INSPIRATION AND IRIDESCENCE
Chemistry in Art

by

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THESIS

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AUTHORIZATION

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Jason B. Laney

ACKNOWLEDGEMENTS

I would like to first thank my family and friends for the support you have given me through the years. Without great mentors and teachers, I could not be where I am today. A special thanks to these mentors: Nils Lou, Don and Cindy Hoskisson, my Japanese potter friends, Chris Baskin, Matt Katz, and Jack Troy. I would like to thank my thesis committee members: Kevin Crowe, Chaz Martinsen, and Taylor Pasquale. Finally, I would like to thank all of the people that I have woodfired with and that I will fire with in the future.

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THESIS STATEMENT

This document is an exploration of how to control the surface of both clay and glazes through the use of chemistry and controlled testing. With the clay surface, my goal is to create both a visual and physical texture, which includes a variety of aggregates. With the glaze surface, my goal is to create iridescent oilspots in a variety of different colors to interact with functional and sculptural forms.

For the process of creating this thesis, my passion for iridescence in clay and glazes has been combined with my interest in Shigaraki clay and geology. Ever since I saw an iridescent surface on work coming out of a wood kiln, a goal of mine has been to find a way to recreate this effect.

My trip to Japan in 2018 ignited my interest in clays from the Shigaraki region, which inspired me to use raw materials to create a similar clay body. In addition, rocks and geological formations have inspired me to create work having a surface that looks like natural rock.

Glaze chemistry, especially the interactions of layering glazes and how glazes are affected in different atmospheres, has been an interest of mine since I started my clay career. An accidental blue-green iridescent oilspot glaze piqued my interest because it was not only iridescent, but the blue-green coloration was a combination that I had never seen before in glazes.

ABSTRACT

Inspiration and Iridescence
Chemistry in Art

Jason B. Laney

Hood College – MFA Thesis—August 2021

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Chemistry is key to gaining control of the entire ceramic process. I experimented with clay and glaze chemistry to achieve my aesthetics, which include my interests in visual and textural clay surfaces, as well as iridescence. I accomplished this in three ways: creating Shigaraki-inspired clay, sculpting rock-inspired work, and trying to recreate an accidental iridescent oilspot glaze.

My knowledge of clay chemistry allowed me to make a single clay body that blends aspects of natural and commercial Shigaraki clays, and provides the opportunity for iridescence in woodfire. Clay chemistry also allowed me to control the visual and physical texture in both my Shigaraki-inspired clay and in creating work that looked like it was chipped directly out of rock. Knowledge of glaze chemistry allowed the detailed pursuit of replicating an accidental glaze, and finding many potential interesting glazes. Knowledge of chemistry can enable one to achieve their desired aesthetics in ceramics.

INTRODUCTION

This thesis explores my interest in visual and textural clay surfaces, as well as my quest for iridescence. These will be shown in three ways: through creating Shigaraki-inspired clay, sculpting rock-inspired work, and trying to recreate an accidental iridescent oilspot glaze.

My interest in ceramic pieces that have both a visual and physical texture began when I saw a 17th Century flower vase from Iga, Japan. The loose style of this form first drew me to the piece. Later, I saw Shigaraki jars, which exhibit an interesting tension between looseness in form when viewing up close and tightness in form when viewing the silhouette at a distance.

I have had an interest in rock formations since I was a young child. As an adult, I have been attempting to recreate the look of natural rock in clay. I have begun to hone in on the clay chemistry and the addition of aggregates, as well as ways to fire the work to achieve this goal.

When I first saw iridescence on work coming out of a wood kiln, I became intent on creating this effect in clay and glazes. The expansion of my knowledge of chemistry has given me the tools to have more control in the pursuit of iridescence. Using this knowledge, I will incrementally try to recreate the accidental glaze.

CHAPTER I: PERSONAL AESTHETICS

My experiences using woodfire kilns and taking ceramic chemistry classes resulted in my interest in controlling the surfaces of both clay and glazes. My interest in firing my ceramics in wood kilns began with firing in an anagama kiln. During this process, I observed that wood-fired pieces can be very complex and tell the story of the firing. There are many variables that can affect a woodfired piece: type of wood, firing duration, location in the kiln, pieces that are around it, clay type, and glaze type. Woodfired ceramics can have complex visual colors, and there is a potential for each side to look completely different depending on exposure to ash, fire, duration, and hot gasses.

Even though I have a passion for woodfiring, in order to achieve oilspots in a glaze, I have to fire them in an oxidation atmosphere in an electric kiln. Oilspots are formed near the end of a firing when iron releases oxygen, creating bubbles on the surface of the glaze that then melt out into the oilspot effect. In reduction atmosphere in gas, salt and wood kilns, oxygen is driven off of iron very early in the firing.

Clay Chemistry

Shigaraki-Inspired Clay

My first exposure to this clay was when I went to Japan in the summer of 2018. I have a friend in Sapporo, Japan, who only uses Shigaraki clay in his anagama kiln. During dinner at his house, we ate and drank out of pieces from his kiln. The visual and physical texture was unlike any clay I had ever used before. For instance, one of the bowls had a large chunk of silica stone in it that was exposed on both sides of the bowl’s wall. When Shiro Otani came to Hood College and when I fired with him at Peters Valley School of Craft, he showed how Shigaraki potters throw the clay with the coil-and-throw method to avoid tearing up their hands from the aggregate. He also talked about the town, Iga, being located just over the mountain from the town, Shigaraki, which explains the similarity in clay from both areas.

While in Sapporo, I demonstrated with a commercial Shigaraki clay that was the best clay I have ever used. This clay was very plastic, but also had incredible strength—so I was able to push it further on the wheel than any other clay I had used. For a number of years prior to graduate school, I experimented with adding aggregate to mimic the natural Shigaraki clay, and I also made clay bodies that have the potential for iridescence.

Rock-Inspired Work

My interest in rocks and rock formations started when I was a child hunting for fossils with my dad. Being from the west, there are large amounts of dramatic rock formations. I have been inspired by geological formations I have seen throughout my travels in North America and Europe. These formations have ranged from large coastal rocks to massive monolithic rocks to sedimentary rock layers. The dramatic variations in rock have inspired me to create work that looks like it has been directly chipped out of rock.

For years, I have been making rock-like work. This includes a series of pieces inspired by erosion—mainly inspired by the Oregon coastline. These originally were sculptures of marbled clay that were cut to resemble strata in rock. I prefer the look of natural rock in my work compared to the more manufactured-appearing work that I have seen from some other ceramic artists.

Glaze Chemistry

My first experience with an iridescent glaze in a wood kiln was developed by accident and necessity. The night before a woodfiring, the normal shino glaze I used was empty, so I needed to make the glaze and found that I didn't have two of the three ingredients. The replacement raw materials changed the glaze from white to iridescent. This accident helped to give me an idea of what materials can actually cause iridescence in a wood kiln.

I developed a deeper understanding and interest in clay and glaze chemistry by taking classes from Matt Katz. The accidental iridescent oilspot glaze renewed my interest in creating iridescence in glazes.

CHAPTER 2: MATERIALS AND METHODS OF STUDIO EXPLORATION

Clay Chemistry Process

Shigaraki-Inspired Clay

The process for finding a clay similar to the Shigaraki clay I used in Japan started with making a triaxial blend of 500 gram batches, which was approximately 1¼ pounds of workable clay. The formula I used was 80% clay, 15% Custer Feldspar, and 5% Silica.

Clay #1: Hawthorne Fire Clay

Clay #2: Foundry Hill Crème

Clay #3: Redart

I graded each of 10 variations to find the best three—and these were:

Clay #1: Hawthorne Fire Clay

Clay #2: 2/3 Hawthorne Fire Clay, 1/3 Foundry Hill Crème

Clay #3: 1/3 Hawthorne Fire Clay, 1/3 Foundry Hill Crème, 1/3 Redart

For the second triaxial blend, I used 500 gram batches with the 3 best variations from the previous testing. After grading each of 10 combinations, I found the best to be:

53.25% Hawthorne Fire Clay

8.87% Foundry Hill Crème

17.74% Redart

This blend is the closest I have ever come to the clay I used in Japan. I used this clay in all of the Shigaraki-inspired pieces for my thesis exhibit. To help recreate the appearance of natural Shigaraki clay, I started adding silica sand of different levels of coarseness. The product I used was pool-filter sand found at a local hardware store. I also added another type of sand (masonry sand) that I obtained from a local masonry contractor. I used coarse granite from chicken grit found at any farm supply store to replicate the feldspar found in natural Shigaraki clay. The only difference is that there sometimes would be iron spotting in the granite as it melted—unlike natural feldspar, which is pure white. As I got more and more comfortable with the clay, I kept increasing the amount of aggregate.

My clay body was fired in various atmospheric kilns that ranged from electric, gas, salt, and two different wood kilns.

- Electric kilns fire in an oxidized atmosphere.
- Gas kilns start in an oxidized or neutral atmosphere until body reduction (Cone 012 to 08), then heavy reduction through body reduction, then light to medium reduction through the rest of the firing.
- Salt kilns start in an oxidized or neutral atmosphere until body reduction (Cone 012 to 08), then heavy reduction through body reduction, then light to medium reduction until Cone 8 or 9. Then salt is added to the kiln and the damper gets closed most of the way to create heavy reduction keeping the salt vapor in the kiln to react with the clay, then the damper is reopened, a draw ring is removed from the kiln to see the level of salt effect on the clay, repeat salting until the desired effect on the clay is reached, then keep the kiln in mild to medium reduction until the firing is over.
- Wood kilns move through atmospheric cycles with each stoke, heavy reduction at the beginning of the stoke dropping the temperature as the wood ignites, then through medium to light reduction as the wood burns. The temperature has the greatest climb in a neutral to oxidized atmosphere as the temperature peaks and starts to drop, and it is time to stoke again. This is repeated until the end of the firing, usually to Cone 10 to 12, throughout the kiln. Using wood kilns showed me a

wide spectrum of the potential of my clay body. The most dramatic effects were found in Jack Troy's wood kiln fired for four days. The results show that this type of clay prefers to be fired longer and hotter to achieve dramatic effects.

All of the pieces in this section were made in the traditional Shigaraki coil-and-throw method. By using a large amount of aggregate, sometimes to the point of it feeling like wet cement, I began to appreciate why Shigaraki potters use the coil-and-throw method instead of the center-and-throw method.

Rock-Inspired Work

I used reclaimed clay with mixes of silica sand, masonry sand, and coarse granite in creating the rock-inspired pieces in my thesis exhibit. The cups and teabowls were thrown thick so that I could use a putty knife to cut in and tear the clay, creating the look of a natural rock surface. When I would occasionally cut through the piece, I would take clay and push it from the inside through the hole, which created the look of a rock emerging through the surface. The vases were made solid using a putty knife to cut away and tear the clay to create a rock-like surface. These pieces were then cut apart, hollowed out, and put back together—which not only lessened the physical weight of the piece, but also gave it the potential to be functional. The sculpture, "Rockaway", was made with the focus on the final appearance instead of worrying about the weight of the piece.

Glaze Chemistry Process

This exploration started in a glaze chemistry class when a fellow student used a mislabeled raw material in making a glaze. This accidental glaze produced an iridescent blue-green oilspot made from the colorants iron and copper (Figure 1), and an iridescent brown-blue oilspot made from the colorants iron and rutile (Figure 2).

Figure 1: Accidental Glaze,
Iridescent Blue-Green Oilspot

Figure 2: Accidental Glaze,
Iridescent Brown-Blue Oilspot

The original glaze was supposed to be a variation of a Barium Matte glaze. The original intended recipe was:

- Nephline Syenite 44.2
- Barium Carbonate 36.5
- Old Mine #4 9.9
- Silica 9.4
- Copper Carbonate 3.0
- Red Iron Oxide 6.0

In further testing with this formula, my results were more of an oil slick glaze, while the testing that Matt Katz conducted resulted in a Barium Matte glaze. The only chemical that the student had used from Hood College was barium carbonate, so that was the first place I looked to find out what caused the variation in the glazes. In investigating the barium carbonate bucket, there was a bag inside that said "Barium Carbonate," and inside that was a bag with the label "GF 111." I had never heard of GF 111 and, through research, I found that it was an old frit that is chemically similar to the currently common frit 3134. This explains why the accidental glaze and my initial experiments were glossy glazes, while Matt Katz' glaze was a matte glaze.

I began my quest to find the accidental glaze by replacing barium carbonate from the original glaze recipe with frit 3134 (Figure 3A, Oil Slick Glaze Unity Molecular Formula [UMF] Calculator; and Figure 3B, Oil Slick Glaze Stull chart).

010119-1				Written by Matthew Katz matt@ceramicmaterialsworkshop.com	
Notes				**Cone 10**	
SiO_2/Al Ratio 7.81:1		Alkali Metals 0.50		Alkaline Earths 0.50	
SiO_2 2.68	Collective "Al_2O_3" 0.34	Na_2O 0.37	K_2O 0.06	MgO 0.00	CaO 0.40
B_2O_3 0.29	Al_2O_3 0.34	Li_2O	CuO 0.07	SrO	BaO
TiO_2 0.00	NiO	Bi_2O_3	SnO_2	ZnO	Fe_2O_3 0.10
Cr_2O_3	ZrO_2	P_2O_5		MnO_2	CoO

Glaze Formula

Select Material Click on cell to expose drop down menu	Insert Amount	Material	100% Batch	Material	Desired Batch Size 100
Neph Sy	44.20	Neph Sy	40.55	Neph Sy	40.55
3134 (Frit)	36.50	3134 (Frit)	33.49	3134 (Frit)	33.49
Flint	9.40	Flint	8.62	Flint	8.62
OM4	9.90	OM4	9.08	OM4	9.08
Red Iron Oxide	6.00	Red Iron Oxide	5.50	Red Iron Oxide	5.50
Copper Carbonate	3.00	Copper Carbonate	2.75	Copper Carbonate	2.75

Figure 3A: Oil Slick Glaze,
UMF Calculator

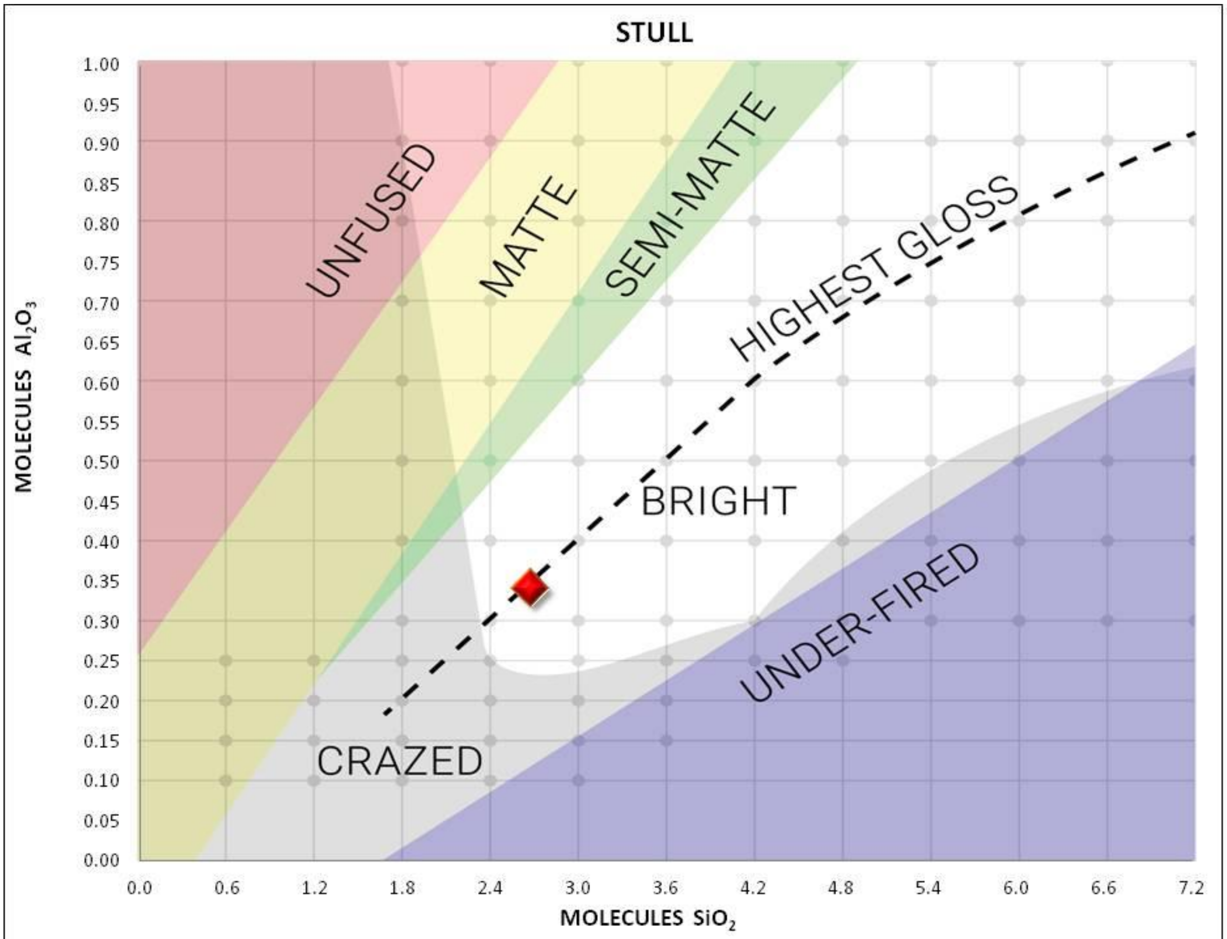

Figure 3B: Oil Slick Glaze,
Stull Chart

I then used the UMF calculator and the Stull chart to systematically map out the glaze in an attempt to find the accidental glaze. My initial mapping was done by incrementally adjusting the silica and alumina levels as seen in Figure 4.

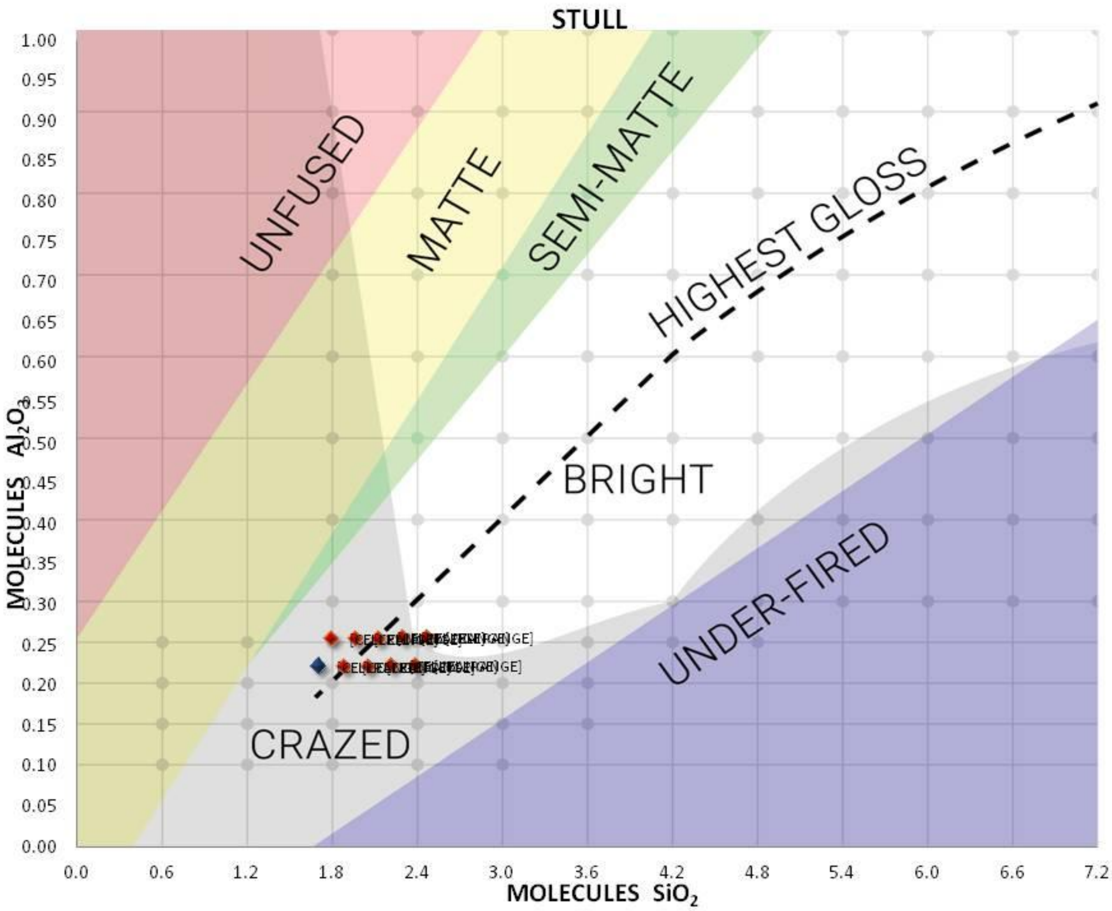

Figure 4: Test A, Silica and Alumina Levels,
Stull Chart

After extensive testing, I was unable to achieve any oilspot glazes so I started testing by adding bone ash to the formula in an attempt to cause the iron to bubble, which encourages the creation of oilspots (Figure 5).

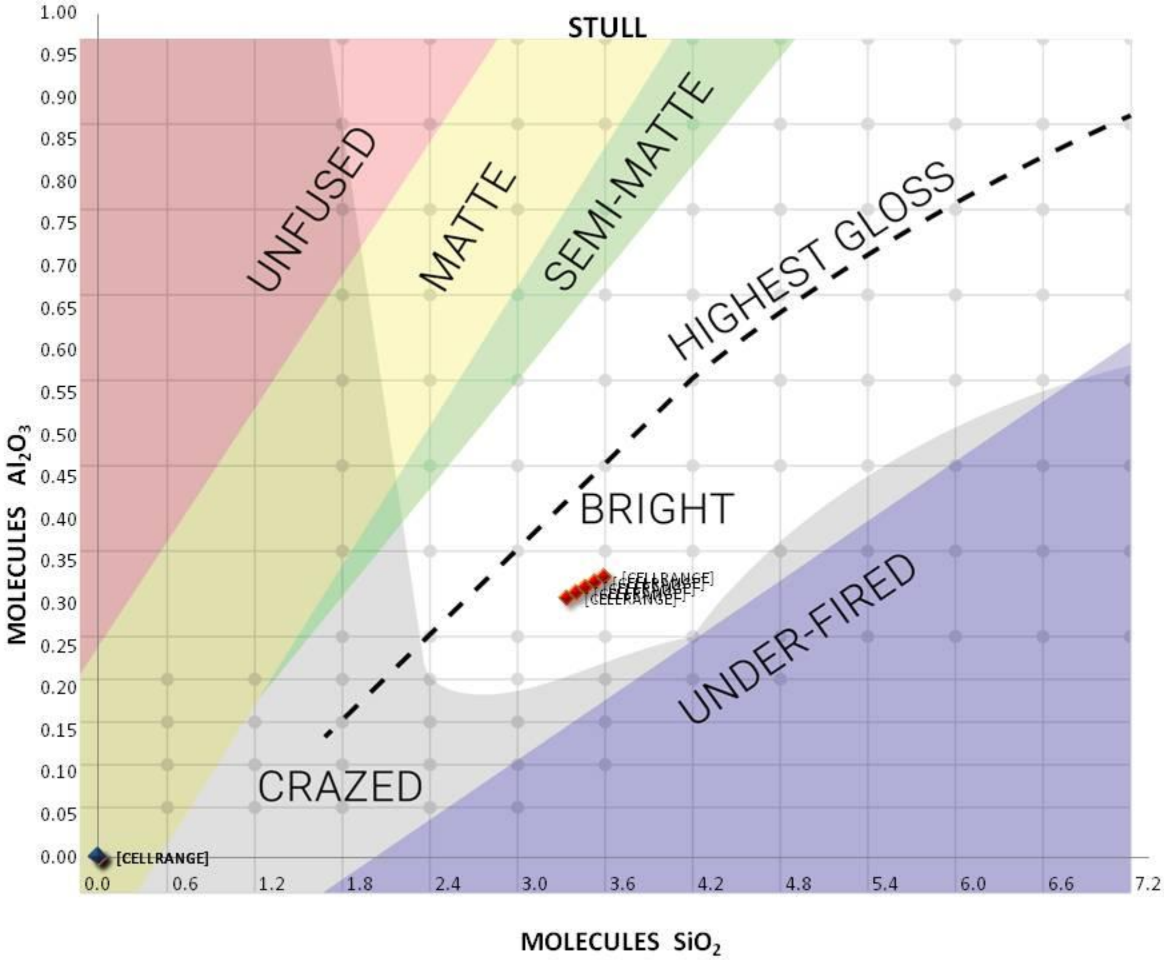

Figure 5: Bone Ash Tests,
Stull Chart

The oilspot glazes I had found through previous bone ash tests did not give me the blue-green oilspot I was looking for. My next step was to incrementally add barium carbonate while decreasing frit 3134 (Figure 6).

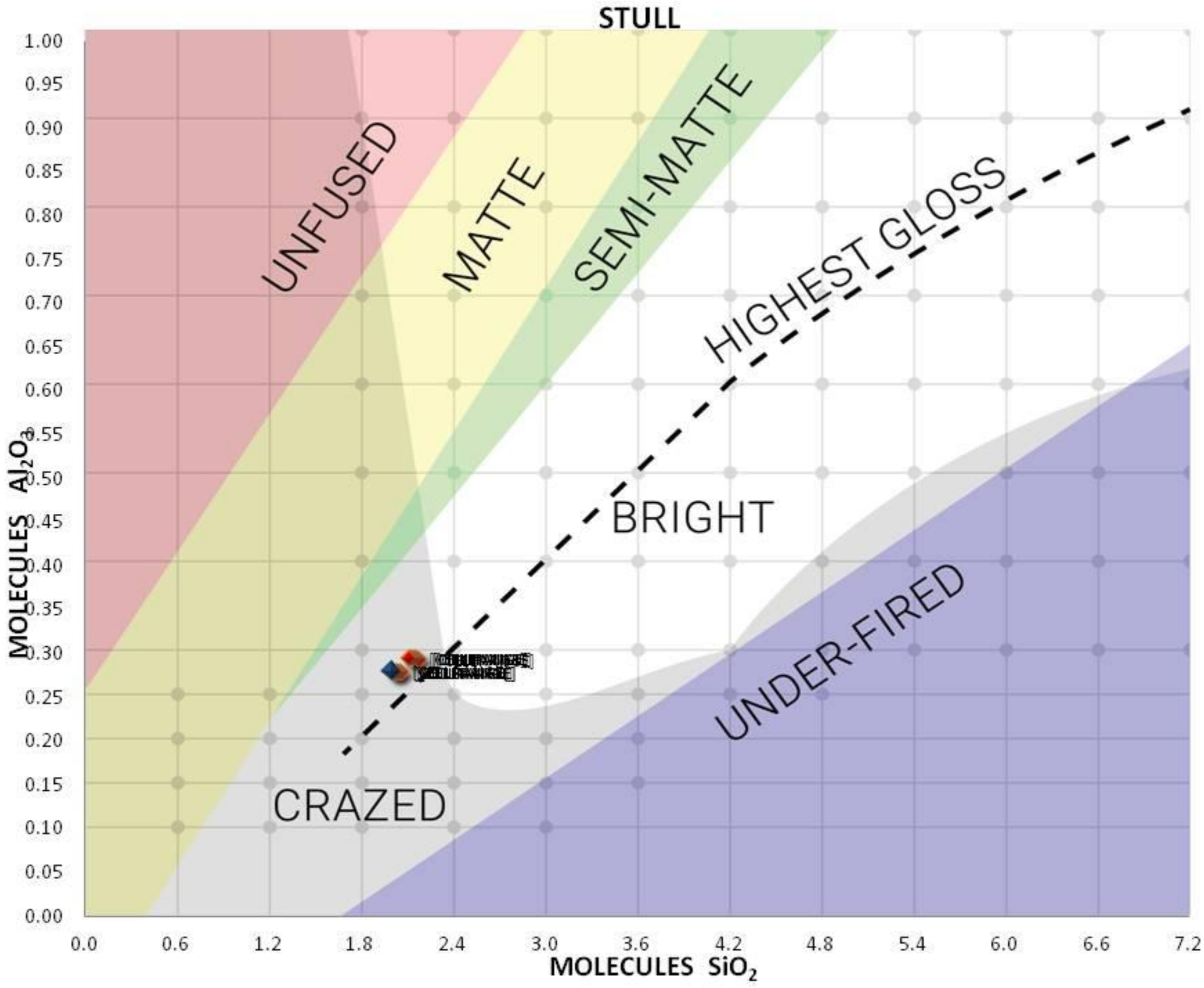

Figure 6: Barium/Frit 3134 Tests,
Stull Chart

With the barium tests, I started to get some of the blue-green coloration that was in the original accidental glaze. This indicates that the accidental glaze has both barium and frit in it. The challenge is to find the exact ratio and have the glaze create an oilspot.

CHAPTER 3: THESIS EXHIBITION

The focus of my thesis and thesis exhibit was to use clay and glaze chemistry to create visual and tactile surfaces that reflect my inspirations. My thesis exhibit was broken up into distinctive areas of clay chemistry and glaze chemistry. The clay chemistry section was broken up into two distinct parts: Shigaraki-inspired clay and rock-inspired work.

Clay Chemistry

Shigaraki-Inspired Clay

I curated this section of the exhibit to display a broad spectrum of what my clay can do in different atmospheric firings. This work was fired in Jack Troy's wood kiln for four days, in Hood College's wood kiln for 32 hours, or in Hood College's salt kiln for 16 hours. These firings show the broad-spectrum of color and visual texture that this clay can achieve. The following are selected photos from the exhibit.

This jar was fired for 4 days on its side on shells in the front of Jack Troy's wood kiln. The top photo (Figure 7A) shows the bottom side; the bottom photo (Figure 7B) shows the top side. I chose this piece because I believe it is one of the most dramatic pieces made from this clay body. The wood ash, hot gasses, and duration of the firing not only exposed the aggregate in the clay, but also a variation in colors caused by the duration of the firing. This also created a large black transition line between what was exposed to direct flame and what was hidden by the shells.

Figure 7A: Woodfired Jar, Side A, Side-fired, Shigaraki-Inspired Clay

Figure 7B: Woodfired Jar, Side B, Side-fired, Shigaraki-Inspired Clay

This jar was fired twice—once in the back of Hood College's wood kiln standing straight up, and once in Hood's salt kiln fired on its side. This shows the subtleness that this clay can exhibit. The top photo (Figure 8A) shows not only the front of the piece from the woodfiring, but also the bottom of the piece during the salt firing. The bottom photo (Figure 8B) shows the back of the piece from the woodfiring and the top of the piece from the salt firing. These different firing positions resulted in this piece being one of the more unique pieces in the entire exhibit. The top photo shows the ash depositing on the shoulder of the jar and the bottom photo shows an orange triangle that is a reflection of the flue and the hot gasses that wrapped around the piece during the firing.

Figure 8A: Woodfired/Salt-fired Jar, Side A, Shigaraki-Inspired Clay

Figure 8B: Woodfired/Salt-fired Jar, Side B, Shigaraki-Inspired Clay

This jar was fired for four days on its side on shells in the side-stoke area of Jack Troy's wood kiln. The top photo (Figure 9A) shows the shell markings, which are more subtle in this area of the kiln because the flame is slower. The bottom photo (Figure 9B) shows the ash collecting and melting on the top side of the piece. This piece also spent time partially covered in ash from stoking wood.

Figure 9A: Woodfired Jar, Side A, Side-fired, Shigaraki-Inspired Clay

Figure 9B: Woodfired Jar, Side B, Side-fired, Shigaraki-Inspired Clay

This summer teabowl was fired in Hood College's salt kiln. The top photo (Figure 10A) shows that the salt was very subtle with its effect on the glaze. The bottom photo (Figure 10B) shows the underside of the bowl, which is the most dramatic part of this piece because the firing exposed all of the aggregate that was added to the clay.

Figure 10A: Woodfired Summer Teabowl, Inside, Shigaraki-Inspired Clay

Figure 10B: Woodfired Summer Teabowl, Outside, Shigaraki-Inspired Clay

This teabowl was fired in Jack Troy's wood kiln for four days. This piece is especially interesting because the small teabowl shows two dramatically different pictures of what this clay can do. The top photo (Figure 11A) shows the more protected side with a subtle transition shown by the black line. The bottom photo (Figure 11B) shows black created from direct impact of fire and hot gasses.

Figure 11A: Woodfired Teabowl, Side A, Shigaraki-Inspired Clay

Figure 11B: Woodfired Teabowl, Side B, Shigaraki-Inspired Clay

This teabowl was fired for four days in Jack Troy's wood kiln. The top photo (Figure 12A) shows what the clay can do when it gets blasted with heat. The black area is starting to self-glaze into an oil spot effect. The bottom photo (Figure 12B) shows that the clay can still have subtle variations in colors while the other part of the piece is being blasted with fire and hot gasses.

Figure 12A: Woodfired Teabowl, Side A, Shigaraki-Inspired Clay

Figure 12B: Woodfired Teabowl, Side B, Shigaraki-Inspired Clay

This teabowl was fired in Jack Troy's wood kiln. The top photo (Figure 13A) shows the clay starting to self-glaze into an oilspot glaze, and the aggregate in the clay body is starting to pull through the glazed areas. The bottom photo (Figure 13B) shows a more protected side of the piece, but still has variations in color of both the glaze and the clay.

Figure 13A: Woodfired Teabowl, Side A, Shigaraki-Inspired Clay

Figure 13B: Woodfired Teabowl, Side B, Shigaraki-Inspired Clay

This vase was fired in both Hood College's wood kiln and Hood's salt kiln. This piece was fired in the very front of Hood's wood kiln on the floor, collecting a large amount of ash depositing on its surface. The top photo (Figure 14A) shows the ash starting to melt during the salt firing. The bottom photo (Figure 14B) shows almost a "starry night" of the aggregate in the clay that is being exposed from the two different firings.

Figure 14A: Woodfired Vase, Side A, Side-fired, Shigaraki-Inspired Clay

Figure 14B: Woodfired Vase, Side B, Side-fired, Shigaraki-Inspired Clay

Rock-Inspired Work

With the geologic pieces, my goal was to attempt to recreate the look of rock and to create the appearance that these pieces were chipped directly out of stone. To get this aesthetic, I experimented with not only the clay chemistry, but with different aggregate amounts and types, cutting and tearing the clay, as well as studying how atmospheres affected clay and glaze chemistry.

This vase was fired in Jack Troy's wood kiln on its side for four days. This piece was sitting in hot coals for a large part of the firing. This is shown in the top photo (Figure 15A), which has an almost blue-black surface. One unique thing about this surface is that it sparkles almost like mica. The bottom photo (Figure 15B) shows the wad marks, indicating that the piece was fired on its side.

Figure 15A: Woodfired Vase, Side A, Side-fired, Rock-Inspired

Figure 15B: Woodfired Vase, Side B, Side-fired, Rock-Inspired

This vase was fired on its side on shells in the front of Jack Troy's wood kiln for four days. The top photo (Figure 16A) is the only part of this vase that shows it was made with multiple kinds of clay, and indicates where the piece was sitting on shells. The bottom photo (Figure 16B) shows that this piece has a lot of melted ash, but also unmelted ash, giving it a unique texture.

Figure 16A: Woodfired Vase, Side A, Side-fired, Rock-Inspired

Figure 16B: Woodfired Vase, Side B, Side-fired, Rock-Inspired

This piece, "Rockaway" (Figures 17A and 17B), is inspired by the sea stacks at Rockaway Beach in Oregon. One of the most interesting parts of this sculpture is that it shows how dramatic the surface can be using the same clay, fired in different parts of the kiln, and for different durations.

Each part of the sculpture tells a different story of where and how it was fired. The arch was fired on its side in the back of Jack Troy's wood kiln for four days. The surface effects resulted from hot gasses and minor ash deposit. The large rock piece was fired in the very front of Jack Troy's wood kiln for four days, and was covered in hot coals for large parts of the firing. This is shown by the blue-black surface. The small rock was fired at Hood College's wood kiln next to the side-stoke and was fired for 32 hours, creating subtle effects on the surface.

Figure 17A: Woodfired Sculpture, "Rockaway,"
Side A, Rock-Inspired

Figure 17B: Woodfired Sculpture, "Rockaway,"
Side B, Rock-Inspired

These three teabowls (Figures 18, 19 and 20) were fired in Hood College's wood kiln for 32 hours. What makes these three pieces unique is that they are all the same clay body and the same glaze. This shows how important location in the kiln is to the end effect on each piece.

Figure 18: Woodfired Teabowl, Iridescent Glaze, Rock-Inspired

Figure 19: Woodfired Teabowl, Iridescent Glaze, Rock-Inspired

Figure 20: Woodfired Teabowl, Iridescent Glaze, Rock-Inspired

This teabowl (Figures 21A and B) was fired in Peter's Valley Noborigama kiln for two days. This is one of the first pieces that I made out of my Shigaraki-inspired clay. This piece showed the potential for this clay to self-glaze into an oilspot glaze.

Figure 21A: Woodfired Teabowl, Side A, Rock-Inspired, Thesis Clay Body

Figure 21B: Woodfired Teabowl, Side B, Rock-Inspired, Thesis Clay Body

This collection of cups (Figure 22A) was fired in Jack Troy's wood kiln for four days, Hood College's wood kiln for 32 hours, or Hood's salt kiln for 16 hours. The cup on the bottom left (Figure 22B) was fired in Jack Troy's wood kiln and was one of the first of the series that I made. It shows the beginnings of my exploration into creating a rock-like surface. The cup on the bottom right (Figure 22C) was one of the last cups I made, and was fired in Hood's salt kiln. This piece shows how far I progressed into making the cups look like rock.

Figure 22A: Woodfired Cup Collection, Rock-Inspired

Figure 22B: Woodfired Cup, Rock-Inspired

Figure 22C: Woodfired Cup, Rock-Inspired

Glaze Chemistry

The wall hung glaze tests are part of my pursuit to create iridescent oilspot glazes. Through chemistry, I am attempting to systematically recreate the results of a glaze that was created by an accidental mislabeling of a raw material. Out of hundreds of test tiles, I chose the most interesting glazes to showcase this pursuit. Bowl forms were used to provide a larger surface to show the glazes rather than using the original test tiles. These bowls show the effects that can happen in subtle variations in the chemistry of a glaze.

Iron and Rutile Glazes

I chose 16 of the most interesting variations of my glaze tests to potentially be shown for my thesis exhibit. Some variations had too much stress between the glazes and the clay, causing the pieces to tear apart. The following eight glaze tests (Figure 23A) were the most interesting variations that survived the firings. All eight of these are actually more interesting than the original glaze that I was trying to replicate with these colorants. Sample close-ups of the glazes are shown in Figures 23B and 23C.

Figure 23A: Glaze Test Collection, Iron and Rutile

Figure 23B: Glaze Test, Iron and Rutile

Figure 23C: Glaze Test, Iron and Rutile

Iron and Copper Glazes

I used the same 16 glaze recipes as the previous iron and rutile glaze tests, except that I changed the colorants to iron and copper (Figure 24A). The effects in these ten glaze tests are difficult to see looking head on. The iridescence and depth of these glazes are much more visible when viewed from the side (Figures 24B, C, D and E).

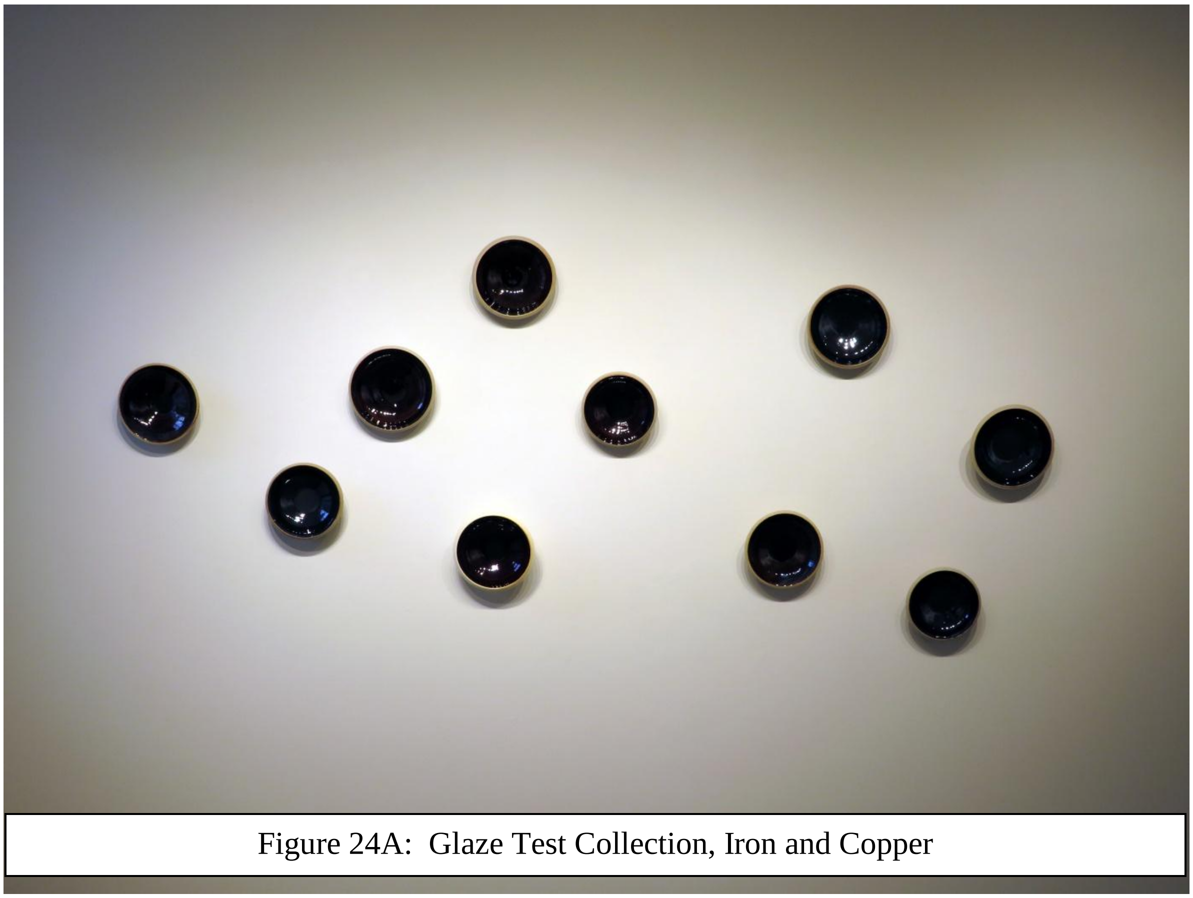

Figure 24A: Glaze Test Collection, Iron and Copper

Figure 24B: Glaze Test,
Iron and Copper

Figure 24C: Glaze Test,
Iron and Copper

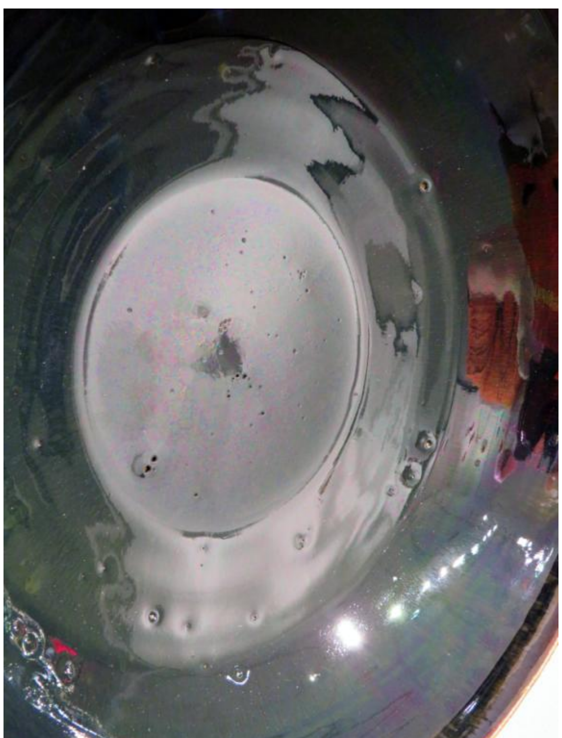

Figure 24D: Glaze Test,
Iron and Copper

Figure 24E: Glaze Test,
Iron and Copper

CHAPTER 4: RESULTS

Clay Chemistry

Shigaraki-Inspired Clay

I created a clay that was plastic, could handle high temperatures from the front of wood kilns, and had the potential to be iridescent. What I love about my clay is that it has a visual and physical texture to the surface. Another exciting and surprising aspect of my clay body is that, when blasted by heat and ash in a wood firing, the clay can not only have an iridescent surface, but it can basically self-glaze. The iridescence and oilspot appearance comes from the iron in the 17% Redart clay and, with over 50% fire clay, the pieces don't lose their form.

Below are discussions of select pieces from each form I made which represent the firings of my clay body.

Bowls. The fluted rim bowls, inspired from my Hokkaido potter friends, are unglazed with heavy aggregate of mainly coarse silica sand. These unglazed bowls showed subtle effects of fly-ash accumulating on the inside rim and the bottom of the bowls. The inside walls transition from heavy fly-ash to slight iridescence which was affected by hot gases, to a dull iron-red on the shadow side. The outside of the bowl shows transitions similar to the inside, with the rim showing slight erosion from the ash. The aggregate is both visible and textural on these bowls.

The shino-glazed bowls have heavy aggregates of coarse silica sand and masonry sand. The white shino had little interaction with the clay body except where it was inundated with ash, which caused erosion lines through the glaze, revealing a cherry blossom shino appearance.

The temmoku-glazed bowls include fine silica sand. Inside of the bowls, the iron in the temmoku glaze displays the many variations that iron can create—from yellows to reds, blues, greens, metallic iridescence, and iron crystals. This complexity is due to the bowls being located near the front of the wood kiln and the ash heavily fluxing the glaze.

My intent was to see how my clay body varied in appearance and feel with the variety of different aggregates. The fluted bowls were interesting because they showed how my clay specifically interacts with a wood kiln. The white shino bowls had the most subtle effect of all of the bowls because the shino I used is not greatly affected in wood kilns. The temmoku bowls were most successful due to the complexity of how the iron and the glaze reacted in the wood kiln.

Jars. The jars were left unglazed, allowing the kiln to paint the surface. I side-fired each piece in an attempt to create a dramatically different surface on each side. Some were much more successful than others with their dramatic surfaces showing the potential of the clay body, while others were much more subtle. Overall, these jars exhibited many of the complex surfaces that can be created by my clay body being fired in reduction kilns.

The most successful and dramatic jar is shown in Figures 7A and 7B. This jar shows the complex surfaces of my clay that can be achieved when being fired in the front of a wood kiln. The sides of this jar show the transition from a heavily fluxed surface due to ash accumulation to the protected side affected by hot gasses. This jar exhibits everything that I am looking for in a clay body fired in a wood kiln.

The jar shown in Figures 8A and 8B exhibits subtle effects from both of its firings in wood and salt kilns. This jar was fired in the back of a wood kiln, so it was mainly affected by hot gasses and a small amount of fly-ash that collected on the shoulder. The salt firing melted the ash and exposed a shadow that was created from the jar being next to the flue in a wood kiln. This was the least dramatic of the jars that were fired.

Teabowls. Each teabowl has its own unique characteristics depending on how I glazed it, where it was located in the kiln, and which kiln it was fired in. The hotter the teabowls got, the more the aggregate came to the surface and the Redart in the clay body started to flux into its own glaze.

The teabowl shown in Figures 11A and 11B displays variations in both the clay and glaze. The clay shows the transition from a heavily-ashed surface to the iridescence caused from hot gasses. The shino glaze transitions from a matte surface that was inundated with ash to the glossier side affected by hot gasses. The part of this teabowl that I find most interesting is shown in Figure 11A where the clay fluxed by ash transitions into iridescence.

The teabowl shown in Figures 13A and 13B has a dramatic surface caused by the interaction of the movement in the clay and fire. The push-outs in this teabowl not only create a triangular form, but also create unique areas for ash to accumulate and transitions in shadows to appear. Due to large amounts of ash collecting inside of this teabowl, the glaze transitions from white to cherry blossom to a splash of iron and rutile colorations with crystals just beginning to form.

Rock-Inspired Work

Being around dramatic rock has been a significant influence in my creativity, inspiring me to attempt to recreate those surfaces in clay. My ceramic rock pieces are meant to show the visible and physical texture of natural rock. My primary goal was to make these pieces look like they were chipped out of rock—their functionality as vessels is secondary to the surface of pieces.

These pieces successfully create the appearance of the complexity of rock formations through the use of aggregate and the interactions of atmospheric firings with all of the individual angles created by the cutting and tearing of clay.

Below are discussions of select pieces from each form I made which represent the unique multi-faceted surfaces of rock formations.

Cups. The cups are only glazed on the inside and rim for functional comfort. This allows the firing to create most of the visual surface on the outside of the piece. The cut-and-torn surface of each cup, the location in the kiln, and the firing type (gas or wood), create a uniqueness similar to natural rock.

The cup in Figure 22B shows how the cut-and-torn surface of the clay interacts with the ash deposited throughout the firing. The cup in Figure 22C has a complex cut-and-torn surface, especially where the clay was pushed out to resemble a protrusion of rock.

Teabowls. I used a variety of shinos on the teabowls, most without soda ash, similar to the traditional shinos I saw on my trip to Japan. When I poured the glaze on the teabowls, I used loose gestures and left areas unglazed to resemble mountain scenes. Figure 21B is a prime example of this technique, which I incorporate in all of my teabowls.

Vases. With these pieces, the effects of woodfiring created a large variety of colors that tell the story of the firing and the location of the piece in the kiln.

The vase in Figures 15A and 15B is an example of the lava-like appearance that can occur when the piece is buried in coals for much of the firing. In this case, it has a surface that sparkles like mica. Even though this piece was buried in coals for much of the firing, it still has a variety of coloration instead of the expected blue-black coloration. It has the appearance of rock that fractured to reveal the colorations underneath the surface.

I think the vase shown in Figures 16A and 16B is the most successful piece in creating a 360-degree surface that looks like rock—with fissures, shear zones, sedimentary layering, and pyroclastic surfaces. Its multi-faceted surface is due not only to the marbling of clays, but also that it was fired partially in coals.

"Rockaway." This 3-piece sculpture, shown in Figures 17A and 17B, was inspired by a sea stack formation at Rockaway Beach, Oregon. It is a dramatic and violent part of the Pacific Ocean, with crashing waves and window-shaking storms. This sculpture, fired in two different kilns, shows how firing duration and location can dramatically affect the surface of the piece.

- The arch shows the effects of hot gasses with little ash. This caused slight variations in color on the exposed side, while the other side has more color variations due to the hot gasses.
- The center piece shows the effect of the clay being buried in coals. The side with iridescence was buried in coals until later in the firing when the heat was able to melt any ash on the surface, creating a glossy iridescence. While the other side shows the angle of the coals in the blue-black region, the rest of the surface is colored from ash melting throughout the firing.
- The small piece was in front of the side-stoke area, so it received heat and ash from two directions. The surface is less complex overall from the other two pieces because it was fired for 32 hours, while the other pieces were fired for 4 days.

Glaze Chemistry

So far, I have been unable to recreate the iridescent blue-green oilspot. Due to the blue-green colorations found in the barium tests, my best guess is that I will be able to recreate this glaze by incrementally adding barium, while decreasing frit 3134. Then I will begin adjusting alumina and silica levels to map out possibilities. The frustration is that the glaze could be recreated in the next test or hundreds of tests later.

The interesting and frustrating part of trying to recreate an accidental glaze is all of the potential variables. Using Katz's UMF Calculator, I can map out where the glaze would be with barium carbonate and where it would be with frit 3134. In theory, it should be somewhere in-between, since the glaze should be a mix of both barium and 3134. After incrementally mapping out glaze possibilities, I began to understand that there really are infinite possibilities of glazes, and that this could require a lifetime of exploration.

The results of testing for this thesis were not only an educational experience, but also provided new and interesting results that add to the knowledge of how to manipulate raw materials to create iridescence.

CHAPTER 5: DISCUSSION

The research and experiments done during my thesis are only the start of my exploration of clay and glaze chemistry. Moving forward, I plan to further explore and experiment in Shigaraki-inspired clay, rock-inspired work, and iridescent oilspot glazes.

Clay Chemistry

Shigaraki-Inspired Clay

Something is lost when you try to recreate a natural clay. Even if you have the complete chemical makeup and can make a clay to perfectly match it chemically, clay made in a mixer can never be the same as natural clay because one is created over millions of years.

My clay body is more successful for my aesthetic when fired in wood kilns--the hotter and longer, the better. The complex atmospheres of a wood kiln and duration of the firing allows the clay to mature into a complex surface that can only happen in this type of firing. Salt can give some decent results, but not enough to continue with this method of firing.

Gas and electric kilns are not firing types that are worthy of pursuing using my clay because they do not create richness in the clay body.

Rock-Inspired Work

I am fairly confident that I can successfully make work look like rock. I plan to add more aggregate, and start throwing pieces thicker to provide the potential for more extreme effects. I intend to further experiment with color variations of clay, rock formation pieces, and layering clay to make it resemble strata caused by geologic events.

Glaze Chemistry

In retrospect, I am glad that I used the iron and copper colorant combination in pursuit of the accidental glaze. If I had chosen the iron and rutile colorant combination, I would have stopped earlier because some of the glazes in the exhibit are much more interesting than their accidental glaze counterpart. I will continue to try to find the blue-green oilspot glaze and work on making some of the iron and rutile glazes from my exhibit durable.