NYSCC @ Alfred University's

Raw Materials Cookbook 2009

"Yo past cookbooks, you were great, we're really happy for you and we gonna let you finish, but this is the best cookbook of all time. OF ALL TIME!"
-2009 Raw Mats Class-

Name: Brett Thomas
Research topic: Container glass as a raw material in clay bodies
Firing Range: Cone 3

Development:

The goal of this research was to determine how a heavy mesh soda lime container glass would effect the maturation of a clay body. By adding a material that melts fluidly at relatively low temperatures, I hoped to reduce the amount of energy used during the firing.

The container glass was anything found in the glass Recycling bin. In this case “Tazo” tee bottles, brown beer bottles and empty votive candle containers were used. After cleaning the glass containers to remove wax, glue, paper etc., the containers were processed using machines found in the Claystore. Materials were passed through the Jaw Crusher and then the Plate Mill. Processing the glass dry proved to be a faster and more efficient process, although screening through a 30 mesh screen was much easier with water than without.

In the clay body a line blend was then produced with varying amounts of the Glass cullet and Pyrax. The Pyrax was used in theory as a stabilizing refractory.

In the end the effect that occurred after firing the clay body to cone 3 proved to be the most interesting aspect of the project. For this reason, tile “A” was chosen to serve as the clay body to experiment with further. From this point on, colorant was also added to the clay body in order to allow for the colored defenestration of the formed glass papules that occur at cone 3.

After adding 10 percent pigment to the clay body, and wet mixing it made for an aesthetically pleasing result.

Line Blend

Tile	Grolleg	Tile 6	C&C	Talc	Glass	Pyrax	Total
A	25	20	15	5	30	5	100
B	25	20	15	5	27.5	7.5	100
C	25	20	15	5	25	10	100
D	25	20	15	5	22.5	12.5	100
E	25	20	15	5	20	15	100
F	25	20	15	5	17.5	17.5	100
G	25	20	15	5	20	20	105

Tile	Shrinkage		Absorption	Workability
	Wet to dry	Wet to fired		
A	8%	12%	9.6%	The Plasticity of the ball clay made up for the lack of plasticity of the Kaolins. These clays in combination with very little frit created a quite white body. The body coated the glass particles (30 mesh and everything under) quite well just as it would a fine grog. Workability was directly comparable to a fine grog. I experienced little to no slumping.
B	8%	10%	8.5%	
C	6%	8%	9.3%	
D	8%	9%	9.9%	
E	6%	9%	10.7%	
F	6%	9%	12%	
G	6%	8%	10.8%	

Further Experimentation:

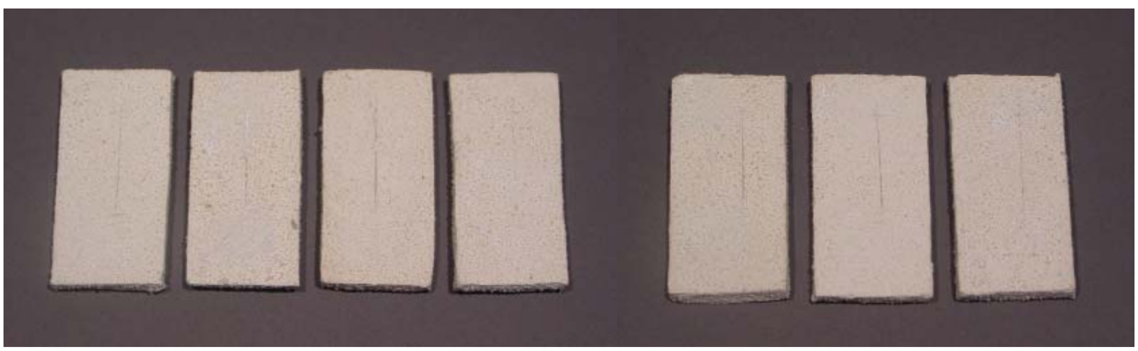
Adding 10 percent colorant to the clay body, wet mixing it, and firing to cone 3 added some very interesting color and surface texture. The glass formed in to papules like blisters on the surface, specifically with the cobalt carbonate. The cobalt produced a dark gun metal black clay and papules that were a rich violet blue. All of the other colorants I added were Mason stains once again at 10 percent. These all appeared to be the same color (give or take) before and after firing. The Mason stains did not get active with the glass like the cobalt did. The glass with the stains remained close if not the same color as it was in a raw state.

The following colorants were used in the clay body in increments of 10%

- Pemco Grey stain
- Nickle Silicate Mason Stain #627
- Hazelnut Mason Stain #6126
- Best Black Mason Stain #6600
- Mason Evergreen #6200
- Cobalt Carbonate
- Nickel Oxide

The raw materials... Tazo, Jack Adams and votive candle

30 mesh cullet



Point A-G (from left to right)

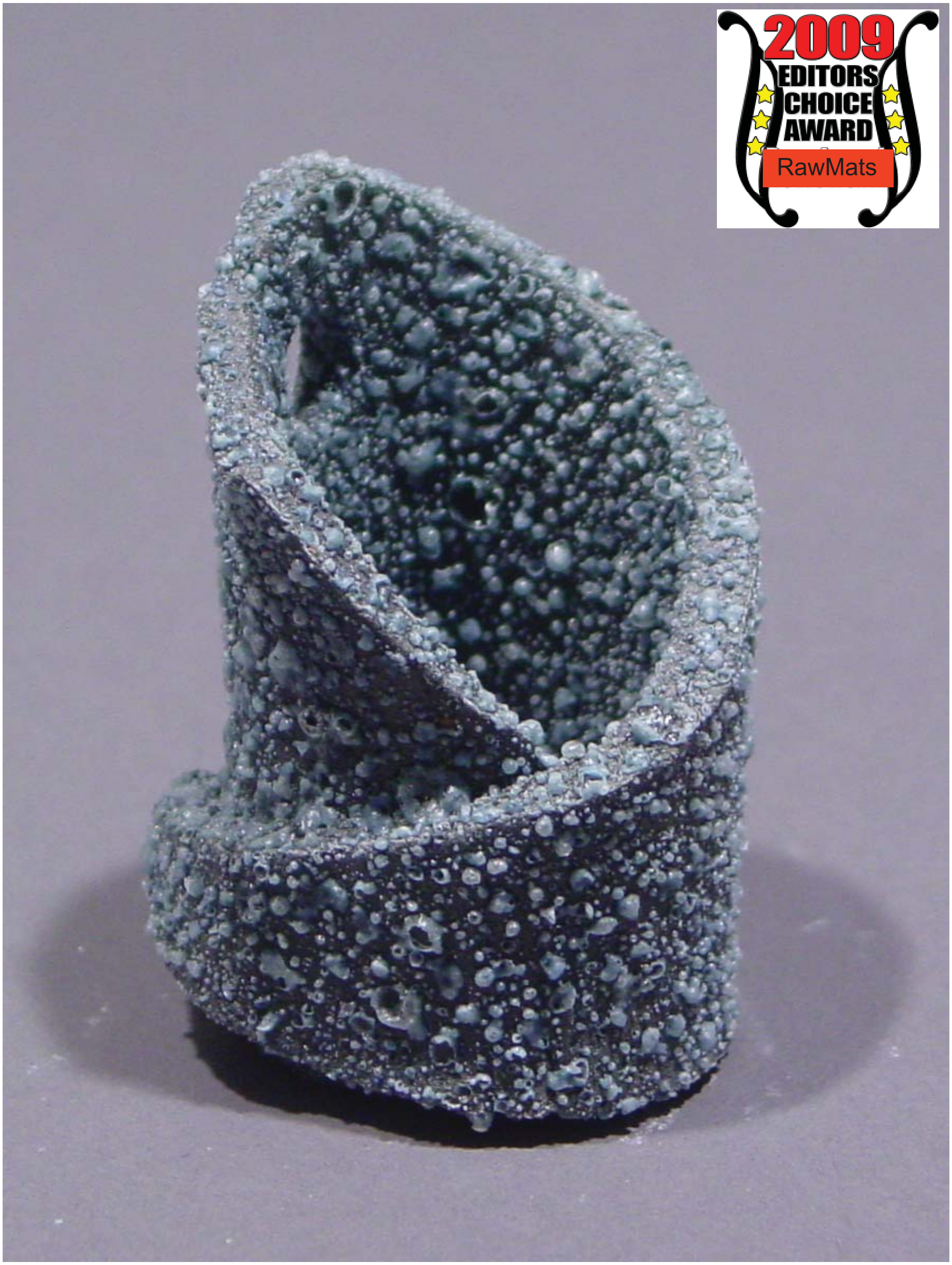
Point B at cone 05 (left) vs. point A at cone 3 (right)

Point A was used for subsequent color tests

Hazelnut, Evergreen and Pemco Grey

Best Black, Nickel Oxide, and Cobal Carbonate

Marbleized using the above versions



Best Black

Name: Nick Moen
Research topic: Colored Translucent bodies
Firing Range: Cone 6

Development:

My goal was to make a colored translucent body. I wanted to figure out how to add colors without making the body opaque. I decided that I could add color by mixing colored grog into a translucent body. I was hoping that light would pass through the thin porcelain body, with the color of the grog accentuating the light.

I figured that the best way to get a white and translucent clay at cone 6 was to use the purest kaolin, Grolleg, and a glass former to bring the temperature of the kaolin down. I used Ferro frit 3110, a high power low-mid fire flux to bring in both the flux and the silica to help the Grolleg vitrify at cone 6. Using a recipe from the 2007 cookbook, I used a line blend using just Grolleg and frit 3110 to find the right ratio. The recipe I chose as a base was as follows:

Nick's Cone 6 Translucent Porcelain:

Grolleg	60%
Frit 3110	40%

To wet mix I added 33 g water to a 100 g batch.

The following are the Mason Stains that I added in the respective percentages:

Mason Shrimp Pink #6022	10%
Mason Zr Ca Blue #6391	10%
Mason Praseodymium Yellow #6433	10%
Mason Alpine Rose #6001	10%
Mason Cobalt Free Black #6616	6%
Mason French Green #6219	10%

The following steps were followed to make the colored grog from the base body:

1- Wet mix the base porcelain. Must be mixed wet and sieved to avoid clumps of frit.
2- Add the Mason stain to the wet batch.
3- Let the batch get bone dry.
4- Crush the bone-dry batch into smaller pieces using a rolling pin.
5- Sieve the bone dry pieces through a 10-mesh screen.
6- Sieve the pieces that were smaller than 10-mesh through a 30-mesh screen.
7- Use the pieces that were not small enough to go through the 30-mesh screen so the remaining bone dry sample pieces were smaller than 10-mesh but larger than 30-mesh.
8- Fire the bone-dry pitch to cone 04 in a clay container that will hold the soon to be grog.
9- Once the grog is fired, wet mix a new batch of the base recipe as in step #1.
10- Let the mix dry until it is in a workable state.
11- Wedge in the colored grog.
12- Make something with it!

Test Tile Number	Added Percentage of Grog
1	4 % Rose
2	6 %
3	8 %
4	10 %
5	8 % Blue
6	10 % + 10 % fine yellow pitch
7	12 %
8	14 %
9	10 % Yellow
10	12 % + 12 % fine blue pitch
11	14 %
12	16%
13	10 % Black
14	15 %
15	30 %
16	8 % Green
17	Rainbow!
18	18 % Green
19	24 %
20	10 % Pink
21	20 %
22	30 %
23	10 % Blue + 10 % Yellow
24	18 % Orange + 14 % Blue pitch + 20 % Yellow pitch

Conclusion:

There are a number of different places where this project could go. It would be interesting to try one of these recipes as a casting body. It would also be interesting to try to make the objects thinner and to play with light. Sanding the surface down could be cool so the depths of grog would be accentuated.

1-4

5-8

9-12

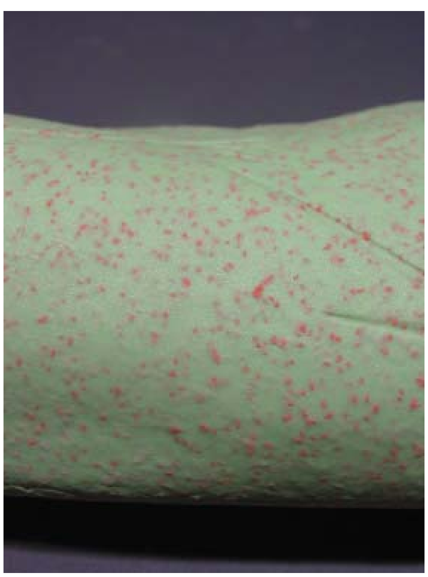
13-16

17-20

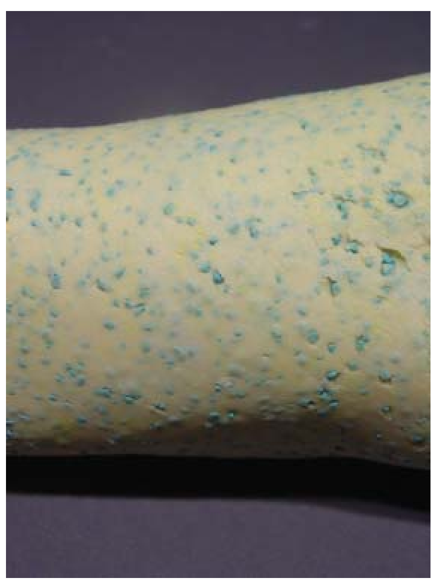
21-24

Detail of 15

Detail of 10

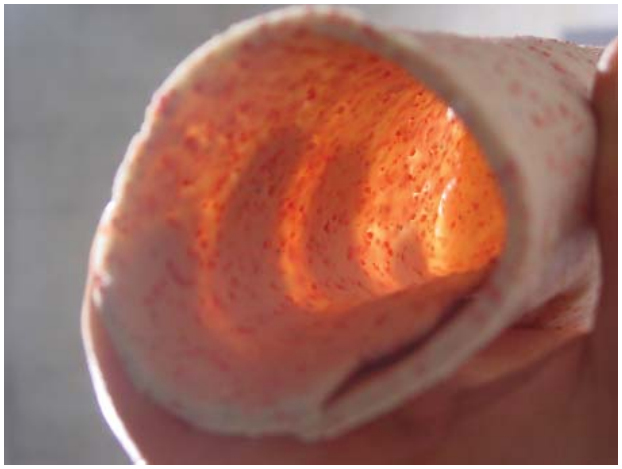


Detail of 24

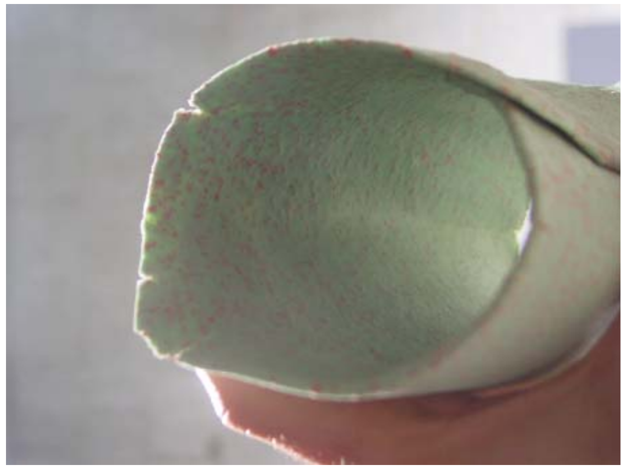


Detail of 6

Detail of 21



Translucency of 4



Translucency of 24

Translucency of 13

Translucency of 23

Translucency of 20

Fired blue and orange pitchers ready for addition to the base body

Name: Shane Buckley
Research topic: Dry sifting clay body
Firing Range: Cone 04

Development:

The goal of my research was to develop a cone 04 clay body that could be dry sifted onto ceramic sculpture or functional ware and which would be dense enough to hold its shape after firing.

I started with the cone 04 recipe my partner and I had developed in class for the Potluck body project. I removed all grog from the recipe to improve sifting and added colorant to make the color more desirable. I then mixed a nine-part line blend of the body where the flux, Frit 3124, went from 35% to 75% in increments of 5%.

	1	2	3	4	5	6	7	8	9
Tennessee #10	32.5	30	27.5	25	22.5	20	17.5	15	12.5
EPK	16.25	15	13.75	12.5	11.25	10	8.75	7.5	6.25
Tile 6	16.25	15	13.75	12.5	11.25	10	8.75	7.5	6.25
Frit 3124	35	40	45	50	55	60	65	70	75
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Add: Nickel Oxide	3	3	3	3	3	3	3	3	3

I did this to see at what point the body would be dense enough to hold its own shape but not melt into a puddle. I wet mixed the nine 400 gram test samples to create a homogeneous mixture. I then let the test samples completely dry to a bone dry state. After the tests were dry, I crushed them and poured them out into test lines on a tile setter covered in alumina hydrate to be fired.

Once fired, I was able to see which point was most suited to be sifted based on density and over all melting. I Choose point 5 which had 55% 3124. I then created a cardboard apparatus to be used in masking out a shape to sift the body through to have more control of the resulting shape. The resulting shape was as I desired before firing but the shape split apart in shrinking in firing. This may not happen when used on another ceramic object but if it is to be used alone, as in the test, there will be cracking issues most likely based on the lack of packing the particles.

Points 1-3

Points 4-6


Points 7-9


Point 1


Point 5


Point 7


Point 8


Point 5 passed through a template...

Name: Brandi
Research topic: Making a clay refrigerator
Firing Range: Cone 016

Development:

For my final project I chose to create a clay body for use in the production of ceramic refrigerators. I will ultimately be taking this project to Brazil to implement it on a permaculture center in the Amazon; therefore I chose to use all naturally occurring or easily accessible materials to mimic the challenge of creating a similar clay body on site.

The refrigerator consist of two ceramic bowls, unglazed, that sit inside of each other with a space between their walls. The space is filled with sand, which is dampened twice a day with water. As the water evaporates through the walls of the outside pot, heat is drawn away from the inside pot through passive cooling.

The challenge of this project was to create a clay body that could be fired at very low temperatures, as the pots will ultimately be fired in pit kilns, while being strong enough to hold up to transportation and constant use. The body also had to be quite porous to allow for quick evaporation of water through the walls of the pot.

Process:

I began with a local Alfred clay. I created one test tile with nothing but the clay to determine how it fired on its own. I then created a triaxial using sand and sawdust as fillers to open up the clay body and allow for evaporation. The end points of the triaxial were: A- 100% clay, B-60% clay 40% sand, C- 92% clay 8% sawdust. I was not able to wedge in more than 8% sawdust by weight.

I fired the tests to cone 016 which is in the mid to high range of pit fire temperatures. While the tests were quite porous and had extremely high absorption rates they were not strong enough to use.

Tile #	Wet to fired shrinkage	Absorption
1	6%	12.04%
2	6%	11.90%
3	5%	15.29%
4	5%	11.79%
5	4%	13.98%
6	5%	17.84%
7	4%	11.54%
8	6%	14.27%
9	6%	17.44%
10	5%	22.33%
11	3%	10.92%
12	7%	14.16%
13	6%	16.51%
14	3%	19.04%
15	4%	21.20%

I decided to add a frit to the body. The problem was finding a frit that would melt at such a low temperature. I opted to test both a leaded and unleaded frit and decided on Ferro 3110 for the unleaded and Ferro 3403 for the leaded version. I made two tiles and placed a spoon full of frit on each to determine if the frits would melt on their own. I then fired the tiles to cone 016 in an electric kiln.

I also created line blends of the clay mixed with 0 to 70% frit increasing the frit by ten percent for each tile. After adding more than 50% frit the clay became too dilatant to work with, however I fired a sample of 60 and 70% anyway just to see what happened.

After firing the frit samples I found that both melted at the desired temperature and decided to create the final refrigerator using the unleaded frit.

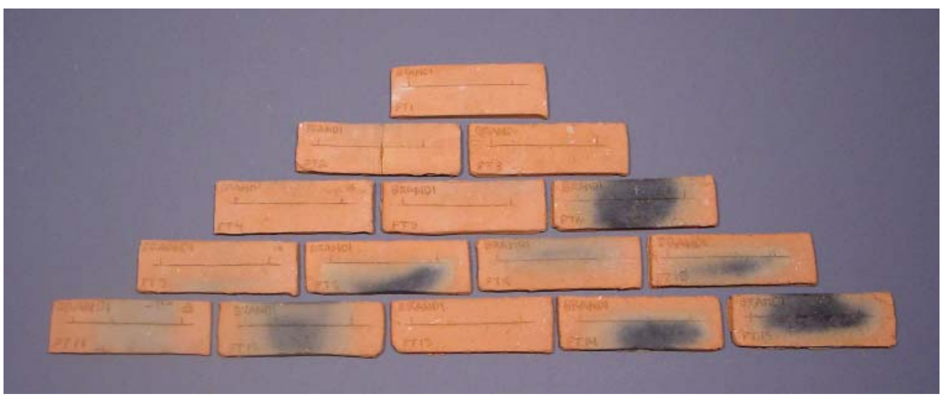
After considering all of the tests I settled on a final recipe. I used point five from the triaxial blend as it had a fairly high absorption rate, and was also semi workable. I then calculated in thirty percent frit.

Final Recipe:

Alfred Clay	61
Sand	7
Sawdust	2
Frit 3110	30

I then mixed a ten pound batch of the clay body and made a miniature fridge to determine if the body worked.

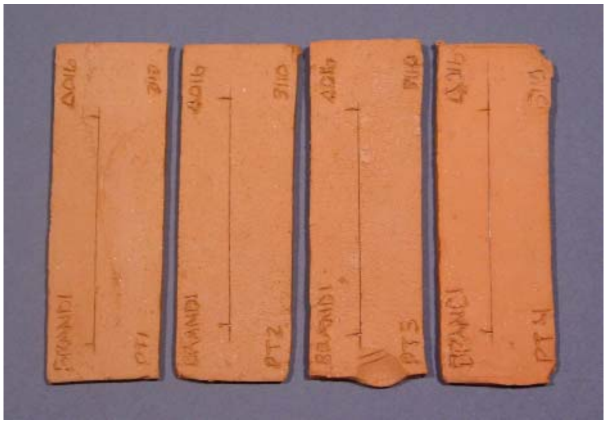
I measured the temperature with a standard refrigerator thermometer. Before wetting the sand the internal temperature of the fridge was 68 degrees F. After the sand was watered and the fridge was left to set for an hour the internal temperature of the fridge was 48 degrees F. The results showed that the clay body did work for ceramic refrigerators. The temperature hovered just above the 45 degrees that is considered safe for most milk and cheese products.



Original triaxial blend

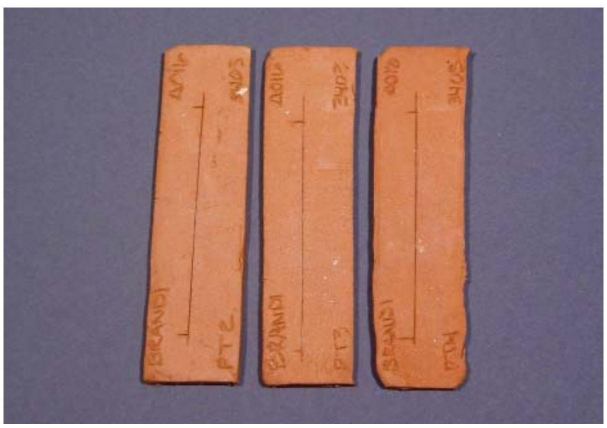
Discoloration in the samples is due to sawdust

Frit additions

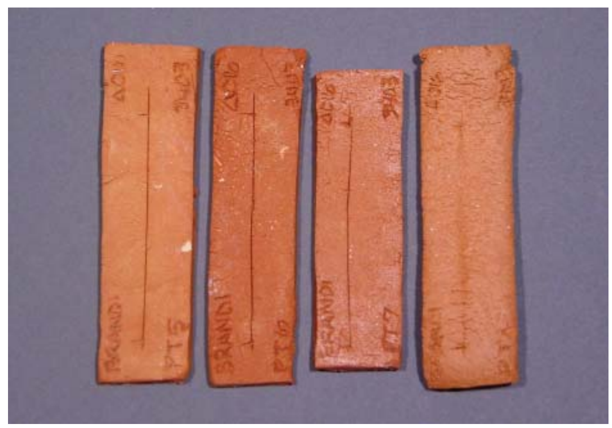


Additions of frit 3110 (0-30%)

Additions of frit 3110 (40-70%)



Additions of frit 3403 (10-30%)



Additions of frit 3403 (40-70%)

Frit 3110 (left) and 3403 (right)

Cooling underway...

Uncovered vessel during testing

Note the layer of sand between inner and outer vessels...

Name: Matt Brej
Research topic: Frost-proof body
Firing Range: Cone 04

Development:

I originally wanted to try and create a throwing body that would be able to withstand winter freezing and thawing conditions. There were two ways to go about this. The first was to create a body so dense that water would be unable to enter into the pores of the clay to freeze and expand, thus cracking the piece. The other way would be to increase the porosity of the body in such a way that pore channels are created and the ice has extra room to expand and not crack the clay. I chose the latter of the two and decided to use grogs as fillers in my test.

To begin I started with Labs 2, 3, and 4 for the Potluck throwing body that Luz and I created in class. These were triaxial blends consisting of different ratios of Red Art, Yellow Banks #101, OM-4 Ball Clay, Talc, Ferro Frit 3124, Hawthorne Bond 35 mesh, Bentonite, and fine grog. We made tiles measuring 5 by 15 cm which were of the average thickness we would be working with on finished products. To test the tiles created in those labs, I consulted Cushing's Handbook's 3rd edition. Page 17 of the handbook explains the complete test to determine whether or not a clay sculpture body is safe to leave outdoors in winter climates.

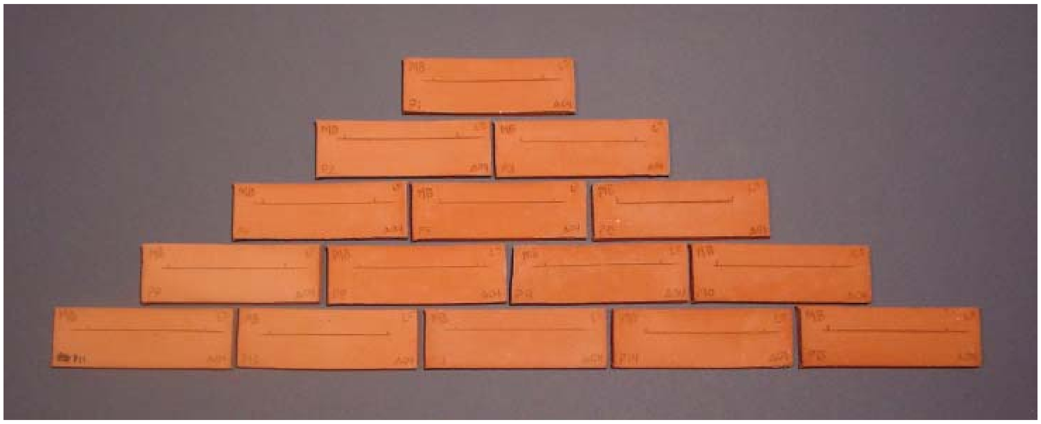
After the tiles were fired, the first step was to weigh them. In essence, let your result be value D. Then soak the tiles in water for 24 hours. Remove the excess surface water and weigh them again. Let that result be value C. Then boil the tiles for 2 hours, let them cool and weigh them again. These results will be your B values. By using the B, C, and D values you can use formulas to determine different absorption rates. To get the values in question, you need to subtract the dry weight from soaked weight and divide that by the dry weight. This value would be C2. You would use the same idea to find the boiled ratio by simply replacing the soaked weight with the boiled weight. Let that value be B2. According to Cushing's Handbook, if the C2/B2 ratio is less then or equal to 0.78, then the body would be winter proof. To the best of my knowledge this number is a ceramic standard from ASTM. The results from my tests on labs 2, 3, and 4 are as follows:

C2/B2 values

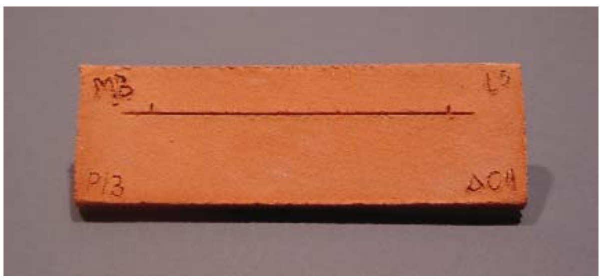
Sample #	L2	L3	L4
1	1.15	1.76	1.6
2	1.3029	1.61	1.477
3	1.16	1.25	1.64
4	1.248	1.399	1.55
5	1.33	1.42	-
6	1.13	1.349	-
7	1.87	1.54	-
8	1.174	1.44	-
9	1.354	1.45	-
10	1.187	1.41	-
11	1.82	1.46	-
12	1.8	1.47	-
13	2.45	1.49	-
14	1.36	1.57	-
15	1.18	1.32	-

I chose the lowest ratio from L2 to begin with and made my test. I used point 6 from this lab which consisted of 30.4% Red Art, 30.4% Yellow Banks #101, 31.3% OM-4, and 8% Talc. Then I created a triaxial blend with that being point A, point B being 60% point A plus 40% fine grog, and point C being 60% point A plus 40% medium grog. After the tiles were made and fired, I ran the same test as before. The ratios are listed below...

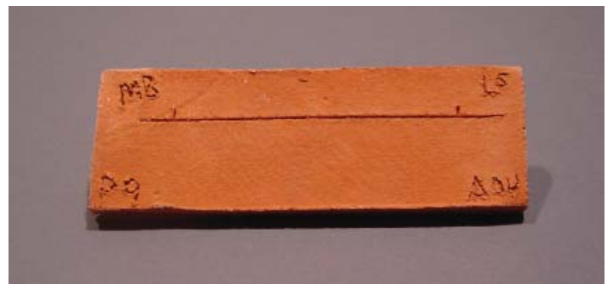
L5	C2	B2	C2/B2
1	0.0881	0.0835	1.05
2	0.0868	0.0818	1.06
3	0.0805	0.0767	1.05
4	0.0918	0.0944	0.972
5	0.0815	0.0853	0.955
6	0.0797	0.0812	0.98
7	0.1080	0.1150	0.93
8	0.0916	0.0931	0.98
9	0.0835	0.0855	0.97
10	0.0910	0.0992	0.91
11	0.1014	0.1059	0.96
12	0.0984	0.1018	0.96
13	0.0905	0.0961	0.94
14	0.096	0.1101	0.87
15	0.0934	0.1106	0.84



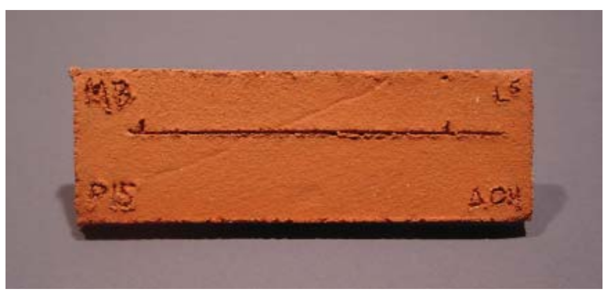
The triaxial set



Point 13



Point 9



Point 15

Comparative texture of Pt. 9, 13 and 15 (top to bottom)

From my results, point 15 in L5 is the most likely to withstand winter climates with a C2/B2 ratio of 0.84. I am unsure whether or not this will work, but this winter I will be leaving these tiles outside in the elements to find out what happens. If the experiment doesn't produce successful results, which it probably won't, additional blends may need to be used to get the critical ratio to be lower. For further exploration I recommend taking one of the samples in L5 and making adjustments based on what you want the body to be able to do. Hopefully we can accomplish making a cone 04 body that will be able to withstand brutal winter conditions.

In conclusion, I have learned that a frost proof cone 04 throwing body is pretty much out of the question. You aren't firing the clay hot enough to create a super dense clay body, so you are stuck with increasing porosity to obtain that frost proof result. The addition of 40% grog in point 15 makes the clay almost un-throwable. In my opinion, getting results from a point that were as close as they were to 0.78 outweighs the question of whether it can be thrown or not. At high temperatures I believe a frost proof throwing body might be possible but it sure would be dense. Hopefully the initial work I have done will push someone to completely develop a frost proof cone 04 body.

Name: Mindy Friday and Justin Crowe
Research topic: Fiber clays
Firing Range: Cone 9

Development:

Adding fibers to a clay body is commonly done with toilette paper, but we were curious about the affects of adding other fibers. Paper fibers change the properties of the clay depending on the amount you add. The fibers add significant green strength and possibly fired strength as well. Paperclay also improves the ability to join pieces together at the bone-dry stage using paperclay slip. The fibers we tested were chosen to give a variety of interesting results. The Fibers differ in thickness, length, and volume and give an opportunity to have a wide range of test results.

Hypothesis:

Our hypothesis is that other fibers may be more effective than toilette paper fibers and that toilette paper may be used so commonly because of its convenience and ability to break down easily. We also think that other fibers may have properties that the toilette paper does not have.

Testing Method:

For each test we made two tiles, each 20 cm in length. One was tested for bone dry strength and the other we fired to cone 10 (figures for the strength of fired results are not available). Because we were unsure if the tiles would break or bend, we tied a washer on a string around each tile that hung 1 cm above the table. The tile sat on two bricks that we placed 15 cm apart. We started out using small cups of sand, but quickly realized we were going to need more weight. We placed a small test tile in the middle of each test so that the weight would be more concentrated in the middle. On top of the test tile was place a weight form the scales and a bucket to hold the sand. The sand was added slowly in 1000 gram increments until the tile broke or the washer hit the table. The weight of the sand, bucket, scale weight, and test tile were all added together to get the results for the test.

Reeve’s Porcelain Body: The characteristics of this cone 10 porcelain, according to the Val Cushing Handbook, is that the material is high is translucency but low in plasticity.

#444 Stoneware Body: This cone 10 Stoneware has good plasticity and is used for the sophomore wheel class.

Reeve's Porcelain

Grolleg	40
Custer Feldspar	34
Flint	26
	100%
Add:	
V-Gum	3

#444 Stoneware

OM-4	23.81
Goldart	23.81
Hawthorn 35	38.1
G-200	9.52
Sand	4.76
	100%

Cotton:

These fibers are short and fine. This is the closest material to traditional Toilette paper fiber that we tested and is generally intended for the manufacturing of paper. The cotton fibers came in sheets that had to be soaked over night and blunged or mixed with a drill.
All of the mixtures were good to work with. The best addition seemed to be 6%, but there was little decline in workability, even up to 15%.

Nylon:

The nylon fibers are fine and also very long, consistently about 2 cm in length. The workability in the 6% mix was decent. The fibers take up a lot of volume in the clay body. Plastic samples were very difficult to cut through with a fettling knife because the knife pulls at the fibers. The 9% addition was nearly unworkable because there was such a high concentration of fibers that the clay would not stick to itself when wedged. The 15% was not even workable. It could not be wedged and there was not enough clay material to cover the fibers fully. There was some clumps of white fibers protruding from the body.

Fiberglass:

The fiberglass appears to be thicker and has a long flat appearance. It is also a stiffer than the other fibers and is about 2 cm in length. Fiberglass can irritate your skin so I wore gloves when I handled it. This is a major setback to the realistic workability of the material.

In the clay it was interesting because it would stick out everywhere due to its stiff quality. It resisted the flow of the clay body when it was near the surface. Fiberglass is not a porous material, so it lacks the ability to bind with the clay like some of the other material that are more absorbent. It wedged fine in all mixtures. It was a difficult material to cut because of the length and stiffness of the fibers.

Flax:

Flax is also manufactured for the production of paper. The fibers are longer than the cotton samples but shorter and thicker than the nylon samples. They are around 1 cm in length. Flax is tan color and smells like a farm.

Toilette Paper:

This is the common fiber method of strengthening clay. I soaked the paper overnight and blunged it but using a drill to mix without pre-soaking was also effective. The toilet paper was the finest fiber tested. Toilet paper was also the easiest of the fibers to break down.

Its workability was great in all the mixtures. It was even decent to cut because of the small fibers. This was the only clay that I thought I could add more fiber to without seriously disrupting workability. The higher amount of fiber I added, the thinner I could get the material.

Hemp:

Hemp is the thickest and longest fibers we tested. When I pulled it out of the bag in a big clump, I considered cutting the fibers down smaller, I chose not to because none of the other fibers were as long. I thought it would be an interesting test to leave them long.

The hemp took up so much space compared to the clay particles that it also acted as a sponge for the porcelain slip. The workability of the clay mixture was nearly impossible at 6% and impossible at 9% and 15%. The 6% tile was made by hitting the hemp clay on the table until it was close to the correct size because it was impossible to cut with a knife or roll out. To do any of the test with 444 was impossible, this may have been because of the sand in the clay body.

Reeve's Porcelain Bone Dry Test Results:

The following are the total amount of weight (in grams) supported before breaking...

Fibers Used	6%	9%	15%
Cotton	12,786	10,191	8,061
Nylon	9,476	5,473	N/A
Fiber Glass	3,511	10,411	9,371
Flax	10,924	8,473	4,357
Toilet Paper	3,835	8,536	6,161
Hemp	4,473	N/A	N/A

Weights:

Bucket	354 g
Tile	62.52 g
20 lbs weight	2076 g

Reeve’s Porcelain Shrinkage

Fibers Used	Wet to Dry	Total Shrinkage
Reeve’s Porcelain	5%	15%
Cotton 6%	4%	15%
Cotton 9%	2%	15%
Cotton 15%	4%	18%
Nylon 6%	1%	14%
Nylon 9%	1%	15%
Nylon 15%	N/A	N/A
Fiber Glass 6%	2%	10%
Fiber Glass 9%	0%	9%
Fiber Glass 15%	0%	9%
Flax 6%	4%	14%
Flax 9%	2%	16%
Flax 15%	4%	14%
Toilet Paper 6%	6%	15%
Toilet Paper 9%	5%	19%
Toilet Paper 15%	7%	19%
Hemp 6%	4%	14%
Hemp 9%	N/A	N/A
Hemp 15%	N/A	N/A

#444 Stoneware Bone Dry Test Results:

The following are the total amount of weight (in grams) supported before breaking...

Fibers Used	6%	9%	15%
Cotton	5,122	5,294	5,221
Nylon	5,402	12,640	6,022
Fiber Glass	5,742	3,492	4,697
Flax	8,218	4,124	5,112
Toilet Paper	4,492	5,397	<2,492
Hemp	N/A	N/A	N/A

Weights:

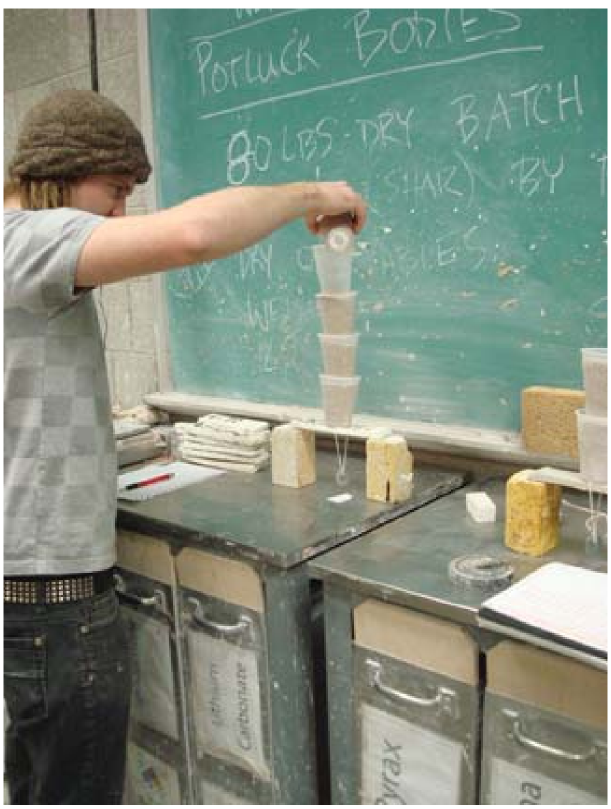
Bucket	354 g
Tile	62.52 g
20 lbs weight	2076 g

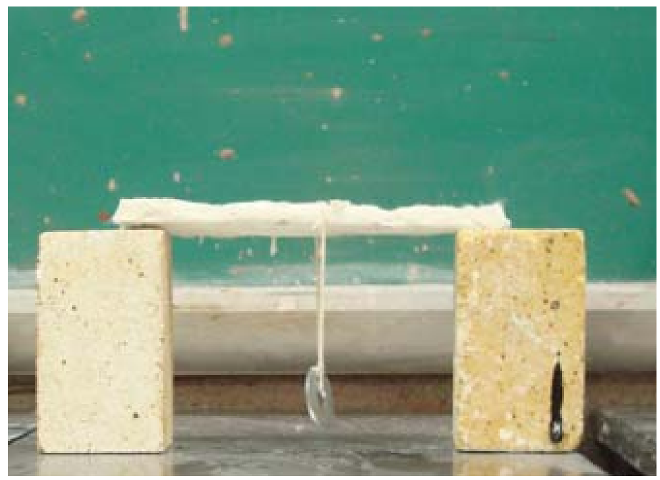
#444 Stoneware Shrinkage n/a

Conclusion:

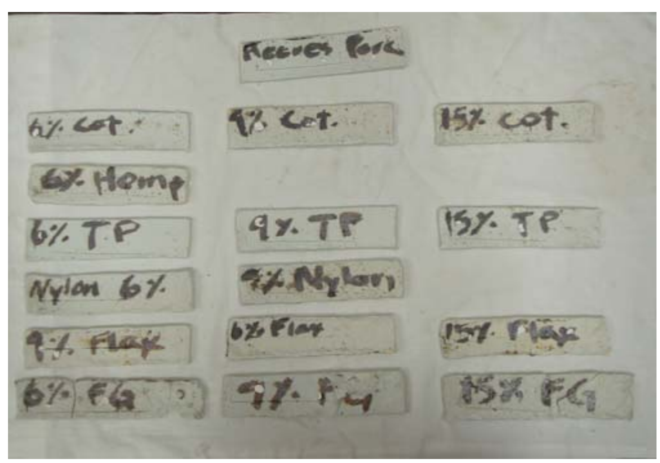
Some of our results from the weight test did not make sense. For example, the test with toilet paper addition broke before the control test that did not have any fibers, but when we tried breaking it by hand, one could definitely feel that the paper clay was much stronger.

Although some of the tests done were very strong, there workability was very limiting. Consistently the tests with 15% fiber added were weaker than the test with 6% and 9% fibers added. Instead of using the same percentages for all the fibers, I think it may have been more useful for our test to take the mass of the fibers into consideration. For example, the hemp was impossible to work with at the percentages we used, but if the tests were done at much lower percentages, we could have had more desirable results.





Strength Testing Method



Additions to Reeve’s Porcelain prior to firing

Note: The following images show samples using the #444 body only....

Cotton 6% (1A), 9% (1B), and 15% (1C)

Nylon 6% (2A), 9% (2B), 15% (2C)

Fiberglass 6% (3A), 9% (3B), 15% (3C)

Flax 6% (4A), 9% (4B), 15% (4C)

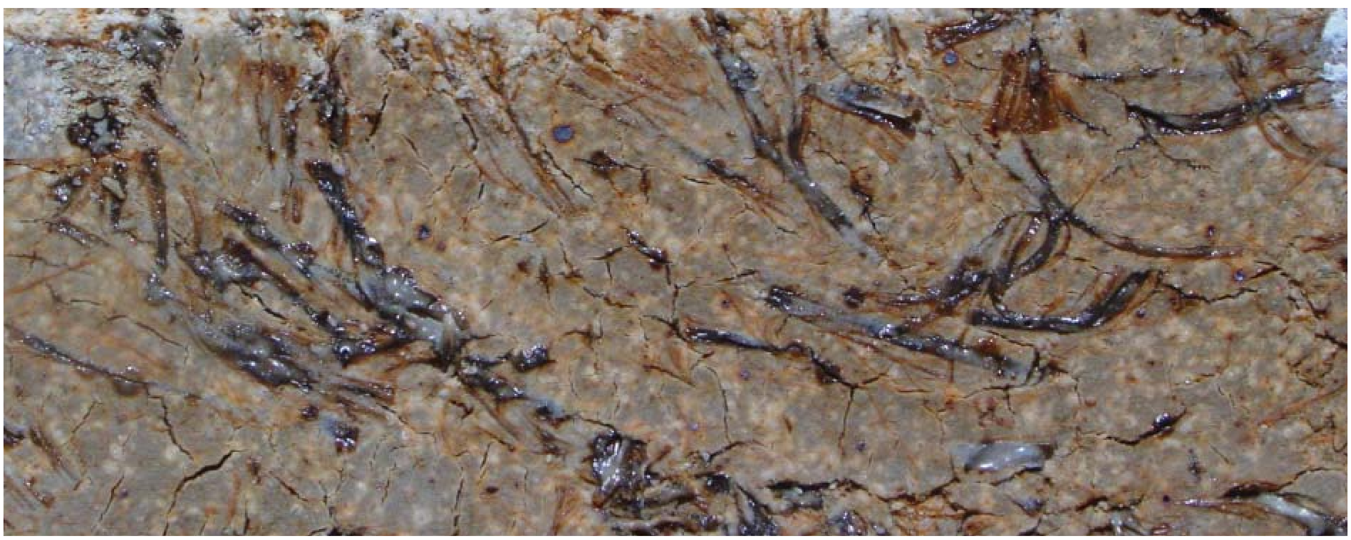
Hemp 6% (6A), 9% (6B), 15% (6C)

#444 body by itself

#444 body with 9% Fiberglass (3B)

#444 body with 15% Fiberglass (3C)

#444 body with 15% Fiberglass (3C)



#444 body with 9% Fiberglass (3B)

#444 body with 15% Fiberglass (3C)

Name: Caleb Elsbree
Research topic: Researching Shinos
Firing Range: Cone 6 wood-fired

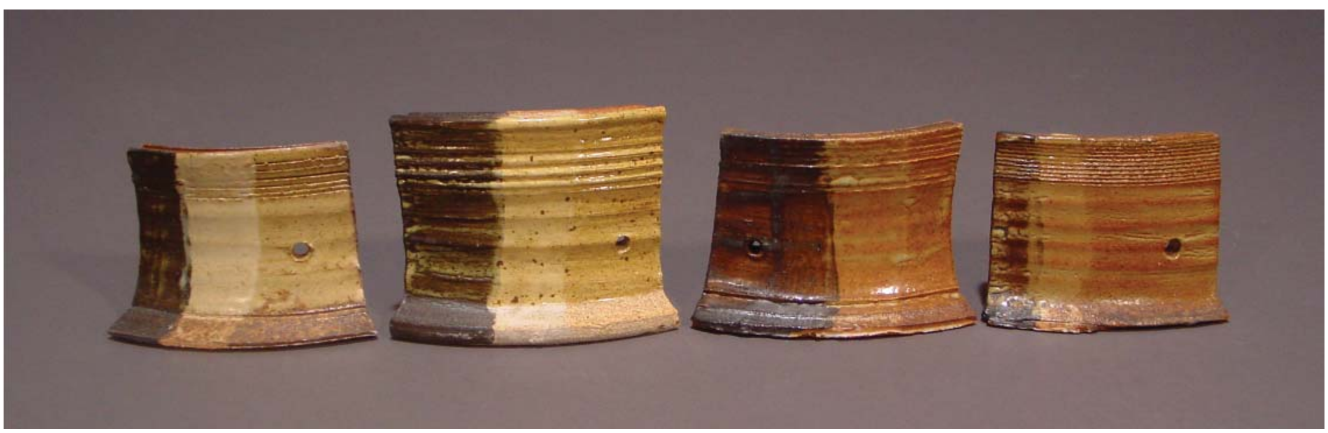
Development:

The quality of surface is an integral part of my pots. My real instincts about the treatment of a glazed surface are the more detail, the better. Few things hold and spur my interests more than searching for new “moments” in pots, when the interaction of glazes and texture spark a distinct composition on a remote area of the piece. Presently my attention is leaning toward creating pots that consist of round, robust forms coupled with vast areas of smooth surface and textured bands framing this space. The glazes I need have to be able to cover areas without texture, but naturally feature a variance in color (i.e. one glaze which produces two colors on the same surface).

Goal: To create a dark, runny surface with a lot of variance for wood firing. I originally intended to study some wood fire slips for green application, but due to time restraints decided to research and further develop some of the cone 6 shino glazes that Kaye Waltman was experimenting with in last year’s Cookbook. The glazes I started with were Korean 22, Lana’s ball crawl, Falls Creek Shino 2, Falls Creek Shino 6, and Adam’s Shino. The Falls Creek shinos and the Adam’s shino are more runny glossy glazes whereas the Korean 22 and Lana’s ball crawl are crawling glazes.

First Test: My first test consisted of a 4-part line blend for each glaze, trying out different oxides in each one to find the color that I like the most.

Korean 22	Tile #1	Tile #2	Tile #3	Tile #4
Lithium	4	4	4	4
Custer	60	60	60	60
Whiting	10	10	10	10
Magnesium Carbonate	26	26	26	26
Flint	10	10	10	10
Black Nickel Oxide	1	2	3	4



Lana’s Ball Crawl	Tile #1	Tile #2	Tile #3	Tile #4
Nepheline Syenite	60	60	60	60
Magnesium Carbonate	22	22	22	22
OM-4	18	18	18	18
Manganese Dioxide	2	5	-	-
Black Nickel Oxide	-	-	2	6

Falls Creek Shino 2	Tile #1	Tile #2	Tile #3	Tile #4
Frit 3134	33	33	33	33
Whiting	3	3	3	3
Zinc	10	10	10	10
Flint	8	8	8	8
Redart	53	53	53	53
Black Iron Oxide	2	4	-	-
Black Nickel Oxide	-	-	2	4

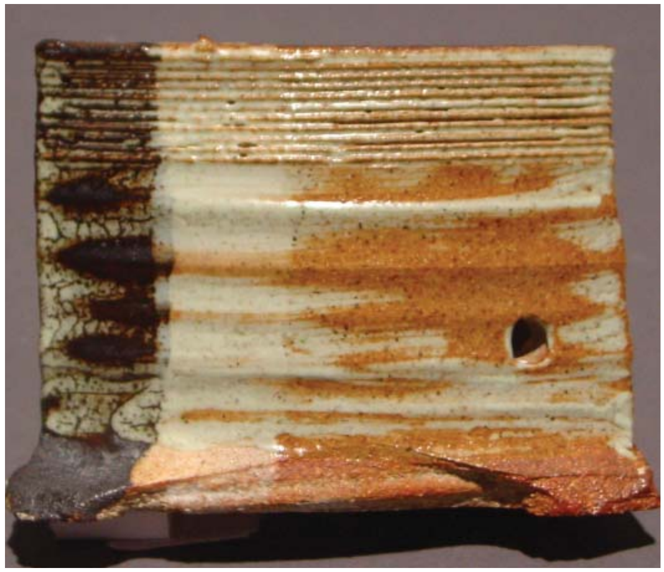
Falls Creek Shino 6	Tile #1	Tile #2	Tile #3	Tile #4
Frit 3134	40	40	40	40
Dolomite	5	5	5	5
Redart	30	30	30	30
Red Iron Oxide	1	-	-	-
Black Iron Oxide	-	1	-	-
Black Nickel Oxide	-	-	1	-
Black Copper Oxide	-	-	-	1

Adam's Shino	Tile #1	Tile #2	Tile #3	Tile #4
Kona F-4	15	15	15	15
Laguna Borate	35	35	35	35
Barium Carbonate	5	5	5	5
Whiting	10	10	10	10
Flint	10	10	10	10
Tin	13	11	13	11
Black Iron Oxide	2	4	-	-
Green Nickel Oxide	-	-	2	4

My winners for the first test were the second tiles of the Falls Creek 2, Adam's, and Korean 22 sets.

Falls Creek 2 (Tile #2)

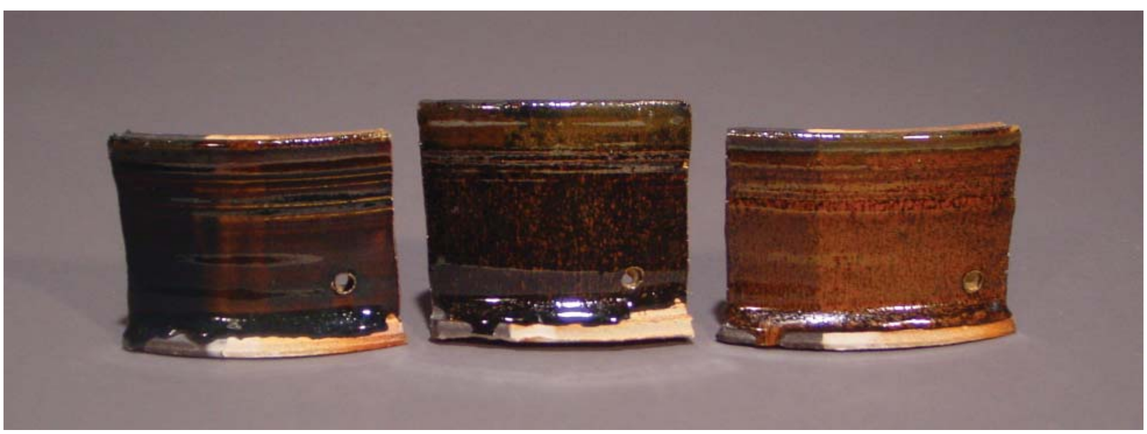
Adam's (Tile #2)



Korean 22 (Tile #2)

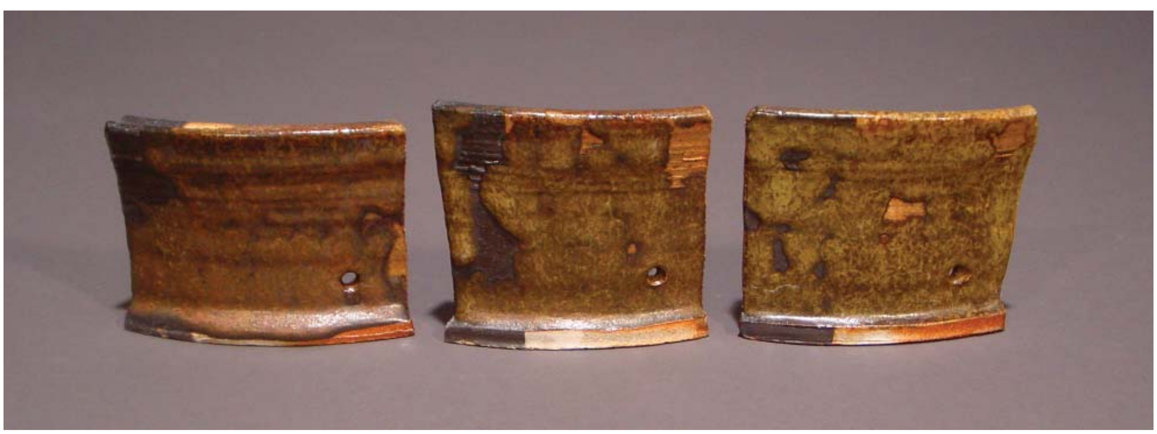
The Next Step: All of the test glazes were applied to bisque test tiles of #570 stoneware each overtop of an area of black slip, white slip and clay body. The tiles were fired in the new wood kiln in an oxidized atmosphere. Upon removal from the kiln the tiles were inspected for quality and effect. Only the formulas yielding the best results made it to the second round of tests.

The Second Test:



Falls Creek Shino 2 (2)	**Tile #1**	**Tile #2**	**Tile #3**
Frit 3134	33	33	33
Whiting	3	3	3
Zinc	10	10	10
Flint	8	8	8
Redart	53	53	53
Black Iron Oxide	0	2	4

Adam's Shino (2)	**Tile #1**	**Tile #2**	**Tile #3**
Kona F-4	15	15	15
Laguna Borate	35	35	35
Barium Carbonate	5	5	5
Whiting	10	10	10
Flint	10	10	10
Tin	11	11	11
Black Iron Oxide	4	6	8



Korean 22 (2)	**Tile #1**	**Tile #2**	**Tile #3**
Lithium	4	4	4
Custer	60	60	60
Whiting	10	10	10
Magnesium Carbonate	26	26	26
Flint	10	10	10
Black Nickel Oxide	10	8	6

The alteration of the recipes for the second test sprung from weaknesses in the first tests glazes. I felt Black Iron Oxide proved to be the most effective colorant on the table and thus found itself into all three final recipes. I removed the tin from the Korean 22 in an attempt to eliminate the white opacity of the glaze. What resulted is a chunky speckle glaze that contains hints of grey, tan mossy green and black that will crawl in areas where it is applied thick. The Falls Creek recipe with the most Black Iron Oxide wielded the most impressive surface of the blend but the recipe which had no BIO turned out to be a really nice transparent black, another successful result. I prefer the effect of Adam's 3 over the other two versions of the blend.

Korean 22 (2) (Tile #3)

Adam's Shino (2) (Tile #3)

Falls Creek Shino 2 (2) (Tile #1)

Falls Creek Shino 2 (2) (Tile #3)

Conclusion: The search for the perfect glaze is a long, tiring journey, but at least now I have a few more options in my arsenal.

Name: Shawn Baker
Research topic: Building with rehydrated fiber clays
Firing Range: Room temperature to cone 10

Development:

Towards the end of my sophomore year I began to experiment with slab building paper clay. I was at first attracted to the strong, resilient and workable nature of the altered clay body. I discovered that I was able to cast thin slabs on plaster and work with them at any state during their drying process. I found it was even possible to rehydrate bone dry slabs to then work with (i.e. through bending and forming). The idea of fabricating and producing a number of designed or textured slabs of fiber clay to have on hand for building interests me very much. For this project I decided I would test different fibers to find which would facilitate a better rehydration process, image retention and workability both in wet and rehydrated states. I chose newspaper and sheep's wool as my testing materials. In order to do this, I decided to fabricate a textured template that would facilitate the production of functional vessels. The template would efficiently yield a 6 inch tall by 3 inch wide tumbler (to which I would then manually add a slab-rolled bottom). I chose to use a variation on the cone 10 off-white/tan plastic hand building body that was developed in my Potluck lab group throughout the semester.

Objectives: To test the effects of additions of 0.25%, 0.5%, 1%, 2.5% and 5% (by weight) of newspaper and wool on initial workability, the rehydration process, post rehydration workability and image retention in a plastic cone 10 hand building body.

Clay Body Composition:

Gold Art	66
Tennessee #10	22
Custer Feldspar	8
Flint	4
	100%
Add:	
Paper or Wool	various amounts

Non-ceramic materials: Fiat Lux newspaper, local unspun sheep's wool
Processes: Design of positive slab, mold making, preparing/mixing fiber body, casting fiber body, building cast slabs, rehydrating slabs, building rehydrated slabs

Positive slab: Threw out a large slab of #444 stoneware, flipping it throughout the process to maintain even compression. Cut the slab to my desired dimensions (about 6"x11") and added texture and image using plaster stamps. The edges were rounded to ensure easy release from the mold. Let dry to leather hard state.

Plaster Stamps

Original Slab

Mold making:

Set up coddles leaving about 2 inches on all sides. Rubbed Murphy's oil on slab, table and coddles before pouring plaster. Poured plaster until it was about 2 inches deep. Let set. Removed slab and dried mold in hot box for casting.

Creating a low-relief mold using a clay positive

Prototype tumbler

Preparing/Mixing fiber:

Paper: Cut the newspaper into roughly 1x1” pieces and weighed the appropriate amount dry. Before dry mixing the clay body, place the newspaper pieces in very hot water and let sit for 10 minutes. Do not use more water than you need because it is easiest to use the water in the pulp to wet mix the clay. Make sure paper is at a pulpy consistency before mixing. Use high speed drill or shar to mix a thick slurry.

Preparing newspaper

Wool: Cutting the wool is a more involved process because the material will not disperse in water as it is naturally hydrophobic. To start, weigh out a few grams higher than desired amount. Use sharp scissors to cut ¼ inch pieces off of the bundle.

Rough amount

Cut once


Balled up


Cut twice

Once you have cut all of the wool once, ball it up in your hands until it holds itself together well. Then cut through the bundle once more in the same fashion. Weigh exact amount needed. DO NOT put into water and DO NOT use drill or shar. The rotational force of these machines will spin the wool and create very strong knotted tangles around the mixer head. Once you have wet mixed your clay add the wool in small handfuls and disperse it thoroughly with your hand before adding more.

Casting/building:

Once the mold is totally dry and ready for casting, sprinkle alumina hydrate or talc on mold to help release the slab. Scoop more clay than needed into the mold and trowel flush and level with a table scraper or piece of wood. Make sure to not scrape away plaster when leveling. Also try to fill the entire surface at once to maintain consistent compression. Let dry until an edge can be lifted to pull slab. Cut cast slab into two even pieces: one to build with immediately and one to dry and rehydrate. Mark “wet” and “dry”. The following images are of wool clay.

Wool clay ready for mold

Starting to fill mold with wool clay

Mold troweled with flat scraper

Mold emptied

Object released and cut

Slab rolled into cylinder (with hand)

Re-hydrating/building:

Use cheesecloth to rehydrate. Wrap objects entirely with cheese cloth. Make sure that all surfaces are touching the cloth to ensure even moisture distribution. Spray the cloth lightly/evenly, allowing the clay to soak, flipping and repeating every 5-10 minutes until it reaches a workable state. Let the clay sit for a few minutes after it has reached a workable state and then build (i.e. bend into a cylindrical form).

Drying the slabs by fully wrapping in cheesecloth

Observations:

Paper

- Clay with the least paper was the easiest to cast/mix. Very smooth, pulled slab out of mold easily and cleanly.
- Clay with most paper was harder to cast/mix. Slab tore and cracked coming out of the mold and during building.
- Clay with least paper came out of the mold and built wet the easiest; after rehydration this sample cracked and fell apart when building.
- Clay with most paper rehydrated quickly and evenly. Most workable of the samples after rehydration.
- Slabs built out of the mold were most workable as paper content decreased whereas slabs were more workable after rehydration as the paper content increased
- Slabs with mid to high amount of paper were much stronger than samples with lower

amounts.
- Because of cracking and clumping, samples with low percentage additions of paper maintained the best surface texture when used for building straight out of the mold. High percentage additions maintained the best texture after rehydration.

Wool
- All samples of wool clay were very strong out of the mold.
- Sample with 5% wool was extremely strong and fabric-like when working with. This sample resembled felt.
- All wool samples rehydrated well (cheesecloth helped a lot). Samples with high wool content were most workable and cracked the least while building.
- Samples with least amount of wool cracked a little bit during building but not nearly as bad as paper samples with least amount of paper.
- High wool content samples were very workable and strong.
- Wool clay samples maintained the surface texture of the slabs better than all of the paper samples.
- High wool content samples maintained surface texture best after rehydration and building. All were pretty good when used to build straight out of the mold.

Potential Uses:

I think that the wool clay samples displayed characteristics that would have a great deal of potential for future uses. The strength and workability of the high wool content clay samples really struck me. When I pulled the 5% wool sample out of the mold it resembled a wet piece of fabric that could be shaken like a blanket. I think that a combination of paper and wool could create a very strong, workable and resilient clay body that would facilitate rehydration well. There is a endless potential to experiment with different types of hair. I think that it would be interesting to develop some sort of fabric clay that could be easily wrapped, folded and manipulated.

Fired results of wool worked wet:
additions of 0.25%, 0.5%, 1%, 2%, 5%

Fired results of wool rehydrated:
additions of 0.25%, 0.5%, 1%, 2%, 5%

Fired results of paper worked wet:
additions of 0.25%, 0.5%, 1%, 2%, 5%

Fired results of paper re-hydrated:
additions of 0.25%, 0.5%, 1%, 2%, 5%

Fired results: Worked wet... 5% wool (left) vs. 5% paper (right)

Fired results: Worked after re-hydrated... 5% wool (left) vs. 5% paper (right)

Name: Ben Jones
Research topic: Casting recipes
Firing Range: Cone 10 and lower

Development:

My objective for this project was to create two high temperature-casting bodies: a dense, light colored stoneware body; and a translucent porcelain body.

The Stoneware body:

I was concerned with strength and density for this body as I planned on using it for a future project that would involve tension of the wares. For this reason I chose to use the stoneware recipe that Caleb and I developed earlier in the semester for the Potluck body project (a body we called the Vista body)

Vista Slip:

Tile 6	18.22
C&C Ball Clay	36.42
XX Sagger	18.22
Hawthorn Bond 50 mesh	10.12
Flint	1.21
Custer	6.9
Fine Grog	8.91
	100%
Add:	
Darvan 7	0.9918%
Water	41

Dispersant additions for Vista Slip:
200 grams of dry material
82 grams of water
1 drop of Darvan= .0522 g

Drops of Darvan	Consistency	Gelling	Settling
2-22	not able to stir	n/a	n/a/
22-30	Pasty	Fully gelled	Solid
32	Very thick unless mixed constantly	Fully gelled	No settling
34	More fluid than 32 but still thick	Fully gelled	No settling
36	pourable	Somewhat gelled	No settling
38	Fluid	Not gelled	No settling
40	Fluid	Not gelled	No settling
42	Fluid	Gelled	Little settling
44	Fluid but thicker than 40	Somewhat gelled	Some settling
46	Fluid	Somewhat gelled	Little settling
48	Fluid	Somewhat gelled	Little settling

Settling and gelling after 12 hours: No samples changed in amount of settling, all gelled

Conclusion/Observations: Point of minimum viscosity of 40 drops. 38 is a good point to cast with (i.e. 0.9918% Darvan).

The Porcelain body:

The objective was to convert a body that is very difficult to work with in plastic form into a casting slip and to accentuate the translucent properties of the post fired clay.

Porcelain Slip:

Grolleg	30
Cornwall Stone	20
Bone Ash	40
Flint	10
	100%
Add:	
Darvan 7	1.5138%
Water	50%

Dispersant additions for translucent Porcelain Slip:
200 grams of dry material
100 grams of water
1 drop of Darvan= .0522 g

Drops of Darvan	Consistency	Gelling	Settling
2-30	not able to stir	n/a	n/a
30-44	Very thick	n/a	n/a
46	Thick to stir	Fully gelled	n/a
48	Thinner but still thick	Fully gelled	n/a
50	Easier to stir	Fully gelled	n/a
52	Big change from 50, fluid	Gelled	No settling
54	Fluid	Somewhat gelled	No settling
56	Fluid, minimum viscosity	Not gelled	No settling
58	Fluid	Slightly gelled	Some settling
60	Thicker	Slightly gelled	Some settling
62	Fluid	Gelled	Settling

Settling and gelling after 12 hours: All samples gelled and settled over night

Conclusion/Observations: The casting sample that used 58 drops produced the smoothest results (i.e. 1.5138% Darvan). This body does not go to cone 10. It starts slumping at cone 6.

Porcelain Slip fired to cone 10

Porcelain Slip fired to cone 6 (left) and unfired (right)

Vista Slip fired to cone 10

Name: Betsy Foster
Research topic: Colored translucent slip for dipping
Firing Range: Cone 6

Development:

My objective for this research was to make a dipping slip for burnout materials. I wanted to fire this at a lower temperature than I saw most of the recipes for dipping slip in past cookbooks. I decided to use cone 6 rather than cone 10, which was used in past cookbooks. The goal was for this to be semi transparent after being fired, and then to add colorants to it.

Dipping Recipe:

Grolleg	45
Frit 3110	45
Flint	10
	100%
Add:	
Darvan 811	0.682
Water	40

Colorant additions:

Ferro Blue 620	5%
Mason Deep Crimson #6005	10%
Mason Chartreuse #6236	10%

First I determined the amount of Darvan needed in my body by doing a dispersant test. I found my recipe from a slumping body that was used in a past cookbook and added a small amount of flint. I then experimented with different commercial colorants.

I folded little paper fans and dipped them in the slip. I did four fans for each slip: one with no stain, as well as a version using each of the three colorants listed above. I did one dip for each variation, and left the fan “closed.” I did the same thing with the next round, only I did two dips for each fan. The third round I did one dip, but I opened up the fan.

The next step with this slip would be to either go much more transparent with no colorants, or get even brighter with the colors. I would dip bigger things to understand how this reacts with the burnout materials and would also try a greater range of numbers of dips.


Translucency with Mason Chartreuse


Translucency with Ferro Blue

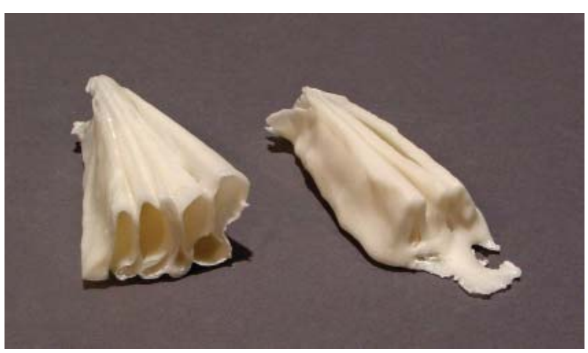

Translucency with Mason Deep Crimson


Translucency without colorants

Open fans. 1 Dip.

Closed fans. 1 Dip.

Closed fans. 2 Dips.



Closed fans. 1 Dip on the left, 2 dips on the right.

Name: Tracey Lee
Research topic: Slip casting a glaze
Firing Range: Cone 6

Development:

The objective of this research was to develop a once-fired porcelain casting slip that was translucent and highly vitrified at Cone 6. I developed the body with the intention of using it for purposes of tiles/installation. However, this body is versatile in its uses.

The recipe for this body closely resembles that of a rudimentary glaze. The process of casting is particularly advantageous for working with this material—as it would most likely be miserable to build with in a plastic form. Through casting, a decent amount of detail is captured.

Among many issues, there are some size limitations to using this body. This body is ideal for small and medium size casts. Slumping is definitely an issue with broader and larger forms.

Now that we know a “glaze” can be cast, the next step in research should involve the following:

a) Making the body more economical/affordable. What could one use instead of frit 3110? Can we lower the temperature of firing and still attain sufficient results/maturation/translucency?
b) The addition of color
c) The addition of other materials to give the body strength in firing for larger casts (combat slumping)

The qualities of this body are rather unique in that it almost does not seem to be “clay.” Many responses have included: “wow, it looks like plastic or resin!”

A dispersion test using Darvan 7 was done to each test to make the material castable.

Test 1:

Test 1	1	2	3	4	5
Grolleg	50	50	50	25	25
Nepheline Syenite	50	25	-	75	50
Frit 3110	-	25	50	-	25
Total	100%	100%	100%	100%	100%

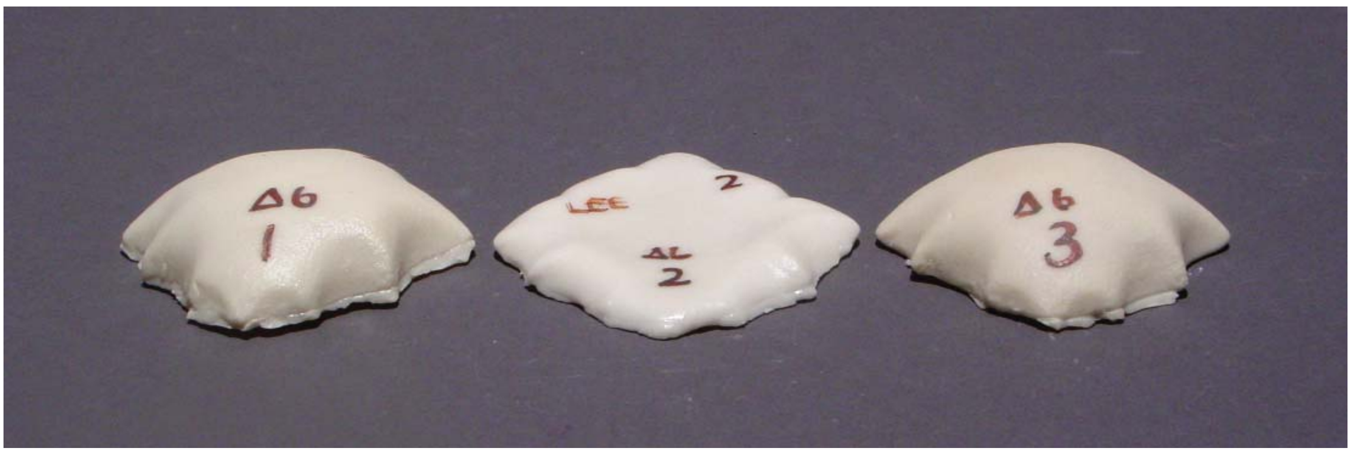
Test 2:

	1	2	3
Grolleg	40	30	50
Nepheline Syenite	35	40	15
Frit 3110	25	30	35
Total	100%	100%	100%

Final Recipe:

Grolleg	50
Nepheline Syenite	30
Frit 3110	20
	100%
Add:	
Darvan 7	0.112%

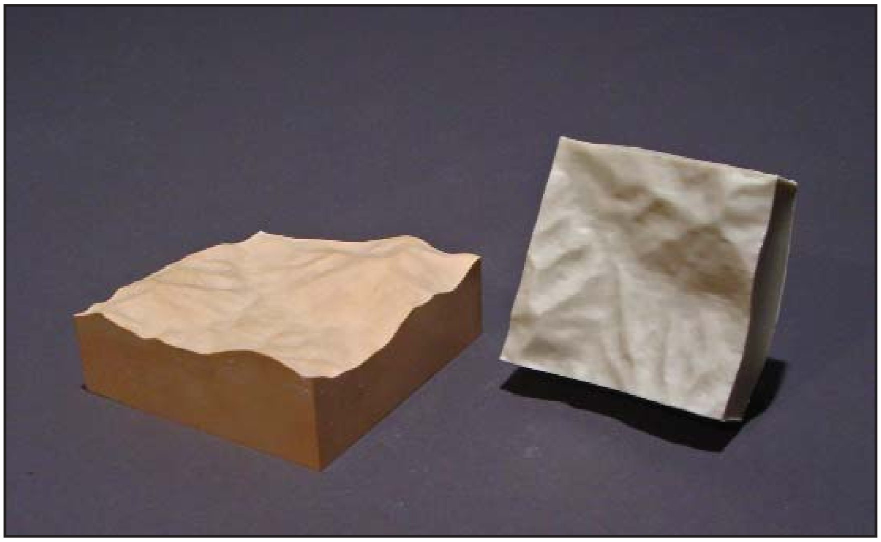
From first test (missing #3). Note the slumping with increasing amounts of flux.



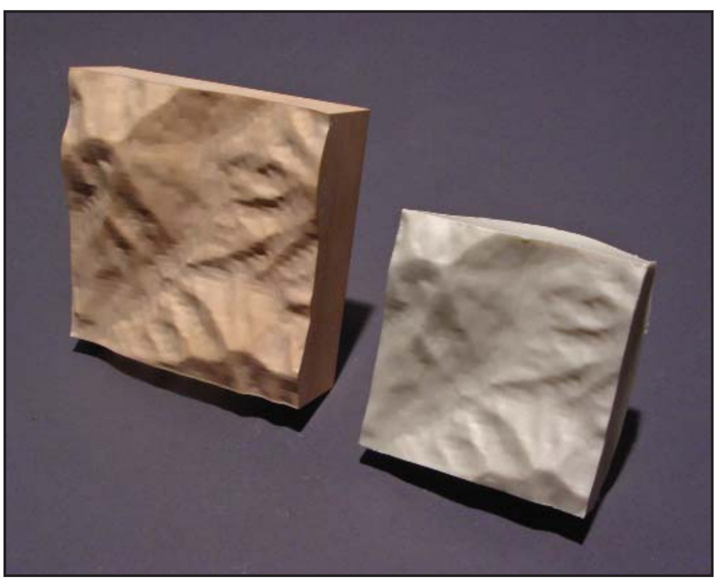
From the second test

Larger objects from the second test

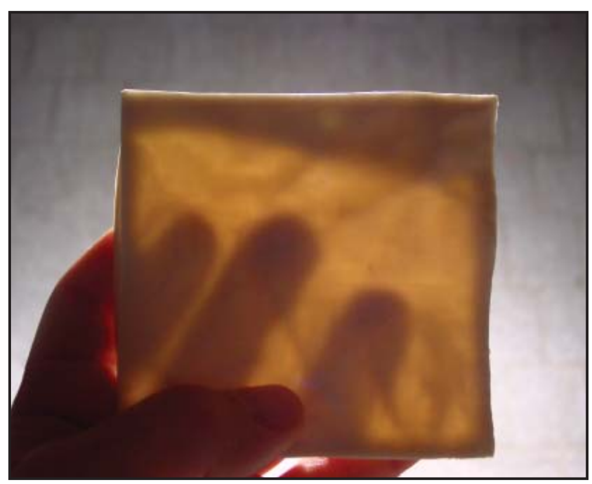
Results using the final recipe...



On the left, a digital terrain model cut out of prototyping board on a CNC milling machine (model dimensions approximately 5” x 5” x 1.5”). A 1-part plaster mold was created from the model and used to cast the resulting ceramic form on the right.



Alternate view of above, showing detail retained during the process.



Translucency of the final object.

Name: Alex Reed
Research topic: Ceramic oil sticks for drawing/mark making
Firing Range: For dry application; could be fired up to Cone 10

Development:

I undertook this project with the goal in mind to develop a way of applying a ceramic ‘slip’ onto bone dry or leather hard clay. I am attracted to the waxy/oily qualities of commercial oil sticks and sought to achieve a similar quality in this research.

I identified the following materials, all available at the Alfred University bookstore or easily found on the internet, for research because of their use in oil paint stick manufacturing:

-Beeswax

-Refined Linseed Oil
Description from Dickblick.com...
“Gamblin’s Refined Linseed Oil is pressed from American flax seeds and refined using an alkalai process. This low acid oil is about as light and pure as it gets. Use linseed oil to thin oil colors and increase their brilliance and transparency. Linseed oil increases the tendency of white and lighter colors to yellow over time. AP non-toxic.”

-Cold Wax Medium:
Description from Gamblincolors.com…
“Cold Wax can be used to make oil colors thicker and more matte. A soft paste formulated to knife consistency, Gamblin Cold Wax medium is made from naturally white unbleached beeswax, alkyd resin and odorless mineral spirits (OMS). Gamblin Cold Wax Medium can be thinned to brush consistency by dissolving in a small amount of OMS. The surface of paintings made with beeswax mediums will become only as hard as a beeswax candle. Adding Galkyd to cold wax painting medium/oil colors mix will increase the sheen and flexibility of the paint film. Use a small amount to make Galkyds more matte. Gamblin Cold Wax Medium contains no oil so it can be applied as a wax varnish over a dry oil painting.”

The slip recipe I used for testing is as follows:

Slip Recipe:

EPK	50
OM-4	25
Flint	25
	100%

Process:

I prepared 5 samples of the recipe above, wet mixing the ingredients together over a hot plate, adding melted beeswax at 10% intervals. After drying out the fives samples I divided each sample in 5 smaller samples. For the 10%-20% wax sample group I added linseed oil at 10% intervals up to 50%. For the 30%-50% wax sample group I added cold wax medium at 10% intervals up to 50%. After drying out the samples I tested each sample by making a mark on bone-dry clay.

Results:

The sample that 'drew' with the most fluidity contained 10% beeswax and 30% linseed oil. I did not fire any of the samples; my main concern at this point was developing an application method. The additive amounts may have to be tweaked according to your specific recipe. Future research could be centered on how the additives react in a high temperature environment.

10% B.W.	20% B.W.	30% B.W.	40% B.W.	50% B.W.
10% B.W. 10% L.S.O.	20% B.W. 10% L.S.O.	30% B.W. 10% C.W.M.	40% B.W. 10% C.W.M.	50% B.W. 10% C.W.M.
10% B.W. 20% L.S.O.	20% B.W. 20% L.S.O.	30% B.W. 20% C.W.M.	40% B.W. 20% C.W.M.	50% B.W. 20% C.W.M.
10% B.W. 30% L.S.O.	20% B.W. 30% L.S.O.	30% B.W. 30% C.W.M.	40% B.W. 30% C.W.M.	50% B.W. 30% C.W.M.
10% B.W. 40% L.S.O.	20% B.W. 40% L.S.O.	30% B.W. 40% C.W.M.	40% B.W. 40% C.W.M.	50% B.W. 40% C.W.M.

B.W. = Beeswax; L.S.O = Linseed Oil; C.W.M.= Cold Wax Medium

Detail of 10% beeswax and 30% linseed oil

Applied to bisque ware

Detail from above

Name: Nicholas Comstock
Research topic: Self glazing body
Firing Range: Cone 6

Development:

The purpose of this research was to develop a colored self glazing body that fires to cone 6 and has the ability to be built vertically without the form losing its shape.

Process:

Each body was dry mixed and then brought to a plastic consistency by adding just enough water. Samples where rolled into slabs and then cut to form tiles (15 cm x 5 cm). A 5 x 5 cm tile was placed on the top of each larger tile to test its ability to fuse. The tiles then were place on tile setters with a good coating of alumina hydrate between the tiles and the setters. The tiles were cantilevered to test their slumping characteristics. These bodies were then fired to cone 6 in oxidation.

-First test recipes:

	#1	#2	#3	#4	#5
Grolleg	49	49	49	49	49
Frit 3110	51	51	51	51	51
Total	100%	100%	100%	100%	100%

Add: Copper Carbonate	10	8	6	4	2

Add: Nickel Oxide (Green)	10	8	6	4	2

Add: Cobalt Carbonate	3	2.5	2	1.5	1

Results:

The results were rather surprising. The bodies fluxed more than expected. The additions of copper carbonate were far too much, even at 1%. There could be a possibility of using these as a kiln cast body in the future. Cobalt carbonate and nickel oxide was more of my destination. All of the nickel oxide and cobalt carbonate tiles slumped and fused. The edges softened and the form was distorted. The surface was very glassy and had characteristics of another material. Out of the three color tests the nickel oxide seemed the most desirable.

Copper and two of the cobalt results. Copper ran.
Cobalt seemed more stable.

Detail from above

The three remaining cobalt results and the nickel results

Detail of some nickel samples

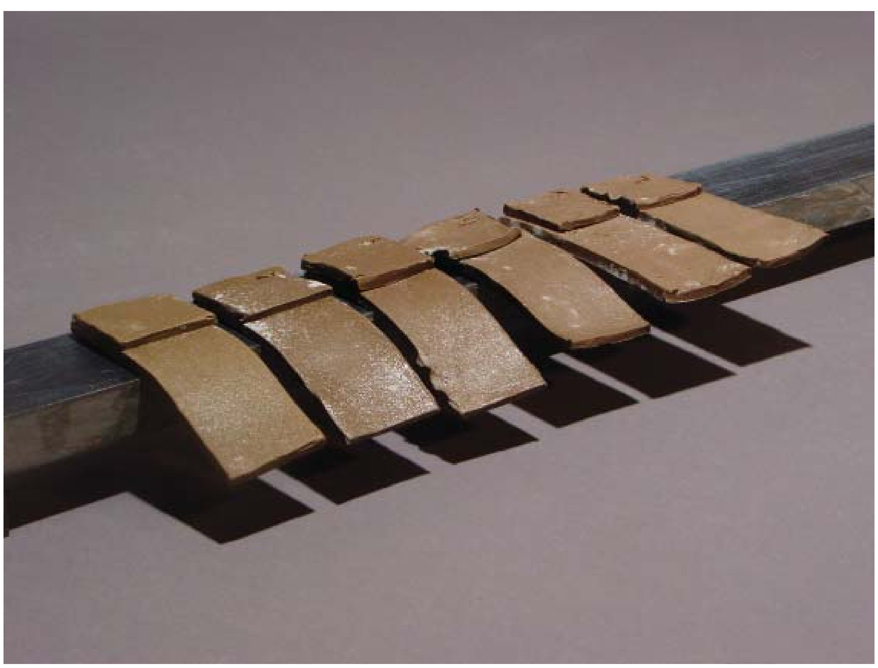
Test #2

Process: Procedures remained the same as the first test except the body was mixed as a slip first and then dried to form a more plastic body. I tested only the nickel oxide body this time but instead of adding a colorant to a base, I kept the colorant value constant and the varied the grolleg and frit 3110. I also made objects to tests their ability to stand vertically.

Second test recipes:

	#1	#2	#3	#4	#5	#6
Grolleg	48.04	52.04	56.04	60.04	64.04	68.04
Frit 3110	50	46	42	38	34	30
Nickel Oxide	1.96	1.96	1.96	1.96	1.96	1.96
Total	100%	100%	100%	100%	100%	100%

Results: Tiles 1-4 slumped to some degree and began to have a gloss to them. All of the tiles fused. I think tile #1 is the most desirable from this test. The edges began to soften and started acting more as a self glazing body. The structural tests worked well and all of them stood without slumping. I think the next test would be to do another line blend with tile #1 with the lowest amount of frit 3110 and continue increasing the frit in the other tiles by the same increments as above (i.e. 54, 58, 62 etc.). This will show the limits that this body will have standing vertically without slumping.



Slump test with #1 on the left and # 6 on the right

Detail of sheen on test #1

Vertical test with #1 on the left and # 6 on the right

Detail of #1

Detail of #3

Name: Tim Peters
Research topic: Self glazing casting slip
Firing Range: Cone 08-06

Development:

My objective for this project was to create a self-glazing, low fire, colored casting slip. Since Egyptian paste seemed ideal in coloration, temperature, and surface I decided to go about my research using a few well known recipes:

Chappel EP #8 - Cone 06

EPK	40
Flint	19.5
Ball Clay(Ten #10)	16.5
Nepheline Syenite	9.25
Sodium Bicarbonate	4.25
Soda Ash	4.25
Borax	4.25
	100%

Chavarra #2 - Cone 08

Nepheline Syenite	38
Silica	20
EPK	15
Soda Ash	10
Sodium Bicarbonate	7
Ball Clay (C&C)	5
Calcium Carbonate	5
	100%

Process:

In batches of 200 grams (dry weight) and starting with 40% water, I began trying to deflocculate the two recipes using Darvan #7 to find the minimum viscosity point.

50 Drops of Darvan= 2.1 grams
1 drop of Darvan = 0.042 grams

Chavarra #2

Drops of Darvan # 7	Viscosity
0	Thick paste
2	No change
4	No change
6	Slightly Thinner
8	No Change
10	No Change
12	Thinner than 6
14	No Change
16	No Change
18	Thinner than 12
20	No Change
22	No Change
24	Thinner than 18
26	No Change
28	Thinner than 24
30	Thinner
32	No Change
34	No Change
36	No Change
38	No Change
40	No Change

Chappel EP #8

Drops of Darvan # 7	Viscosity
0	Thick paste
2	No change
4	Slightly Thinner
6	No Change
8	No Change
10	Thinner than 4
12	No Change
14	No Change
16	Thinner than 12
18	No Change
20	No Change
22	No Change
24	Thinner than 18
26	Slightly thinner than 24
28	No Change
30	No Change
32	Slightly thinner than 26
34	No Change
36	No Change
38	No Change
40	Thicker

After reviewing my results for these two bodies, I added 20 drops of water, which is almost 10% more water. This addition barely thinned out all samples of both tests; I then added 20 more drops of water. At an approximate total of 20% more water added to all samples of both tests (a total of 60% water), 70% of the results were a little less resistant to stirring. All samples were fully gelled and no settling seemed apparent, so there was no reason to continue with this course of action.

I then decided to try a test using just water to see if I could reach a consistency thin enough for a casting slip. I finally met this point at 88% water. This posed a problem, for most casting slips only require 40-45% water. Anymore than this can create a lot of material to settle and does not allow the slip to stand-up in the mold within a reasonable amount of time.

Conclusion: None of the tests proved to be thin enough or were incompatible for a casting slip. The soda ash in both recipes was acting as an extra dispersant and too much water was needed to create a slip. The next step of this process was to change both of the recipes in order to attempt this again.

Chavarra #2 (Modified)

	100%
Nepheline Syenite	38
Silica	22
Kaolin (EPK)	15
Soda Ash	6
Sodium Bicarbonate	7
Ball Clay (C&C)	7
Calcium Carbonate	5
	100%

Online at www.digitalfire.com (a clay resource web site), I found that sodium carbonate (or soda ash) is used in conjunction with sodium silicate as an alternative deflocculant to Darvan #7. Commonly, 0.05% soda ash with 0.2-0.3% sodium silicate is used. Against this advice I tried to change the recipe instead. So, I modified Chavarra #2 by removing 4% soda ash and adding 2% more silica, and 2% more Ball Clay.

All tests were similar to the first; all samples remained fully gelled and no settling occurred (even with the two additions of 10% water).

With the Chappel EP#8 recipe I lowered the soda ash by 2% and added 2% Kaolin. I did this with the hopes of improving the successful deflocculation of materials.

Similarly to Modified Chavarra #2, all tests were conducted the same and still all samples remained fully gelled with no settling.

Chappel EP#8 (Modified)

	100%
Kaolin (EPK)	42
Silica	19.5
Ball Clay(Ten #10)	16.5
Nepheline Syenite	9.25
Sodium Bicarbonate	4.25
Soda Ash	2.25
Borax	4.25
	100%

Casting: Since all tests fully gelled and could not be made into a castable product, I brushed the solutions inside of molds 1/8”-1/4” thick. In the beginning the casts took 30-50 minutes to set up in the molds. Yet, as I kept using the molds, the sodium in the slips started to corrode or wear away the plaster. Subsequently, it took progressively longer and longer (up to 90 minutes). The molds themselves only lasted for about 4-6 casts each. All four recipes were cast in a series of three: 1 with no colorant added, 1 with 2% copper carbonate, and 1 with 3% copper carbonate added. The gelling of the samples in the molds was a problem in itself, but luckily few were deformed when removed.

Fired Results: Although the firing temperatures between the Chavarra #2 and the Chappel EP#8 were different, their modified versions were fired to the same temperatures as themselves. The cone 06 Chappel’s samples seemed to have a darker finish to them, not just because they were fired to a higher temperature, but the fluxes within them enhanced the effects of the copper carbonate. So much so that the samples with copper carbonate added to them were blackish and the two samples with no colorant added were a dingy brown. On the other hand, the Chavarra recipes had flat, non-glossy whites and undulating blue-black effects for the 2% additions, but not so much for the 3% addition. Overall, the fired samples did not have that much of a glossy effect and the plaster that seemed to collect on some of them had adverse effects to the reaction of the copper carbonate and the sodium bicarbonate.

Further Research: If I were to continue trying to deflocculate an Egyptian paste into a slip casting body there would be a few changes that would have to be made and other possibilities to explore. First, I would make terracotta molds to help withstand the sodium carbonate (soda ash) and sodium bicarbonate. This is not a sure way of casting this paste for the pores of the terracotta could be plugged up after a long series of casts. Secondly, a severe reduction, if not total removal, of the sodium bicarbonate would be necessary. Lastly, but not least, a change from copper carbonate to other colorants or oxides could be tested, such as: nickel oxide, various inclusion stains, or even an iron oxide.

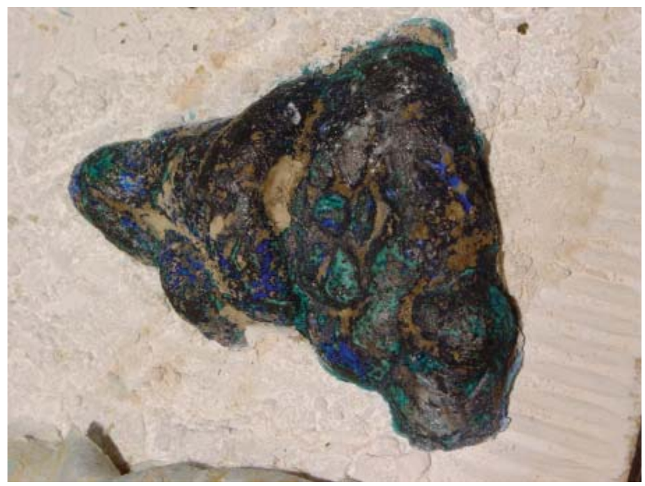
Original series

Modified series

Chappel EP#8 with 3% copper carbonate

Chavarra #2 with 3% copper carbonate

Chappel EP#8 with 2% copper carbonate



Chavarra #2 with 2% copper carbonate

Chappel EP#8 with no colorant

Chavarra #2 with no colorant

Chavarra #2 (modified) with 3% copper carbonate

Chavarra #2 (modified) with 2% copper carbonate

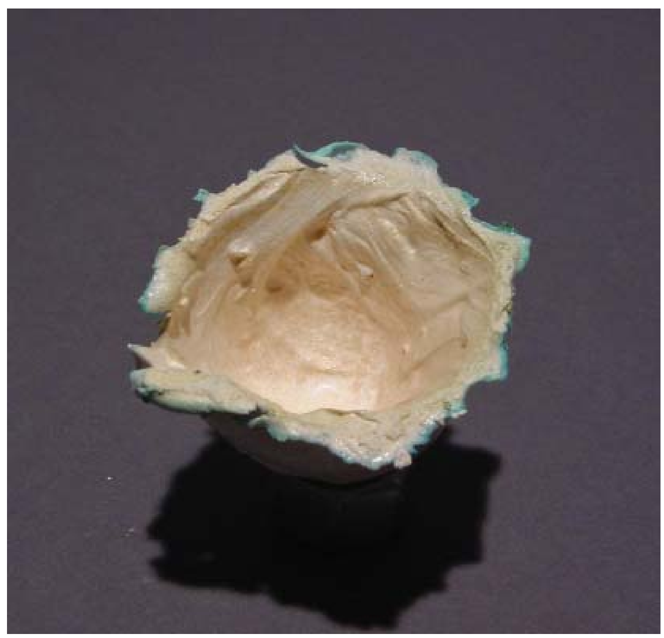
Chappel EP#8 (Modified) with 2% copper carbonate

Chavarra #2 (modified) with no colorant

Chappel EP#8 (Modified) with no colorant

Mold damage caused by salts

Detail of damage caused by salts



Results obtained using the brushing technique

Evaluation of Potluck clay bodies...

Developed by: Shane and Nick (group 1)
Intended use: Throwing
Cone: 04

Recipe:

Tennessee #10	33.9
EPK	16.9
Tile 6	16.9
Frit 3124	22.3
Fine Grog	10.0
	100%

Wet to dry Shrinkage: 5.7%
Dry to fired Shrinkage: 6.1%
Total Shrinkage: 11.7%

Absorption: 4.73%

Class Ratings:

Very Poor	Poor	Average	Good	Very Good
1	2	3	4	5

Throwing:
(14 students surveyed)

Plasticity	4.1
Building Strength/ Resistance to slumping	3.4

Hand Building:
(3 students surveyed)

Plasticity	4.0
Building Strength/ Resistance to slumping	3.0

What the critics are saying...

“Feels very smooth. Great workability on the wheel.”

“A nice smooth white throwing body.”

“Weak and coarse but white.”

“Took two attempts to throw: slumped the first time, however this may have been a moisture issue...”

“Too soft, had trouble controlling the clay while handbuilding. Cracked in half during the drying phase.”

“Good plasticity. A little more workability would be nice, but can still make it work as-is.”

“Pretty nice clay. I liked the grog, seemed fairly strong. No major problems.”

“Nice white body for C.04. Good plasticity with average formability”

“Slabs threw OK.”

“Easy to wedge and to handle. Throws like a dream! Ability to handle well on the wheel is excellent”

“Beautiful to throw with. Almost Porcelain-like.”

“Very smooth to throw and nice surface. Was a little too wet.”

Developed by: Luz and Matt (group 2)
Intended use: Throwing
Cone: 04

Recipe:

Red Art	20.1
Yellow Banks 101	20.1
OM-4	20.6
Hawthorn Bond	5.0
Frit 3124	16.0
Talc	3.2
Fine Grog	15.0
	100%

Wet to dry Shrinkage: 5.8%
Dry to fired Shrinkage: 4.6%
Total Shrinkage: 10.4%

Absorption: 0.75%

Class Ratings:

Very Poor	Poor	Average	Good	Very Good
1	2	3	4	5

Throwing:
(14 students surveyed)

Plasticity	3.5
Building Strength/ Resistance to slumping	3.4

Hand Building:
(3 students surveyed)

Plasticity	4.3
Building Strength/ Resistance to slumping	4.7

What the critics are saying...

"Did not hold its form. I fought with it on the wheel the whole time."

"Wetness of the clay was an issue. Throws smoothly and nice color."

"I feel that this would handbuild nicely. Could model with this pretty well. Seemed to stay and not slump."

"Held form really well. Nice to throw with. This clay has a very nice coarseness and is quite plastic. I like!"

"Slabs threw well."

"It was my clay, of course I like it."

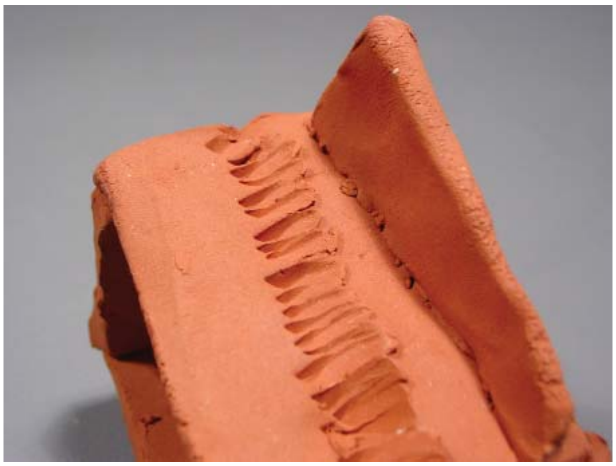
"Nice strong body. Plastic, workable and a beautiful color. Good amount of grog."

"This clay has structure throughout the whole session."

"Because of the grog there was good strength but poor plasticity compared to body #1."

"It was a little groggy but threw pretty well. Could have been more plastic."

"Not as workable as body #1, however it was significantly wetter."



Developed by: Nick and Justin (group 3)
Intended use: Throwing
Cone: 6

Recipe:

Barnard Sub (Laguna)	13.4
Lizella	13.4
EPK	27.4
OM-4	21.4
Frit 3124	10.7
Nepheline Syenite	2.7
Flint	3.0
Fine Grog	8.0
	100%

Wet to dry Shrinkage: 4.4%
Dry to fired Shrinkage: 5.9%
Total Shrinkage: 10.3%

Absorption: 3.70%

Class Ratings:

Very Poor	Poor	Average	Good	Very Good
1	2	3	4	5

Throwing:
(14 students surveyed)

Plasticity	4.0
Building Strength/ Resistance to slumping	3.1

Hand Building:
(3 students surveyed)

Plasticity	3.0
Building Strength/ Resistance to slumping	2.0

What the critics are saying...

"Surprisingly pleasant to work with. Some slumping when too much water is added. Nice color too!!"

"Not very dense feeling body. Poor workability. Barnard may cause health problems over time?"

"Was way too soft but felt good throwing it."

"Cream cheesy. It would peel off in my fingers."

"Too wet to throw. Too dark."

"More coarse than the other throwing bodies. Slightly thixotropic."

"Sort of had cracking look even though very wet feeling, but not sticky to the touch. Slumped a lot while handbuilding."

"Seemed pretty nice. It was a little wobbly when I was closing the form but may just have been too wet."

"Felt "airy" or fluffy. Strange consistency... maybe just too wet?."

"Very touchy. Not a good candidate for large sculptures."

"Weak bone dry strength. Cracked. Short."

Developed by: Brandi and Alex (group 4)
Intended use: Throwing
Cone: 3

Recipe:

Red Art	37.4
Gold Art	18.7
Newman Red Sub	18.7
OM-4	10.6
Frit 3124	4.0
Fine Grog	10.6
	100%

Wet to dry Shrinkage: 6.2%
Dry to fired Shrinkage: 6.0%
Total Shrinkage: 12.2%

Absorption: 1.04%

Class Ratings:

Very Poor	Poor	Average	Good	Very Good
1	2	3	4	5

Throwing:
(13 students surveyed)

Plasticity	3.8
Building Strength/ Resistance to slumping	4.2

Hand Building:
(3 students surveyed)

Plasticity	3.3
Building Strength/ Resistance to slumping	3.3

What the critics are saying...

"Soft and buttery with a beautiful color! Very plastic and smooth to throw with. Takes forms very nicely. I would use this body."

"Slabs threw well. Cracked a bit while wet."

"A little more strength would be nice, especially when thin."

"This was a good clay. We made friends. It did what I wanted and it is a very pleasant color."

"Nice and plastic. Very fun to throw with."

"Plastic and workable. Responsive, not too sticky. Great color."

"Threw well even though it was a little inconsistently mixed."

"The clay is fairly plastic but a little difficult to alter but threw nicely."

"Good structure and ability to keep form. Nice amount of grog. Easy to wedge."

"Smooth body, color is good. Seems like it would be a good body for throwing."

"Awesome color. Nice gritty texture. Favorite clay of them all."

Developed by: Caleb and Ben (group 6)
Intended use: Throwing
Cone: 10

Recipe:

Tile 6	18.2
C&C Ball	36.5
XX Sagger	18.2
HB 50	10.1
Custer	6.9
Flint	1.2
Fine Grog	8.9
	100%

Wet to dry Shrinkage: 5.8%
Dry to fired Shrinkage: 8.5%
Total Shrinkage: 14.3%

Absorption: 1.58%

Class Ratings:

Very Poor	Poor	Average	Good	Very Good
1	2	3	4	5

Throwing:
(13 students surveyed)

Plasticity	4.2
Building Strength/ Resistance to slumping	4.2

Hand Building:
(3 students surveyed)

Plasticity	4.3
Building Strength/ Resistance to slumping	3.7

What the critics are saying...

“Threw very well, no slumping issues while throwing.”

“Perfect”

“Creamy in a good way. Worked well with handbuilding.”

“Holds shape well without slumping.”

“Was a little short when pulled thin.”

“YES! Short marks just before tearing. Thinness dose not create a decline strength.”

“Threw well, very plastic and easy to manipulate.”

“Very smooth.”

“Took two tries to get a successful form thrown, but on second try the clay threw beautifully. A bit of slumping made forming a little challenging.”

“Very nice to throw with. Could be made very thin. It is a very white clay for stoneware. Nice.”

“Slabs threw well. Cracked at bone dry, but slabs are thin.”

“Pretty smooth body. Nice color.”

Developed by: Rachel and Brett (group 7)
Intended use: Handbuilding
Cone: 04

Recipe:

XX Sagger	32.5
C&C Ball	16.2
Tile 6	16.2
Frit 3124	22.1
Pyrax	4.5
Flint	4
Fine Grog	4.5
	100%

Wet to dry Shrinkage: 5.7%
Dry to fired Shrinkage: 8.8%
Total Shrinkage: 14.5%

Absorption: 2.77%

Class Ratings:

Very Poor	Poor	Average	Good	Very Good
1	2	3	4	5

Throwing:
(14 students surveyed)

Plasticity	4.1
Building Strength/ Resistance to slumping	3.4

Hand Building:
(2 students surveyed)

Plasticity	5.0
Building Strength/ Resistance to slumping	3.0

What the critics are saying...

"Seemed too plastic at first, but as I worked with it, the clay held its form well."

"Very plastic but poor strength. Felt like wet porcelain."

"Nice white 04 body. Shrinkage may be too high for some hand-building"

"Smooth to throw. Nice color, good strength"

"No tearing, very plastic. Although cut, may stick back together."

"Super Buttery! Fantastic throwing qualities. Surprisingly easy to form considering how smooth the clay is. Very plastic. Very nice."

"Clay seemed to stick to my hands while I was throwing it even with enough water. It was like throwing cream cheese. Also not terribly strong. I'm not a fan."

"Structure is poor. Slumping may occur. Not suitable alone, and with water even less. A pleasing texture though, and beautiful handling (wedging)."

"This is a strange clay to throw with. It is unusually smooth for a handbuilding body. Even with water it stuck to your hands."

Developed by: Mindy and Tracy (group 8)
Intended use: Handbuilding
Cone: 3

Recipe:

FHC	37.2
Helmer	18.6
OM-4	18.6
Nepheline Syenite	11.6
Frit 3124	7.0
Fint	3.4
Fine Grog	3.4
	100%

Wet to dry Shrinkage: 5.4%
Dry to fired Shrinkage: 9.0%
Total Shrinkage: 14.4%

Absorption: 2.16%

Class Ratings:

Very Poor	Poor	Average	Good	Very Good
1	2	3	4	5

Throwing:
(14 students surveyed)

Plasticity	4.1
Building Strength/ Resistance to slumping	4.1

Hand Building:
(3 students surveyed)

Plasticity	4.0
Building Strength/ Resistance to slumping	3.7

What the critics are saying...

“Threw really well. Reminded me of B-Mix™. Plastic, strong, really nice clay.”

“Meh... it isn’t Superman.”

“Could use some grog.”

“Great to throw tall with. It was like a dream.”

“This clay has structure throughout the whole session. Easily wedged and the wall support was amazing!”

“A nice body to throw with. I like the color.”

“Nice body. Issues with strength during throwing.”

“Very nice to throw with. Very little grog makes a buttery throwing experience. Also very plastic and forms nicely.”

“Slabs threw well. Cracked at bone dry, but slabs were thin.”

“Threw really well and was very smooth. Great color.”

“I was able to handbuild with it well, but it was boogering up if that makes sense.”

Developed by: Shane, Dave and Tim (group 9)
Intended use: Handbuilding
Cone: 10

Recipe:

Tennessee #10	18.9
Gold Art	56.7
Lizella	7.8
Flint	12.5
Fine Grog	4.0
	100%

Wet to dry Shrinkage: 5.6%
Dry to fired Shrinkage: 6.6%
Total Shrinkage: 12.2%

Absorption: 3.03%

Class Ratings:

Very Poor	Poor	Average	Good	Very Good
1	2	3	4	5

Throwing:
(13 students surveyed)

Plasticity	3.9
Building Strength/ Resistance to slumping	3.2

Hand Building:
(3 students surveyed)

Plasticity	4.3
Building Strength/ Resistance to slumping	3.3

What the critics are saying...

"There was no real support. It slumped and wasn't able to get any height."

"The clay felt sturdy. It was easy to throw with and had a good amount of grog."

"Nice color. Very smooth."

"Turned to mush quickly after starting to throw."

"Was very soft and a lot of grog to throw."

"Relatively spongy feeling... joins well without a slip."

"Was very soft and a lot of grog to throw."

"Very plastic, but limited forming: slumped very easily`."

"Good but not great."

"Actually pretty plastic. Good color."

"Just went everywhere. Want to let it dry some before working with it."

"Slabs threw well."