

Saggar Firing Workshop

Judy Nelson-Moore

Methods Handout



In this workshop we explore methods of preparing and firing clay works in saggars to produce beautiful surface effects resulting from the interaction of clay and fire. Similar to sawdust or pit firing, I sometimes call it fume firing, mummy firing or garbage firing. This is an unpredictable firing technique. I make no guarantees of good results! We will explore and experiment in the workshop by loading the saggars with participant's small test pieces. We will unload the saggars after the kiln has been fired and evaluate the results.

Each workshop participant should bring 1-2 small **bisque** pieces (or green paper clay). Pieces to be placed in saggars should be no more than 125 cu inches (that's like 5 x 5 x 5") or smaller.

At left: Mummy-fired sculpture, *Desert Tree* by Judy Nelson-Moore

What is a saggar?

A saggar is a container surrounding the ceramic ware as it is being fired in the kiln. Traditionally, saggars are made of clay, as are the ones we will use in this class. These can be either specially made saggars or "found" saggars from flowerpots or other utilitarian pots. I have also used sawed-off oil barrels in a pit. Other materials for saggars can include clay-soaked burlap (called mummy firing), which we will include a demonstration. You can also build a saggar out of bricks inside the kiln.

The purpose of the saggar is to provide an environment for fuming. Various materials such as garbage, seaweed, straw, sawdust, wood excelsior, magazine pages, copper or brass wire, salt, copper carbonate, iron oxide, cobalt carbonate are placed in the saggar or tied to the pieces. At the firing temperature, these create a "fuming" atmosphere and the chemicals are transferred to the surface of the clay to form random and serendipitous patterns and designs of color. The color range is black, gray, pink, maroon, orange, blue, green and other colors depending on what chemicals are used in the saggar.

Making Saggars

Make saggars as large round, or oval wastebasket shapes. Make out of well-grogged sculpture clay. Make them fairly thick-walled, but not too thick (no more than ½"). Even thickness is more important. I like to put raised stripes on the bottom to lift the pieces off the bottom of the saggar. If you want lighter, patterned pieces, put holes in the saggar sides (small, spaces irregularly and on opposite sites). The number of holes is up to you. Make a lid that fits well. I like to make a lip that comes down on the outside at least 2 inches. Or, you can use an old kiln shelf as the lid. Fire the saggars empty initially to a fairly high temperature...at least cone 1-3.



Making and Preparing the Pieces to be Fired

All sizes and shapes of pieces have been fired in saggars. I have fired pieces from 1" to 5' in saggars or mummy firing. Some people claim that rounded, smooth shapes fume best, and certainly some wonderful flame patterns can be seen on well-rounded jar shapes. Certainly large areas of smooth clay tend to show off the fuming patterns better.

The pieces should not be too thick. Prepare the pieces by firing in a bisque fire. Some people claim that a low bisque (or no bisque) gives the best results, but the resulting pieces are too fragile for my liking. I have been experimenting with firing the pieces higher initially (I have done up to cone 6) to make the body stronger and have had good results. I have also been experimenting with saggar firing a piece that is subsequently glaze fired (either low or high fire). The glaze bubbles and produces a wonderful texture over the carbon in the saggar-fired piece. I have also refired saggar pieces that didn't turn out well in the first saggar firing with mixed results. If you really hate the results put through an electric firing in-between to burn out as much of the carbon as possible, reapply a thin terra sigillata before the next saggar firing.

Terra Sigillata

What is Terra Sigillata? A slip made of the very finest (tiniest) clay particles. Can be any color, any clay. When applied to the piece, it can be burnished to give a soft sheen or a high gloss. Historically used as an alternative to glaze by American Indians, Greeks, and other "primitive" potters around the world. We use terra sigillata in fume firing, because it gives a nice sheen. Many people, including myself, claim that it is the raw clay particles that fume the best. Therefore, terra sigillata applied to bisque is my preferred method. This allows the base piece to be fired to avoid too much breakage that occurs with saggar firing greenware. Cracks in the terra sigillata finish which may occur when applying to bisque can be avoided by using a THIN coat.

How to Make Terra Sigillata (T.S.)

You can either use a recipe (see one in this recipe section) or...here's the way I do it...not precise at all: Put some clay in a bucket. Use Red Art for red, Jordan (friend claims produces good oranges), KY Ball Clays (not as white as...), Grolleg porcelain (very white). Try local clays. Add about 3-4 times water to the amount of clay. Add some calgon (I use a capful of liquid per container). Stir well. Let sit for 2-24 hours. Pour off the water from the top and discard. Pour off the center cloudy section into another container, leaving the heavy particles at the bottom behind (discard). Save the center portion as the T.S. If too thin, thicken through evaporation. If not shiny enough, let sit again and separate again, or add more calgon, let sit and separate again. Dip a shard into the T.S and see if it looks good. It should be slippery feeling and you should be able to polish the shard to a sheen...how much sheen depends on the type of clay and how good a job you did of getting the smaller particles. You can find lots of more precise recipes for T.S. in books and on the Internet. Try them if you are dissatisfied with the T.S. you get the easy way.

Add mason stains or oxides for color...10-40%. However, I have found that most colors burn out in a saggar firing. Generally, you should use the colored terra-sigs for regular non-fuming firings.

Materials for the Saggar

You need the following types of things for the saggar:

Required:

Something to produce carbon

This is the garbage, sawdust, seaweed, straw, wood excelsior, wood chips, charcoal, seeds/feed, dog food, etc, etc, etc. My favorites are seaweed and wood excelsior. If this is all you use, you will most likely get black/gray effects. For totally black with hardly any gray, use a very tight saggar.

Optional:

Something to produce color

I use iron oxide and copper carbonate. These produce yellows, oranges, reds (rust, pink, maroon, and shades in between), green, black, gray, brown. It's the red colors

that excite most people. I've used cobalt carbonate, but it is too blue for my taste. Use just a tiny bit. Others can be tried. I've read that sulfates fume well.

Inert Stuff (this is used as spacers, supports, or fillers to thin out the carbon stuff)

- ☞ Vermiculite. Mix this with sawdust to cut the black effect of sawdust. Be careful as it is toxic.
- ☞ Fire brick pieces can hold things in place.
- ☞ Slabs or Shards

Salt

- ☞ This volatilizes and carries the chemicals and carbons onto the piece as well as creates interesting patterns.
- ☞ I prepare an iron oxide, copper carbonate, salt and water solution and brush on the inside of the saggars and on shards, as well as dribble around (but not on) the pieces in the saggar. If you put a lot of iron and lots of carbon stuff and salt, you may get black iron crystals. The copper hopefully makes lovely pinks, mauves, reds. The iron can make reds, oranges, browns and black. If the copper makes greens, instead, it's probably because it didn't get reduced.

Pattern Makers

- ☞ Copper, brass or other composition wire for black or other color lines
- ☞ Grasses or weeds or paper patterns held tightly against the piece by wire or tape or clay slab or shard will hopefully resist the carbon and produce white lines and pattern.
- ☞ Custom-shaped slabs to fit the piece or found shards to lean against the piece. Paint the salt/oxide/carbonate solution on the slab/shard, let dry, and place against the piece to produce a pattern. Put grasses in-between for lines in the pattern.

Other things (these are reported to work by others, but I haven't had much luck)

- ☞ Colored papers are supposed to fume colors on the piece. These would be high clay-content papers like National Geographic. All I've found is that they produce gray/black. Maybe at a lower temperature, they would work better.
- ☞ Various compositions of wire are supposed to produce different color lines. All I've ever gotten is black.
- ☞ Tape applied to the piece is supposed to provide a white line...it has produced black smudges for me.

Stacking the Saggar



General

- ☞ Decide if you want color, overall light effects, dark effects, patterning.
- ☞ For light effects, use less carbon stuff.
- ☞ If you want dark effects, put in more carbon stuff.
- ☞ For color, use the salt/copper/iron mix described above. Paint on the inside of the saggar walls and on shards laid up next to each piece.
- ☞ For lines, wrap the piece in wire. Prepare a slab to fit the piece for white (resist) lines.
- ☞ For patterns, put different size/shape of shards, carbon stuff, and salt/copper/iron mix. See special effects below.

Special Effects

- ☞ Black lines. Wrap with copper or brass wire. Thin for thin lines (too thin and it disappears). Thick for big, thick black stuff on your piece. No plastic on the wire, please...that produces unpleasant black sticky stuff.
- ☞ Resist effects. Create a shaped slab. Be careful that the slab around the piece will not break your piece as it shrinks and contracts around the shape. Put grass, wire, paper patterns, tape, or other items next to the piece. Paint the shard inside with salt/copper/iron mixture and LET DRY. Carefully place slab next to the piece in the saggar. If the slab is not quite dry, probably OK for the workshop as the firing will not commence immediately and they will have time to dry out after loading. Don't use plastic stuff...it makes a gummy black mess.
- ☞ White lines. Put grass next to piece and shard or shaped slab next to the piece.
- ☞ All black: If you don't want color, stack the piece totally smothered with lots of carbon stuff (see list above) in a very tight saggar (no holes, tight lid). Sawdust is best for this.
- ☞ Colors. Use salt and oxides or sulfates.
- ☞ Specific patterns. Cut pattern out of paper, tape, form in wire. See resist effects. Wrap wire or shape wire and hold next to piece.
- ☞ Slip resist. Paint entire piece with thick slip. When it cracks, the fuming will go into the cracks and where the slip was solid will resist the fuming. Scrape off the slip after firing to reveal the pattern underneath

Mummy Firing



How to prepare a mummy

- Prepare a slip of any clay. Add paper-pulp for a stronger mummy.
- Put a big plastic sheet on the tabletop.
- Dip a piece of burlap big enough to wrap around the piece into the slip (completely saturate) and lay out on the table. Alternately, butter the slip onto the burlap.
- Cover the burlap with paper to keep slip off the piece.
- Put carbon stuff, chemicals on the paper.
- If desired, put shaped slab or shard around piece as described above.
- Put the piece in the middle of the pile. Cover with stuff to fume the top and paper to keep the slip from getting on the piece.
- Pull the burlap up around...make sure stuff is on all sides.
- Wrap with string.
- Let set until firm enough to load into kiln without getting slip on the other stuff in the kiln. If not completely dry when loaded, wait until dry before firing.
- Stack into kiln carefully. The mummy will partially fall off during the firing, depending on how much slip you use, the composition of the slip, and how well it is wrapped.

Firing

Type of kiln

I have done saggar firing in a pit, in gas kilns and in electric kilns. Gas kilns have more reliably produced the best results in the past. I have observed Mata Ortiz potters fire above ground similar to a pit firing. Some Dutch potters I talked to did fume firing on bricks in the open at low temperature, fuming with colored papers. Other people with whom I have talked do fume firings in oil barrels or barbecue containers.



At left is a gas kiln loaded with saggars and mummies before firing.

Temperature

I usually saggar fire to cone 08. I have tried as low as cone 010 and as high as cone 10. Higher temperatures (above about cone 01) are a totally different look, more burnt, less color. Terra sigillata becomes matt above about cone 01. Some people fume fire at lower temperatures than 08.

Opening the kiln

Unlike raku, leave the pieces in the kiln until they are totally cooled. In this workshop, we will open the saggars together (no peeking before!!!) so we can see the results from the placement of the pieces, talk to the people who stacked the pieces, and evaluate the results. Evaluating the results when opening the saggars is your best learning tool. I recommend taking notes about how you loaded your piece, and provide a notes page with this handout.



At left: same kiln load as above...after the firing. Notice that the mummies stayed together fairly well. There is a hole in the mummy on the left.

Post-Firing Treatment

- **Wash.** Wash the piece in water, even using a soft scrub pad (like dish washing pad) to clean off the stuff that is stuck on there. Use gloves as the chemicals in the firing are on the piece.
- **Seal.** If desired, seal with ½ white glue or matt acrylic medium or Dorland's wax (oil painter's wax) or floor wax or butcher's wax (these are some of the things I have heard of people using or used myself). I like the matt acrylic medium or Dorland's wax best. These will help to bring out the colors and patterns, sometimes amazingly so. I have had pieces that I thought had no fuming, only to have them turn a wonderful orangey with the medium applied.

- However, these surface preparations may alter the colors and patterns...so if you really, really love it, leave it alone.
- **Refires.** If you don't like it, try refiring. You can put in as is, apply terra-sigillata and refire, or bisque it again and then reapply terra sigillata. Try firing to a higher or lower temperature. If too light, for example, try a very low fire paper fuming outside the kiln just on bricks to get some more color. Or, refire in a regular glaze firing, either low or high fire, with or without a glaze. You will get something more interesting than the effect that you don't like using any refire method.



At left: Workshop participant Rhonda Main and pieces just unloaded from the saggars and mummies.

Recipes:

These are some old recipes I have from George Tompkins, Yuma, Arizona, from a workshop 20 years ago. See his beautiful fumed work at www.claystuff.com.

Terra Sigillata

15g calgon
500g Clay
1 gal Water

Let stand overnight. Pour or siphon off top $\frac{3}{4}$. Let thicken or boil off water. Should be thickness of milk or $\frac{1}{2}$ and $\frac{1}{2}$.

Bone (greenware) slip

50 Edgar Plastic Kaolin (EPK)
25 Nepheline Syenite (Nephsy)
25 Frit #25

Can apply thin to bisque, also.

Bisque slip

25 EPK
50 Nephsy
25 Frit #25

For dark colors, add up to 20% copper carbonate

Spray or brush on Bisque

References:**Books:**

Barrel, Pit, and Saggar Firing, A Collection of Articles from Ceramics Monthly, Sumi von Dassow Editor.

Sawdust Firing, Karin Hessenberg, University of Pennsylvania Press. Part of The Complete Potter series, edited by Emmanuel Cooper. 1994.

Articles:

David Ogle's Saggar-fired Porcelain, David Ogle, Clay Times, January/February 2004.

Decorating with Volatile Materials in Saggars, Ruth Allan, Ceramics Monthly, January 1992, Page 75

Low-Temperature Salt/Saggar Firing, R. Bede Clarke, Ceramics Monthly, November, 1988, Page 48

Saggar Firing in a Raku Kiln, Linda Riggs & J.D. Riggs, Clay Times, March/April 1988.

Saggar Firing in a Raku Kiln, Orlene Bates & J.D. Riggs, Clay Times, Vapor Glazing in a Saggar, Richard Behrens, Ceramics Monthly, June/July/August 1976, Page 60

NOTES:

Record here how you stacked your pieces into the saggars and the results

| Piece Description | How Stacked | Results |
|-------------------|-------------|---------|
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Ideas to Improve or change: _____
