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Personalized Glazes for My Work

Robert Black

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Robert Black

Candidate for the Master of Fine Arts
in the College of
Fine and Applied
Arts of the
Rochester Institute of Technology

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Hobart Cowles, Advisor

DEDICATION

To Mr. Preston, Loan Officer First National Bank
White River Junction Vt.
To Hobart Cowles; Professor, Ceramics, School for
American Craftsmen.

To whom I will forever be indebted.....

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I. Preface

A. Why a concern with personalized glazes

My background prior to the School for American Craftsmen had been restricted to the New England area. I worked for a time with a New Hampshire potter and grew accustomed to the 'craft'-look of New England pottery. Glaze consideration was an important feature in marketing a saleable product. Most of the glazes that were popular there were of shiny green or blue tones. These were practical and useful, for they could be cleaned very easily. The stark color relationship was attractive to summer tourists and vacationers, so the potters prospered. After a short time I grew tired of this kind of glaze surface treatment. It seemed proletarian at best, and I thought that there should be a better more sophisticated way to operate. I suspected that matte glazes should do the trick, but I had no facility for working with them. Along about this time I attended the Haystack Craft School in Maine, and got interested in using clay as a material for sculptural work. Again glazing was a problem. To relate it to mass and volume in sculpture forms was intriguing and complicating. It was apparent that the gloss blue and greens were out of the question. The most feasible solution looked again to be the high-fire matte glazes.

Upon entrance to the School for American Craftsmen, I set out to explore the possibility of using the matte glaze for production pottery and sculpture processes, only to run into another problem or realization. Now there was available an infinite variety of Alfred University Matte glazes to choose from. It seemed that the same short-comings I recognized in the shiny-blue-greens of New Hampshire were present in these new glazes. The surface quality, texture, and color seemed to be a slick coating, appropriate for any surface other than fired stoneware. The satin finish of some of the glazes seemed fine for strict adherence to basic wheel thrown forms, but not at all adequate for clay work as I envisioned it in my development.

My concern for personalized glazes stems from this background experience.

B. Statement and introduction of thesis format

Because of an interest in glaze technology and its relationship to form in clay, this paper is divided into three separate sections. The first section deals with sculptural forms; a search for an answer within a set of aesthetic limitations. The following section is a consideration of wheel work and the matte glaze. Portions of the third and fourth sections are objective. This is necessary for accurate reporting

of the research involved. Illustrations are referred to by number and are contained in a separate section of the thesis.

II. Sculpture

A. Statement of the problem

As one thesis project, I have considered clay form in relation to vertical wall surfaces. Problems were many. Of primary importance was the determination of whether or not to use the wall as a vehicle for my own design, or design a special piece for each given wall area and environment.

In the beginning I felt that it would be good to design pieces for the specific area in which they were to be placed. It seemed that this idea made sense since a wall is part of a room, and a room is designed for a specific function; whatever goes on the wall should therefore adhere to that function. Robert Jarvis, a former MFA student, took this point of view. His mural work can be seen in the entranceway of the Fine and Applied Arts building. The problem was to design something in keeping with a space that people are passing through regularly. His design incorporates a flowing line horizontal to the floor at about shoulder height. Because it would be impossible for people to stop and study the work, it had to be easily noticed and assimilated by passers-by. The flowing line in relation to a static background suggests movement. It

is significant to consider that this particular design is totally based on the time and place of its execution.

Another example of design adherence to environment is the mural work of Frans Wildenhain. Of particular interest is the mural at the Strassenburg Laboratories in Rochester. Strassenburg is a company in the business of manufacturing pharmaceuticals. The mural is based on the nature of the business. It is a narrative depicting the relationship of man, medicine, and life. A most interesting feature of this particular piece is that individual pieces take on a new character or meaning when looked at from a short distance. From afar the work is lyrical, almost literal in its depicting of man and medicine; however, when one studies an area apart from the total, something new happens. The particular section takes on an abstract quality and the strength of design is purely one of a form and color relationship. In other words the mural can be said to 'work' in and out of context of the Strassenburg Laboratories. One only has to look at the close-up photo on page 140 of Ceramics, A Potter's Handbook[1] to understand the relationship of which I speak.

Both Jarvis and Wildenhain work in low relief. Both use bright-glaze colors to enhance their designs.

[1]Nelson, Glenn, Ceramics, A Potter's Handbook (New York: Holt Rienhart and Winston, 1960), p. 140.

Another early influence in my investigation of wall decoration was the work of the west coast potter John Mason. Unlike Jarvis and Wildenhain, Mason works with very little reliance on glazes. Most of his work is left unglazed with only the natural color of fired clay for color. Again unlike the afore-mentioned craftsmen, Mason works in high relief; the clay parts sometime being six or eight inches from (above) the wall surface. His forms seem to have a character unto themselves as they do not rely on a particular environment to aid in their appeal.

I thought at first that this aspect would make the work singular and make it hard to apply to a variety of different wall situations. Surprisingly, almost all of his work fits in well in many diverse locations. All of these wall murals are based on rock formations for a design element. The universality of a natural rock formation may be the reason why Mason does not need to adapt designs to specific places.

Thus an understanding of two successful approaches to wall mural execution has been attempted. This knowledge helped a great deal in my own investigations with wall sculpture. Obviously, the most immediate problem for me was trying to find a suitable way to relate my clay work to wall surfaces; i.e.: to try and decide which of the before mentioned trends to follow.

B. Influences Involved

It is necessary for me to relate this section in two categories; the first being the influence other craftsmen have had on me to pursue sculpture work; the second, how natural objects influence my work.

As I have previously mentioned, my background before R.I.T. was that of making pottery-i.e.: functional wheel-thrown pottery. I had planned to continue this in graduate school. An interview I had at Syracuse University with Henry Gernhardt was instrumental in my development toward sculpture work. I brought some pots with me as examples of my work and he reacted thus: "So you can make pots-so what?- what can you do with clay?- what with the way we can get clay today and glazes, I can make a production potter out of you in six months - if you really want to be a production potter, stay working in your basement - don't go to graduate school to make a lot of pots. If you can use the wheel, at least be creative. Your drawings show much more of what you can do than your pottery does."

My original reaction to this was one of distrust and skepticism. After having taught high school for two years, I felt that a teacher suggesting creativity was just shooting the breeze. However, after time and experience at R.I.T. I have grown to appreciate that advice....to a point where it has become instrumental in providing me incentive to spend a lot of time

investigating anything other than wheel-thrown functional pottery.

Another person who mentioned similar phrases was Frans Wildenhain. During my first semester critique he looked at one of my pitchers and remarked: "ah, it is good - you cannot go too much farther with wheel work, you can only learn to make them bigger and bigger." This advice convinced me that I should try to do something other than wheel work with my time. It also became apparent to me that making a lot of pottery in a school situation is out of context with the nature of the institution. One cannot be involved in a productive business unless he has the facility to bring to that enterprise. It just seemed childish to try and fantasize a business operation in the midst of the ivory tower. What was being suggested to me was that I take advantage of the idealism and protection inherent in school situations by using it as a vantage ground for investigation.

The problem for me then, was how to determine an effective approach to designing wall pieces.

C. Approach to problem solving

As a senior at New England College, I was involved in woodcut printmaking. I was very fond of German Woodcut Expressionists, mainly Ludwig Kirchner, Emile Nolde and Schmit-Ruttloff. At one point I actually

copied their prints. The clarity of line fascinated me. It seemed the woodcut had established 'hard-edge' long before modern trends adapted it. I was involved in work that was expressionist in character. The pastels and woodcuts (1) (2) (3) (4) were bold designs whose basis was a very obvious juxtaposition of shapes, a kind of basic-design orientation of positive and negative areas.

This was the background I brought to clay-sculpture work. It seemed to me that this previous work lent itself best to clay on vertical surfaces. Thus the decision was made to explore relief decoration as the particular area of my consideration of ceramic sculpture.

The first approach was one of application. I had many sketches prepared similar to (1) and (2) drawings. The idea had to be translated to clay and the first wall piece came about quite literally that way. For some reason I had to work in large scale. I just could not do small models at this time. Perhaps it was because of the large omnipresent, flat, brick surfaces that compose the Rochester Institute of Technology campus.

The procedure was to roll out a large slab of stoneware clay of approximately fifteen square feet. A drawing was then copied from my sketches on to the piece.

In some cases a large cardboard pattern was used and the clay design was traced from this pattern onto the piece. Then the slab of clay was cut apart accordingly.

The slab was about two inches in thickness and no additional clay was added to that, thus the work was a low relief piece.

For the most part, in this first piece, (5), I was concerned with form for its own sake. I made no allusion to reality. The work is a straight-forward basic-design problem in figure, ground, and color relationship. I felt as though I should limit my first attempt to simple glazing with four very obvious colors. What evolved was a puzzle of sorts with the shapes and colors interlocking throughout. It was a cubist-mechanical figure layout that seemed to be a fitting piece for an industrial environment. The weakness of the piece is apparent from first-glance. It of course shows a naivete, but this is to be expected in a first piece. The real shortcoming is in the size and shape monotony. All the design areas are of the same size, and commitment to purpose. It is what one may call a safe rendering.

To correct the problem in size relationship the next piece was designed with a large round area at one end and a long straight shape attached to it. (6). The piece was more successful in that the space areas

were interesting in their variety. The glaze treatment was essentially the same as in the first piece; three matte glazes of black, yellow, and white. Although the basic design problem had been eliminated another related situation was producing difficulty.

In striving to correct and manipulate forms the work was taking on a static appearance. The over-control of shape and form was destroying the inherent properties of clay; being a plastic medium. The pieces looked tight and measured. Another factor responsible for this was the relationship of drawing to the clay forms. The drawings were schematic patterns at best. They were not related to anything naturally occuring, not to speak of clay material.

Resolution came about in an incidential manner when I attended the Haystack summer school in Deer Isle, Maine. The school is located along the rocky coastline of Maine. The rocks are large magnificent boulders. Some of the forms are sculpture pieces in their own right. Upon seeing these I reacted very positively, as they suggested great possibility for high-relief wall mural design. I spent much of my time drawing the natural rock forms. It seemed to help a great deal in freeing up the stylistic trend that my previous ideas had. The next few pieces were more or less literal translations of the natural rock form.

A good example of this period of work is the first rock-form plaque. (7). After studying natural rock pieces, i.e. how they have formed after breaking apart and the relationship of small cracks and crevices to large unbroken surfaces, I employed these characteristics as design elements in sculpture work. Almost immediately the character of work changed. The rock form (7) bears little resemblance to previous work. It was definitely good to use nature as a focal point for an idea. Although the first pieces were formal specimen renderings of rock forms, they nevertheless provided a sound basis for later designs.

Thus my approach to problem solving in ceramic sculpture has been a series of experiences related to a progression of work. For me, this approach is relevant. I have always been good at analyzing and intellectualizing an immediate shortcoming, but the resulting remedy has always been less than satisfactory when compared to a long-term development.

The end result of my efforts at ceramic sculpture is my current work: (10), (11). The work is more subjective than previous efforts in high-relief work. I have tried to incorporate the nature of the rock form and the plastic intuitive quality of clay. The forms are no longer a literal transcription of rocks, but a more

personal reaction to the meaning rocks have for me; qualities of elegance, solidity, reverence, and grace.

The following section will deal with the adaptation of glazes to this work. Glaze application and formation held specific problems peculiar to the character of the sculpture pieces involved.

D. Glaze consideration

Specific glaze problems will be dealt with in the last two sections of the thesis. At this time it is necessary to consider glazes as related to sculptural forms.

In the first mural (5) detailed sketches were prepared previous to working with clay. The clay work was simply a medium for transfer of the drawing. The same kind of 'blueprint' technique was employed in glazing. Three colors were decided upon: yellow, black, and white. This basic color was then added to the drawing to aid in deciding which piece would receive which color. Thus the color relationship was done in as calculating a manner as the form relationships of the piece were done. The result, as previously stated, was in accordance with the technique; very tight and contrived in appearance.

The glazes themselves fit into this format. They were satin-matte glazes, whose surface quality and color was smooth and finished in appearance. The glazes were sprayed on in a controlled manner insuring even thickness

and color quality. It appeared as if someone had painted wooden pieces rather than giving the impression of glass melting over ceramic during a heating process. It could be said that there was no organic "living" quality present in my first efforts at wall designs. Everything about them was too static, manipulated, and too self-conscious. The result was a very static rendering of color in glaze.

The second mural (6) fits into approximately the same category as the first. The design was more interesting and adventurous, but the glaze was just as schematic. Again colored sketches were prepared before-hand, and the same basic matte glaze was employed. The addition of a red background increased the mannered characteristics of the work.

Actually it could be said that the glazes worked very well with these two designs. The problem was that the original concept was weak and limited and the glaze consideration fit into this format.

As mentioned in the second section of 'influences involved': the following work departed from this strict adherence to plan and color scheme. For reasons previously stated and explained, the rock-form series (7 - 11) employed more successful design ideas, the character of which was organic and sophisticated. This way of working had its own particular problems in glaze consideration.

It was apparent from the outset, that the former glazes and application techniques would not be applicable for this new work. Most of the form was in high-relief and that quality was a main-stay in the design. Any overt use of a glazed surface would detract from the varied planes and surfaces of the sculpture. At first (7) I was hesitant to use any glaze at all, but I felt that the cracks and crevices of the rock form should be highlighted as nature does it by weathering and contrast in color of the broken rock strata.

The first attempt at solution was to employ raw oxides (in this case copper) (7) in the lower sections of the relief pattern. This was done to accent the three-dimensional quality of forms. This seemed to work well, but the color was still somewhat static in appearance. The oxide had no natural runny quality as glass does in heat, and remained 'untouched' by the fire and heat.

The second attempt at solution was to employ specialized glazes to do the job. In a later chapter these will be explained more fully. Briefly, the glaze was designed to break from a matte surface into a dry, brown area. It had the same rough characteristic as the copper, but it was more in keeping with the form relationship. It was used in combination with iron

oxide to give it a black-breaking brown color arrangement. I felt that this color worked well with unglazed high-fire stoneware clay. It was now possible to produce the effect of a rock form in color and structure. The best example of this is in plaque (11).

My next concern with glazing sculpture was to try an experiment with a subtle variety of colors and glaze movement. It seemed an interesting area in which to work because to my knowledge little has been done in relating high-relief forms in mural design with high intensity color.

In plaque (8) glaze was poured at random over the surface of the clay. The form was not completely covered with glaze, much of the clay was left bare. This approach resulted in a very active surface. The blue glaze was vibrant in relation to the brown of the unglazed stoneware. The shortcoming was that the over-all appearance was one of lack of control. The clay forms contrasted abruptly with the freedom of glaze application. It seemed that there should be a compromise in the neutral appearance of plaque (7) and the free quality of plaque (8).

At this time I had been experimenting with ash-like glazes. (Specifically dealt with in section IV.) These glazes were formulated to run in a controlled manner over the surface of pottery. They would not

appear as long legged streaks as in (8) but as very slight but noticeable movements of glaze surfaces. This glaze seemed to be the medium which I was seeking. It produced interesting mottled color effects while running slightly at vitrification temperature. The surface was not glossy, thereby not detracting from the rough sculptural quality of the piece. On piece (9) this glaze is used in a minimal amount to feature the most plastic shape included in the piece. This may be a more contrived rock form than some previous efforts, but I feel that the glaze relationship in this piece is the most successful of this series.

Thus the title 'personalized glazes' is given credence in the analysis of glaze and sculpture work. It was very necessary for me to compound and formulate glazes that fit into clay vernacular as I see it. Careful glaze understanding and adaptation was important for me to successfully complete my ceramic sculpture.

III. The Matte Glaze

A. Overview

The idea of glaze consideration is based on the ceramic work involved. For me this fits into two categories; one being wheel thrown forms, the other sculptural forms. My proposal was to try and formulate a glaze adaptable to both ways of working.

I have said little about my wheel-thrown objects; this shall be explained now. As in the sculptural project, I have been concerned primarily with form. My wheel work is quickly thrown, often with throwing ridges left apparent. I spent much time studying the effect throwing ridges have on ware. In the early stages of my throwing (12), ridges were left at random with little sense of relationship to the proportion of the pot. As I became more experienced I realized that the same effect of many throwing ridges can be obtained by selectively leaving finger marks on the ware; not as ever-present as previous work. In the end the effect given by a few finger marks was more satisfactory than the proliferation of hand impressions. As an example of design progression in wheel work the following illustrations are noted: (12), (13), (14), (15), (16), (17). These slides are separated into groups of two for contrast and comparison. The first group, (12, 13), give very obvious examples of throwing

ridges. The first illustration has very bold concentric lines throughout the interior of the platter. Although interesting, the rings take on a static quality. The second offering typifies a selective use of the ridges. The decision of where to place the rings/ridges is critical. The over-all quality of this piece is more sophisticated and stronger than the previous work.

The next comparison is much the same phenomenon. The overt-boldness of pitcher (14) is an over-stated design, wherein the subtle relationships of (15) work much better. This characteristic is also present in analyzing the vase form of (16) with that of (17).

Given the sculpture and wheel forms, the next problem was how to relate a glaze to them. The clay surface in both ways of working was the major strength inherent in the designs. A glaze coating therefore should not be something to mislead or detract from this. A gloss glaze has the quality of reflecting light from its surface. This is fine for a smooth surfaced bowl or slab of clay; for it to acquire a jewel-like quality. However for my work it was necessary to provide surface quality that was less glass-like. This requires that the form be apparent and obvious, and not be obscured by reflecting light. Obviously the gloss surfaced glaze was out of the question. The matte glaze, with its

dryer, more opaque surface was more nearly the glaze that fit the purpose.

I tried many matte glazes, all of differing color intensities; as stated previously, the first group of murals was finished with a matte surface. Although this glaze presented no obvious problems, it did have a 'sterile' characteristic. For lack of any better explanation, it looked like latex water-base house paint to me. I needed something that looked more interesting, something that responded visually to the process of heat and melting of glass.

An interesting type of glaze that prompted my initial investigation was the ash glaze. Here was a surface interesting in its characteristic runny quality. The few glossy places were not objectionable, as most of the surface was a matte quality. The glaze looked very promising for adaptation to my work and investigation began as follows.

B. Statement of the problem

As a research project I have worked at producing a cone 10, matte glaze. I have chosen this because I like matte glazes and I was interested in developing new surface characteristics for them, for employment in my work.

It seemed to me that the matte glaze was the best alternative for hand thrown and sculpture work. However,

the surface quality of many matte glazes is very "finished" looking. The color and texture is consistent and continual. I proposed to try and alter the surface to make it more interesting while still keeping the non-shiny characteristic inherent in a matte glaze. The problem involved was that many ingredients added to alter the surfaces also increase fluidity, and therefore promote a glass-like glaze, something I was trying to avoid.

The search for this particular type glaze was influenced by an ash glaze of the American potter William Farrel. This glaze is based on a high ash percentage, the alkaline content being the flux. This glaze is a typical ash-type. The surface is broken by long legs or runs of glaze, caused by the movement of the glass. Although the surface was fluid, the over-all quality was semi-opaque, not glossy. I began this study by formulating an ash glaze of my own.

The glaze I was pursuing would have the following descriptions: a semi-opaque, earth colored (brownish-green) glaze, with streaks from the glaze movement on a vertical surface. The glaze would be slightly textured and mature at cone nine.

Unless specifically stated, all tests use manganese, rutile, and red iron oxide as colorants. The glaze tests were all weighed out in one hundred gram lots, screened

through forty-mesh, then a thrown test tile was dipped into each glaze.

The reader should think of the glazes in terms of raw materials and batch recipes, as that is the way I found most convenient for formulation. For sake of organization an identification symbol has been used to refer to the glazes such as A1, A2, etc. The formulas themselves are in the appendix, and may be referred to there.

C. Laboratory procedures and results

The basis for the first series of tests was a high magnesia matte glaze. This glaze was decided upon because of inherent qualities of the glaze: a fine texture, and due to magnesia; a durable and opaque glaze. Tests A-3 through A-6 used increments of iron oxide as coloring agents. Test A-1 was the glaze without additives and A-2 was with an addition of 2.5 cobalt carbonate. All of these tests had iron wash brushed on the rim under the glaze coating. Glaze application for all the tests consisted of a double-dipping, or thickness on the upper portion of the tiles with a single thickness glaze coating toward the bottom.

The first A-1 test resulted in a consistent surface quality. Where the coating was thin the color appeared to be brownish tan. Where the coating was a double

thickness the glaze was very opaque and a white-green color. On the rim the iron bled through the glaze resulting in a dark-brown green tone. The green color seemed to be coming from iron in the clay body. Test A-2 had similar qualities except that there was an over-all bluish tint from the addition of cobalt carbonate instead of the green cast in the previous work.

In tests A-3 through A-6 the increments of red iron oxide produced a green color where the glaze was thick and a pronounced brown in thinner applications. The surface was smooth and opaque. This glaze seemed to break over throwing ridges and the resulting color was darker on the ridge. In all five tests the glaze seemed to vitrify properly and fit the clay without shivering, crazing, or crawling. The increase of iron oxide was: 1.0-A-3; 1.5 A-4; 2.0 A-5; 2.5 A-6.

In tests A-7 through A-12 the same high magnesia matte base was used with increments of cobalt carbonate and red iron oxide. In general the surface characteristics were good; smooth, opaque, and an even melt was evident. The color was much darker than in the previous tests due to the presence of cobalt carbonate. Where the glaze was a double thickness (especially in A-7, A-8, A-9) the color tended to be green. This glaze also broke over throwing ridges promoting a darker color on the ridges. Where the glaze was thin the iron content

encouraged brown speckling; a mottled effect. The additions of iron and cobalt are noted in the appendix.

In the series of test A-13 and A-14 manganese, rutile, chromium, and iron were added as colorants. A-13, which used 2. manganese and 2.0 rutile, was tan-yellow in color with very obvious and frequent spotting of dark brown and black. Test A-14, which used 2.0 rutile and 2.5 chromium was much the same as the previous test, except that the color was more in the brown hue. The iron under the glaze worked very well, coming through and producing a burnt effect. Test A-15 was very different from the other two. The glaze seemed to smooth over in a more satin finish, rather than the dry matte which the others appeared to be. The iron, (1 gm) seemed to flux the glaze and produce an obvious green cast, while the 5.0 rutile gave a yellow color where the glaze broke over ridges.

In the next series, B1, B2, B3, the georgia kaolin was decreased in amounts from 33.0 called for, to 14.0. This was done to try and decrease the alumina requirement effecting a run in the glaze similar to an ash glaze, yet maintaining the basic properties of a matte appearance. Colorants were added to make the results a little more obvious. They were 1. black copper oxide and 1. red iron oxide. Test B1 had a marked increase in glaze surface

movement. The glaze had moderate run marks. The copper and iron produced a mottled black and yellow color. B2 with a kaolin content of 22.0 was very similar to B1 in color and surface. B3 with a kaolin content of 14.0, had the most glaze movement and closely resembled the ash glaze. Where the glaze ran, a green-yellow color was evident, probably due to the iron in the clay body.

In test series C1 through C7 hardwood ash was added to the same magnesia matte glaze. As a colorant in all of these tests 1.0 manganese carbonate was added to the base. C1 and C2 (.5 and 1.0 additions ash respectively,) showed no obvious difference in appearance. C3 with 2.0 ash had pronounced mottling of surface, with yellow and grey spots throughout the surface. Where the glaze was applied thickly the opaque surface was more mottled. Test C5 (10 ash) seemed to be the high-point for the mottled color characteristic within a smooth surface. The thin application had very brilliant gold and green-yellow hues, whereas the thicker application produced somewhat more subtle color tones. Tests C6 and C7, (20.0 and 30.0 ash respectively,) were dry and metallic where the glaze was on in a thick coating.

Test D1 was a single effort at an ash type glaze using no colorant. The result was a dry pale green-yellow surface, typical of ash glazes. The glaze was

applied thinly, but it was suspected that if the application was heavier, the glaze would bead and run considerably.

Test D2 was aimed at providing a dry, consistent surface for sculpture work. The result of the combination of three ingredients was precisely that. The glaze seemed to pick up iron from the clay body resulting in a pale green and blue color. The glaze was very opaque, as the iron under the coating was barely discernible.

Test D3 was high in alkaline fluxes along with a high content of ash. This resulted in a very runny glaze, probably more typically 'ash' glaze than any of the previous tests. Where the glaze puddled and took on a gloss surface a craze was evident, again typical for the high alkaline content.

D. Conclusions

The A test was run to provide insight to the quality of the base matte glaze. In that, this test was successful. This particular matte was selected for use because it was interesting of its own accord; i.e. most of the A tests did not have surfaces and color characteristics common to matte satin glazes. I felt that test A-5 was the most successful. My pottery usually has pronounced throwing ridges and this glaze with its green breaking

brown characteristic on the ridges relates especially well with the mottled brown of the smooth surfaces.

The next series of tests, A7 through A12 were successful in producing a fine series of black glazes. For me finding a good black glaze was very important because so many of the available black glazes have no high-lights and are rather stark in appearance. Most of these tests had a highlight of green and brown, depending on glaze thickness. Test A7 was especially good for having pale green color. Where the glaze was thick the green tended to be obvious. A thin application produced a black. Test A10 held the best possibility for a black glaze. Almost all black, this glaze had brown highlights when applied thinly.

Probably the most interesting of all the tests was the B group. I was interested in the effect of the ash glaze, but in a more controlled manner. Also it made good sense to artificially produce an ash effect and not be dependent on locally available wood ash. This was accomplished by decreasing the clay content or alumina in the glaze. In effect it did the same thing that additions of ash do; raise the proportion of RO, or flux to the glass-former, silica. However ash is alkaline and tends to be unstable and craze; this problem does not happen when the ingredient being considered is clay.

Probably the most satisfactory of all the series was B-3. The mottled effect on the throwing ridges was very complementary to the form of the work. The running quality was not "omnipotent", as in ash glaze, but subtle and in good proportion to the other features of the work. In comparing these results to the C-series, I suggest that they are preferred to the actual ash combinations in glazes.

The C-series was done as a counter measurement for the B series, as this was a test of actual ash combinations. The results of tests C-4 and C-5 were the most satisfactory. The ash produced a mottled color quality that is somewhat garrish. These combinations did not run as expected, but the effect was one of color dispersement.

The D-1 test was a single glaze test. It seemed to be underfired, or lacking sufficient flux, as the resulting test was dry. Conclusions are that it is not a suitable glaze as is. Perhaps with more ash in proportion to the glass and stiffener it would be better.

The D-2 test provided a suitable dry matte surface. This glaze would be adequate for sculptural work, or non-utilitarian pottery due to the rough surface. It could be improved by adding a bit more flux.

Test D-3 resulted in the closest approximation to

the standard ash glaze. Where the glaze was thick, the surface was very shiny; when thinly applied, the surface took on a dry quality. It would be good for casually-thrown wheel forms.

IV. The Crystalline Glaze

A. Statement of the problem

Along with my consideration of matte glazes, I have also researched crystalline glazes. As has been found with a variant of the matte glaze, I have discovered the potential of the crystalline glaze in relation to my ceramic work.

Crystalline glazes, strictly speaking, are of two types: one has large crystal clusters on the surface of the glaze; the second type called aventurine, has single crystals in smaller clusters suspended in the glaze. The problem with crystal glazes is that the crystals are sometimes an overpowering design element if they are large and metallic. The presence thereof can displace inherent strengths of form in fired clay. My problem was to try and produce a glaze with small enough crystals to lend subtle interest to the surface area, but not so overwhelmingly interesting to distract from the piece at large.

As a general rule, crystal formation is promoted by additions of zinc, titanium, and iron. These in combination with alkaline fluxes should produce crystal

development. Another help in the process is the firing cycle. A firing, after reaching vitrification temperature, should be allowed to drop only about one hundred degrees fahrenheit after maturity, and then be held at this level for several hours before cooling. As I was interested in small crystal development, this was no problem. I ran these tests in an ordinary stoneware glaze cycle hoping that quick cooling would aid in preventing large crystal development.

The format for glaze calculation and mixing is the same as in the previous section. Organization is, again, identification by symbol, i.e: E1, E2, etc. The formulas may be found in the appendix.

B. Laboratory procedures and results

The test E1 was formulated in hopes that the iron in the ball clay would combine with the very large proportion of zinc oxide to form small crystals. The result was that some crystal development did occur, however the large zinc content and alumina content produced a glaze with a very dry opaque surface. The color was grey-green. The glaze fit the clay body well as there was no evidence of crazing or shivering.

Test E2 was formulated with a low clay quantity, as this is helpful in forming crystals. Its high zinc content combining with titanium would be helpful.

The result was in keeping with the prediction. The glaze had a smooth glossy surface. There were some small zinc crystals present, however, the small amount of rutile seemed to do more to encourage a rutile blue color than promote crystals. The brown quality near the surface of clay could be zinc crystals.

The E3 test was originally an albany-slip glaze with whiting present to help bleach dark iron pigment from the slip. Although the glaze had a high alumina content present in it, I felt it was worth experimenting with increments of zinc oxide and rutile to combine with the iron and produce either a zinc silicate crystal or rutile crystal.

The additions of a moderate amount of zinc oxide were very similar in appearance in all of the following glazes: E3A; E3B; E3C. Results were the same; the color varied from yellow- green to blue. The throwing ridges were revealed by a broken glaze to be brown. The glaze seemed to fit well; there was no evidence of crawling or crazing. Crystal development was noted by a semi-rough texture where the glaze was thick. Color varied considerably with thickness and glaze movement.

Tests were done to investigate the possibility of using a bristol glaze as a base for crystal development. Bristol glazes are usually formulated for an industrial,

one-fire technique. For this reason they usually contain a large amount of clay for glaze adherence. Zinc is also present in commercial renditions of the bristol glaze to produce: opacity, reduction of expansions and an increased firing range.

In tests E4, A,B,C, it was desired that decreases in the amounts of alumina would promote crystal development by the action of the alkaline fluxes combining with the zinc and flint. The results were hardly discernable from one another. Using red iron oxide as a colorant, it seemed that E4b and E4c were more pale red in hue than the first test, as the surface was very strong red in color, and was glossy and bright. The color or semi-opaque glaze quality was not affected by thickness. There was no crystal development evident anywhere in this glaze.

C. Conclusions

It was concluded that test E1 was satisfactory in the aspect that crystal development did occur. The surface being very dry, lends itself to working on sculpture work; light would not be reflected from the surface of the work, thus not affecting the form relationship. The glaze fit very well so expansion factors are not a problem. The crystals might become more obvious if there were more free silica in the glaze

for the zinc oxide to react with. Therefore, additions of flint would be in order if one were to desire a more pronounced glass-crystal development.

The surface quality in test E2 did much to highlight the blue-brown color arrangement. A bright glossy surface, it seemed to be consistent at whatever glaze thickness was used. There were small crystals evident. The crystals were of two kinds, a rutile crystal and a zinc crystal. The zinc crystal seemed to be more obvious after a thin glaze coating. Near the surface of the clay, the rutile crystal was obvious where the glaze was thick, contributing to the striking blue color of the glaze. Aesthetically this glaze is very bold and garrish. Used in a minimal manner, it could be very effective.

Test E3 was the most visually interesting of all the new glazes. The character of the glaze is based upon two phases of glass melting but staying separated in layers. It produces a mottled color effect that is enhanced by the slight movement of glaze in heat. The calcia tends to bleach the albany slip and the iron in reduction giving a green tint to the surface. Titanium is added, to encourage rutile crystal development, and this can be recognized by the yellow crystalline surface spots.

As in test E2 this glaze could be very effective if used sparingly.

In test E4, the A,B,C, series were very similar. It was, technically speaking, the best result of the entire project. The glaze seems to be very consistent in fitting and color relationships. This is probably the reason why it is used in great abundance commercially. One commercial use for the glaze is in manufacturing architectural bricks. One can understand why such a reliable glaze would be a necessity in that kind of production.

For my uses and interests, one of muted color and texture in glazes, the Bristol glaze is of little help. The surface is a bit too static in its perfection.

SUMMARY STATEMENT

Much has been learned about the relationship of glazes to the clay work I produce. The most recent pottery and murals bear testimony to that. Although in number, the amount of original useful glazes is small, the two or three glazes arrived at work extremely well with the shapes and forms they were on.

As has been mentioned repeatedly, I was not interested in a static, finished appearance. The technique found most useful in that regard was a double dipping of two or more glazes. This helped the glaze to move, or run during firing, and provided for an interesting surface arrangement of color and texture.

This employment of technique is very evident in figures (18), (21) and (22). This glaze is combination of E-3B and E-5. E-3B is used under the dry matte glaze and the results are an interesting mottling of brown, orange and black hues. The glaze works extremely well with the surface treatment of the clay, i.e. note the glaze break-up on the handle and lid of (21). Of all the glazes discussed, I was most satisfied with this one. Another characteristic of this glaze is the pleasant way in which it moves in relation to finger ridges left on the ware. Attention is again given to (18) and the variety of color accompanying the two

ridges left on the jar.

The double-dipping effect is best illustrated by figures (19) and (20). The glaze used here was a standard matte glaze with a 5% ash increment: E-6. The over-lapping of glaze thickness produced an interesting variety of color and texture. On (19) the lower portion of the jar has a double thickness of glaze producing a light color on the bottom. The colored bands on these pieces were produced by brushing on standard washes.

A summation of sculpture work is given by reference to figures (23) and (24). The same black-ash-matte glaze, A-10, was employed, as in earlier work. Through involvement with this kind of sculptural high-relief work, the forms have become more sensitive and sophisticated. Growth through this investigation is measured by a comparison of early considerations of glaze and form in clay; 5,6,8,12,14 with later investigation (18-24). The reader may draw his own conclusion, for me this thesis has been a worthwhile learning experience.

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APPENDIX

Formula		Test Number	Coloring Oxide
Base		A-1	0
Buckingham Spar	26	A-2	2.5 $CoCO_3$
Georgia Kaolin	33	A-3	1.0 Fe_2O_3
Dolomite	26	A-4	1.5 Fe_2O_3
Whiting	7	A-5	2.0 Fe_2O_3
Flint	7	A-6	2.5 Fe_2O_3
	99	A-7	1. Fe_2O_3 & 2.5 $CoCO_3$
		A-8	1.5 Fe_2O_3 & 2.5 $CoCO_3$
		A-9	2.0 Fe_2O_3 & " "
		A-10	3.0 Fe_2O_3 & " "
		A-11	4.0 Fe_2O_3 & " "
		A-12	5.0 Fe_2O_3 & " "
		A-13	2.0 MnO_2 & 2. Rutile
		A-14	2.0 Rutile & 2.5 Cr_2O_3
		A-15	5.0 Rutile & 1. Iron

Buckingham Spar	26.0		
Georgia Kaolin	33.0		
Dolomite	26.0	B-1	1.0 CuO 1.0 Fe_2O_3
Whiting	7.0		
Flint	7.0		

Buckingham Spar	26.0		
Georgia Kaolin	22.7		
Dolomite	26.0	B-2	1.0 CuO 1.0 Fe_2O_3
Whiting	7.0		
Flint	7.0		

Buckingham Spar	26.0		
Georgia Kaolin	14.0		
Dolomite	26.0	B-3	1.0 CuO 1.0 Fe_2O_3
Whiting	7.0		
Flint	7.0		

Buckingham Spar	33.0	C-1	1.0 MnO_2 & .5 Ash
Georgia Kaolin	14.0	C-2	1.0 MnO_2 & 1.0 Ash
Dolomite	26.0	C-3	1.0 MnO_2 & 2.0 Ash
Whiting	7.0	C-4	1.0 MnO_2 & 5.0 Ash
Flint	7.0	C-5	1.0 MnO_2 & 10.0 Ash
		C-6	1.0 MnO_2 & 20.0 Ash
		C-7	1.0 MnO_2 & 30.0 Ash

Buckingham Spar Ash Hardwood Kaolin Whiting		D-1	0
Hardwood Ash Georgia Kaolin Flint		D-2	10.0 Fe_2O_3
Hardwood Ash Buckingham Spar Whiting		D-3	0

Kentucky Sp. Ball	23.6			
Whiting	23.6	E-1	0	
Soda Spar	10.6			
Zinc Oxide	47.0			
Whiting	10.0			
Zinc Oxide	26.0	E-2	Rutile 40	
Kaolin	6.0			
Flint	20.0			
Neph. Sy.	34.0			
			ZnO	Rutile
Albany	80.0			
Whiting	20.0	E-3A	5.0	5.0
Edgar Plastic Kaolin	20.0			
Albany				
Whiting		E-3B	10.0	5.0
Edgar Plastic Kaolin				
Albany				
Whiting		E-3C	20.0	5.0
Edgar Plastic Kaolin				

Bainbridge Spar	47.0		
Whiting	8.3		
Zinc Oxide	6.7	E-4A	0
Ball Clay	1.0		
Kaolin	1.0		
Flint	36.0		

Bainbridge Spar	47.0		
Whiting	8.3		
Zinc Oxide	6.7	E-4B	0
Kaolin	1.0		
Flint	36.0		

Bainbridge Spar	47.0		
Whiting	8.3		
Ball Clay	1.0		
Zinc Oxide	6.7	E-4C	0
Flint	36.0		

Kona - F4 - Feldspar	49.0	
Edgar Plastic Kaolin	25.0	
Dolomite	22.4	E-5
Whiting	3.5	
Hardwood Ash	5.0	

Ball Clay	100	
Nepheline Syeninite	170	
Whiting	40	
Calcined Kaolin	180	E-6
Cornwall Stone	250	
Dolomite	140	
Talc	140	

List of Illustrations

WORK PICTURED

Figure 1. Woodcut Dim. 18" by 14"

Figure 2. Drawing Dim. 20" by 30"

Figure 3. Woodcut Dim. 14" by 18"

Figure 4. Woodcut Dim. 10" by 10"

Figure 5. Mural Dim. 3' by 5'

Figure 6. Mural - Detail

Figure 6. Mural Dim. 3' by 5'

Figure 7. Mural Dim. 6' by 4'

Figure 8. Mural Dim. 3' by 2'

Figure 9. Mural Dim. 4' by 1'6"

Figure 10. Mural Dim. 2' by 3'

Figure 10. Detail

Figure 11. Mural Dim. 5' by 2'

Figure 11. Mural Dim. 5'6" by 2'

Figure 12. Platter Dim. 18"

Figure 13. Platter Dim. 19"

Figure 13. Platter Dim. 19"

Figure 14. Pitcher Dim. 8"

Figure 15. Pitcher Dim. 11"

Figure 16. Pitcher Dim. 13"

Figure 17. Vase Dim. 10"

Figure 18. Brown Jar Dim. 10"

Figure 19. Stripped Jar Dim. 12"

Figure 20. Small Covered Jar Dim. 8"

Figure 21. Cylinder Jar Dim. 14"

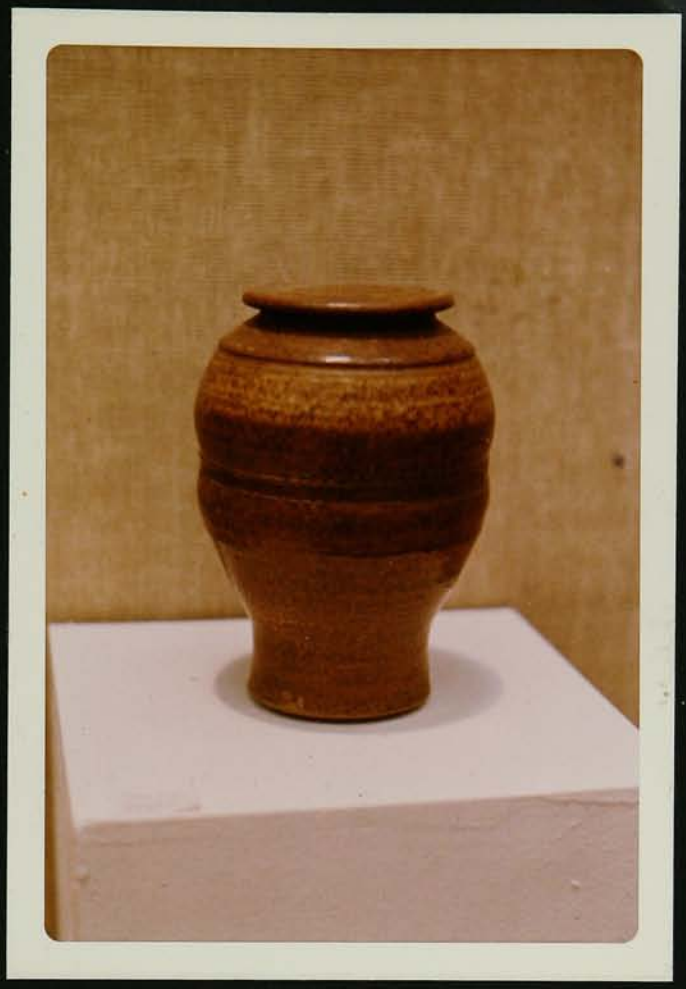

Figure 22. Brown Jar Dim. 12"

Figure 23. Rock Form #3 Dim. 5'

Figure 24. Rock Form #4 Dim. 5'