Rio staff for making this possible.



Sarita's "Diamond" punched pattern bracelet.

In summary the most important points noted during the workshop for working the Argentium/Copper mokumé-gane were as follows:

- The AS/Cu mokumé can be worked as severely as straight Argentium sheet.
- Anneal at a low temperature (dull red in dim light) for a short period of time. Do not quench until the color has disappeared from the metal. Note: the copper component in the mokumé aids in seeing heat color.
- Use paste flux and easy solder for soldering. AS/Cu mokume melts at a temperature somewhat below IT solder so be easy on the heat. Let cool before quenching as per annealing.
- AS/Cu mokumé can be heat treated just like straight Argentium. Heat in an oven or kiln at 580°F (304°C) for one to two hours and cool.
- Final finishing is very fast, especially for the AS backed flat grain, due to the "no-fire-scale" characteristic of Argentium.
- The word is "clean, clean and clean" for good etching and patina results.



Mark's "Diamond & Star" pattern, etched, & heat-treated belt buckle.

Bonus Picture Gallery

Part 1, Twist



Note the tight diagonals of the twist.



Course filing to reveal the pattern.





Forging to widen the bar.



Note that these are forging hammers!
Heavy hits are better than little taps.



Cross peen hammering.



Not a time to be timid! Forge the rod deeply!



Surface hardening from wimpy blows may
cause delaminations.

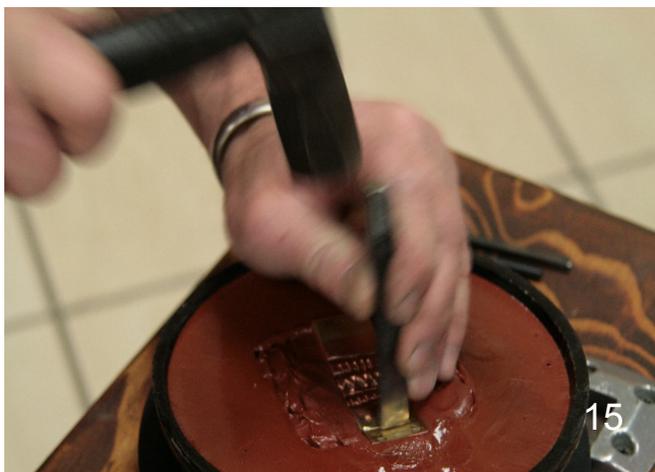


A simple twist in copper & brass.

Part 2, Repoussé & Punching



Chasing on a soft base.





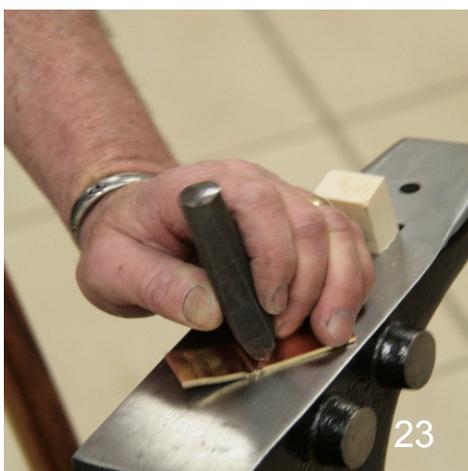
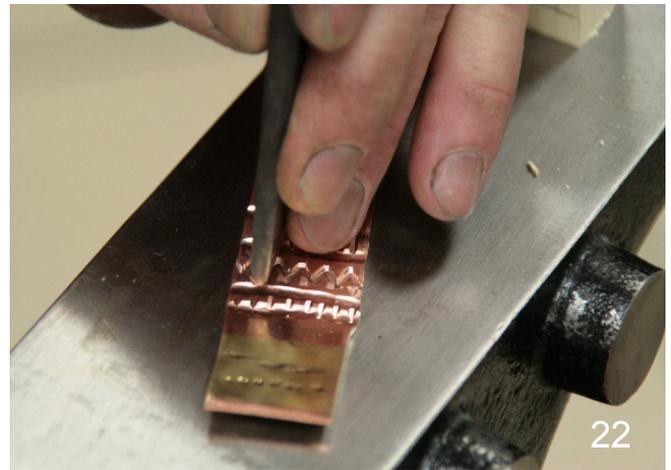
Punching on a hard base.



Using standard tools.



Note the punches are driven deep into the stock.



Note the wood peg in the hardy hole to soften the anvil's ring.

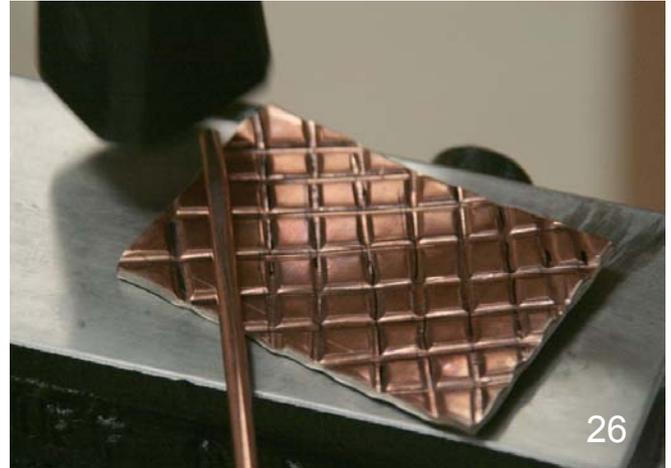


Improved tools.



25

A square steel rod.

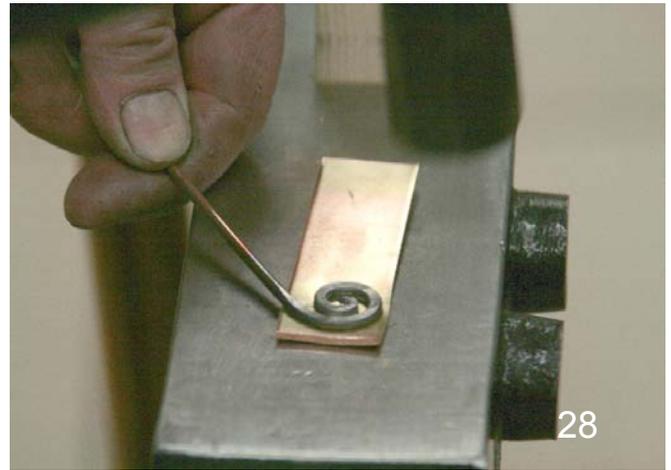


26

Incising a diamond pattern.



27



28

A steel rod incising a spiral.



29

Lots and lots of...



30

...filing, filling, filing, filling.

Part 3, Stock Removal



Choosing the bur.



Pattern development by stock removal.





Concentration.



Contemplation.



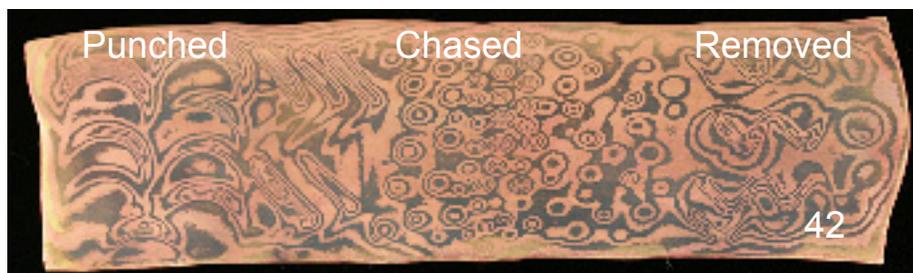
When in doubt... a bigger hammer.



A little lip biting... always helpful!



Each of us made a sample like these two. It is 1" x 3" x 14ga copper/brass flat. Patterns were developed three ways. The center in #41 has been filed and sanded to reveal the pattern. #42 shows the three techniques with a patina. This is a great way to get a feel for the process.





“Hammer with Smith”

Ask Phillip & you will soon find out...
It is all about the hammer!

