5-15-1973

Serving Dishes

J. Freimarck

SERVING DISHES

J. Freimarck

A thesis submitted in partial fulfillment of the requirements for the Master of Fine Arts Degree, in Ceramics, in the School for American Craftsmen, College of Fine and Applied Arts, Rochester Institute of Technology.

May 15, 1973

Advisors: Hobart Cowles
Robert Schmitz
Frans Wildenhain

Thesis Proposal

I propose to work on a variety of open and covered dishes that can be used for cooking, serving, or eating food. The forms will be thrown on the wheel, or made on drape molds. All of the pieces will be ovenproof and, if clay and glaze experiments are successful, a limited number will be flameproof as well.

Table of Contents

List of Plates

I selected my thesis subject, "Serving Dishes," for several reasons. Most immediately I chose it because I intend to set up a shop as soon as possible. It seemed prudent to find out something about molds, ovenware, and flameware before I left the resources of R. I. T. behind.

A less obvious, but more fundamental reason for this choice, stems from my concern with functional pottery. The essence of pottery, for me, is that it symbolizes man's simultaneous need to order his world and satisfy his physical needs. I enjoy working with the traditional forms of pottery, trying to discover new things perhaps, but just as important, participating in the tradition.

I cannot really explain why a sense of continuity with past actions is important to me, because I have never been able to express my sense of wonder at the mere fact of existence. I think about "life" a lot. But, not getting past the first step, deprived of epiphanies and epigrams, I am left in a barely coherent state. When I was in the

Merchant Marine some time ago, I always rose before first light, and wherever we were, the North Atlantic in January, or the Indian Ocean in July, the thing I was most aware of at dawn, was not the sun rising, but our wake disappearing on the trackless sea. Recently I came across a Japanese poem, written by the monk Mansei during the Heian period, which captures something of the sense of time and mutability which often concerns me:

> This world of ours ---
> To what shall I compare it?
> To the white waves behind a boat
> As it rows away at dawn.

It is perhaps, the sense of impermanence which I am most aware of in pottery. Easily made and broken, it is mud raised temporarily to another plane of existence, much like man himself. I make pottery in order to take part in, and emphasize, this process. I make functional pottery in particular to remind myself, and the eventual user of the piece, that the daily routine is life itself. It seems appropriate then, to concentrate attention on pieces used to serve food; for a meal is an admission of the passage of time, the loss of energy, and yet it is also an affirmation of life.

However, a sense of awe alone is not going to make a good pot. The job is to translate abstract ideas and feelings into a physical object, which in turn becomes a vehicle of thought for the viewer. How directly these "literary" concerns can be made obvious to the viewer is another question. But I do believe a body of work has integrity only when it results from the attempt to embody an idea in a physical shape.

I have tried to express some of my concerns through the design of my pots. Intellectually I would like to be more involved with organic concepts. But emotionally I seem unable to deal with them at this time. I suspect my sense of form is not sophisticated enough. But I also feel I am concerned with another, conflicting, idea. This is that man is not merely part of the ebb and flow of life, but asserts himself in it, even against it, searching for the perfection he lacks, as if to be in some way perfect would be to gain immortality. This perfection can be perceived, or tentatively stated, but never attained.

Geometric forms have this perfection, and in many of my pots I have tried to create, in form or decoration, a sense of geometric shapes working against irregular ones. The "cauliflower" bowls in Plate I are made with barely manipulated slabs, but have bases cut in rough geometric shapes. Some of the slab dishes, such as those in Plates III and IV, are square with irregular glaze lines and wire cuts.

Plate I

Plate II

Plate III

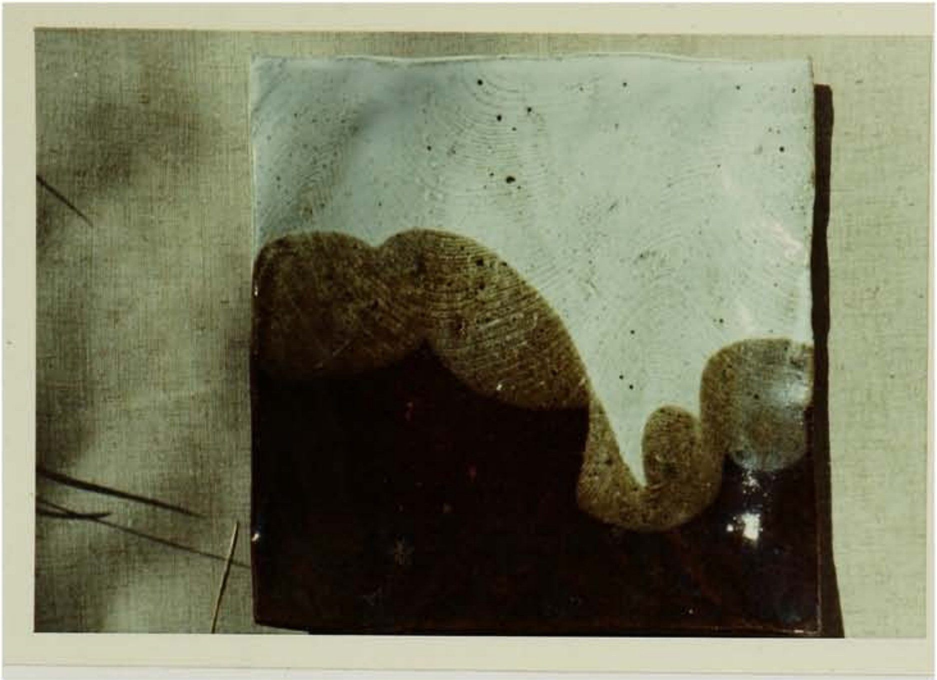
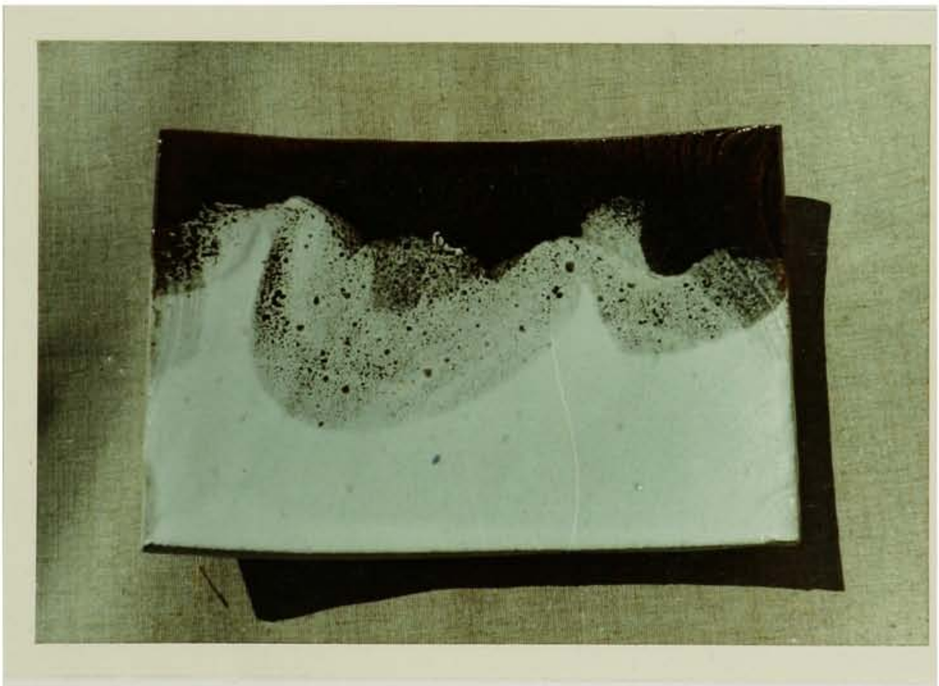


Plate IV



Other slab dishes, like that in Plate V, combine natural and cut sides. The green glaze on these pieces is an unadjusted slip clay dug from the roadside in Victor, New York. It is not an exciting glaze for many people; but I use it frequently because of its conceptual value, its "naturalness."

Treatment of more traditional shapes is slightly different, but produces similar effects. Thrown bowls are sometimes gently deformed, as in Plate VI. Fingerprints occur on hard edge lines, Plate VII. With other pieces the black glaze, appropriately called Perfect Black, functions as a negative area, breaking and reinforcing the form, as in Plate VIII.

II

The molded plates are all simple geometric forms. Plates usually are, so I do not claim anything on that score. However, the use of molds does not produce the factory like regularity one might expect. In fact, none of my molds are perfectly symmetrical. This, combined with cutting the rims without a template, and the manipulation incurred while removing the mold, creates more variation in a molded plate than a thrown one. This softens the geometric form, making its statement more tentative, still, in some small way, in a state of flux.

Plate V

Plate VI

Plate VII

Plate VIII

My first mold was made with clay because I was not sure how to proportion a mold and did not want to be limited by the short setting-time of plaster. This approach worked so well that all of my prototype molds are clay. The molds, except for round ones which are thrown, are made in the following manner. First, I decide on the final dimensions of the piece, and increase these by 15 to 20 per cent to compensate for the combined shrinkage of the mold and the piece made from it. Then overhead and cross section views of the mold are drawn on paper and cut out. The overhead view is used to establish the pattern on top of a slab of clay, while the cross section view is transferred to a piece of wood which is used as a rib, or template, for the sides.

The clay is Cedar Heights "Redart," with a 25 per cent addition of A. P. Green,"Empire G", grog. Redart has high bisque strength and the recipe is simple. To lighten the molds and avoid drying problems, I hollow the molds out, leaving a handle in the back. The handle is a matter of convenience, and sometimes, necessity. My octagonal dishes must be taken from the mold while too damp to lift off, yet dry enough to have begun riding up on the mold. They can be removed only by turning the mold over and pulling up on it with one hand, while pushing down on the plate with the other. A mold resting on the contracting plate will cause it to crack.

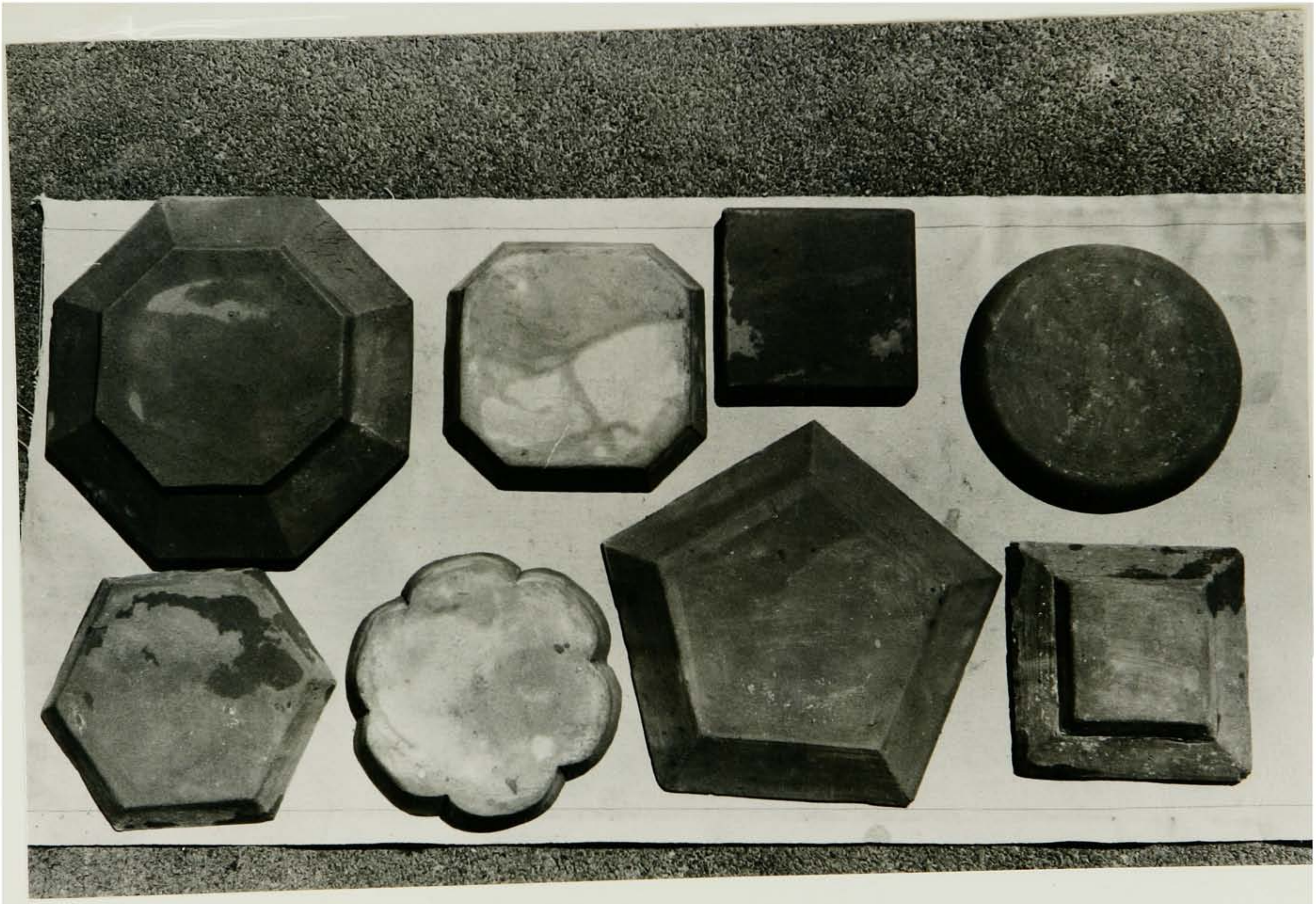


Plate IX Bisque molds

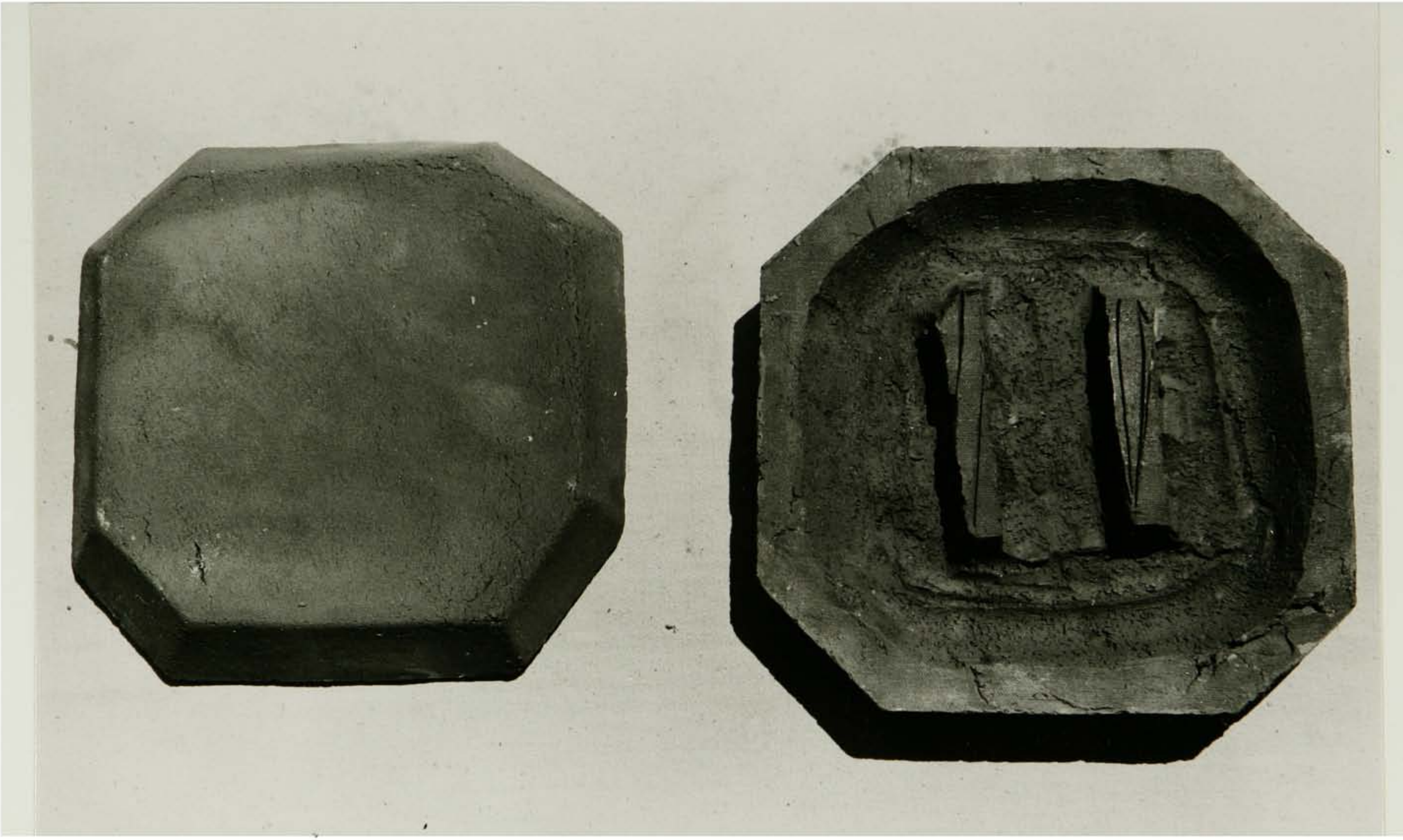


Plate X Left, press mold. Right, reverse of original.

The bisque molds are very good, and I have come to prefer them to plaster in every way. There is little breakage or chipping, and no plaster contamination. More important, the bisque mold has a faster absorption and drying rate. It also seems to have better release characteristics.

However, I was not convinced of this superiority until I made the plaster molds. I wanted a number of similar molds and thought plaster would be the answer. I can remember few more time consuming, frustrating, experiences. The first step into this mess was deceptively simple. Not wanting to lose my bisque mold in the plaster, I made a clay negative of it, then cast a plaster positive. Easy. After that I made every mistake in the book. I soaped the mold, but not the flashing; the negative cracked. I soaped everything so well I could not seal the flashing to the table top. I poured the plaster too fast and floated the mold. Finally I got some negatives. But the plaster I poured into them had a higher density; this enabled the new, expanding, plaster to crack the molds. I was in the plaster room so long people thought I was away on vacation. Plaster is easy to work with once you know how; Appendix A contains some information I found helpful.

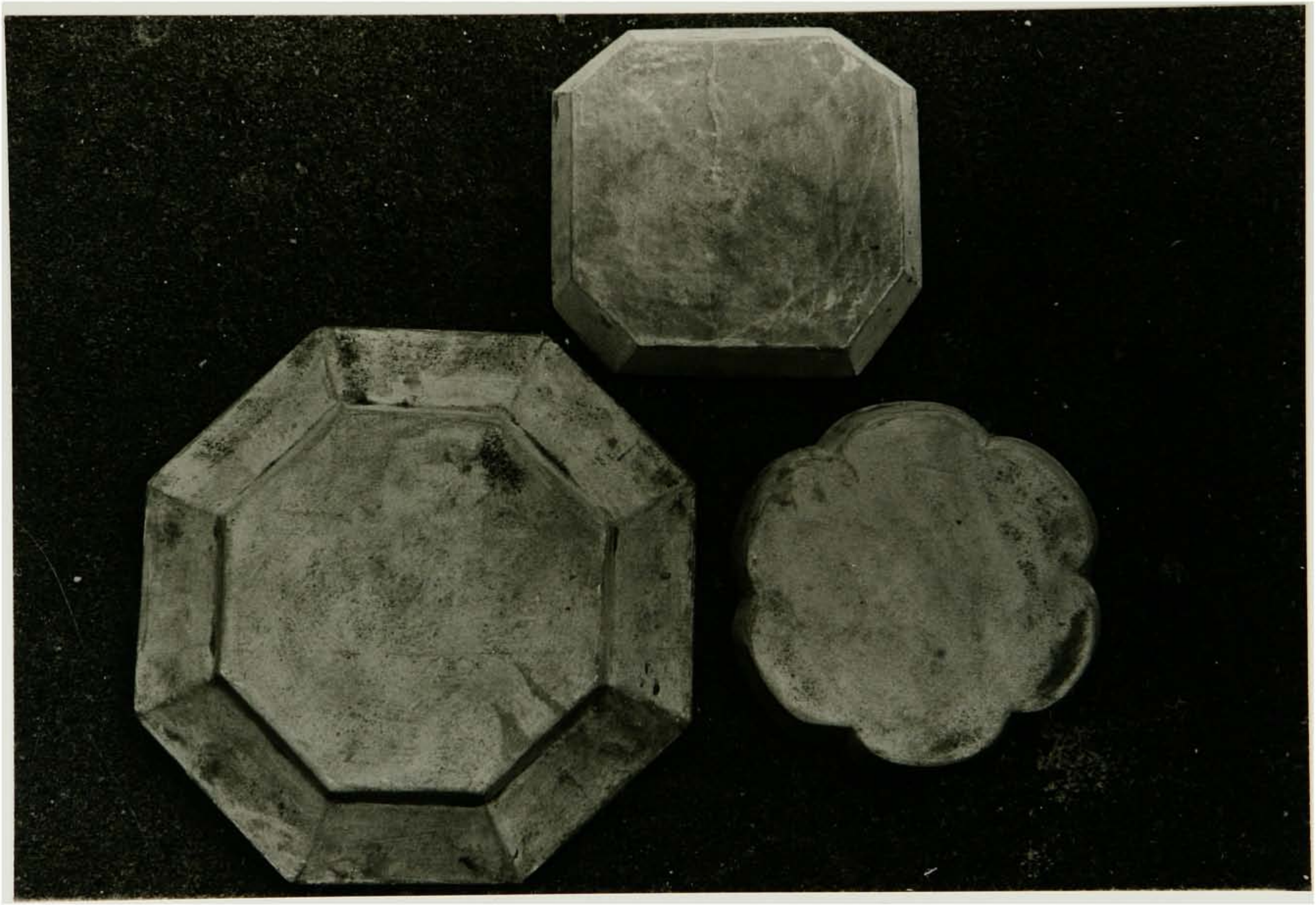


Plate XI Plaster molds

After a long time I emerged with my positive molds. While they were setting up I put in string handles anchored with washers. When the molds were dry I used a surform file to trim the edges and, on the octagonal mold, to establish the cutting angle.

These molds were satisfactory. But I preferred the bisque molds. Pretty soon I was pressing Redart slabs into the plaster negatives. The resulting bisque molds were, of course, a bit smaller than the original one, but otherwise they were fine. This established, I think, the one place I would use plaster again. With a design I was sure of, I could further shorten the process by making a plaster mold of the fresh clay model.

III

I make slabs for the plates in two ways. The first, which may well be the fastest although I use it least, is what I call "floor pulling." To do this I flatten a ball of clay slightly and then, kneeling on the floor, throw it gently to the concrete surface while simultaneously pulling it towards me. It is turned over and the process repeated. With a little practice any geometric shape can be approximated.

If the clay is not turned over, but constantly pulled with the same side up, it begins to tear and becomes less and less plastic. However, this produces an interesting, cracked, surface texture. The edges of the slab can be enhanced by a soft wavelike ridge if, prior to pulling, the sides of the flattened ball are squared up. I use these slabs for the cauliflower bowls, and dishes such as the one in Plate XII.

Turning the clay over with each pull produces a smooth, plastic, slab with edges more fluid looking than those of a rolled slab. These are used for dishes like the one shown in Plate XIII.

"Floor pulling" can also be used for molded plates. A weighed ball can be pulled to an almost perfect fit. A rolling pin and extra clay quickly remedy any shortcomings. I suspect this is the fastest method for making medium sized slabs. However, most slabs for the molded plates were made by the second method of wedging blocks of clay and slicing them.

I originally did this to obtain plates with a wire cut pattern on the surface. In order to produce a number of plates at once, I built a square frame of 1" x 3" pine which can be made smaller inside by adding precut boards. A large ball can be forced into this frame, saving time and producing a compressed block of clay. The frame is removed and the clay

Plate XII

Plate XIII

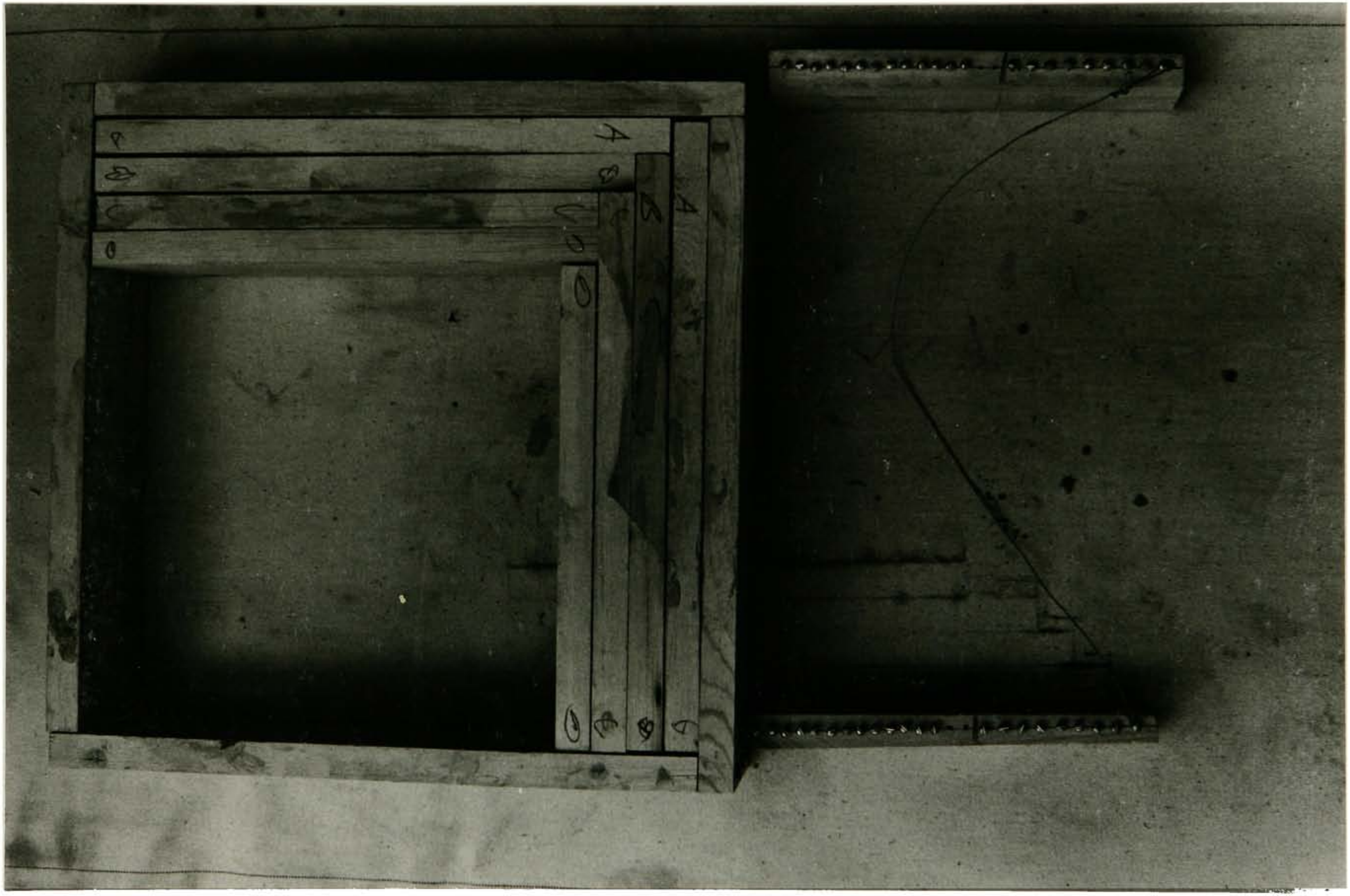


Plate XIV Slab box and cutting wire

cut with a wire looped over screws placed at 3/8" intervals on two pieces of oak. The wood is drawn along the table top, while the wire is moved up or down before each cut.

Before using the slabs I roll them out a bit to add strength, and to remove the wire marks; the surface is finally smoothed with a rib. This entire slab making process is very logical and orderly, but quite time consuming.

Draping a mold is an uneventful process and I have only a few things to say about it. First, when fitting the slab do not push clay up into the bottom; it causes bowing. Last, cheese cutters are best for cutting along the edge of a mold; they shave off less plaster, and give a surer cut even on bisque molds.

If draping is simple, the next step, bisquing, makes up for it. My plates cannot be stacked in the usual way because the rims are too uneven. However, they can be placed inside each other if enough silica sand is put in the bottom of each plate so the next one will clear the sides. Theoretically these stacks can be high, but in practice three is best. Taller stacks are hard to heat and cool evenly; sometimes all but the top and bottom plate will crack. Despite a relatively high loss in the bisque, the steep sides and narrow rims of the plates eliminate severe warping in the glaze firing.

IV

All of these plates are made with "ovenware" clay. I became interested in ovenware when I noticed how often I heard about casseroles and platters cracking in the oven. Since my storage space was limited, I wanted an ovenproof body I could use for all of my throwing. I read Cardew and Flanery, talked to other potters and came up with a number of approaches to adjusting a stoneware body for ovenware.[1] The following points can be combined in any logical fashion.

1. Decrease silica. The goal is a low coefficient of thermal expansion. "Quartz inverts from its alpha form to a beta form at [1060°F.] with a sudden expansion of 2.2 per cent. Free quartz is converted to tridymite at [1598°F.] with an abrupt expansion of 15 per cent. Free quartz reverts back to its alpha form, with corresponding contractions, upon cooling."[2] Another form of quartz, cristobalite, has an alpha-beta transformation between 392-578°F. Its expansion is three times greater than that of quartz. Furthermore, some free quartz begins to

---

[1]Michael Cardew, Pioneer Pottery (New York: St. Martin's Press, 1969). Rick Flanery, "Stoneware and Porcelain Fireplaces" (unpublished M.F.A. thesis, R.I.T., 1969).

[2]John Dickerson, Raku Handbook (New York: Van Nostrand Reinhold Co., 1972), p. 17.

convert to cristobalite at 1832°F.[3] Several things can be done. Flint can be dropped from the body, or milled zircon substituted. Calcined alumina can be added to combine with the free silica and form mullite. Kyanite can also be added.

2. Use the body with the least free silica.[4]

3. Do not overfire the body. A glassy body is brittle.

4. Avoid alkaline fluxes. Use high alumina (steatite) talc rather than spars.

5. Fire only to cone 4. This is just before cristobalite forms.

6. Increase porosity. Add fireclay and grog.

7. Decrease porosity. Increase conductivity in an already dense body by adding silicon carbide grog, or graphite.[5]

8. A rapid cool between 2372°F. and 1832°F. reduces the formation of cristobalite.

9. Avoid thick walls.

10. Have a good glaze fit.

Most bodies can be used in an oven for months before cracking. A test for thermal shock resistence should be severe enough to produce immediate results, yet not demand the strength more appropriate

---

[3]Cardew, <u>Pioneer Pottery</u>, p. 38.

[4]Appendix B contains a partial list of SiO_2-Al_2O_3 ratios.

[5]B. Williams, notes from a George Weltner lecture.

to flameware. I never did find such a test, and I do not know how to determine, without laboratory analysis, if a body is ovenproof. However, I was able to make some definite improvement in my body. I eliminated flint and feldspar from my body, doubled the grog, and was already using low silica clays. Cardew mentions talc will aid the formation of a cordierite body at cone 10.[6] Cordierite, $2MgO.2Al_2O_3.5SiO_2$, has very low thermal expansion. I made a 5 per cent addition of steatite talc to my body and it seemed to work well. Then, being a typical American consumer, I decided twice as much would be twice as good. The clay bloated terribly. I went back to 5 per cent and have had no further difficulties using the following body and glazes for ovenware.

Body	Cedar Heights "Goldart"	50
	North American Fireclay	20
	Kentucky "Special" Ball Clay	15
	Steatite Talc	5
	A. P. Green "Valentine PBX" Fireclay	8
	A. P. Green "Empire G" Grog	8

Glazes Victor Slip

Carol's White

Nepheline Syenite	25
Georgia Kaolin	7
Flint	25
Cliffstone Whiting	15
Talc	13
Zircopax	15

[6]Cardew, Pioneer Pottery, p. 75.

Alec Hazlett's Clear

Nepheline Syenite	10
Clinchfield Feldspar	20
Georgia Kaolin	24
Flint	38
Cliffstone Whiting	24
Bone Ash	8%
Red Iron Oxide	0-10%

Perfect Black

Clinchfield Feldspar	42
Flint	23
Cliffstone Whiting	13
Kentucky "Special" Ball Clay	8
Cobalt Oxide	4.7
Red Iron Oxide	3
Chromium Oxide	1
Zinc Oxide	2

One additional approach I did not try, but will look into, is the addition of calcined spodumene to the body. John Dickerson uses it to increase shock resistence of raku clay, and my own work on flameware suggests this might be beneficial.[7] The use of low-iron spodumene, reportedly now available in commercial quantities, should minimize the problems regular spodumene can create with glaze color.

V

However, large additions of spodumene might create problems with the glaze fit. This has been my biggest difficulty in trying to develop a flame-

---

[7]Dickerson, Raku, p. 17.

ware body. I do not care for ceramic frying pans; although decorative, they are simply not as safe or effective as metal ones. The only art proper to the kitchen is the art of cooking; the ceremony should be saved for the eating. For this reason I do not make frying pans, bundt cake pans, or anything else in which food is cooked, but not served. My interest in flameware is confined to casseroles and baking dishes made for recipes which involve sautéing, or bringing the contents to a boil during intermediate steps.

My first working information was the rumor Bill Sax's flameware was 60 per cent fireclay and 40 per cent petalite. Cardew, who doubts good flameware can be made between cones 6 and 9, suggests a body of 40 per cent clay and 60 per cent petalite or spodumene.[8] He compares the two latter materials and merely notes the slightly lower thermal expansion of petalite.[9] However, John Fishwick's research has shown spodumene, ($Li_2O.Al_2O_3.4SiO_2$), is actually superior because it, unlike petalite, ($Li_2O.Al_2O_3.8SiO_2$), can pick up free silica. At 1800°F. it undergoes an irreversible change to beta spodumene, accompanied by a 33 per cent increase in volumne. This material forms a series of associations ranging

---

[8]Cardew, Pioneer Pottery, p. 75.

[9]Ibid., p. 56.

from $Li_2O.Al_2O_3.4SiO_2$ to $Li_2O.Al_2O_3.8SiO_2$.[10] Fishwick writes: "The ability of spodumene to assimilate another 4 mol. of silica, thereby lowering its expansion coefficient, makes it a more desirable mineral for thermal shock applications than petalite."[11] Experiments showed a 10 per cent addition of spodumene to kaolin eliminated the formation of cristobalite at cone 10, while cristobalite was present even after a 30 per cent addition of petalite.[12]

Studio potters have traditionally used petalite for shock resistence. However, on the basis of my reading, and due to a temporary shortage of petalite because of the embargo against Rhodesia, I decided to change Sax's recipe from 40 per cent petalite to 33 per cent spodumene. I planned to make successive decreases in the spodumene, but did not get to it because of problems finding a glaze to fit. However, I did mix up test batches of the following flameware bodies.

---

[10] John H. Fishwick, "Spodumene aids fast firing, improves bodies," Ceramics Industry Magazine, May, 1967, p. 35.

[11] Fishwick, R. R. Van der Beck, R. W. Talley, "Low Thermal Expansioh Compositions in the Systems Spodumene-Kaolin and Petalite-Kaolin," American Ceramic Society Bulletin, XLIII, (1964), p. 835.

[12] Ibid., p. 833.

			%Shrinkage Dry	Total	%Absorption
A.	Spodumene	3.3	4	5	12.30
	A.P.Green Fireclay	6.6			
B.	Spodumene	3.3	5	7	10.70
	A.P.Green	5.1			
	Tenn. "#5" Ball Clay	1.5			
C.	Spodumene	3.3	6	10	12.95
	A.P.Green	3.3			
	Tenn. Ball	3.3			
D.	Spodumene	3.3	6	11	0
	Tenn. Ball	6.6			
E.	Spodumene	3.3	3	4	1.33
	North American Fireclay	6.6			
F.	Spodumene	3.3	5	9	.53
	North American	3.3			
	XX Sagger	3.3			
G.	Spodumene	3.3	6	8	2.70
	Talc	.2			
	A.P.Green	1.3			
	Goldart	1.5			
	Tenn. Ball	1.8			
	Bentonite	.2			

Body G is from a list of flameware bodies proposed by George Weltner.[13] I made bowls from each body, placed them while empty over a gas flame for 15-20 minutes, then dropped them in cold water, sat them on ice, threw them in the snow, and they all survived. The bodies throw without too much difficulty and the stage for trimming and adding handles, though shorter than usual, is long enough not to cause any problems.

The real difficulty is getting a glaze to fit these bodies. I avoided spodumene based matts

---

[13]Appendix C contains a list of these bodies.

because I wanted to eliminate the metallic scratches kitchen utensils leave on matt glazes. Hoping to find a glossy glaze I made at least 150 glaze tests on over 300 test tiles. But all of the tests showed signs of both crazing and shivering. This produced cracks that could not only be seen, but often felt as well. The glazes stayed on the tiles during fast heatings and coolings, but I did not feel the results were acceptable.

Frustrated, I put the whole thing aside until I picked up the April, 1973 issue of Ceramics Monthly and found a list of lithium glazes developed by Richard Behrens.[14] Two of the glazes work on flameware! Whew.

A. Carmel Gloss

Amblygonite	27.5
Dolomite	12.8
Kaolin	21.2
Flint	38.5

B. Grey Gloss to Lavender Matt

Lepidolite	50
Ba Co_3	20.2
Whiting	4.8
Kaolin	9.3
Flint	15.7

[14]Richard Behrens, "Glazes from Lithium Compounds," Ceramics Monthly, XXI (April, 1973), pp. 42-43.

Plate XVI

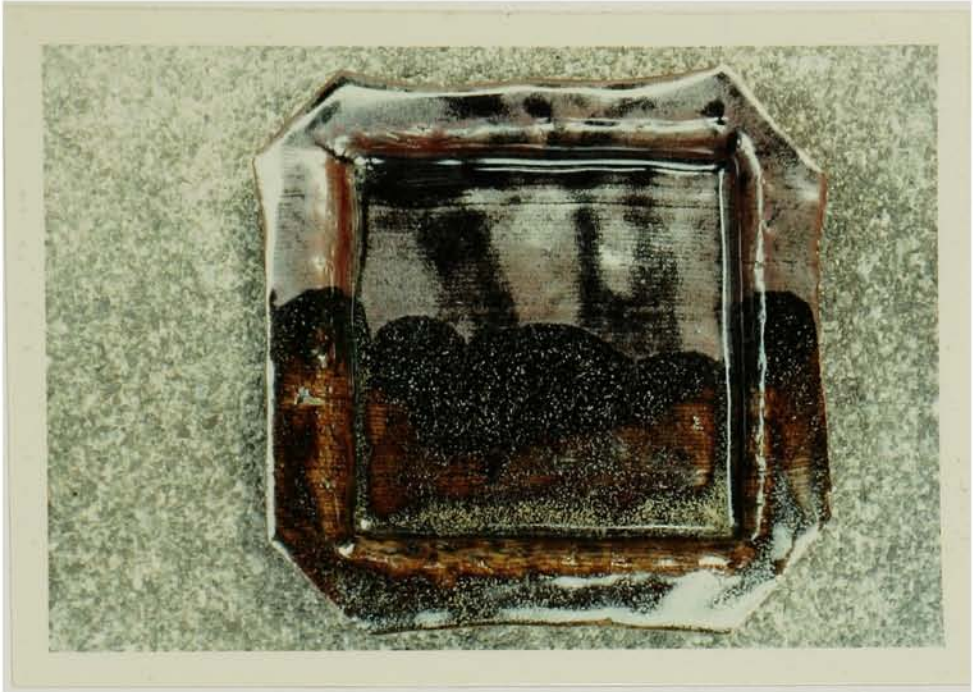


Plate XVII

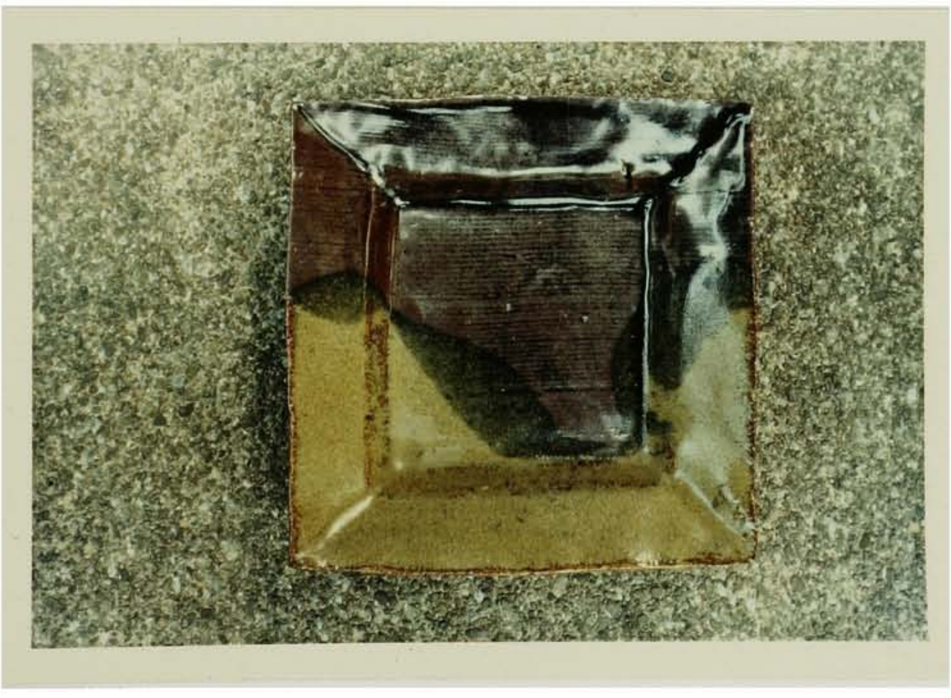


Plate XVIII

Plate XIX

Plate XX

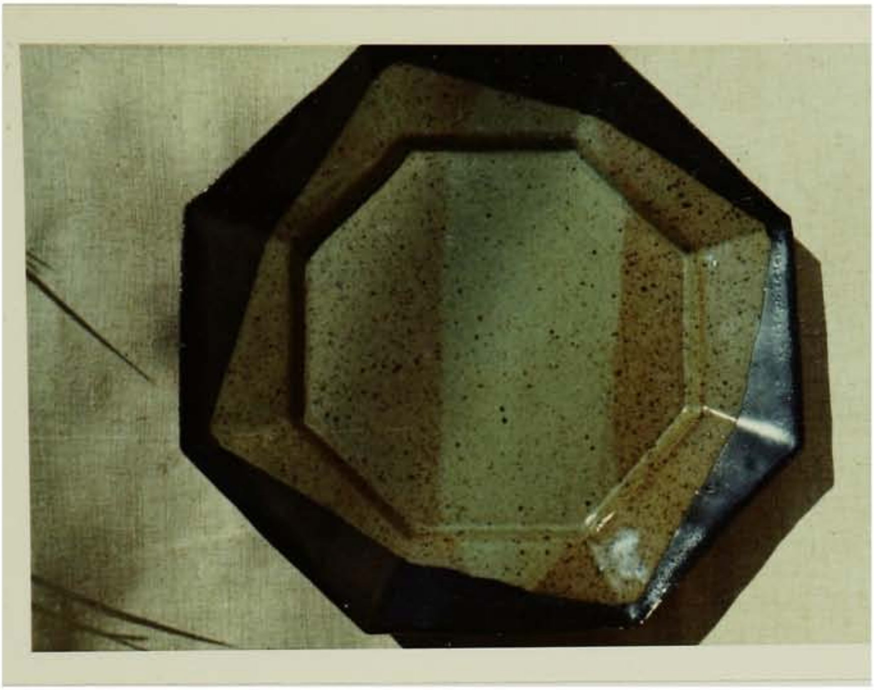


Plate XXI

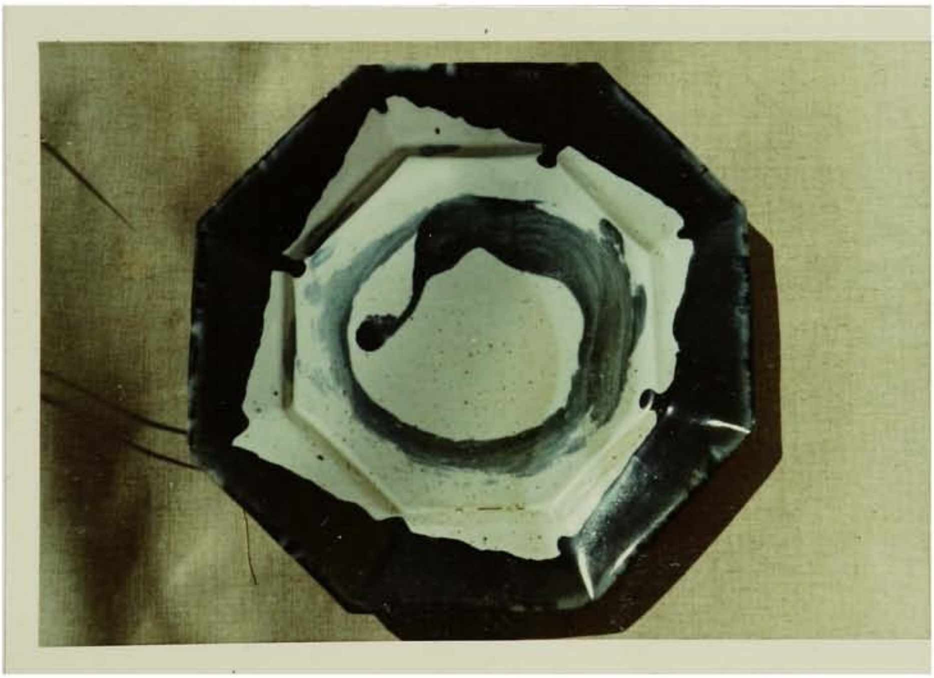


Plate XXII

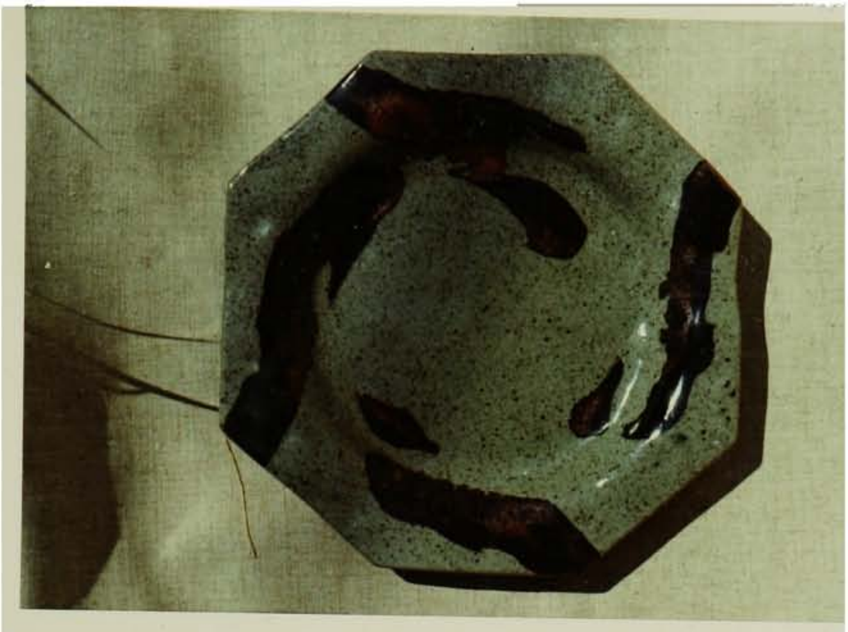


Plate XXIII

Plate XXIV

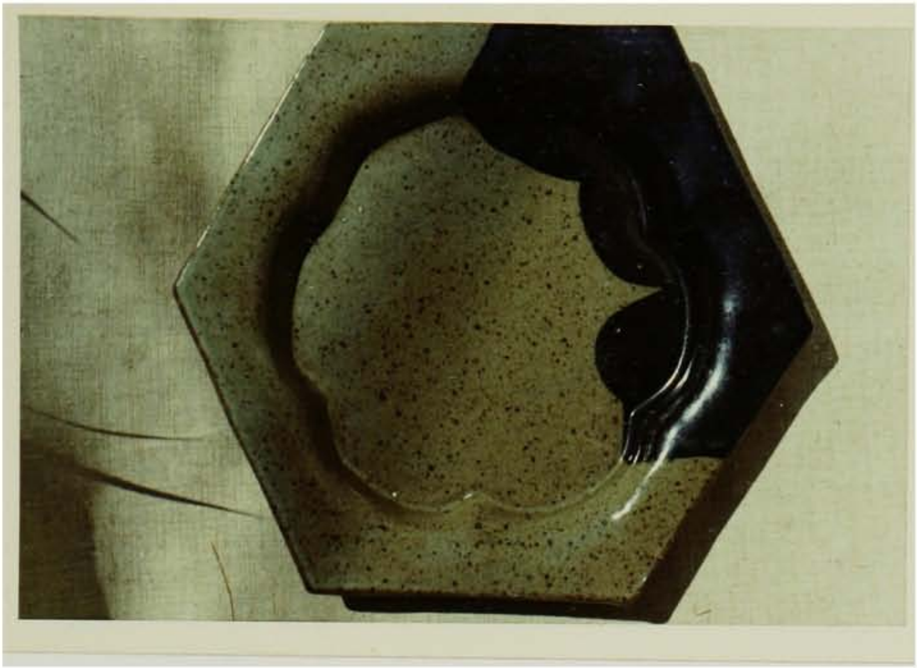


Plate XXV

Appendix A

#1 Pottery Plaster has a non-hydrocal base. It is made for ceramic use, where a high rate of uniform absorption of moisture from the clay is necessary. It is a moderately low "setting expansion" plaster, that can be used with average sucess as a free forming, tooling plaster. It has a fairly gradual "set", with a long liquid period, and limited period of plasticity. A general purpose plaster, it does not get very hard, and can be carved and worked freely.

Plaster Mixing Procedure

1. If timing is critical, make sure the equipment is free of old plaster, it will speed the setting time if you do not.

2. If you are doing extensive casting it is worth the extra time to weigh both the water and the plaster before mixing. The ratio for #1 Pottery Plaster is 75 parts water to 100 parts plaster.

3. Gradually add the plaster to water that is room temperature or lower. Setting expansion varies with the consistency of the mix and the temperature of the water.

4. After the weighed plaster is added, or, if it is not weighed, after a mound of plaster forms above water level, let the mix soak for two minutes.

5. Gently stir the material from the bottom to break up lumps and force air bubbles to the surface.

6. Let the mixture stand for a number of minutes while air bubbles continue to rise. This can be hastened by shaking the container gently.

7. Pour the slurry into the previously prepared volumne. Every surface the plaster will touch should be coated with one of the parting compounds listed on the following pages.

8. Wash your plaster handling equipment in running water immediately.

Parting Compounds or Separating Mediums

These formulae for separating mediums have been used quite generally for many years, and are the most common parting compounds used on models and patterns.

PREFERRED ⊗ **Stearic Acid** or Stearine and Kerosene—Formula: ¼ pound stearic acid shaved to flakes, 1 pint kerosene, 1 ounce Aerosol O. T. 100.

Mix the three ingredients and heat* to the boiling point to dissolve them. Stir well. Apply to the pattern with a soft brush, preferably a camel hair brush. If brush marks show when applied, thin with kerosene. The thinnest film can be spread if the solution is warm.

Aerosol is added to this formula to keep the stearic acid, an animal fat, and the kerosene, a mineral oil, in solution. This mixture is one of the most widely used of all the parting compounds. However, it should *not* be used repeatedly on wet HYDROCAL† A-11 or HYDROSTONE† cement molds since it is not compatible with them.

⊗ **Petroleum Jelly** (Vaseline). Petroleum jelly may be used successfully if it is cut back with approximately 2 parts of kerosene to one of jelly. Blend the mixture by heating* and stir well.

Lard Oil. Lard oil may also be used successfully if the pattern or model and room are warm at time of application. If room or model is cool, the lard oil will become too heavy and will not spread thin enough. Kerosene may be used as a cutting agent.

Light Lubricating Oil. Light lubricating oil may be used if applied sparingly. Excess oil may cause separator runs and produce a soft surface on the gypsum cement model.

⊗ **Carnauba or Bayberry Wax.** Carnauba or Bayberry wax paste is made of equal parts (by weight) of Carnauba or Bayberry wax and gasoline blended by heating* The solution may be applied warm to either a dry or moist gypsum cement pattern and then allowed to dry. After the gasoline has evaporated, polish the wax with a cloth. This polished wax acts as a sealer, as well as a parting compound.

Soap. Potters or Neutral Potash Soap (English Soft Soap). After producing a thick lather with a sponge, spread over the entire mold or pattern area. Remove all excess soap with clean sponge in order to preserve pattern detail. (GREEN SOAP can be used, but must be boiled for 20 minutes prior to using) (the raw state of the soap)

Spirits of Camphor. When fine detail work is being done, such as the reproduction of jewelry spirits of camphor is the most successful separator.

**Note:* *This medium is inflammable when subjected to too much heat and proper precautions should be taken in its preparation.*

Physical Data of the HYDROCAL Gypsum Cements

	#1 Pottery Plaster	Pattern Shop HYDROCAL	A-11 HYDROCAL	B-11 HYDROCAL	HYDROSTONE* HYDROCAL	High Expansion HYDROCAL		Industrial White HYDROCAL
						Consistency		
						35CC	40CC	
Normal Consistency: parts water to 100 parts cement by weight to make a pourable slurry	75	50-55	40-42	48-50	28-32			38-42
Setting time (min.) Initial Gilmore Final Gilmore	15"-24" 22'-28"	17"-25" 25"-35"	16"-22" 20"-26"	16"-22" 26"-32"	16"-22" 22"-28"	20"-25" 30"-40"	25"-30" 35"-45"	20"-30" 30"-40"
Setting Expansion (inches per inch) Maximum Average	.003 .00225	0.002 0.00125	0.0005 0.0004	0.0005 0.0004	0.002 0.0016	0.0175	0.014	0.003 0.0025
Compressive Strength (lb. per sq. inch) Minimum Wet Minimum Dry	740 1600	1500 3200	2000 4500	1750 3750	4000 11000	1000 2700	875 1900	2700 5500
Surface Hardness* Monotron Test--Dry	25	45	75	60	160	45	40	85
Alkalinity	Alkaline	Neutral	Alkaline	Alkaline	Alkaline	Sl. Acid	Sl. Acid	Neutral
Slurry pH	9-10	6-7	10-11	10-11	10-11	4.5-5	4.5-5	6-7

*Kg. load 0.01" penetration with 10 m.m. diameter steel ball.

Appendix B

Alumina-Silica Content of Clays

	SiO_2	Al_2O_3	Chemical Analysis	Empirical Analysis
Edgar Plastic Kaolin	46	39	1:1.2	1:20
XX Sagger	57	29	1:1.9	1:3.2
Kentucky "Special"	50	29	1:1.7	1:2.9
Tenn. Ball #5	52	31	1:1.7	1:2.9
Bandy Black	61	25	1:2.2	1:4.2
C. H. Goldart	57	28	1:2.0	1:3.5
Jordan	67	20	1:3.4	1:5.7
A. P. Green Fireclay	56	38	1:1.5	1:2.5
Calvert	58	24	1:2.4	1:4.1
Albany Slip	57	16	1:3.6	1:6.1
Michigan Slip	58	13	1:4.5	1:7.6
Buckingham Feldspar	66	18	1:3.7	1:6.2

Appendix C

"Weltnerware" is a flameware body developed by George Weltner of Andover, New York. The recipe is given in the chart below, followed by four additional formulas.

	A	B	C	D	E
Petalite	30	30			
Spodumene	20	20	30	40	40
Pyropholite			20		
Potash spar or Talc	2	2	2		
A. P. Green Fireclay	13				
Stoneware clay	15	27	27		
Ball clay	18	20	.20	60	
Bentonite	2	1	1		
Grog			5		
Body A					60

Weltner recommends bisquing the body to cone 06, and that beta Spodumene be used in bodies 4 and 5. A reliable cone 11 glaze for "Weltnerware" is:

Petalite	76.9
Talc	14.2
Whiting	3.4
Kaolin	5.5.

Standard spodumene many be substituted for petalite; low-iron spodumene will give a white glaze.

Bibliography

Behrens, Richard. "Glazes from Lithium Compounds." Ceramics Monthly, XXI (April, 1973).

Cardew, Michael. Pioneer Pottery. New York: St. Martin's Press, 1969.

Dickerson, John. Raku Handbook. New York: Van Nostrand Reinhold Co., 1972.

Fishwick, John H. "Spodumene aids fast firing, improves bodies." Ceramics Industry Magazine, (May, 1967).

________, Van der Beck, R. R., Taley, R. W. "Low Thermal Expansion Compositions in the Systems Spodumene - Kaolin and Petalite - Kaolin." American Ceramic Society Bulletin, XLIII (II, 1964).

Flanery, Rick. "Stoneware and Porcelain Fireplaces." Unpublished M.F.A. thesis, R.I.T., 1969.