GREENWICH HOUSE POTTERY

HANDBOOK 2020

"I'M ETERNALLY GRATEFUL THAT I STILL HAVE THE STRONG DESIRE TO WORK WITH CLAY AND THAT GREENWICH HOUSE POTTERY EXISTS WHERE I AND SO MANY OTHERS HAVE FOUND A PRECIOUS HAVEN."

Lilli Miller, Student since the early 1950s

GREENWICH HOUSE POTTERY
2020
HANDBOOK

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INTRODUCTION

Greenwich House Pottery (GHP) has been introducing New Yorkers to the joy of clay for more than 115 years. Throughout this time we have had thousands of teachers and staff who have contributed to our institutional knowledge. This is information that cannot be found anywhere else. We have attempted to compile it here, in one convenient volume.

The Greenwich House Pottery Student Handbook is a resource for students of any age or skill level. It contains all of our current clay, glaze, slip and terra sig recipes, in addition to the materials we use and the processes in which we use them. However, this is more than a book of recipes or a how-to manual; it also serves as a historical document, a record of our past, in addition to a narrative of our present.

The first known version found in our archives was put together sometime in the 1980s. Each subsequent edition is made with the hope of increasing the depth of information, improving upon the format and adding to the ease of use. We purposefully make all of our clay and glaze recipes available, we have no secrets and we want everyone who wants them to have access. We include procedural information so beginners or those starting their own studios can benefit from our century of experience.

This handbook is for educational use only. We make it available for free on our website; however, it can be purchased in printed form in our registration office. We would like to thank the countless people over the decades who have contributed to our success and the development of this information.

“THE STORY OF GREENWICH HOUSE POTTERY IS THE STORY OF AMERICAN CERAMICS. NO OTHER INSTITUTION MATCHES OUR DEPTH OF EXPERIENCE AND HISTORY OR HAS SHAPED THE FIELD OR ART SCENE LIKE GHP.”

Adam Welch, Pottery Director

THE HISTORY OF GREENWICH HOUSE POTTERY

Greenwich House opened on Thursday, November 27, 1902 (Thanksgiving Day) at 26 Jones Street just 75 feet from where the Pottery now stands. It was founded as the Cooperative Social Settlement Society of the City of New York and incorporated by Felix Adler, Robert Fulton Cutting, Eugene A. Philbin, Henry C. Potter, Jacob Riis, Carl Schurz and Mary Kingsbury Simkhovitch. As a Settlement House (Progressive Era Reform Movement), Greenwich House sought to alleviate poverty and urban congestion, and to help unify immigrants and bring communities together.

Greenwich House Pottery (GHP) traces its humble beginnings back to the manual training programs of Greenwich House. As early as 1904, Greenwich House offered clay modeling classes to children as an activity to keep them off the street and out of trouble. Soon after, amateur clubs geared toward acclimating immigrant adults to America and serving as an alternative source of income were also introduced. In 1905, Gertrude Whitney served as a member of the Greenwich House Board of Directors and donated $5,000 to support clay modeling, facilitating the move to a studio at 28 Jones Street where a comprehensive pottery department was formed by 1908. The Pottery is the only remaining program from that Handicraft School and has the distinction of being the oldest and longest running program at Greenwich House.

The Pottery is located in a beautiful 3-story brick building located at 16 Jones Street. Jones Street is named after Dr. Gardner Jones who married Sarah Herring in 1773, whose father, Elbert Herring, owned a considerable tract of land known as Herring Farm where NYU and much of the West Village now sits. The Pottery's building was built for Greenwich House by the famous architects Delano & Aldrich in 1928 as the Greenwich House Arts and Crafts Building. It housed Greenwich House's Handicraft School, but also was in the intervening years used for a time by New York University, the New York Department of Education and even a branch of the New York Public Library system until 1948 when the Pottery officially took up residence.

Greenwich House has a history of not only being committed to supporting its local community, but of also fostering the growth of statewide and national movements for social reform. Greenwich House and its members and workers were directly and indirectly responsible for the passage of women's suffrage in New York in 1917, tenement housing reform and New York Workers Compensation Law, and for the founding of the ACLU (American Civil Liberties Union, first formed as the National Civil Liberties Bureau), and the NAACP (National Association for the Advancement of Colored People). At the first official meeting of the House the board of managers elected Gertrude Whitney to the Board of Directors. She remained committed to Greenwich House until she opened the Whitney Museum of American Art in 1931. Greenwich House had such notable members as: Franz Boas, John Dewey, Amelia Earhart, Crystal Eastman, Learned Hand and Mary White Ovington, to name a few. Greenwich House currently offers a wide array of programs designed to enrich the lives of New Yorkers in addition to the Pottery, including Barrow Street Nursery School, Greenwich House After-School and Summer Arts Camp, Greenwich House Music School, four senior centers, Senior Health and Consultation Center, Methadone Maintenance Treatment Program, Chemical Dependency Program, and the Children's Safety Project.

GREENWICH HOUSE HAS A HISTORY OF NOT ONLY BEING COMMITTED TO SUPPORTING ITS LOCAL COMMUNITY, BUT OF ALSO FOSTERING THE GROWTH OF STATEWIDE AND NATIONAL MOVEMENTS FOR SOCIAL REFORM.

In addition to being an important home for social reform, GHP's unique history encompasses the evolution of American ceramics. Its earliest iteration was as a craft program geared toward social welfare. For decades the Pottery was also known as a production facility making high quality pots for the garden and table, filling orders for notable New Yorkers such as J.P. Morgan and Edward Harkness. The artists within the Pottery Department called themselves the Greenwich House Potters and later, the Greenwich House Potters and Sculptors. Ceasing production in the 1940s, the Pottery refocused on education. It later became a hub of the post-war studio crafts movement. We have the largest faculty and student body and the widest variety of courses of any ceramics art center in New York City. GHP truly has something for everyone.

The most respected artists pass through our doors leaving behind a vast array of techniques and inspiration—Ann Agee, Kathy Butterly, Nicole Cherubini, Warren MacKenzie, M.C. Richards, Betty Woodman and Peter Voulkos are just a few. Besides being the preeminent venue for ceramics in the United States, our residency program serves as an incubator for artists such as Ghada Amer, Simone Leigh, Pam Lins and Rirkrit Tiravanija. Our studios also serve artists such as Trisha Baga, Joanne Greenbaum, Alice Mackler, Louise Nevelson, David Salle and thousands of others. Today, with its diverse program of classes, workshops, lectures and exhibitions serving hundreds of students and thousands of visitors each year, the Pottery is New York City's center for ceramics. In 2009, New York City Mayor Michael Bloomberg awarded GHP a Mayoral Proclamation and declared September 10th, 2009 "Greenwich House Pottery Day."

In the spirit of the Greenwich House Potters and Sculptors, the Pottery started a fabrication shop creating custom ceramic production for artists in 2010, the same year that the Ceramics Club found its home here. Ceramics Club was founded in 2007 by artists Pam Lins and Trisha Baga in the basement of Cooper Union as a group interested in using "ceramics as a way to socially interact, make material and collaborate." The group models itself on "propositions gleaned from amateur 'clubs' that in organizing, were interested in dismantling and opposing professionalism—withdrawing distinctions regarding quality, institutions, representations, etc." The membership of the club is in flux, though its core members include: Ricci Albenda, Trisha Baga, Lucky DeBellevue, Marley Freeman, Kathryn Kerr, Pam Lins, Keegan Monaghan, Lucy Raven, Halsey Rodman, Saki Sato, Shelly Silver and myself. The Ceramics Club meets here regularly creating anonymous works that are sold at "artists' prices" to raise money for causes that align with their politic. To date we have raised $7000 for Planned Parenthood, $3500 for Critical Resistance, $3500 for White Helmets, $2000 for New Sanctuary Coalition, $2000 for the Sylvia Rivera Law

Project, $1800 for GHP, $500 for Make the Road NY, and contributed to a fundraiser that grossed $20,000 for Planned Parenthood.

In 2017, Crafting Resistance was formed from more than 100 of our faculty, staff and students as a group of artists and craftspeople who “support organizations that resist the erosion of freedoms instated by the US constitution.” It was created out of a sense of dread and a need to actively engage in democracy and in supporting organizations that were under attack. Led by Jenni Lukasiewicz and in concert with the GHP community, Crafting Resistance helped to raise money in support of civil liberties ($25,000 for the ACLU), the environment ($10,000 to NRDC and GrowNYC), and LGBTQ rights ($3,000 for Lambda Legal). Our community is dedicated to helping the greater good.

In response to our community’s needs, GHP broke ground in 2019 for the first time since the Annex was added to the original Arts and Crafts building in 1929. To keep pace with our current student body and to ensure equal access to the studios for everyone, this building project aims to expand the kiln room into the existing courtyard, add an elevator and a basement with a dedicated clay and glaze mixing lab, and connect the second floor mold-making studio with the main building.

GHP IS DEDICATED TO EXPANDING PUBLIC AWARENESS OF THE DIVERSITY AND COMPLEXITY OF CERAMICS AND FOSTERING THE DEVELOPMENT OF ARTISTS THROUGH INTERNSHIPS, RESIDENCIES, EXHIBITIONS AND CLASSES.

GHP is dedicated to expanding public awareness of the diversity and complexity of ceramics while fostering the development of artists through internships, residencies, exhibitions and classes. Extending our educational mission to make, exhibit and learn from contemporary ceramics, GHP operates *Ceramics Now*, an exhibition series committed to supporting emerging, underrepresented and established artists in the Jane Hartsook Gallery.

Greenwich House’s first exhibition was held at 26 Jones Street in 1905, and showcased pottery and modeling made by students. The exhibition was organized to acquaint the community with the activities the neighborhood youngsters had been engaged in. Prior to the development of a dedicated space, exhibitions took place at multiple locations: 27 Barrow Street, 16 Jones Street (where the Pottery has been since 1948), off-site storefronts, Gertrude Whitney's studio on 8th Street, a New York City Public Library and patrons' garden estates. In 1970, Jane Hartsook (Director, 1945-1982) created a dedicated exhibition space on the second floor. Upon her retirement in 1982, the second floor gallery was renamed the Jane Hartsook Gallery in her honor. In 2013, the Gallery was relocated to street level and inaugurated with Linda Lopez's New York City solo-exhibition debut. The gallery continues Jane Hartsook's legacy in its new location, leading the field in the presentation of the most important ceramics exhibitions in New York City.

The Residency and Fellowship Program is designed to support artists' projects and increase awareness around the importance of creative engagement with ceramics. Operating since the early 1960s when Jane Hartsook invited Peter Voulkos to teach and work at the Pottery, and reinvented in 2013, when Ghada Amer was invited to be a long-term resident. In its current form, the program is an opportunity for experienced ceramic artists to have the time and resources to experiment and create a new body of work, and for artists adept in other media to have the space and support to learn how to work creatively with clay.

GHP is an art center supporting artists and their projects, and teaching and promoting ceramics to the world. Through war, depression, recession and a century of growth and change, GHP perseveres and remains a stalwart of innovation and art. It offers a diverse program of classes for adults and children; solo, group and juried exhibitions; residency and fellowship programs; a lecture series; Masters Series Workshops; and community outreach, all of which serve newcomers, amateurs and professional artists alike. GHP plays a vital role in community building and providing access to the arts. We offer a chance to learn from clay in a direct way and to foster connections between artist, material and community.

GHP IS AN ART CENTER SUPPORTING ARTISTS AND THEIR PROJECTS

Adam Welch, Director 2020

TIMELINE

A

C

B

D

1900 1910 1920 1930 1940 1950

1902
* Greenwich House opens Thanksgiving, at 26 Jones St.
* Gertrude Whitney joins Board

1904-1905
A * Starts offering clay modeling classes in 26 Jones
B * First kiln is installed in the basement of 26 Jones
* Holds exhibition including clay modeling
* Gertrude Whitney donates $5000 for clay modeling
* Pottery moves to 28 Jones

1908
* Starts a separate department within the Pottery School; here pottery is made and sold outside of regular classes

1909
* Pottery School officially begins under director Leon Volkmar (Director, 1909-1911) at 28 Jones

1910
C * Greenwich House purchases 16, 18, 20 Jones for $40,000 (1910)

1925
D * Partners with the Metropolitan Museum of Art and Elizabeth “Libbie” Custer (widow of George Custer) to film “The Pottery Maker” starring our own Victor Raffo

1926
* Installs new kiln in the basement of 27 Barrow St. published in encyclopedia as “largest of its kind”

1928
* Delano & Aldrich design Greenwich House Arts & Crafts building at 16 Jones Street

1930-1935
* A. Sterling Calder, father of Alexander Calder fires his sculpture at the Pottery

1933
* Jackson Pollack takes class; to pay tuition he becomes our janitor
* Lee Krasner takes a class

1939
E * Pottery exhibits work at the World’s Fair

1942
* Maude Robinson retires (Director, 1911-1942)

1948
* Moves to 16 Jones St., formerly the Arts and Crafts building also known as the Workshops

1950s
* Lilli Miller begins taking classes
* Anna Siok begins teaching

1952
* Bernard Leach and Shoji Hamada visit

1954
* Kitaoji Rosanjin lectures and demonstrates

E

G

F

H

1960 1970 1980 1990 2000 2010 2020

1960
F * 1960-1964, 1978 Peter Voulkos teaches in the summer

1970
* Dedicates Gallery on the second floor

1973
* *The Potluck Cook Book* is published

1982
* Names the Jane Hartsook Gallery in honor of Jane Hartsook (Director, 1946-1982) upon her retirement

1993
* Ann Agee Artist in Residence

1994
* Kathy Butterly and Ann Agee on faculty

1999
* Alice Mackler begins taking classes

2005
* Joanne Greenbaum Artist in Residence
* Nicole Cherubini on faculty

2010
* Started GHP Fabrications to produce art for Rirkrit Tiravanija at Gavin Brown Enterprise.
* Ceramics Club begins meeting at the Pottery

2013
G * Hires Ogawa | Depardon Architects to relocate the Gallery
* Ghada Amer Artist in Residence
* David Salle takes private lessons

2016
* Lilli Miller has solo exhibition, *Meditations on an Unending Line*
H * Rirkrit Tiravanija begins taking private lessons
* Begins collaboration with Tom Sachs

2017
* Ghada Amer has solo exhibition, *Déesse Terre*
* Rirkrit Tiravanija Artist in Residence
* Crafting Resistance forms by faculty, staff and students to raise $25,000 for the ACLU, $10,000 for NRDC & GrowNYC and $3,000 to Lambda Legal

2018
* Tom Sachs has solo exhibition, *Chawan*
* Pam Lins Artist in Residence
* Hires Ogawa | Depardon to expand the studio
* *The Potluck Cook Book 2* is published.

2019
* Broke ground on first new construction at the Pottery since 1929
* Rirkrit Tiravanija has solo exhibition, *Untitled (Billy Wilder doesn't drink green tea)*

2020
* Jennifer Rochlin has solo exhibition, Clay is Just Thick *Paint*
* March 16 COVID-19 the Pottery temporarily closes

STUDENT INFORMATION & GUIDELINES

Each student should become familiar with this information to ensure that things run safely in the studios and we can provide you with the best experience possible.

OUR STUDIOS

- In case of emergency, exit out the front of the building.
- First Aid kits are located in the 1st floor bathroom, 1st floor glaze room, 2nd floor wheel bathroom, each of the 3rd floor studios and slipcasting studio.
- GHP is SMOKE FREE.
- No student is permitted to remain in the building after closing.
- GHP is not responsible for the loss or damage of work or personal property.
- You may only attend the class for which you are registered. Under no circumstance may you attend another class.
- Bathrooms are on the 1st floor in the kiln room and in each room on the 2nd floor.
- Information about the studio and its activities will be listed in Pottery Notes, posted on the Message Center and on the website, and will be read during class.
- Do not handle or touch the work of others.
- If you damage another's work, leave a note.
- Follow us on Facebook, Instagram and Twitter to stay current on our studio.
- Talking on cell phones is not permitted in the building except for emergencies. Please respect our community; take calls outside.
- No storing personal possessions on class shelves, or under lockers.
- Locker rentals are $5 per term for currently enrolled students. One per student.
- If a locker is not renewed at the end of term it will be emptied and reassigned.
- Lock personal items in your locker.

STUDIO STAFF & LIAISONS

- All administrative questions or concerns should be directed to a Student Liaison.
- Report studio issues to the Studio Technicians.
- With questions regarding firings, clay or about any general studio concerns speak with the Studio Manager or Studio Technicians.
- The Reception Office will be open on class days from 9:30 – 11:00 am and 6:30 – 7:00 pm so that students can purchase

tools, clay or peruse the library.

- Library books may be checked out by currently enrolled student for two weeks.
- We encourage you to register online; however, Liaisons can register you in person in the Reception Office.

CLAY & GLAZE

- Clay in the barrels is free to use, however, it is not to be removed from GHP.
- Porcelain can be purchased from the Liaison Office in 25 lb blocks.
- Recycling buckets are provided for each clay body. Be careful not to mix clays or add foreign materials to the clay or to the bucket.
- Break up clay to reclaim before it dries out.
- When putting clay back into the clay bucket mash it down to keep it from drying.
- No outside clay or glaze. Exceptions must be approved by Studio Manager.
- Glazes are microwave-, dishwasher-, and food-safe unless otherwise noted.
- Unglazed washes & slips may not be not food safe.
- Always leave lids on clay and glaze buckets to avoid drying out and contamination.
- Do not thin glazes. Ask Studio Technicians about glaze consistency.

FIRINGS & PROCEDURES

- Firing fees are $0.03 for a single firing, $0.06 for a double firing, per cubic inch. The minimum firing fee is $1.00.
- Work is measured during the posted measuring times ONLY and must be measured by a Student Liaison prior to firing.
- You may keep money on a firing log. Once money is added to the firing log it can only be used for firing and is non-refundable. There is a minimum charge of $50 when adding money with a card.
- GHP is not responsible for lost firing slips.
- GHP is not a production studio and cannot accommodate large volumes of work due to limited materials, shelf space and kiln space.
- Do not let work pile up on greenware or bisque shelves, keep it moving: bisque dry work; glaze bisque work; take home glazed work.
- All work must be accompanied by a firing slip. For greenware, use a class ID chip.

- ALWAYS bisque fire prior to glaze firing.
- Students are responsible for placing all work on appropriate shelves in kiln room.
- Low fire clay should NEVER be high fired.
- Do not glaze the bottom of work.
- Do not use stilts in Cone 10 firings.
- Work that was left out, pieces damaged, pieces with sharp edges or pieces without accurate firing slips will be put on the Hospital Shelf.
- Requests for firing credit should be placed on the shelf behind the spray booth with a completed firing credit request form.
- GHP does not issue firing credit for undesired or inconsistent firing results, kiln accidents or work that is lost or damaged. Firing credit is given at the discretion of the Studio Manager for and only for work that is damaged as the result of mishandling by the staff.
- Pieces with sharp edges, within reason, can be left for grinding by the Studio Technicians and will be completed by the next day of class.
- Unclaimed work on the finished glaze shelves, the unclaimed bisque shelves, or hospital shelves are subject to discard after 4 weeks.

CLEAN-UP

- Leave the studio cleaner than you found it.
- Classes and open studio participants are responsible for leaving studios clean at the end of their session.
- Minimize dust: always clean up with a wet sponge.
- Rinse out sponges before, during and after using them.
- Wipe down sink when finished cleaning.
- Tables, bats, ware boards, and banding wheels should be cleaned and put away.
- Potter’s wheels should be cleaned, shut off and splash pans washed and put back.
- Do not store work on bats. Use ware boards.
- Faculty members and studio staff may delegate clean-up responsibilities to ensure complete clean-up of the studios.
- Clean up spills as they happen.
- Clean up, put your work away, return community items and leave the building by the end of open studio or closing time.
- Work left on the tables or counters will be discarded.
- All personal items, clothing and shoes, must be taken home during inter-term breaks unless they are stored in a paid locker.

OPEN STUDIO

- Open Studio is ONLY available to currently enrolled students, on a first-come, first-served basis.
- Observe studio hours. Clean up before leaving.
- Do not show up early or leave late.
- Open Studio hours are posted on the website and on bulletin boards in all studios.
- No tables or wheels can be saved or placed on hold.
- No children, friends, or pets allowed.
- Be courteous.
- Keep conversations quiet.
- When the studio is busy please keep yourself to a 3-hour limit.
- During Open Studio hours students may use wheel or handbuilding studios, though priority goes to students in the studio that corresponds to their class registration.
- Open Studio time may be canceled for GHP functions or events.
- Glaze area has set Open Studio hours.

STUDIO SAFETY

- No sanding or scraping dry clay or glaze in the studio. Always use the spray booth.
- Never place anything on kiln lids.
- Do not use the spray booth, slab roller, or extruder without an orientation from a teacher or staff member.
- Students should not use the clay hoist, clay mixers, grinders or dremels.
- No sharp objects or detachable blades such as X-ACTOs, razor blades, homemade pin tools, thumbtacks, needles, glass shards.
- For your safety and the safety of those around you we require faculty, staff and students to wear shoes while in the studio.

RESPIRATORS

1. Before you do anything in the studio you should consider the health and safety of yourself and the community. If you think "This one time cannot hurt" think about that multiplied daily by the nearly 500 students we have and that is a lot of "one time won't hurt!" Safety First, Every Time!
2. (See Diagram on next page) How to select the correct size respirator, (A) measure the distance between the bridge of your nose and the bottom of your chin. (B) Measure your closed lips. Find your size.*
3. Putting on your respirator. With the mask in one hand put your chin in the chin cup and move the top of the respirator over your

nose. With the other hand put the head strap over your head. Remove slack in strap but do not tighten. Fasten the bottom strap behind your neck, remove the slack but do not tighten. Then tighten the top two straps and lower straps in small equal increments, do not overtighten.

4. Each time you wear your mask check positive and negative pressure. Positive pressure test–cover the exhalation valve with your palm and exhale one normal breath. The mask should bulge without leaking. Negative pressure test – cover both filters with palms and inhale normally. Hold for 5 seconds, the mask should collapse and not refill.
5. If air leaks reposition mask and retest. Though it is counterintuitive there is a chance that you have overtightened the mask. Repeat until correct.

*This is not a substitute for proper FIT TESTING of the respirator as required by OSHA in 29 CFR § 1910.134 and CSA 294.4-02.

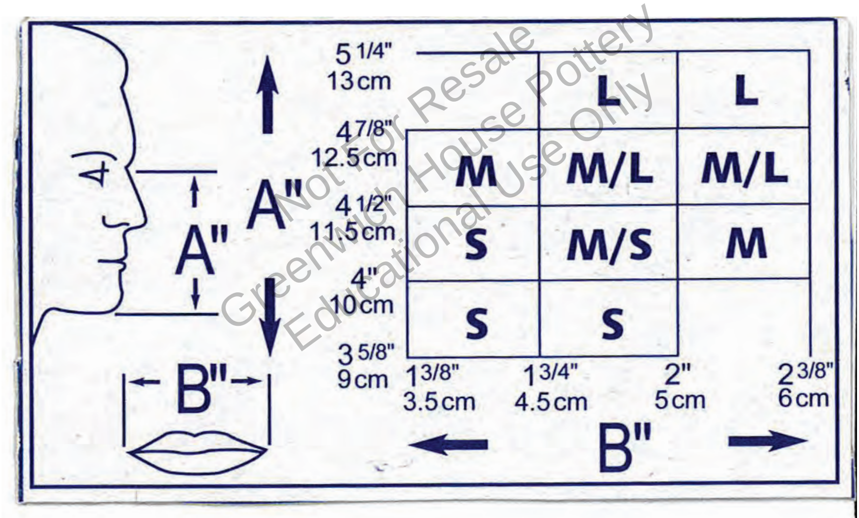


Diagram and procedure from the North Face mask from North Safety Products

"WHEN I FIRST STEPPED INTO THE DOORS OF GREENWICH HOUSE POTTERY, I FELT A SENSE OF WELLNESS, A FEELING OF PLACE AND ATMOSPHERE, WHICH BROUGHT TO ME A SENSATION OF JOY AND COMFORT."

Rirkrit Tiravanija, Resident Artist 2017

CLAY BODIES

CLAY BODIES

GHP clay bodies have, in some cases, been in use for half a century, others for decades. The recipes were introduced through contact with those whom invented them; therefore, we do not take credit for them or claim fidelity to the original recipes as things change over time. In cases in which we have record of the change it will be noted in the recipe.

At GHP we mix and use over 100,000 pounds of clay annually. Our clays are shipped premixed dry (except our porcelain) from Standard Ceramic Supply in Pittsburgh, PA through Ceramic Supply of New Jersey. Previously our clay was shipped from Amherst Pottery in Massachusetts. In 2011, GHP switched its clay distributor which affected our clay composition. Over time, the former manufacturer had adjusted the recipe as needed based on material availability. Therefore some changes had to be made when the switch occurred, which explains why so many took place at that time. Our clay bodies are suitable for handbuilding and throwing. Because we go through so much clay it does not have proper time to age; therefore we use a de-airing pugmill for our T1, Throwing, and White Stoneware. Val Cushing wrote, “Four to six weeks of aging will greatly improve the plasticity of all clay bodies—six months to a year is ideal. One run through a de-airing pug mill is the equivalent of three months of aging.”

These clay bodies can be used for high-fire or low-fire and in reduction or oxidation atmospheres, although results vary according to atmospheric conditions and the temperature reached within the kiln. High-fire indicates the clay bodies are formulated to vitrify at or around Δ10. Typically, though not always, high-temperature firings occur within a reduction atmosphere. Low-fire indicates the clay bodies are formulated to mature at or around Δ04. Low-temperature clay and firings are likely fired in an oxidation or neutral atmosphere. The red earthenware is low-fire clay and is not formulated for temperatures above Δ04 firings though we use it to good effect in our Δ2 firings.

In 2013, we added slipcasting to our curriculum and hired Hiroe Hanazono to develop and start the program. At that time we introduced a Δ10 porcelain casting slip using a recipe we received from Anat Shiftan via Beth Katleman via Brad Parsons. Though slipcasting had been attempted at other times in our history, it did not take off. Now we operate four classes in a separate studio above the kiln room.

In 2015, we added a paperclay class to the curriculum. With clay body research and development done by Lisa Chicoyne who began the paperclay craze at GHP. We modified two clay bodies, Δ10 porcelain paperclay slip and a Δ10 T1 paperclay. We use regular coreless toilet paper in our paperclay. If you can afford it, Lisa recommends pre-shredded cotton linters for additional strength and reduced molding. Paperclay has proven to be more versatile to handle than a regular clay body. The paper fibers create a capillary effect and help the clay rehydrate more evenly so that it can be rewetted and added to without cracking as regular clay would.

CLAY BODY RECIPES

Ingredients mixed in order, measurements are in pounds unless noted.

SLIPCASTING PORCELAIN (2011, credited to Beth Katleman via Anat Shiftan)
Firing Range: Δ06-10, Oxidation or Reduction
Shrinkage: Green=2%, Δ06=3%, Δ04=3%, Δ2=6%, Δ6=11%, Δ10=13%
Porosity: Δ06=14%, Δ04=13%, Δ2=10%, Δ6=2%, Δ10=1%
Color/texture: White, smooth

Water	67 pounds (save 7 pounds mix to taste)
Darvan #7	190 ml
Grolleg	83
Custer Feldspar	38
Silica	31

STANDARD S257 ENGLISH PORCELAIN (Formerly Amherst 2011)
Firing Range: Δ06-10, Oxidation or Reduction
Shrinkage: Green=4%, Δ06=5%, Δ04=5%, Δ2=8%, Δ10=14%
Porosity: Δ06=15.1%, Δ04=15%, Δ2=10.2%, Δ10=0.4%
Color/texture: White, smooth

STANDARD S417 RED EARTHENWARE (Formerly Dicarlo 2011) Water content 37.16%
Firing Range: Δ06-02, Oxidation or Neutral
Shrinkage: Green=6%, Δ06 =6%, Δ04=9%, Δ2=14%, Δ10=10%
Porosity: Δ06 =9.6%, Δ04=6.9%, Δ2=0.3%, Δ10=0.3%
Color/texture: Red, smooth some grog

T-1 SCULPTURE CLAY BODY (Takako Saito student 1970) Water content 29.20%
Firing Range: Δ06-12, Oxidation or Reduction
Shrinkage: Green = 7%, Δ06 = 8%, Δ04=8%, Δ2=11%, Δ10=13%
Porosity: Δ06 =10.9%, Δ04=10.3%, Δ2=4.9%, Δ10=1.3%
Color/texture: Orange-tan with iron specks with good green strength

Hawthorne Bond Fire clay	200
Thomas Ball clay	28
Custer Feldspar	25 (added shivering issues, 2013)
Lizella	20 (replaced Ocmulgee in 2009)
Bentonite	11
Fine grog	70
Medium grog	30

T-1 SCULPTURE PAPERCLAY (Takako Saito 1970/Lisa Chicoyne 2015)
Firing Range: Δ06-12, Oxidation or Reduction
Shrinkage: Green = 7%, Δ06 = 8%, Δ04=8%, Δ2=11%, Δ10=13%
Porosity: Δ06 =10.9%, Δ04=10.3%, Δ2=4.9%, Δ10=1.3%
Color/texture: Orange-tan with iron specks with excellent green strength

Water	9.3 liters
Strained Paper Pulp	14 liters
T-1 clay (See above)	200

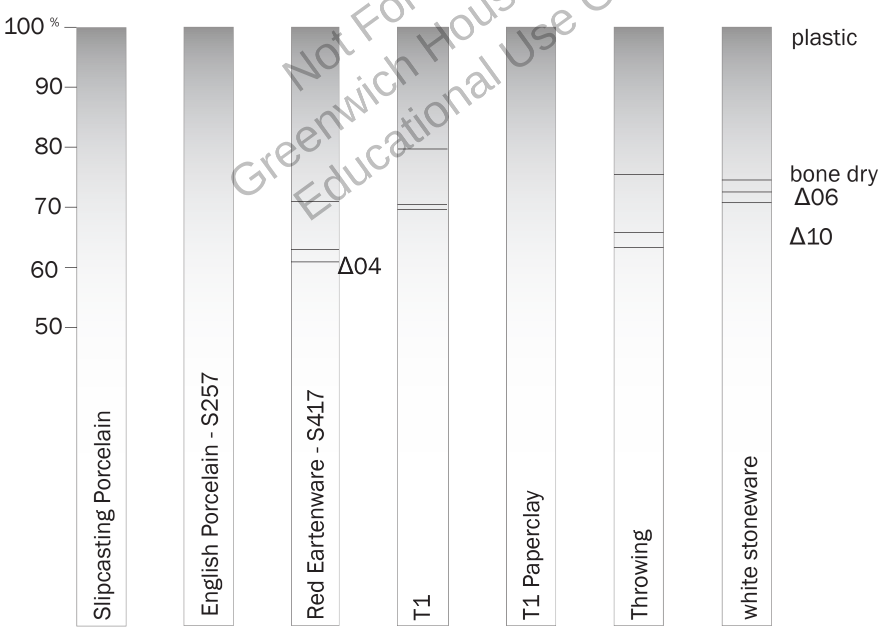
THROWING CLAY BODY (Credited to Jeff Oestreich) Water content 34.33%
Firing Range: Δ06-12, Oxidation or Reduction
Shrinkage: Green=6%, Δ06=7%, Δ04=8%, Δ2=12%, Δ10=15%
Porosity: Δ06=13.5%, Δ04=12.7%, Δ2=4.3%, Δ10=.4%
Color/texture: Tan-Brown, speckled in reduction smooth clay

Hawthorne Bond Fire clay	35 (increased from 20 in 2016)
OM-4 Ball Clay	16.5 (increased from 5 in 2016)
Custer Feldspar	15 (increased from 3 replace G200)
Fine grog	10 (increased from 3 in 2016)
Red Art	10 (replaced Red Iron Oxide 2016)
Salt Lick Clay	30 (added in 2016)

WHITE STONEWARE (Credited to Greg Pitts) Water content 32.49%
Firing Range: Δ06-12, Oxidation or Reduction
Shrinkage: Green= 6%, Δ06=6%, Δ04=6%, Δ2=10%, Δ10=13%
Porosity: Δ06=14.2%, Δ04=13.1%, Δ2=6.7%, Δ10=.1%
Color/texture: White to gray in reduction smooth and plastic

Foundry Hill Cream	20
Custer Feldspar	20 (changed from G200 in 2016)
Flint 200	20 (changed from Flint 325 in 2016)
Tile #6	20
XX Saggar	15
Pyropholite	5
Bentonite	2

This is a diagram of the water content of our clay bodies and fired ceramic ware. This test was done on each of our clay bodies over a sampling of five tests and averaged. Plastic clay is considered 100%. On average our White stoneware is 32.49% water.



“GREENWICH HOUSE POTTERY HAS A UNIQUE PLACE IN THE ARTWORLD AS WELL AS THE HISTORY OF ART IN NEW YORK. THE POTTERY HAS A RARE VISION FOR THE IMPORTANCE OF CERAMICS AND CONSISTENTLY EXPRESSES DIVERSE POINTS OF VIEW.”

Ghada Amer, Resident 2013, 2017

MIXING CLAY

MIXING CLAY

Equipment:

1. Pound scale
2. Clay mixer
3. Respirator

Procedure:

1. Put on your Respirator.
2. Calculate the quantity of clay. Measure the materials using scale.
3. If mixing from scratch, add water first, according to total desired quantity. (Water is about 25% by weight of dry mix.)
4. Wet the sides of the mixer with a sponge.
5. Add clay ingredients slowly before adding fillers and allow to mix.
6. If using bentonite, mix with water up to 24 hours before to allow water to percolate between clay particles.
7. If using nylon fibers, mix with hot water so that they can disperse.
8. If using barium carbonate, mix with water prior to adding it to the clay.
9. If adding macaloid, mix with water prior to adding to the clay.
10. Check consistency. If it is getting too dry, stop adding dry clay. Scrape the sides of mixer and continue to mix.
11. Mix entire batch for 10 minutes. Over mixing heats the clay up, drying it out and wearing down the equipment.

MIXING PAPERCLAY

Equipment:

1. Metal mesh strainer
2. 5-gallon bucket
3. Clay mixer
4. Electric drill and blunger
5. Respirator

Procedure:

1. Put on your Respirator
2. Put 9.3 liters of water in the clay mixer and add 50 pounds of a clay recipe.
3. Mix to slip consistency.
4. Prepare pulp by breaking down one roll of coreless toilet paper in hot water. Mix with a blunger until paper becomes slurry.
5. Strain the excess water from the pulp and measure out the necessary amount.
6. Add the strained paper pulp to slip.

7. Using your hand, make sure the pulp is completely mixed into slip. Scoop slip from the bottom of the clay mixer so that it is mixed in thoroughly.
8. Add 1.5 cups of bleach and mix, which helps prevent mold growth and smell.
9. Add the dry clay mixture slowly and allow it to mix.
10. Check consistency. If it is getting too dry, stop adding dry clay.
11. Mix the entire batch for 10 minutes. Over mixing heats the clay up, drying it out and wearing down the equipment.

MIXING PAPERCLAY SLIP

Equipment:

1. Metal mesh strainer
2. 2 5-gallon buckets
3. Drill and blunger attachment

Procedure:

1. Decide on your paper to clay ratio by volume of slip to toilet paper pulp. We use 1 part strained pulp to 4 parts slip.
2. Measure out the necessary slip and mix to a smooth consistency.
3. Prepare paper pulp by breaking down toilet paper in hot water. Mix with blunger until paper becomes slurry.
4. Strain the excess water from the pulp and measure out the necessary amount.
5. Add the pulp to the slip and mix well, making sure to check bottom of bucket.

MIXING PAPERCLAY SLIP for the 3D Printer

Equipment:

1. Plastic or metal taping knife
2. Clean printing tube

Procedure:

1. Same procedure as above, yet half the paper pulp.
2. Add water to the clay to soften, consistency should be unwedgeable but not yet liquid, like a Brie.
3. Scrape out air bubbles with a paint scraper until a decent amount accumulates.
4. Wedge into the clay canister and repeat until full.
5. Air bubbles in the clay will cause the print to sputter.

TESTING YOUR CLAY BODY

SHRINKAGE TEST

Conducting shrinkage tests on your clay will give you a better understanding of what your clay body goes through during its different stages from wet to fired. Make test bars of each clay body that you use in your studio; two or more bars for each temperature for greater accuracy. We sampled five bars for each temperature. Make the bars 5” L x 2” W x ½” thick and mark a 10 cm line with short perpendicular lines across the ends of the line. Use centimeters for greater accuracy. To calculate the shrinkage, measure each clay bar from wet to dry and from dry to Δ06, Δ04, Δ2, Δ6, Δ10, or whatever your preferred firing range(s).

wet to dry: $\frac{\text{line wet} - \text{line dry}}{\text{line wet}} \times 100 = \%$ shrinkage

dry to fired: $\frac{\text{line dry} - \text{line fired}}{\text{line dry}} \times 100 = \%$ shrinkage

wet to dry % + dry to fired % = % total shrinkage

ABSORPTION TEST

Absorption is an indication of the pore space within fired ware. Stoneware and earthenware never actually reach zero pore space, while porcelains come quite close. For unglazed ware to be functional in the modern sense of sanitary ware it can tolerate about 1% porosity without leaking. Industry has differing tests to determine the absorption rate of ceramics. Using the fired clay bars from the shrinkage test, weigh each fired bar dry. Boil the bars in water for an hour, remove each separately, blot and re-weigh: This gives you your clay body’s porosity at each firing temperature. We sampled 5 bars for each temperature. The test herein is standard within the field, though one industrial example recommends 5 hours boiling and 19 hours soaking.

$\frac{\text{fired weight wet} - \text{fired weight dry}}{\text{fired weight dry}} \times 100 = \%$ of absorption

WATER OF PLASTICITY TEST

To calculate the % of water in clay, it is first necessary to discover the weight of water in a piece of plastic clay.

plastic weight – dry weight = weight of water

dry clay: $\frac{\text{weight of water}}{\text{weight of dry clay sample}} \times 100 = \%$ moisture content

GLAZES

GLAZES

Our glaze recipes come from many sources. The Δ10, Δ6 and Δ04 glazes at GHP are regarded as food safe unless otherwise noted. (*To be certain of the safety of a glaze have your pottery tested by a professional testing facility. You can try Brandywine Science Center. Phone: 610-444-9850 web: www.bsclab.com/Pottery_Testing.html.) This means our glazes are, in theory, chemically stable and contain no lead, barium or other materials currently deemed toxic when fired properly. Whether or not a glaze is "food safe" is determined by a number of factors: glaze and clay body maturity and solubility or stability of fired glaze materials. For a glaze to be food safe it must be properly sealed (i.e. clay and glaze have bonded properly and fired to maturity).

Our "not-food-safe" glazes are so designated because they are unstable in the fired state and may leach. High-fire clays that have not been fired to maturity (i.e. Δ6-10) have not had sufficient temperature to vitrify the clay and bond glaze to ceramic. Though they might look and function fine, we cannot be sure. Low-fire glazes on high-fire bodies might craze and peel off because the thermal expansion is not suited to the high-fire clay and food or liquid can penetrate the glaze surface. For this reason we consider our low-fire glaze food-safe ONLY when applied to our low-fire Red Earthenware. But again, testing would confirm.

The finished results of a glaze have many variables: kiln temperature, duration of firing, location of the piece in the kiln, density of the ware stack, volatile oxides present (i.e. copper), kiln atmosphere, barometric pressure, timing of reduction, rate of cooling, glaze application, and even the length of the time that the work sits on the shelf waiting to be fired. With this many variables it can be difficult to achieve consistent results, which is why it is healthy to be cautious of test tiles.

MIXING GLAZES

Equipment:

1. Triple beam gram scale for measuring
2. Two 5-gallon buckets–A 10,000-gram batch of glaze will fit in a 5-gallon bucket, one to mix, one to pour into while sieving
3. Jiffy mixer and drill
4. Sieve–A 60-mesh or 80-mesh sieve
5. Respirator
6. Bucket
7. Latex gloves

Procedure:

1. Put on your Respirator.
2. Calculate the quantity of glaze.
3. Measure the materials using the scale; add to an appropriately sized container.
4. Dry mix the measured materials in the container; avoid raising dust.
5. Wet mix by adding about 2/3 water by volume and stir.
6. Sieve the glaze through the sieve at least twice to remove lumps. Evenly distribute the materials by pouring from one bucket through the sieve into the other bucket.
7. When adding bentonite, mix with water up to 24 hours in advance.
8. The consistency of a glaze should be that of a heavy cream. Do not mix in more water than needed to reach this consistency. It is easier to thin out a glaze then it is to make it thicker.
9. To achieve consistent results, measure the relative density of the glaze with a hydrometer and again before each subsequent use.

GLAZE APPLICATION

All glazes are affected by application including but not limited to: the glaze thickness, how thoroughly the glaze is mixed, the specific gravity (relative density), the thickness of the bisqueware, the peak temperature achieved, the surrounding ware and firing atmosphere.

1. Bisque the object. We only fire glaze work that has been bisqued.
2. Clean off the bisqueware by either quickly rinsing under running water, and letting it dry completely (30 minutes), brushing it off with a damp sponge, or spraying it with air to remove any dust.
3. Stir the glaze thoroughly; be sure to scrape & stir the bottom and sides of bucket.
4. If using wax or latex resist, allow the wax or latex to dry completely before glazing.
5. Use dipping tongs to dip into glaze, pour glaze over or into your piece, or use your hands. To dip the piece be sure to shake excess glaze off of the piece and wipe the foot and the lid and gallery.
6. You can also spray glaze on the ware using a spray gun.
7. If using multiple glazes, allow glaze to dry between coats or to avoid the risk of contamination.
8. Know the glaze and your desired application (this takes experimentation).
9. Glaze that is too thick can run or crawl. This is especially true when layering glazes.
10. If the glaze begins to crack and peel when drying, rub cracks.
11. If the glaze flakes off or has been applied too thickly, wash off the glaze entirely and allow your bisque to dry for 24 hours before re-glazing.

TEST TILES

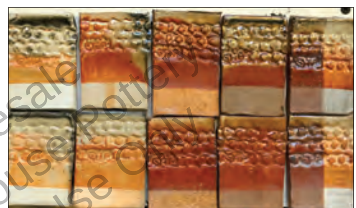
We have two rows of five test tiles. The top and bottom rows are the same order of clay bodies, from left to right: porcelain, white stoneware, T1, throwing clay and throwing clay coated with red slip on the left and white slip on the right-hand side of the tile. We fired each row of tiles in different kilns and display them in two rows so that you can see the extreme variety of possibilities. These test tiles also show you the overall effect the clay body has on the glaze results. Eartenware test tiles are coated with black copper wash on the left and white slip on the right-hand side of the tile and plain earthenware in the center.

Δ10 GLAZE RECIPES

Ingredients are in grams.

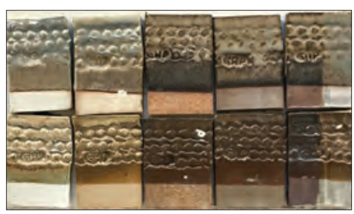
ADAM WELCH AVERAGE SHINO (Replaced spotted shino in 2010)
Color: Rust to white carbon-trapping

Nepheline Syenite	3800
Spodumene	1700
OM 4 Ball Clay	1100
EPK (or Georgia)	1000
Minspar 200	1000
Custer Feldspar	400
Redart	200
Soda Ash (dissolve)	800



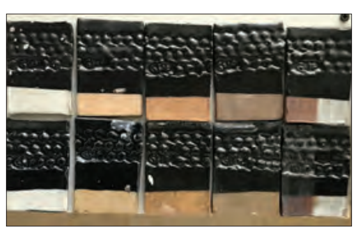
BYRD MATTE
Color: Matte brown to tan, glossy and blue gray on whiteware

Nepheline Syenite	6500
Dolomite	2100
Zircopax	900
OM 4 Ball Clay	500
Bentonite	300
Manganese Dioxide	200
Cobalt Carbonate	50



CHARLIE D BLACK
Color: Opaque semi-gloss black, breaks bluish-black over whiteware

Nepheline Syenite	2000
Minspar 200	2000
Silica	2000
Dolomite	1500
Talc	1300
OM 4 Ball Clay	1000
Whiting	200
Cobalt Oxide	500
Mason Stain 6600	300
Manganese Dioxide	300
Bentonite	175
Epson Salts (dissolve)	200



CHUN BLUE

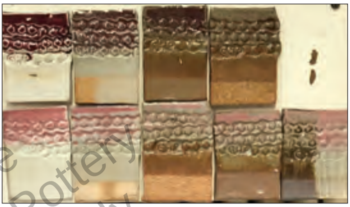
Color: Opaque gloss-orange rust to mottled baby-blue with some violet

Minspar 200	4556
Silica	2944
Gerstley Borate	952
Dolomite	952
Whiting	281
Zinc Oxide	184
EPK	130
Bentonite	100
Copper Carbonate	82
Rutile	433
Tin Oxide	281

CHUN RED

Color: Opaque glossy mottled red to pink-grey when thin

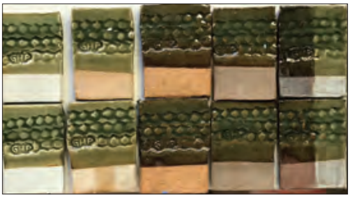
Custer Feldspar	4230
Silica	2680
Gerstley Borate	880
Dolomite	880
Strontium Carbonate	400
Tin Oxide	260
Whiting	260
EPK	230
Zinc Oxide	180
Copper Carbonate	50



DARK CELADON

Color: Transparent glossy olive green, darker green

Minspar 200	4400
Silica	2800
Whiting	1800
EPK	1800
Red Iron Oxide	240
Manganese Dioxide	120



DON REITZ GREEN

Color: Matte green to black

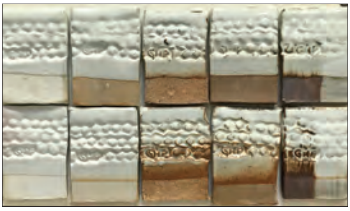
Nepheline Syenite	7067
EPK	707
Petalite	1519
Whiting	507
Gerstley Borate	202
Cobalt Carbonate	101
Rutile	101

GLOSS WHITE (Added in 2016, formerly Chinese White)

Color: Opaque gloss white

Glaze settles fast and hard. Stir regularly.

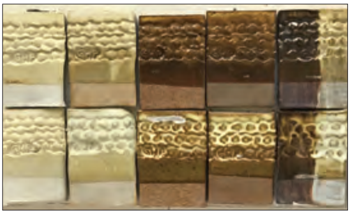
Custer Feldspar	8300
Zircopax	1000
Whiting	900
Silica	800
Bentonite	330



HIGH ALUMINA MATTE

Color: Matte speckled tan, off-white and lavender on whiteware

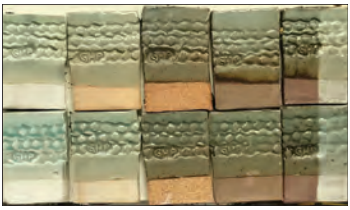
Custer Feldspar	4890
EPK	2510
Dolomite	2240
Whiting	350
Epsom Salts (dissolve)	200



NELSON'S CELADON

Color: Glossy green to icy-green

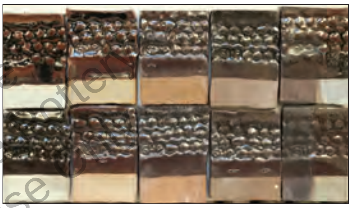
Minspar 200	4400
Silica	2800
Whiting	1800
EPK	1000
Red Iron Oxide	100
Bentonite	100



OESTREICH TENMOKU

Color: Glossy black breaks brown

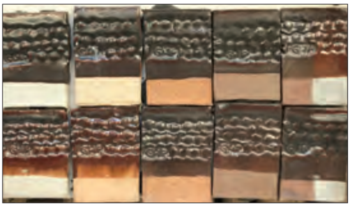
Custer Feldspar	4838
Whiting	1164
EPK	537
Silica	2014
Zinc Oxide	224
Barium Carbonate	224
Bentonite	300
Red Iron Oxide	805



OHATA KAKI (Added in 2016)

Color: Glossy persimmon rust

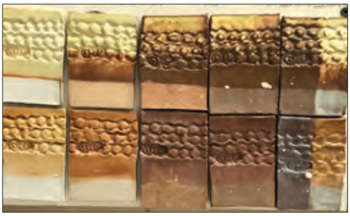
Custer Feldspar	3000
Silica	2000
EPK	2000
Dolomite	1500
Bone Ash	1500
Red Iron Oxide	1000



OLD YELLOW

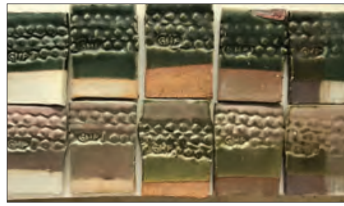
Color: Satin yellow to ochre

Nepheline Syenite	6390
Dolomite	2110
Zircopax	1600
OM 4 Ball Clay	430
Red Iron Oxide	100
Bentonite	300
Epson Salt (dissolve)	200



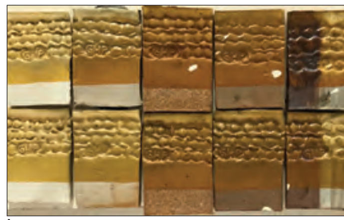
ORIBE (Not Food Safe)
Color: Gloss iridescent dark green

Custer Feldspar	3090
Silica	2530
Whiting	2240
EPK	1250
Talc	780
Bone Ash	110
Black Copper Oxide	550



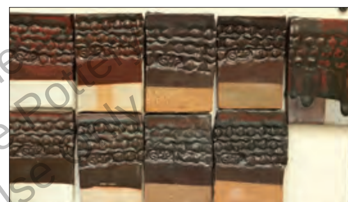
RUTILE GOLD MATTE
Color: Satin yellow gold - blue, runny

Custer Feldspar	4900
OM 4 Ball Clay	2500
Dolomite	2250
Whiting	350
Rutile	800



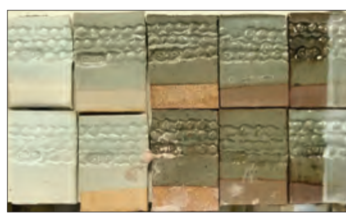
SCHERZER RED
Color: Opaque satin matte brick red to golden ochre metallic black

Grolleg	3700
Silica	1900
Pearl Ash	1100
Custer Feldspar	700
Whiting	2600
Red Iron Oxide	1000
Bone Ash	300



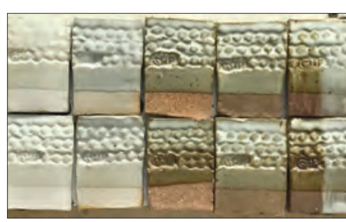
(GHP) SUE'S CLEAR
Color: Transparent gloss icy green

Custer Feldspar	2500
Whiting	2500
EPK	1800
Silica	3500
Gerstley Borate	120
Tin Oxide	100



TEMPLE WHITE
Color: Opaque satin cream white

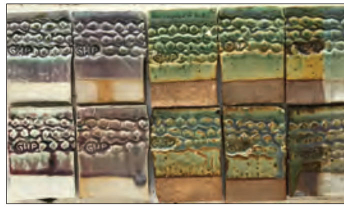
Custer Feldspar	3470
EPK	2360
Silica	1890
Dolomite	1960
Whiting	310



VAL'S (CUSHING) BLUE (aa cobalt blue)
Color: Matte blue to black

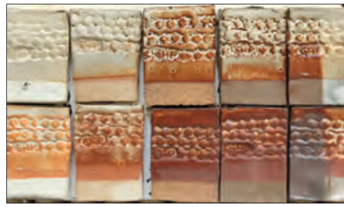
Cornwall Stone4600	
Whiting	3400
EPK	2000
Cobalt Carbonate	200

VAL'S (CUSHING) GREEN (aa copper blue-green)
Color: Matte blue-green to black



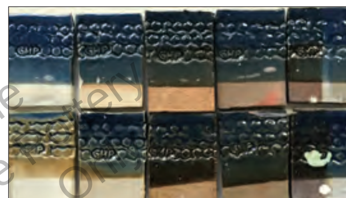
Cornwall Stone	4600
Whiting	3400
EPK	2000
Tin Oxide	400
Copper Carbonate	400

WHITE SHINO
Color: Opaque glossy orange to white.
Crawls when thick.



Nepheline Syenite	4500
Spodumene	1520
OM 4 Ball Clay	1500
Minspar 200	1080
EPK	1000
Soda Ash (dissolve)	400

YING CHING BLUE
Color: Transparent glossy light blue



Custer Feldspar	4000
Silica	3000
EPK	1000
Dolomite	700
Strontium Carbonate	600
Whiting	310
Red Iron Oxide	150
Cobalt Carbonate	50 (up from 25g in 2014)

Δ6 GLAZE RECIPE
Ingredients are in grams.

HIROE HANAZONO CLEAR (Added in 2011)
Color: Clear with slight green hue

Minspar 200	3500
Silica	2100
EPK	1000
Whiting	800
Gerstley Borate	1800

Δ04 GLAZE RECIPES
Ingredients are in grams.

ANDREA GILL'S MAJOLICA
Color: Opaque semi-gloss white

Frit 3124	6600
Minspar 200	1800
EPK	1000
Nepheline Syenite	600
Zircopax	1500
Bentonite	300

BERMUDA BRUCE (added in 2015)
Color: Green glossy

Gerstley Borate	4365
Nepheline Syenite	1575
EPK Kaolin	1485
Silica	1395
Bermuda Green Stain	900

BLUE BRUCE (added in 2015)
Color: Sky glossy blue

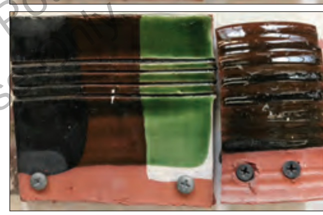
Gerstley Borate	4365
Nepheline Syenite	1575
EPK Kaolin	1485
Silica	1395
Robin's Egg Blue Stain	900

DEB'S BLUE
Color: Deep sea blue

Frit 3195	3600
Frit 3134	2400
EPK	2000
Copper Carbonate	200
Cobalt Carbonate	40

DEB'S MOSS GREEN
Color: Translucent light green

Frit 3195	3600
Frit 3134	2400
EPK	2000
Copper Carbonate	200
Burnt umber	320



DEB'S ORANGE-RED
Color: Orange-red

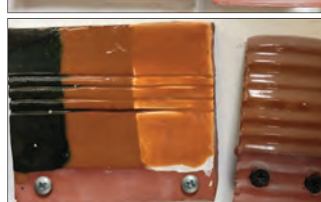
Frit 3195	3600
Frit 3134	2400
EPK	2000
Mason stain 6026	400

DEB'S PURPLE
Color: Light to medium lavender

Frit 3195	3600
Frit 3134	2400
EPK	2000
Mason Stain 6385	240
Cobalt Carbonate	24

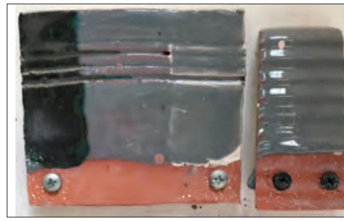
EXPERT BROWN (added in 2015)
Color: Light glossy brown

Frit 3195	7920
EPK Kaolin	900
Bentonite	180
Golden Ambrosia Stain	630



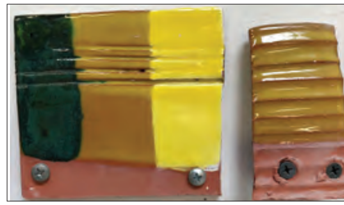
EXPERT GREY (added in 2015)
Color: Glossy gray

Frit 3195	7920
EPK Kaolin	900
Bentonite	180
Cobalt-free Black Stain	45
Tin Oxide	270



FAT YELLOW
Color: Translucent bright yellow

Frit 3124	8500
EPK	1000
Flint	500
Mason Stain 6450	800
Bentonite	300



JACKIE'S GREEN
Color: Satin grass green

Gerstley Borate	3420
Lithium Carbonate	900
Nepheline Syenite	450
EPK	450
Silica	3870
Victoria Green Stain	900

JACKIE'S IVORY
Color: Matte pearlescent ivory

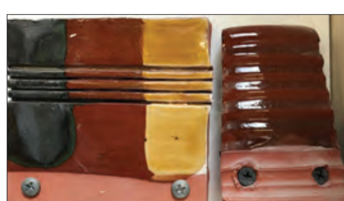
Gerstley Borate	3040
Lithium Carbonate	800
Nepheline Syenite	400
EPK	400
Silica	3360
Bentonite	80
Light Rutile	320
Zircopax	480

JACKIE'S PEACOCK BLUE
Color: Matte mottled peacock blue

Gerstley Borate	3040
Lithium Carbonate	800
Nepheline Syenite	400
EPK	400
Silica	3360
Bentonite	80
Copper Carbonate	240

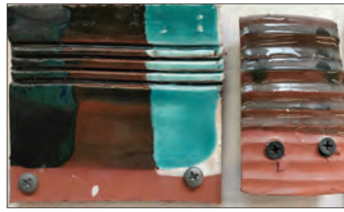
KATHY'S AMBER
Color: Transparent glossy amber

Frit 3124	3000
Gerstley Borate	3000
Nepheline Syenite	2000
EPK	1000
Silica	1000
Red Iron Oxide	400



KATHY'S TURQUOISE
Color: Glossy turquoise

Frit 3195	3000
Gerstley Borate	3000
Nepheline Syenite	2000
EPK	1000
Flint	1000
Copper Carbonate	200



KD CLEAR
Color: Transparent gloss clear

Frit 5301	1430
Gerstley Borate	535
Silica	1430
EPK	2860

PAD DUSK
Color: Light turquoise

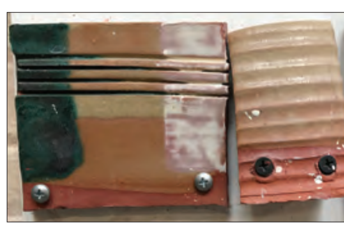
Lithium Carbonate	2090
Nepheline Syenite	5600
EPK	875
Magnesium Carbonate	40
Rutile	240
Mason Stain 6319	3000

ROB'S SATIN MATTE BLACK
Color: Opaque satin black

Minspar 200	2400
Whiting	880
Zinc Oxide	400
Gerstley Borate	900
Frit 3124	1920
EPK	800
Manganese Dioxide	640
Copper Carbonate	400
Red Iron Oxide	160
Chrome Oxide	80

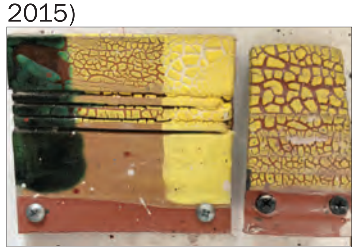
WEIRD BASE
Color: Semi-transparent satin clear

Gerstley Borate	5000
Wollastonite	5000



YELLOW BEAD (Not Food Safe) (added in 2015)
Color: Opaque yellow beading

Frit 3195	3850
EPK	1400
Magnesium Carbonate	1750
Praseodymium Stain	700



SLIP / WASH / TERRA SIGILLATA / LUSTER / KILN WASH / RESIST / PLASTER / CRACKS / REPAIR

ABOUT SLIP

Slip is typically considered an underglaze, that is, it is applied under the glaze. Industry makes underglaze which is essentially slip that is formulated to be applied on greenware, bisqueware or even over a glaze. Industry has added gum or sodium silicate to help with application and settling issues. Slips are a mixture of clay, possibly a colorant, and water used for applying on a clay body, generally to the surface of greenware to change its color, texture and/or to add decoration. Because slip is made primarily of clay it shrinks as the clay body shrinks which allows it to be applied to wet and/or leatherhard clay. If attempting to apply to bisque do not apply too thickly as it will likely crack and/or flake off. Alternatively, use a deflocculated slip or one with calcined clay for bisqueware. Slip is not to be confused with an engobe, though often these terms are used interchangeably. An engobe is a cross between slip and glaze, firing to a more vitreous state than slip though not as dense as glaze. Engobe is made with a flux and a colorant in addition to clay.

To make colored slip you should first mix the colorant stain with a small amount of water and blend. Blending the stain with water first ensures that the stain is evenly dispersed throughout the slip and will reduce color spots. Once stain is thoroughly mixed add mixture to the slip and mix. Follow this same procedure if you are making colored clays.

Slip is also a term for a process: To slip and score. This slip (slurry) is used as a construction adhesive to ensure greater joint strength between clays, i.e., handles, slabs, coils, etc. Slip is like glue for clay. This slip is generally the same clay formula as the clay body it is used on, only wetter. There is no reason you could not use colored slip to join clay parts together, other than the bond might be weaker with the addition of colorant.

Δ04-Δ10 SLIP RECIPES

Ingredients are in grams.

BARRY'S FISH SAUCE (BASE)
Color: Matte white

Grolleg	4370
Minspar 200	2350
Silica	1560
Bentonite	940
Pyrophyllite	780

BLACK SLIP
Color: Matte black

Grolleg	2190
Redart	2190
Minspar 200	2350
Silica	1560
Bentonite	940
Pyrophyllite	780
Red Iron Oxide	500
Black Iron Oxide	300
Manganese Dioxide	300
Cobalt Oxide	100

COBALT SLIP
Color: Matte blue

Grolleg	4370
Minspar 200	2350
Silica	1560
Bentonite	940
Pyrophyllite	780
Cobalt Oxide	150

GREEN SLIP
Color: Matte green

Grolleg	4370
Minspar 200	2350
Silica	1560
Bentonite	1560
Pyrophyllite	780
Chrome Oxide	400

*replaced Green Chrome Stain, 2017

RED SLIP
Color: Matte red

Grolleg	2190
Redart	2190
Minspar 200	2350
Silica	1560
Bentonite	940
Pyrophyllite	780
Red Iron Oxide	500

RUTILE SLIP
Color: Matte tan

Grolleg	4370
Minspar 200	2350
Silica	1560
Bentonite	940
Pyrophyllite	780
Rutile	80

WASH

Wash, also called majolica stains, sink-in decoration and inglaze, are similar to watercolors and can be applied to bisque, over or under glaze. If a wash is applied to the foot of a pot it may flux and stick to the kiln wash when fired. A typical application is to apply wash over majolica glaze, but they could work over all glazes, though it is advisable to test first. Wash can be applied to the surface of bisqueware and then wiped clean leaving residue behind in the recesses. Wash are made using extremely concentrated colorants which will act as a flux in combination with glaze. If applied too thickly, a wash will often cause the glaze or wash to run. This can damage kiln shelves, other people's works and your own piece. Be careful!

Using Ceramic Stains* or Oxides to Create a Wash
At GHP we mix ceramic stain or oxides with gerstley borate (hydrated calcium borate, which means it contains calcium and boron) to create

a soft glaze. A soft glaze is a low temperature glaze that melts between 1112°F–1922°F. It is designed this way so that it can be applied on top of an unfired glaze so that when fired it “sinks-in” (i.e. fluxed in) and stains the glaze. These “washes” traditionally were used as an inglaze decoration painted on top of majolica, but have been adopted for many other purposes. Compare with enamel or lustering, which are onglaze techniques that do not flux into the glaze below.

Stains are purchased in powder form and are used in clay bodies, glazes, slips and enamels. The strength of color depends on the amount of stain used in the mixture. Typical applications of stains are: up to 5% in transparent glaze, up to 10% in opaque glaze and up to 15% in clay bodies. Experiment and test. Stains are expensive so use only as much as needed to get your desired effect.

CERAMIC STAINS VERSUS OXIDES

Stains mostly maintain their color through environmental change whereas oxides will be dramatically affected by the firing atmosphere and temperature and the glaze formula. Oxides are the chemical combination of oxygen with a metal. Unlike stains the colors they produce in the firing is dependent on the oxides “around” them. Therefore to achieve certain colors it is necessary to create a bond in isolation and protect the colorant from combining with the “wrong” molecules. Stains are made by mixing together the oxides or materials and calcining them so that they combine on a chemical level. Compared to oxides, stains are formulated to give the same color without interference with the environment. Further still there are stains that are encapsulated by zircon through sintering (a mutual attraction and bonding without a liquid melt that happens just before the liquid phase, an electrical friction). Zirconium silicate (a compound of zircon and silica) is the basis for many high-temperature stains and is mostly unaffected by temperature up to 2372°F.

We have long termed these ceramic stains mixed with a flux and water as “wash” though that moniker is actually a verb not a noun. The idea is that the “wash” is used similarly to watercolor painting, applied to greenware, bisque, as inglaze, over or underglaze.

*Mason Stains, Cerdec-Degussa, Spectrum, Blue Heron are proprietary.

MIXING WASH

Equipment:

1. Triple beam gram scale for measuring
2. Clean sealable container for storing
3. Respirator

Procedure:

1. Put on your Respirator.
2. Calculate the quantity of wash needed.
3. Measure the materials using scale; add to an appropriately sized container.
4. Mix into 1 pint of water to make a thin watercolor-like consistency.
5. To make your own washes, start with a 50:50 mix of stain and Gerstley Borate and test.
6. Add more Gerstley Borate if test is dry after it is fired.

Δ04-Δ10 WASH RECIPES

Ingredients are in grams.

BLACK COPPER WASH

Color: Matte black

Gerstley Borate	100
Black Copper Oxide	150

BLUE WASH

Color: Matte bright blue

Gerstley Borate	441
EPK	87.75
Mason Stain 6339	220.5

GERSTLEY BORATE WASH

Color: Matte milk white/brownish

Gerstley Borate	to taste

GREEN WASH

Color: Matte green-brown

Gerstley Borate	441
EPK	87.75
Chrome Oxide	220.5

RED IRON WASH

Color: Matte red to black

Gerstley Borate	100
Red Iron Oxide	167

RUTILE WASH

Color: Matte yellow to tan

Gerstley Borate	100
Rutile	167

TERRA SIGILLATA

TERRA SIGILLATA APPLICATION:

Terra sigillata, also called “Terra Sig” or “Sig” is applied to greenware with a soft brush. If you desire a burnished finish, apply sigillata to a bone-dry pot, a few square inches at a time. When the area has lost its surface moisture but is still dark, rub with a soft cotton cloth, plastic bag over your finger, the back of a spoon, or a stone. You may apply several coats, but more than two can cause the sigillata to flake. Terra sigillata does not work well under glazes because its dense burnished surface is less porous and therefore is less easy for glaze to adhere. The ideal firing temperature range is Δ04-Δ02 to maintain burnishing but it can be fired up to Δ10.

MIXING TERRA SIGILLATA

Equipment:

1. Measuring cup
2. One-gallon container with lid
3. Length of clear rubber or plastic flexible hose
4. Ball Mill
5. Respirator

Procedure:

1. Put on respirator.
2. Dissolve soda ash in 1 cup of hot water then add to the remaining 13 cups of water.
3. Blend clays into water mixture and mix well. Break up lumps. Use a mixer if available.
4. Ball-mill for 6 to 10 hours.
5. Let stand, undisturbed, for 24 hours.
6. Do not move the container; carefully siphon off the uppermost, thinnest liquid. This thin liquid is the Terra Sigillata.
7. Adjust through the addition or evaporation of water to measure 1.2, or less, on a hydrometer–the consistency of skim milk.

Δ04-Δ10 TERRA SIGILLATA RECIPES

Ingredients are in grams.

BLACK TERRA SIGILLATA

Color: Opaque matte black

Fire Clay	500
OM4 Ball Clay	500
EPK	500
Black Iron Oxide	105
Manganese Dioxide	105
Black Stain (6600)	210
Soda Ash	10
Water	14 cups

WHITE TERRA SIGILLATA

Color: Opaque matte white

OM 4 Ball Clay	500
EPK	1000
Soda ash	15
Water	14 cups

RED TERRA SIGILLATA

Color: Opaque matte brick red

Newman Red	300
Redart	1200
Soda Ash	15
Water	14 cups

LUSTER

Luster is a metallic overglaze surface applied to either a glaze (matte or gloss) or an unglazed, though fired, surface. Luster is a very thin layer on the surface of the ware. The luster firing is generally a lower temperature than the prior glaze firing and just hot enough for the metal luster to adhere. Resin lusters, gold or palladium (called white gold) are used at GHP. They are prepared and ready to use out of the bottle. During firing, luster reduces the metal compound into a pure metal surface in an oxidized firing. This requires the luster has a reducing agent mixed in the solution to create a localized reduction.

In the last few years the use of luster has increased significantly in our studio and experimentation is still ongoing. First introduced *en masse* in 2010 through GHP Fabrications while working on a project for Gavin Brown's Enterprise fabricating work for Rirkrit Tiravanija. That project used 10,000 grams of palladium luster.

LUSTER APPLICATION

You must wear protective equipment, gloves and respirator, when lustering. We recommend the NIOSH OV/P100 vapor filters. The luster can be applied through brushing and spraying. As an onglaze, the luster is applied to an already fired surface. The surface must be cleaned prior to applying so that oil or grease is removed. Always wear a mask, gloves, eye protection and apply only in a well ventilated room. If gold is applied too thin, it can become purple in color if it is not cleaned off of unwanted areas sufficiently. If it is applied too thick then the gold can become cloudy or flake off.

KILN WASH

A mixture of refractory materials, kiln wash is used to protect the kiln shelves from glaze, washes, and melting ware. It is made to the consistency of heavy cream so that it can be painted onto the shelf between firings. It is formulated so that it adheres to the shelf but is able to be scrapped off after firing and reapplied. In a private studio, some might decide not to use kiln wash. Kiln wash can cause issues, as it can fly around in the kiln, drop into work during the firing and prevents flipping the kiln shelves from firing to firing–done to keep them from warping.

TRADITIONAL KILN WASH

Alumina Hydrate	5000
Silica	5000

GHP CURRENT KILN WASH (updated in 2017)

Alumina Hydrate	5000
Silica	2500
EPK	2500
Gerstley Borate	400

RESIST

Wax resist is melted wax or wax emulsion traditionally been used to coat the bottom of a pot or gallery of a lid to resist glaze during application. Before industry began producing water-based wax products paraffin wax was used. Paraffin is a petroleum based wax that would need to be heated prior to application. It was smelly and toxic and required a heating source. Shellac and latex are also popular materials in the decoration process. Anything that creates a barrier between the surface and the liquid/substance being applied is a resist; paper, tape, crayon, etc.

New wax products are much easier to use and nontoxic. Wax resist can be applied to greenware, bisqueware or fired ceramic surfaces to assist in the decoration process. It hass been used to help slow the drying of handles to help reduce cracking. It can also be used over top of shino glaze to encourage varying glaze effects. There are several brands that one can buy that vary in quality and cost. We add food dye to our resist so that it is easier to see in the application process. Be careful when applying wax, once it is on the piece there is no taking it off unless it is fired. To create “lid wax” we add alumina to our wax that helps to create a nonstick barrier between the lid and gallery. Lid wax leaves a white residue behind after firing so do not use in decorating.

Latex resist is excellent for use where you require multiple layers or need to be able to remove the resist prior to adding additional layers.

COLORING WAX RESIST

Food dye	Add to taste
Wax	Pint

LID WAX

Alumina Hydrate	1/2 cup
Wax	Pint

PLASTER

The United States Gypsum Company or USG was founded in 1902, the same year as Greenwich House. Visit www.usg.com for complete information regarding plaster and to demystify the plaster process. Plaster is made out of gypsum, a basic mineral, that has been ground and calcined to produce a uniform chemical with consistent properties. The equation of the chemical reaction of plaster is:

$$CaSO_4 \bullet 2H_2O + heat \leftrightarrows CaSO_4 \bullet 1/2H_2O + 1\text{-}1/2H_2O$$

With the addition of water, the plaster will rehydrate and revert back to gypsum. Once the slurry is agitated it takes about 10 minutes for this slurry mixture to begin to set, 45 minutes for it to completely set and harden, and three days for the plaster to reach its peak hardness and strength. During the chemical reaction process, plaster temperatures can reach 140°F, so one must take precautions not to burn one’s skin.

Plaster is used to make slump or hump molds, single, or multi-part molds for slip-casting, as well as in preparatory tasks like wedging clay or drying out slip. The absorptive property of plaster makes this possible. Plaster is like a sponge: it draws water from the clay. The ability of a plaster mold to effectively draw water out of clay depends on its density. The denser the plaster is, the less absorbent it will be. The ideal ratio of water to plaster generally falls between 68 and 90 parts water to 100 parts plaster, by weight. 68 parts water to 100 parts plaster will make for more absorbent plaster than 90 parts water to 100 parts plaster will, and so on.

MIXING PLASTER

Use fresh plaster. Plaster is calcined so chemically bound water has been driven off through heating. Plaster that has been sitting around will clump (absorb and bond with atmospheric water) making it unsuitable to use. Store plaster in a dry environment and keep it well sealed. Plaster should be used within 6 months of the manufacturing date on the package. You can mix the plaster by hand or with a hand-held drill. Hand mixing is not recommended but can be used for small batches (up to 5 pounds). There is a correlation between the physical properties of a finished plaster mold and the energy used in mixing the plaster to make it, therefore a mold made out of hand mixed plaster will not give you as strong a finished mold as plaster mixed with a hand-drill.

Mixing with a hand-held drill is ideal for making mixtures between 5 and 50 pounds. (Batches larger than 50 pounds should be made with a stand mixer.) The drill should be able to maintain 1,750 rotations per minute. The drill should be held at a 15° angle and the propeller should be held 1 inch or so from the bottom. The shaft of the mixer should ideally be in the center of the bucket, half-way between the sides. This will give the optimum distribution of materials.

EQUIPMENT:

- Pound scale
- Respirator
- Drill
- Jiffy Mixer attachment
- Cottle boards
- Murphy's oil soap
- 2 5-gallon buckets
- 1 10-gallon or larger bucket for cleaning

PROCEDURE:

Plan ahead. Mixing plaster may seem like magic and can be intimidating. The only thing you need to do is stay calm and plan ahead. Once you start the process there really is no way of turning back so make things as easy on yourself as you can.

1. Fabricate your form/model.
2. Block your model.
3. Set up Cottle boards or objects to contain liquid plaster.
4. Apply Murphy's soap or mold soap to the blocking and Cottle boards.

5. Determine the volume (volume = length x width x height or for a cylinder use (v = π x radius2 x height)) of space within the cottles, and subtract the volume of your model from that space.
6. Determine the amount of plaster you need. Our studio uses 70 parts water to 100 parts plaster.
7. 2 pounds of water (1 quart) for 2.85 pounds of plaster makes 80 cubic inches of plaster. (slab 8” x 10” x 1”)
8. Wearing a respirator, measure out plaster and room temperature water (between 70 - 100°F). The temperature of the water will affect set time. The hotter the water, the shorter the set time.
9. Pour water into mixing bucket. Water must always be first. Only add plaster to water.
10. Sift or strew plaster into water slowly. Do not dump. Plaster needs time to absorb water.
11. Allow plaster to slake in water for 2 – 4 minutes. This allows water to percolate between each plaster particle. The longer you slake the faster the set time. Too little slaking and you will have other issues with your final mold, such as pinholing. Smaller batches require less slake time.
12. Mix with drill (or hand) for 2 – 5 minutes. Plaster should have a creamy consistency.
13. After mixing, tap on the bucket to release air bubbles to the surface.
14. Pour your plaster slowly into your mold, allowing plaster to conform to the surface and into all crevasses and details starting in the deepest area. You want the plaster to flow evenly. If pouring a large mold, do not pour into the same place for the whole batch as it will produce a hard spot in the final product that will make for uneven absorption.
15. Tap on the table where you are casting with a rubber mallet to bring air bubbles to the surface. Tap the table rather than the cottles, so you do not destabilize your mold.
16. Immediately: Pour any leftover plaster into a plastic bag. Take a paper towel and wipe the mixing bucket out completely and discard the paper towel. Then rinse mixing bucket in clean up bucket.
17. Allow poured plaster to dry thoroughly before removing cottles or moving. Plaster goes through a chemical reaction that begins as soon as it is introduced to water. The longer that reaction takes, the hotter the plaster will become. Once it has completed the heating process (this takes about 45 minutes from when the water and plaster are first mixed together), you can remove the cottles.

18. Molds must be dry before use. Dry evenly. Unless urgent, dry molds naturally on a rack, if possible, to allow even air circulation around the whole mold. Avoid directional drying or heating in a kiln. If you must speed the drying process, do not heat over 120°F.

SHRINKAGE & THE PHYSICS OF CLAY

Clay's properties derive from clay particles, their size and shape, effect plasticity and shrinkage. Clay crystals (not to be confused with a grain of clay which is made up of numerous crystals) are flat hexagonals, about 0.5 micrometers in width - one millionth of a meter, or 0.000039 inch. Clay particles vary in size; kaolin and fire clay having larger crystals than earthenware and ball clay, which are fine. Coarseness effects plasticity, as coarseness increases plasticity decreases.

Wet clay particles slide past one another with little friction. With less water the particles become more sticky and less plastic. Clay is plastic because the water allows the particles to stick together through suction in addition to an electrostatic attraction. Throughout drying the water evaporates and the clay particles begin to collapse together.

Clay particles align themselves perpendicular to the pressure applied to them (See Figure A+B page 50). Therefore pressing downward on clay, the flat face aligns itself flat along the surface of that pressure. As clay particles are shorter in their thickness than their face (think bricks) there is greater shrinkage in-between the face than between their ends (See Figure E page 50). Throwing on a wheel that is rotating counter-clockwise, the throwing rings travel along a clockwise spiral upward as do the clay particles. The shrinkage, and therefore the twisting, follows the direction of the throwing spiral taking the pot further in a clockwise direction (See Figure C page 50).

FINE VERSUS COARSE PARTICLES

Fine particle clays are more plastic, have more water and more particles per equal volume of coarse clay. Fine clay has greater plasticity because the particles have less distance to travel when moving past each other and create a stronger suction and less displacement per particle. Because of their size, when dry, they compact smaller than an equal volume of space filled with large particles. This means that larger clay particles will shrink less (See Figure D).

Illustrations *The Potter's Dictionary* and Cardew's *Pioneer Pottery*.
Fig. A) Clay particles aligned in a handbuilt vessel.

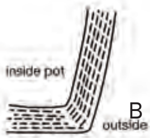
Fig. B) Clay particles aligned at right angles along the throwing lines of a wheel thrown pot

Fig. C) The path at which the throwing line travels along the wall of the pot relative to the spinning wheel. Counter-clockwise wheel will shrink clockwise.

Fig. D) How clay particles react relative to coarseness.

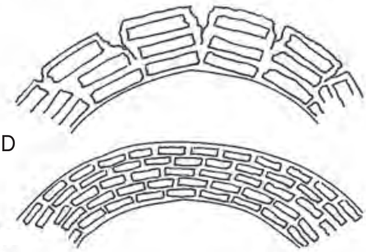
Fig. E) How water between clay particles effects the amount of shrinkage distance, shrinking greater along A than B.

A



B

D

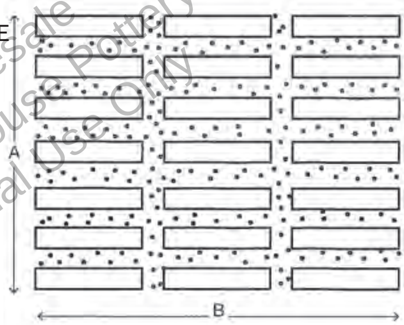


C

Figure 7.25. Allowance for twist during firing

. For clay thrown on a normal wheel (running anticlockwise) the angle of point downwards from right to left.

E



CRACKS: THE JOY AND SORROW

Jim Leedy said: *"I have never seen a crack I didn't like!"* For almost everyone else cracks are the bane of the ceramists existence. Cracks form because of stress within the clay or ceramic object. Stress is the result of clay shrinking through evaporation of water and/or the shrinkage and expansion of ceramic in the firing and/or cooling. When the stress is greater than the capacity of the clay or ceramic, the piece cracks.

How and why cracks form:

1. Greenware cracks result from/are the result of:
    - flaws in the making process.
    - ill-prepared clay.
    - slip applied to a dry clay body or water re-absorption.
    - variations of moisture consistency throughout making process.

- unequal thickness.
- an over abundance of water in making.
- the speed of or uneven drying.

2. Firing and Cooling: Cracks can be caused by:
    - uneven firing temperatures.
    - rapid temperature increase.
    - rapid cooling or proximity to air source.
    - thickness of glaze or uneven glazing.
    - uneven heat retention.

Identifying cracks

1. The wider end of the crack was the point of stress if:
    - the crack formed in the rim, it likely developed in the greenware stage.
    - the crack developed in the base of the work, it is generally arising from the firing, caused by the clay, the kiln stilts or shelf.
2. Examining the edge and face of a crack can aid to diagnose why the crack developed:
    - If the edge of the crack is frayed and on the face (the two sides), it likely occurred gradually and during the making and drying cycle, even though it might not have become apparent until the bisque or glaze firing.
    - If glaze is present and it flows into the edge of the crack and rounded over, this occurred before glaze melt i.e. early in the firing or from the bisque.
    - Alternatively, if the crack edge is sharp and the face of the crack is smooth, it occurred after the glaze had melted and during the cooling cycle.
    - If the face of the crack is smooth but the glazed edge is smooth, then the crack has developed early in the firing prior to glaze melt.
3. The thickness of the crack is indicative of the amount of stress that was present.

Images on page 53.

Image 1-2) Referred to as an “S” crack which occurs in thrown work. It is caused by unequal shrinkage between the walls and base or insufficient compression.

Image 3) Developed as a result of a bisque dunt caused by rapid cooling in the bisque fire. These cracks were likely not visible until after the glaze firing.

Image 4) Face of the crack is smooth and glaze edge sharp. This crack occurs during the cooling cycle and likely to do with heat retention in the work or the shelf.

Image 5) Cracks formed from dropping the glazed pot on the floor. Repair done with gold called Kintsugi.

Image 6) Result of unequal or rapid drying.

REPAIR

Repairing greenware, bisqueware and glazed ware is extremely difficult with varying degrees of success. Though commercial products have been invented to aid in repairing, such as Aztec Mender, Magic Mender and Patch-A-Tatch, we have discovered that paperclay is the most consistently reliable material for repairs of both greenware and bisqueware. Repairing glazeware is an art form in itself. The most famous method is Kintsugi, or the art of Gold Repair.

PAPERCLAY REPAIR (Research compiled by Lisa Chicoyne 2018)

Uses: Repairs bisque and greenware (Make repairs with same base clay as original.)

1. Mix clay into slip the consistency of yogurt. Sieve out grog.
2. In a separate container make paper pulp with a handful of TP in warm water.
3. Strain water from pulp using a wire mesh strainer.
4. Measure out three parts slip and one part paper pulp (25% paperclay).
5. Mix well. It should have an oatmeal-like consistency.

REPAIRING YOUR BISQUE PIECE (Traditional clay + paperclay)

1. If you are joining parts, thoroughly wet both parts. If repairing a crack saturate it.
2. Generously apply paperclay slip and put the two parts together.
3. For crack repairs push as much slip into the crack as possible.
4. Allow piece to dry, if seam or crack present using a paint brush wet the area and add more slip. Use a soft rubber rib to compress slip into cracks. Dry and repeat as necessary. Clay shrinks when it dries so you may need repeat a couple of times.
5. Clean unwanted slip using a damp sponge.

For large and/or structural repairs you should bisque fire again before glazing. For small repairs (non-structural) you do not need to bisque again before glazing.

BASIC REPAIR STEPS

Clear your workspace. Always work in an uncluttered area and give yourself plenty of time to do your repair.

1. Evaluate the break or crack. What material are you going to use? Do you have all the pieces? What kind of supports will you need?
2. Gather and prepare all necessary materials: all the pieces, tools,


1


2


3


4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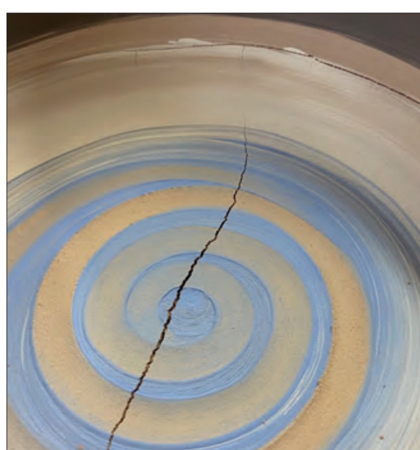
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soft padding and supports, repair material, ware board or firing tray.

3. Inspect the repair. Plan your strategy. How do the pieces fit together? Do you need to score or prepare parts. Set up your repair pieces so you know ahead of time how you are going to approach your repair. Carefully note how the pieces fit together.
4. Follow procedure for the material you chose to use for your repair. For most materials you will have to work swiftly while the material is wet.
5. Allow plenty of time for your mended parts to dry before handling your piece. Once you've set the parts do not disturb until it's dry, and even then treat the broken piece carefully.

TIPS FOR SUCCESSFUL REPAIRS:

- Repairs take time and attention. Don't rush and don't try to take shortcuts.
- If using a coarse or grogged clay, sieve slip before making repair mixture. Smoother clay does a better job.
- Always check the fit and plan your repair before applying repair material to your pieces.
- Rough surfaces hold repairs better than smooth surfaces. When possible roughen or score surfaces to be repaired.
- Complex repairs or multiple breaks may require drying and setting one part before repairing subsequent parts.
- Hairline cracks: It's almost impossible to get repair material into the crack. You can try to widen the crack by carving away some clay.
- The larger the surface area for the repair, the better chance you have of success.
- Use foam, newspaper, etc. to help support piece while you work. You want to limit the stress on the break as much as possible.
- When possible, reinforce breaks with extra repair material around the break. The challenge is to make repaired area look blended and intentional.
- After making the repair do not move the piece until it is completely dry. Most failed repairs are due to disturbing the repair.
- Always inspect repair before firing and add more repair material if traces of the crack are visible. Remember, clay shrinks as it dries.
- Always wait for the repair material to dry before lightly sanding or painting with underglaze and/or glaze.
- Always let the repair dry completely before firing.
- Take great care when loading the repaired piece into the kiln. Use a firing tray to avoid mishandling. Protect the repaired area.

REPAIRING GREENWARE

Uses: Repairs greenware

1. For breaks and large cracks generously apply paperclay slip and put parts together. DO NOT WET CLAY.
2. For small cracks open up crack a bit by carving away clay. Fill with paperclay slip.
3. Allow piece to dry. Add more slip if crack reappears.
4. Repeat as needed. Sand lightly to clean up.

BISQUE REPAIR

Uses: to repair cracks in bisqueware

White Glue	50%
Sodium Silicate	50%
Add: EPK	
Water	until mixture is the consistency of mayonnaise

GREENWARE PATCH

Uses: Repairs leatherhard clay cracks and breaks

Vinegar	1 teaspoon
Karo Syrup	¼ cup
Soda Ash	pinch
Nylon Fibers	pinch
Powder Clay	till pasty consistency

MAGIC WATER

Uses: Aids to prevent cracking and supports joints

Sodium Silicate	3 tablespoons
Soda Ash	5 grams
Water	1 gallon

REFERENCE AND BIBLIOGRAPHY

Bendel, Don and Paula Rice. 1998. *Ceramic*. Flagstaff, AZ: Northern Arizona University.

Cushing, Val. 1994. *Cushing's Handbook*, 3rd ed.

Digital Fire Corporation. www.digitalfire.com.

Fournier, Robert. 2000. *Illustrated Dictionary of Practical Pottery*. 4th ed. London: A+C Black.

Hamer, Frank and Janet. 1991. *The Potter's Dictionary of Materials and Techniques*. New York: Watson-Guptill.

Hopper, Robin. 1984. *The Ceramic Spectrum*. Radnor PA: Chilton Book Company.

Peterson, Susan. 1992. *The Craft and Art of Clay*. Englewood Cliffs, NJ: Prentice Hall.

Pitelka, Vince. *Clay: A Studio Handbook*. Westerville, OH: The American Ceramic Society.

Reijnders, Anton and the European Ceramic Work Center. 2005. *The Ceramic Process.* Philadelphia, PA: University of Penn Press.

Rhodes, Daniel. 2000. *Clay and Glazes for the Potter*. Edited by Robin Hopper. 3rd ed. Iola, WI: Krause Publishers.

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"GREENWICH HOUSE POTTERY IS A NEW YORK TREASURE: ALIVE; ESSENTIAL; AWAITING YOUR DISCOVERY. GREENWICH HOUSE POTTERY IS ONE OF THE GREAT GIFTS OF NEW YORK."

Jerry Saltz, Senior Art Critic for *New York Magazine*, Pulitzer Prize for Criticism

GLOSSARY: TERMS & MATERIALS

ABOUT GLOSSARY

MATERIAL: alias. *see* OTHER SOURCE. F,A,G,O,C* (Formula). Definition.

These are definitions of terms, processes, and techniques useful to the field that are now or have been used at the Pottery or they are found in this handbook. This is by no means an exhaustive list and has been culled from many sources.

With each definition we have included information such as alias', the scientific formula and have coded them–***Flux, Alumina, Glass-Former, Opacifier, Colorant.** These terms represent how the material acts in a glaze or clay body. To be a glaze the formula needs to have Flux, Alumina and a Glass-former present. It can happen that one that one material can fulfill multiple functions.

A

ACTIVE FLUX: Fluxes do not all act the same. Some are active at low temperatures and others at higher temperatures. Active flux means that it has a strong fluxing action.

AGING: There is no definitive answer for the optimum time for aging clay – associated with the percolation of water between clay particles. Some say it is a matter of days while others believe it takes years. Aged clay is more plastic and workable than un-aged clay. Val Cushing said that "Four to six weeks of aging will greatly improve the plasticity of all clay bodies–six months to a year is ideal."

ALBANY CLAY: *see* ALBANY SLIP. C.

ALBANY SLIP: New York slip, Albany clay. C. A plastic alluvial clay from Albany, New York used extensively in clay and glaze until 1986 when the mine closed. It turns into glaze between Δ8-10 without any additional material.

ALIPHATIC: Relating to organic compounds where carbon atoms form chains and not rings.

ALKALINE EARTHS: *see* OXIDE. Oxides of calcium, barium, magnesium, and strontium.

ALKALINE METALS: *see* OXIDE. Oxides of sodium, potassium and lithium.

ALLUVIAL: Material deposited by a river.

ALUMINA: *see* ALUMINUM OXIDE. A.

ALUMINA HYDRATE: hydrated alumina. A. (Al_2O_3 • $3H_2O$) or (Al_2 • $(OH)_6$). A refractory material and a source of alumina used primarily for kiln wash and wadding.

ALUMINUM OXIDE: alumina corundum, dialuminium trioxide, aluminum sesquioxide. A. (Al_2O_3). Refractory, used in glazes to promote viscosity, stability, give hardness and durability. In a glaze it promotes matte surface and helps adhere glaze to the ceramic surface. With too little, the glaze will run with too much; it pinholes. In clay bodies, aluminum oxide is a refractory material and cuts down drying shrinkage.

ALUMINUM SESQUIOXIDE: *see* *Aluminum Oxide*. A.

ANTIMONATE OF LEAD: naples yellow. ($Pb_3(SbO_4)_2$)This is a poisonous, creamish yellow pigment once used to introduce antimony oxide into lead glazes.

ANTIMONY OXIDE: diantimony trioxide, stibium sesquioxide. G,O,C. (Sb_2O_3). An oxide whose properties, are determined by its combination with other oxides. A glass-former but also a opacifier and used to produce yellow.

AP GREEN: *see* *Fire Clay*. Mined in Missouri, a clay with medium plasticity and low shrinkage.

ASH GLAZE: Glaze made with wood or vegetative-derived ash characteristically runny.

AUXILIARY FLUX: *see* *Secondary Flux*.

B

BAKING SODA: *see* *Sodium Bicarbonate*.

BALL CLAY: blue clay. A. A highly plastic fine particle refractory clay that adds plasticity to clay bodies and alumina to glaze in addition to acting as a suspender. It has a higher shrinkage rate than stoneware and fire clay.

BALL MILL: jar mill, pot mill, pebble mill. A machine that uses ceramic balls within a rotating cylinder to more finely crush material within a liquid.

BARIUM CARBONATE: witherite F. ($BaCO_3$). A secondary flux in high temperature glaze producing satin matte. Not food safe in low-fire glaze. (.02-.08%) added to clay stops scumming or efflorescence, mix with water before adding to the clay body. Used in rat poison.

BARIUM OXIDE: F,O. (BaO). An auxiliary flux in frits and high-temperature glaze. It can have a crystallizing effect and gives satin mattes.

BARNARD CLAY: *see* *Earthenware Clay*. An iron-bearing earthenware clay and is often used as a substitute for Albany slip.

BENTONITE: ($Al_2O_3 \cdot 5SiO_2 \cdot 7H_2O$). An extremely fine particle colloidal volcanic clay consisting mainly of montmorillonite used in clay for plasticity and dry strength - in an amount up to 3%, though it has a high shrinkage rate. In glaze it keeps the mix in suspension. Mix with water up to 24 hours before to allow water to percolate between the clay particles.

BICHROMATE OF POTASH: potassium dichromate. ($K_2Cr_2O_7$). A soluble crystalline material with a bright red-orange color. It is used to introduce chromium oxide into low-temperature glazes.

BISQUE: The first firing of greenware (GHP fires bisque to Δ06 or 1828°F) making the ceramic sufficiently hard to accept glaze and durable enough to handle. It is also chemically different from clay and therefore cannot return back to a state of workability.

BLACK COBALT OXIDE: see *Cobalt Oxide*. C.

BLACK COPPER OXIDE: cupric oxide. see *Copper Oxide*. C. (CuO). Coarser grain size and yields more copper than copper carbonate.

BLACK CORE: see *Carbon Core*.

BLACK IRON OXIDE: ferrous oxide, synthetic magnetite. C. (Fe_3O_4). A source of iron for clay and glaze and it disperses better than Red Iron Oxide.

BLACK NICKEL OXIDE: nickelic oxide, nickel sesquioxide, nickel oxide. (Ni2O3). A powerful and refractory colorant producing grays, blues and yellows. More concentrated then nickel carbonate.

BLISTERING: Generally an unwanted gassing that results in bubbles and craters in the glaze occurring when the glaze has not had time to smooth out, or is applied too thickly, or incompatible glaze combination.

BLOATING: Blistering or swelling of the clay body caused by trapped gases resulting in bumps on the surface.

BLUE CLAY: see *Ball Clay*.

BLUE JOHN: see *Fluorite*.

BLUNGER: A machine commonly used in the pottery industry for mixing clay and water.

BONE ASH: calcium phosphate. F,O. ($Ca_3(PO_4)_2$) or ($4Ca_3(PO_4)\ 2CaCO_3$). Ground calcined bones, usually of a cow, it is produced by calcining and crushing bone. It is a high-temperature secondary flux and an opacifier in low-temperature glaze. It gives the translucency to bone porcelain.

BONE PORCELAIN: bone china. A translucent English porcelain made with a minimum of 30% bone ash. One recipe to try is 25% Kaolin, 25% Cornwall Stone, 50% bone ash.

BORATE: A chemical compound which includes the element boron.

BORAX: tincal. F,G. ($Na_2O \cdot 2B_2O_3 \cdot 10H_2O_3$ or $Na_2B_4O_3 \cdot 10H_2O$) A powerful flux in glaze.

BORIC ACID: (H_3BO_3) or (H_3BO_3) or ($B_2O_3 \cdot 3H_2O$). Crystalline water soluble boron mineral.

BORIC OXIDE: boron oxide. F. (B_2O_3). An active flux with a low coefficient of expansion used to make Pyrex.

BOROCALCITE: see *Colemanite*.

BORON: (B). Is used as an igniter for rocket fuel and to regulate nuclear reactors. Chemically uncombined boron is not found on earth.

BORON OXIDE: see *Boric Oxide*. F.

BUCK SPAR: see *Potash Feldspar*. F,A,G. Possibly short for Buckingham Feldspar, a potassium feldspar.

BUCKINGHAM FELDSPAR: see *Buck Spar*.

BURNISHING: Polishing leatherhard clay by rubbing with a smooth pebble or the back of a spoon. For the best burnished results fire under Δ03. Typically a technique used with Terra Sigillata.

BURNT UMBER: C. (Fe_2O_3 • H_2O • MnO_2 • SiO_2). Hydrated calcined iron oxide, a form of ochre with a significant amount of manganese.

C

CALCINE: Heating a material to red heat or to a minimum of 1112°F, removing the chemically bonded water, thus giving it the same chemical content without the additional shrinkage. Calcined materials are useful to reduce shrinkage in clay bodies or glaze.

CALCINED KAOLIN: (Al_2O_3 • $2SiO_2$). Kaolin that has been fired to at least to 1112°F to remove the chemically bonded water and eliminating the shrinkage. Used in clay and glaze to reduce shrinkage and crazing.

CALCIUM BORATE: see *Gerstley Borate*. F,G.

CALCIUM CARBONATE: carbonate of lime, whiting, limestone, lime. F,O. ($CaCO_3$). Carbonate of lime used to introduce calcium oxide into glaze. It is the most frequently used flux in high temperature glazes and helps reduce fired shrinkage in low temperature bodies.

CALCIUM FLUORIDE: see *Fluorite*.

CALCIUM MAGNESIUM CARBONATE: see *Dolomite*. F,O.

CALCIUM METASILICATE: see *Wollastonite*. F,G.

CALCIUM OXIDE: F. (CaO). A flux used in nearly all glazes giving whiteness, hardness, and durability while lowering the coefficient of expansion.

CAMPBELL RED CLAY: Clay mined in New Jersey. Most likely an earthenware clay.

CAN SPAR: Unidentified feldspar used in the Mottled Blue Δ06 glaze from the archive.

CARBON: Is present in most clays which gives clay its grayish color, though this is removed during the bisque oxidation firing. Carbon builds up on pots during atmospheric firings, what is often termed sooting. Though later the carbon burns off helping produce heat within the kiln. This carbon will not burn off unless proper oxidation occurs above 1292°F will discolor glaze and cause black core.

CARBON CORE: black core. The dark gray/black center seen in sherds – the result of heavy or over reducing, where carbon built up in the body cannot burn out. Normally, oxygen enters the pores of the clay and combines with the carbon and escapes as a gas. In reduction the carbon cannot escape. To remedy, go slowly from 1382°F - 1652°F, in oxidation. During this time carbon will take the oxygen from red iron oxide, resulting in the production of black iron oxide and at 1652°F the newly produced black iron oxide becomes a flux and cannot be reoxidized. It is believed that the greatest cause of black coring in bodies is insufficient burn out in bisquing. The effect weakens the clay body and leads to dunting and bloating

CARBON TRAP: Glazes with patterns of gray and black below the surface caused in an atmospheric firing without adequate oxygen. Carbon is refractory and stays in the glaze as long as the kiln is in a reduction atmosphere. Typical of high sodium glazes with considerable solubility. Early reduction before glassification of fluxes enables the porous clay to trap carbon which later appears as spots within the glaze.

CARBONATE: To combine or infuse with carbon.

CARBONATE OF LIME: *see* CALCIUM CARBONATE. F,O.

CARBOXYMETHYLCELLULOSE: *see CMC* GUM.

CAROLINA STONE: *see* CORNWALL STONE. F,A,G.

CASTING SLIP: A clay and water solution with deflocculant used in slipcasting.

CERAMIC: Keramic. Clay that has been made permanent through heat. Originating with the Greek, *keramos*.

CERAMIC CHANGE: The change from workable plastic clay into hardened ceramic. After this point the clay can no longer be rehydrated and worked. Once it is subjected to heat of about 1112°F, it is no longer plastic clay. This is done through higher temperature heating that removes the two molecules of water that are molecularly bound in clay.

CHAMOTTE: *see* GROG.

CHATTERING: The rhythmic rippling (desired or not) which appears during trimming that is caused when the clay is too hard or too soft, if the tool is not sharp enough or if the wheel is turning too fast.

CHEESEHARD: *see* LEATHERHARD.

CHINA CLAY: *see* KAOLIN.

CHINA PAINT: *see* OVERGLAZE.

CHINA STONE: *see* CORNWALL STONE. F,A,G.

CHROME OXIDE: chromium, chromium oxide. O,C. (Cr_2O_3). A glaze colorant that is extremely refractory, generally producing heavy dark green colors.

CHROMIUM: *see* CHROME OXIDE. O,C.

CHROMIUM OXIDE: *see* CHROME OXIDE. O,C.

CLAY: hydrous alumina silicate. ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$). All clay comes from decomposed feldspathic rock. Primary clays are found at or close to their source rock, have a large particle size and are relatively pure making them less plastic with less shrinkage. Secondary clays are removed from its source rock through water, wind or weathering making the particles finer and contain impurities which increase plasticity and shrinkage. Clay is between 10-14% chemically bonded water by weight.

CLAY BODY: A clay-based composition designed for particular working characteristics. Clay bodies have 3 essential constituents 1) clay 2) flux (feldspar) 3) filler (silica, grog). Clay gives plasticity, flux assists in vitrification and fillers reduce dry and fired shrinkage in addition to adding color and texture. Clay bodies have 10% chemically combined water, 10% in-between the particles, and up to 20% for workability. 1 gallon of water weighs 8.3 pounds.

CLITCHFIELD 202 SPAR: *see Potash Feldspar*. F,A,G.

CMC GUM: carboxymethylcellulose, gum. A glaze suspender used to harden unfired ceramic glazes.

COBALT CARBONATE: F,C. ($CoCO_3$). A strong blue colorant and flux used in glaze and slip. More finely ground then the oxide which gives more even color.

COBALT OXIDE: black cobalt oxide. F,C. (Co_3O_4). The oxide form of cobalt. The most powerful of the coloring oxides and a strong flux. More coarse then its carbonate form.

COEFFICIENT OF EXPANSION: expansion, thermal expansion. The physical change of an oxide when heating and cooling affecting the way glaze and clay bodies react to one another. Too much of a difference creates glaze flaws (see blistering, crawling, crazing, dunting, shivering). Here is a list of the oxides listed in order of highest expansion to least.

Na_2O (Sodium Oxide)	4.32
K_2O(Potassium Oxide)	3.90
BaO (Barium Oxide)	1.73
CaO (Calcium Oxide)	1.63
PbO (Lead Oxide)	1.06
B_2O_3 (Boric Oxide)	.66
MgO (Magnesium Oxide)	.45
Al_2O_3 (Alumina)	.17
ZnO (Zinc Oxide)	.07
SiO_2 (Silica)	.05

COLEMANITE: borocalcite, hydrated calcium borate, pandermite, priceite. ($2CAO \cdot 3B_2O_3 \cdot 5H_2O$). A powerful flux, source of insoluble boron, and adds brilliance in color and gloss for glazes.

COLLOIDAL: A substance that consists of particles dispersed throughout another substance.

CONES: Δ *see Pyrometric Cones*. Cone chart on page 84.

COPPER CARBONATE: synthetic malachite, cupric oxide, cuprous oxide. F,C. ($CuCO_3$). A clay and glaze colorant producing a wide range of colors and very responsive to atmospheric change inside the kiln. It is a volatile substance so will affect pieces near it in the kiln.

COPPER CARBONATE ORE: *see Malachite*.

COPPER MONOXIDE: *see Copper Oxide*.

COPPER OXIDE: F,C. (CuO). A flux that is responsive to the atmosphere in firing.

COPPER STANNATE: (CuO_3Sn). Used in the Δ10 glaze Copper Red Kring #2 from the archive.

CORDIERITE: ($2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$). A magnesium aluminum silicate with low thermal expansion used for kiln furniture.

CORNISH STONE: *see Cornwall Stone*. F,A,G.

CORNWALL STONE: carolina stone, china stone, cornish stone, df stone, growan. F,A,G. A feldspathoid material more complex than potash or soda feldspar and contains numerous trace elements, is low in iron and used as a flux in clay and glaze.

CORUNDUM: *see Aluminum Oxide*. A.

COTTLE: cockle, cockling. Expendable wall of wood, metal or plastic to contain poured plaster in the mold making process.

CRACK: *see* SECTION ON CRACKS. A break in greenware, bisqueware or glazeware. There are several varieties of cracks; each has a uniqueness that aids in discovering the reason for it.

CRAWLING: A glaze effect or defect, depending on intention, characterized by glaze separating from the clay body and forming beading or bunching on the surface. It can be caused by dirt, dust or oil on the bisque before glaze is applied or from the glaze being applied to thickly.

CRAZING: Is a common glaze effect (crackle) or defect characterized by fine cracks in the glaze surface. It is caused by the glaze contracting more than the ceramic body, glaze thickness or rapid cooling. To remedy, try increasing the silica, boric oxide or alumina or you can decrease the feldspar; alternatively, you can alter the clay body by adding silica.

CROCUS MARTIS: ($FeSO_4$). Is an anhydrous iron sulfate calcined copper used in glazes as a substitute for red iron oxide.

CRYLOITE: *see* CRYOLITE.

CRYOLITE: cryloite, kryolith, sodium hexafluoroaluminate. (Na_3AlF_6). A fluoride of aluminum and sodium and a source of insoluble sodium used in enameling, frits and glaze used in crater glazes.

CUPRIC OXIDE: *see* BLACK COPPER OXIDE. *see* COPPER OXIDE. C.

CUSTER FELDSPAR: *see* POTASH FELDSPAR. F,A,G.

D

DALTON (RED) CLAY: *see* EARTHENWARE. Iron red clay similar to redart.

DARVAN #7: A deflocculant used to disperse and keep particles in suspension reducing the amount of water needed to make it workable. Similar to sodium silicate, yet needs twice as much to achieve similar results. It does not attack the plaster mold and does not require soda ash making it a good deflocculant for slipcasting clay.

DE-AIRING PUGMILL: *see* AGING. A pugmill with a vacuum that removes the air from the clay making it more compact, dense and giving greater workability. Val Cushing wrote: “Four to six weeks aging will greatly improve the plasticity of all clay bodies–six months to a year is ideal. One run through a de-airing pug mill is the equivalent of three months aging.”

DEFLOCCULANT: A material that disperses clay particles.

DEFLOCCULATION: The action of dispersing clay particles and making slip, clay and glaze more fluid and requiring less water.

DF STONE: *see* CORNWALL STONE. F,A,G.

DIALUMINIUM TRIOXIDE: *see* *ALUMINUM OXIDE*. A.

DIANTIMONY TRIOXIDE: *see* *ANTIMONY OXIDE*.

DOLOMITE: calcium magnesium carbonate. F,O. ($CaMg(CO_3)_2$ or ($CaCO_3 \bullet MgCO_3$). A high temperature flux with calcium and magnesium producing matte durable surfaces.

DUNTING: Cracking of ceramic caused by stress during cooling, primarily from the contraction of body and glaze, if cooled too fast and/or from stress from the glaze and body. Some types:

- A thick layer of glaze on the inside of a pot and a thin or no glaze on the outside resulting in a spiral dunt.
- If the glaze stops short of the foot producing a ring crack.
- If the glaze pools inside the pot creating a split that carries up the rim.
- Unequal thickness of the body.
- A thin brittle body.
- A thin, open or weak body that is underfired.

E

EARTHENWARE: A porous clayware made from low-firing secondary clay.

EARTHENWARE CLAY: Common, usually red, ground clay that contains impurities, and has a low maturing temperature. Used to make earthenware.

EFFLORESCENCE: In French means “to flower out” is when salt leaches through to the surface within a porous material. It happens through the dissolving of an internally held salt. The salted water migrates to the surface, then evaporates and leaves a coat of salt on the surface.

EGYPTIAN PASTE: A low-temperature self-glazing clay body.

ENGOBE: A term used interchangeably with “slip”, though it includes materials in addition to clay. An engobe is halfway between slip and glaze, firing to a more vitreous state than slip though not as dense as glaze.

EPK: *see* *KAOLIN*. Stands for Edward Plastic Kaolin, mined in Florida.

EPSON SALT: magnesium sulfate. F. ($Mg_2SO_4 \bullet 7H_2O$). A deflocculant used in glaze usually with gerstley borate. Improves plasticity in clay bodies.

EUTECTIC: The lowest melting point of two or more substances when combined which is always a lower melting point than either of their individual melting points.

EXPANSION: *see* *COEFFICIENT OF EXPANSION*.

F

FELDSPAR: F,A,G. ($K_2O \cdot Al_2O_3 \cdot 6SiO_2$). An alumino-silicate mineral similar to clay with a proportionally higher flux. The single most important material in high temperature glaze as it contains all three necessary constituents.

FERRIC OXIDE: *see* *Red Iron Oxide*. F,O,C.

FERROUS OXIDE: *see* *Black Iron Oxide*. C.

FERROUS TITANATE: *see* *Ilmenite*. C.

FILLER: Material added to clay bodies to control plasticity, increase working strength and reduce shrinkage.

FIRECLAY: A relatively pure coarse particle clay that is highly refractory though the varieties vary widely in properties.

FIRING: The process of converting clay to ceramic through heating.

Low Temperature Firing: Δ022-Δ01.

Mid-Temperature Firing: Δ1-Δ5.

High Temperature Firing: Δ6-Δ14.

FLASHING: A visual effect on bare clay surfaces in fuel burning kilns particularly wood kilns. This flashed area has been subjected to a thermal variation due to contact with flame, ash or kiln atmosphere and vapors.

FLINT: G. (SiO_2). A black variety of quartz and a source of silica.

FLAMEPROOF CLAY BODY: A clay body that can withstand direct flame for use in cooking.

FLOCCULATION: Altering the physical properties of particles in a suspension so that they aggregate and settle.

FLUORIDE: (F-). An inorganic anion (negatively charged ion) of fluorine and the main component of fluorite.

FLUORINE: (F). Is an extremely reactive and poisonous chemical element and the primary source of fluorine is fluorite.

FLUORITE: blue john, calcium fluoride, fluorspar. (CaF_2). Is composed of calcium fluoride. It is used in frit preparation and as a low temperature opacifier. It is an active flux at the same time that it opacifes. At higher temperatures fluorine becomes volatile and is released as a poisonous gas.

FLUORSPAR: *see* *Fluorite*.

FLUX: Any oxide that lowers the melting point of a clay body or glaze.

FOUNDRY HILL CREAM: *see* *Stoneware*. A clay blend similar to a ball clay.

FRENCH CHALK: *see* *Talc*. F,G.

FRIT: Materials that have been combined and heated into glass and reground removing the toxicity hazard. In clay bodies frit strengthens, improves glaze fit, limit glaze defects and lower the vitrification point.

G

G-200: *see* *Potash Feldspar*. F,A,G. A potash feldspar high in potassium and low in iron. No longer mined.

GALL CLAY: *see* *Ochre*. C.

GERSTLEY BORATE: calcium borate. F,G. ($CaO \cdot B_2O_3 \cdot 5H_2O$). The preferred flux used in glaze as a replacement for colemanite.

GLASS-FORMER: The oxides used to form glass in glazes.

GLAZE: Any substance that melts and fuses into place at a given temperature rendering the ceramic ware food safe and/or giving color to form. For a glass surface there are three necessary constituents: 1) Flux 2) Alumina 3) glass-former; and for effect, you can add: 4) opacifier 5) colorant.

GODFREY SPAR: *see* *Sodium Feldspar*. F,A,G.

GOLDART: *see* *Stoneware Clay*. A plastic variety of stoneware clay.

GOLD LUSTRE: *see* *Lustres*.

GREENWARE: Clay that is not yet fired.

GROG: chamotte. *see* *Molochite*. Fired clay which has been ground and used in clay bodies as a filler to reduce shrinking, warping and cracking. Grog comes in a variety of mesh sizes usually referred to as coarse, medium, or fine. Mesh size corresponds to how many holes per inch in the screen. 20-mesh is more coarse then 40-mesh which is more coarse then 60-mesh. For maximum shrinkage reduction and workability it is suggested to use a variety of mesh sizes in combination so the total is made up of 50% coarse, 10% medium and 40% fine grog. Grog can be used to add dry strength and decrease shrinkage. Other materials can be substituted for traditional grog such as coffee grounds, rice, Cheerios, etc.

GROLLEG KAOLIN: *see* *Kaolin*. An extremely pure English kaolin.

GROWAN: *see* *Cornwall Stone*. F,A,G.

GUM: *see* *CMC Gum*.

H–K

HAKAME: Slip applied with a wide often straw-like brush causing deep grooved brush strokes.

HARD PASTE PORCELAIN: A porcelain clay composed of feldspathic rock, cornwall stone, and kaolin and fired to a high temperature. Has the advantage over soft paste porcelain because it is less likely to crack when subjected to hot liquids.

HAWTHORNE BOND FIRE CLAY: *see* *Fire Clay*. A clay mined in Missouri.

HELMAR KAOLIN: *see* *Kaolin*. Clay mined near Helmar, Idaho with great flashing if woodfired.

HYDRATED ALUMINA: see *Alumina Hydrate*. A.

HYDRATED CALCIUM BORATE: see *Colemanite.*

HYDROMETER: see *Relative Density*. see *Specific Gravity*. An instrument used to measure the relative density of liquids–the ratio of density of the liquid to the density of water used to create consistency in glaze results.

ILMENITE: ferrous titanate. C. (FeO • TiO_2 or $FeTiO_3$). The ore of iron and titanium that is used as a colorant in clay and glaze, similar to rutile but darker.

IMPURE TITANIUM OXIDE: see *Rutile*. O,C.

INGLAZE: see *Section on Wash.* sink-in decoration. Inglaze is decoration which sinks in to the glaze beneath it. Typically applied on top of an unfired glazed piece which will sink into the glaze below during the firing. Typically used in majolica painting.

INLAY: A technique where lines are scratched in clay and filled with colored clay, slip or glaze in greenware or bisque.

INSOLUBLE: Incapable of being dissolved in water.

JIGGERING: Forming a pot by using a spinning mold which shapes the inside while cutting and forming the other side with a shaper.

JOLLEYING: Forming a pot using a spinning mold which shapes the outside while a profile tool shapes the inside.

JORDAN CLAY: Jordan Fire Clay, Maryland Ball Clay/Stoneware. A low iron fire clay.

JORDAN FIRE CLAY: see *Jordan Clay*.

KALIUM OXIDE: see *Potassium Oxide*. F.

KAOLIN: china clay. (Al_2O_3 • $2SiO_2$ • $2H_2O$). The purest, least plastic and most refractory natural clay, essential for making porcelain.

KARO SYRUP: see *Section on Repairs.* Corn syrup used for the greenware patch that when mixed with the other ingredients dries very hard, encouraging bonding.

KEYSTONE SPAR: see *Potash Feldspar*. F,A,G.

KONA A-3: see *Potash Feldspar*. F,A,G.

KONA F-4: see *Sodium Feldspar*. F,A,G. No longer mined.

KILN: A structure built to contain heat in order to turn clay into ceramic.

CROSS-DRAUGHT KILN: cross-draft kiln, natural-draft kiln. A horizontal kiln in which flame and gases travel across the chamber and through the ware, typical of wood-fired kilns.

DOWN-DRAUGHT KILN: down-draft kiln. A kiln where flames are deflected downward through the chamber, dispersing heat more evenly, before exiting out the chimney in the back or bottom of the kiln.

ELECTRIC KILN: A kiln uses electricity to heat the chamber in a neutral/oxidizing atmosphere.

GAS KILN: Usually up or down-draft kilns that use natural gas for combustion.

NATURAL-DRAUGHT KILN: natural-draft kiln, cross-draft kiln.

UP-DRAUGHT KILN: up-draft kiln. Where gases and flame pass upward through the ware to the chimney.

KILN WASH: *see Section on Kiln Wash.* Is a layer of material between the ceramic ware and the kiln shelf. It is designed to prevent glaze, wash or other fluxing materials from sticking to the kiln shelf. The ingredients that are used are highly refractory.

KINGMAN SPAR: *see* *Potash Feldspar*. F,A,G. No longer mined.

KINTSUGI: *see Section on Cracks*. Gold repair, it is the ancient tradition of repairing broken pots with lacquer dusted with gold. Because of the gold the work is still regarded as food safe. Currently the trend has become decorative more than functional.

KRYOLITH: *see Cryolite*.

L

LANDTHANIDE: Comprises the fifteen metallic chemical elements with atomic numbers 57 through 71 on the periodic table. They are collectively known as the rare earth elements.

LATEX RESIST: Resist made with liquid latex that is capable of being applied and peeled off between coats of glaze, slip or terra sig.

LEAD CARBONATE: *see White Lead*.

LEATHERHARD: cheesehard. The stage that clay reaches when it can be picked up without being distorted yet soft enough to work, smooth or apply slip and engobe to.

LEPIDOLITE: lithium feldspathoid, lithium-potassium mica, lithium mica. (LiF • KF • Al_2O_3 • $3SiO_2$). A natural material used to introduce lithium oxide into glaze. It has a lower fusion point than other feldspars and contains fluorine which causes an increase in glaze bubbles and pitting.

LEVIGATION: *see Terra Sigillata*. Refining clay by floating in water so heavier particles settle out and the smaller particles can be removed.

LIGHT RUTILE: *see Rutile*. O,C.

LIME: calcium oxide, live calcium. (CaO). This encompasses several different minerals and manufactured products which are used to introduce CaO into mixtures. CaO is not found in nature. It is used as a flux in glaze and it becomes active above 2012°F.

LIMESTONE: F,O. *see Calcium Carbonate*. ($CaCO_3$).

LITHIUM CARBONATE: F. (Li_2CO_3). An active flux with color responses similar to sodium and potassium. Reduces glaze expansion and promotes crystallization.

LITHIUM FELDSPATHOID: *see Lepidolite*.

LITHIUM OXIDE: F. (Li_2O). A powerful flux that can be used in place of potassium and sodium oxides and helps reduce crazing.

LITHIUM-POTASSIUM MICA: *see Lepidolite*.

LITHIUM MICA: *see* LEPIDOLITE.

LIZELLA: *see* EARTHENWARE. A light red earthenware clay similar to Redart though with higher shrinkage and more iron.

LUSTRE: luster. *see* SECTION ON LUSTER. Onglaze, metallic compounds suspended in an oil-based resin which when fired in an oxidized atmosphere creates a pure metal surface. These are typically applied on top of gloss glaze and re-fired at Δ014-019. We fire on the hotter side for better adhesion.

M

MACALOID: A magnesium alumino-silicate and refined white variety of bentonite, though not quite as plastic, used to keep glaze in suspension. Mix with warm water before adding to the mixture (less than 3%). Also used as a plasticizer in porcelain.

MAGNESIUM CARBONATE: F. ($MgCO_3$). A high temperature flux which produces a smooth, buttery, matte surface similar to dolomite.

MAGNESIUM OXIDE: F. (MgO). A refractory at lower temperature but a flux at high temperature. It lowers the coefficient of expansion in glazes to reduce crazing.

MAGNESIUM SILICATE: *see* TALC. F,G.

MAGNESIUM SULFATE: *see* EPSON SALT. F.

MAJOLICA: maiolica. Low fire decorated tin-glazed earthenware.

MAJOLICA STAIN: Stain or wash used to decorate over top of majolica glaze.

MALACHITE: copper carbonate ore. ($CuCO_3$ • $Cu(OH)_2$). A weathered ore of copper used as a colorant in glazing.

MANGANESE CARBONATE: C. ($MnCO_3$). Colorant for glazes. In alkaline glaze it can produce blue-purple and plum.

MANGANESE DIOXIDE: F,C. (MnO_2). A colorant used to develop purple in low-temperature and beige in high temperature glaze.

MARYLAND BALL/STONEWARE: *see* JORDAN CLAY.

MASON STAINS: A U.S. suppler of stains used as colorants in glazes, clay bodies, slips and washes.

MIN-PRO SPAR: minipro feldspar. *see* SODIUM FELDSPAR. F,A,C. A soda feldspar similar to Kona F-4.

MINIUM: *see* RED LEAD.

MINSPAR 200: minspar feldspar. *see* SODIUM FELDSPAR. F,A,C. A soda feldspar used to replace Kona F-4 and G-200.

MISHIMA: *see* INLAY.

MOLOCHITE: chamotte, grog. (Al_2O_3 • $2SiO_2$) The trade name for calcined kaolin clay with a low-iron content used as a filler in porcelain or white clay to reduce shrinkage and increase green and fired strength. Available in a wide range of mesh sizes.

MONTMORILLONITE: The main constituent of the volcanically produced bentonite.

MOTHER OF PEARL: An overglaze that produces an opalescent color and is iridescent over white but the overall look depends on the glaze it is applied on. It is typically applied over a glazed surface and then fired again at Δ020.

N

NAPLES YELLOW: *see* Antimonate of Lead.

N.A. FIRE CLAY: unidentified fireclay used in one of our sculpture clay bodies from the archives.

NATRIUM OXIDE: *see* Sodium Oxide. F.

NEPHELINE SYENITE: neph sye. F.A.G. ($K_2O \cdot 3Na_2O \cdot 4Al_2O_3 \cdot 8SiO_2$). Alternative to feldspar, active fluxing powers, high in sodium, which may cause crazing.

NEUTRAL ATMOSPHERE: The atmosphere inside a kiln that is neither oxidizing nor reducing. Typically, an electric kiln fires in a neutral atmosphere going through bouts of reduction and oxidation, though predominantly the latter.

NEW YORK SLIP: *see* Albany Slip. C

NEWMAN RED: *see* Fireclay. A red-burning, low-plastic fire clay.

NICKEL CARBONATE: A mixture of inorganic compounds that contain nickel and carbonate.

NICKEL OXIDE: *see* Black Nickel Oxide.

NICKELIC OXIDE: *see* Black Nickel Oxide.

NICKEL SESQUIOXIDE: *see* Black Nickel Oxide.

NYLON FIBERS: Short-cut fibers used in clay bodies from .1-.5% to increase green and dry strength. Disperse in hot water before adding to the clay mixture. T-153 Available through Hercules Inc. (404-447-9120).

O–P

OCHRE: gall clay. C. Colorant used to produce tan, brown and brick red hues. A ferric oxide earth with manganese and other metals.

OCMULGEE: A sandy, coarse, iron bearing sedimentary clay. No longer mined.

OM-4 BALL Clay: *see* Ball Clay. Old Mine #4 references the clay mine this clay is harvested in Kentucky.

ONGLAZE: *see* Overglaze.

OPACIFIER: Minerals used in glaze recipes to make glazes opaque.

OVERGLAZE: onglaze. Color applied on top of the fired glaze surface and subsequently re-fired. The firing is at a lower temperature than the first glaze firing in order that the first fired glaze is undisturbed while the onglaze color fuses on the glaze beneath it.

OXIDATION ATMOSPHERE: An atmosphere in a kiln where there is a plentiful amount of oxygen enabling metals in clays and glazes to develop their oxide colors. Typical of electric kilns and the cooling phase in gas kilns.

OXIDE: A binary compound of oxygen with another element.

PALLADIUM: white gold. see *Lustre*.

PANDERMITE: see *Colemanite*.

PAPERCLAY: see *Section on Clay*. A clay body that uses paper pulp as a filler to increase green strength. Usually the recipe contains between 5 – 49%. The paper must be mixed with water into a pulp before adding to the clay mixture.

PEARL ASH: potassium carbonate. (K_2CO_3). A highly soluble form of potassium, usually used in a fritted form.

PERRINE: Unidentified clay possibly mined in New Jersey that was used in archived sculpture clay body.

PETALITE: F,A,G. (Li_2O • Al_2O_3 • 8SiO). Feldspar-like material containing lithium and behaving like Nepheline Syenite, but less likely to craze. It is thermal shock resistant, therefore commonly used in flameproof clays (60-70%). Used as a substitute for flint to eliminate expansion caused during quartz inversion which occurs at 439°F and causes cracking in the claybody.

PIN-HOLE: A smooth-edged hole in a glaze surface, usually occurring when a bubble of gas bursts during firing.

PIT FIRING: A way of firing ceramic where the work is placed in a pit and combustibles place all around.

PLASTICITY: see *Section on Cracks*. Capacity of wet clay to hold its shape. It is associated with the fineness of grain within the clay body. Clay improves with age. Plasticity is difficult to measure. One reason for the development of plasticity over a period of time is the thorough wetting of the clay particles. Over time the water percolates through the clay and permeates each individual particle of clay. One way to speed up the effects of this is to first mix the clay as a fluid slip. After a couple of weeks drying the clay will begin to change and it becomes denser.

PORCELAIN: A vitrified high temperature white ceramic clay body whose main ingredient is kaolin.

POROSITY: The capacity of a fired body to absorb water.

POTASH FELDSPAR: potassium feldspar. potash spar. F,A,G. (K_2O • Al_2O_3 • $6SiO_2$). The most common form of feldspar and the type generally used in glaze.

POTASSIUM CARBONATE: see *Pearl Ash.*

POTASSIUM DICHROMATE: see *Bichromate of Potash*.

POTASSIUM FELDSPAR: potash spar. see *Potash Feldspar*.

POTASSIUM OXIDE: kalium oxide. F. (K_2O). A powerful flux similar to sodium.

PRASEODYMIUM STAIN: C. (PR). A chemical element is the third member of the lanthanide series considered a rare-earth.

PRICEITE: see *Colemanite*.

PUGMILL: *see* *De-airing Pugmill*. A machine used to make and mix clay.

PYROMETER: An electronic devise indicating the temperature inside the kiln.

PYROMETRIC CONES: cones, Δ. *see* *Cone Chart*. Developed in 1896 by Edward Orton Jr. used to measure the effects of time and temperature inside a kiln. They are made of ceramic material and experience heat the same way as the ware making them a more accurate temperature gauge so that when the cone reaches its designated temperature it will begin to melt and bend over. In a traditional cone pack there will be three cones placed in successive order from left to right, lower temperature to higher temperature. The first cone will be the lower of the temperatures and called the "Guide Cone" (one cone cooler). The second cone will be the "Firing Cone" or the temperature the firing should be. The third cone is called the "Guard Cone" (one cone hotter) to make sure you do not overfire.

PYROPHYLLITE: ($Al_2O_3 \cdot 4SiO_2 \cdot H_2O$). A hydrous alumino-silicate material used to replace some or all of the flint and feldspar in industrial tile clays. It brings about a decrease in thermal expansion.

Q–S

QUARTZ: *see* *Silica*. G. (SiO_2). A source of silica in glaze and clay, it increases the expansion rate so it is not usually added to sculpture clay.

QUARTZ INVERSION: cristobalite inversion, quartz phase, silica inversion. The change in silica (alpha quartz and beta quartz) which occurs every time the crystalline quartz passes through 1063°F and cristobalite inversion at 439°F. There is a change in size which may cause cracks in the ceramic body if it goes through this stage too quickly. There is a 2% increase in volume which is reversible upon cooling.

RAKU: American raku is very different from the original Japanese raku, which originated in the 16th century. The American version was popularized by from Paul Soldner. This version is a form of firing in which ceramic objects are pulled out of the kiln at red heat and placed into a container of combustibles.

RED COPPER OXIDE: copper monoxide. *see* *Copper Oxide*. (Cu_4O).

RED IRON OXIDE: synthetic hematite, ferric oxide. F,O,C. (Fe_2O_3). The most common of the coloring oxides, though very refractory.

RED LEAD: minium, red lead oxide. (Pb_3O_4). A powerful low-fire flux creating vibrant color responses from oxides and carbonates.

RED LEAD OXIDE: *see* RED LEAD.

REDART: *see* EARTHENWARE CLAY. An earthenware clay with a high iron content.

REDUCTION ATMOSPHERE: An atmosphere where there is little oxygen due to the excess of carbon–an incomplete combustion process. If not enough oxygen is present during combustion the free carbon will seize oxygen from any source including the oxides in the ceramic materials. The effect turns the oxides back into their metal state.

REDUCTION COOLING: When maintaining a slight reduction atmosphere in the kiln during the cooling cycle in order to minimize the reoxidation of clay and glaze.

REFRACTORY: Capable of withstanding high temperatures.

RELATIVE DENSITY: specific gravity. Expressed as a number for each material representing the weight of a specific volume of the material. Since 1ml (cc) of water weighs 1 gram the relative density is the same as the weight in grams of 1 cc of the material.

RUTILE: light rutile, impure titanium oxide. O,C. (TiO_2). A natural source of titanium, usually containing iron and occasionally chromium and vanadium. It has a strong effect on other colors and is refractory.

SALT FIRING: A firing process that heats ceramic through gas or wood combustion and at peak temperatures introduces salt into the kiln. The salt volatilizes and the sodium is attracted to the ware creating an orange-peel texture and clear-glazed surface.

SALT LICK CLAY: A stoneware clay similar to Goldart but slightly more sandy.

SAGGAR: A container used to protect ware from direct contact with flames and gases. An alternative use is to produce an atmosphere creating localized reduction.

SAGGAR CLAYS: Similar to fireclay and as smooth as ball clay used as an addition to stoneware, terra cotta, and earthenware bodies.

SAWDUST FIRING: A way to fire ceramics using sawdust that creates intense surface effects. The temperature does not get hot enough to vitrify the clay rendering the ware porous.

SCUM: scumming. Light-colored marks that appear along the edges of ware on unglazed surfaces. This is caused by soluble salts in the clay that crystallize at the surface as the water evaporates. Can be corrected with an addition of 1-2% barium carbonate in the clay.

SECONDARY FLUX: A flux that is not active on its own but becomes active when used in conjunction with other fluxes.

SGRAFFITO: A decorative technique where one scratches through slip to the clay body beneath.

SHELLING: A glaze defect in which glaze, or glaze and slip falls from the body in flakes. It is caused because there is an insufficient bond between the glaze and the body. This happens when the slip is applied to the ware when it is too dry or greasy and therefore never properly adheres to the clay. The glaze pulls at the slip which is not properly bonded to the clay.

SHIVERING: A glaze defect in which slivers of glaze shear away from the pot, as the glaze shrinks less than the clay body. To remedy, try increasing the high expansion oxides, feldspar or decrease the silica in the glaze. Or you can adjust the clay body by decreasing silica or adding feldspar.

SILICA: flint, quartz, silicon dioxide. G. (SiO_2). The main glass-former and source of silica in both glaze and clay.

SILICON CARBIDE 600: (SiC). Non-oxide ceramic and is used in products that must perform in situations of high thermal shock; Can be used to make crater or foam glazes.

SILICON DIOXIDE: *see* SILICA. G.

SINK-IN DECORATION: *see* INGLAZE.

SLIP: *see* SECTION ON SLIP. A mixture of clay and water used for coating clays, generally applied to the surface of greenware to change its color, texture and/or to add decoration. Because slip is made of clay, it shrinks as the clay shrinks which allows it to be applied to wet and/or leatherhard clay. If applied to bisque, do not apply too thickly as it will likely crack and/or flake off. Alternatively, use a deflocculated slip or one with calcined clay for bisqueware.

SLURRY: slip. A semi-liquid mixture of clay and water, generally used in slipping to attach or the condition in order to recycle clay.

SOAPSTONE: *see* TALC. F,G.

SODA ASH: sodium carbonate. (Na_2CO_3). The common source of sodium for glazes, used as a deflocculant in slip.

SODA FELDSPAR: *see* SODIUM FELDSPAR.

SODA FIRING: A firing process that heats ceramic through gas or wood combustion and at peak temperatures introduces Sodium Bicarbonate or baking soda (NaHCO3). It creates a flashed surface in sufficient amounts a slight orange-peel texture.

SODIUM BICARBONATE: baking soda. ($NaHCO_3$). Used in soda firing and in Egyptian paste.

SODIUM CARBONATE: *see* SODA ASH.

SODIUM FELDSPAR: soda feldspar, soda spar. F,A,G. ($Na_2O \bullet Al_2O_3 \bullet 6SiO_2$). Less common than potash feldspar and contains more sodium than potassium, though it has a similar performance. A form of feldspar used as a body flux and in glazes as a silicate provider.

SODIUM HEXAFLUOROALUMINATE: *see* CRYOLITE.

SODIUM METASILICATE: *see* SODIUM SILICATE. F.

SODIUM OXIDE: natrium oxide. F. (Na_2O). An active flux having strong influence on color. It has the highest coefficient of expansion therefore it decreases the tensile strength and causes crazing.

SODIUM SILICATE: sodium metasilicate, water-glass. F. ($Na_2 \bullet SiO_3$ or Na_2SiO_3 or $Na_2O \bullet SiO_2$). Sodium oxide and silica combined in equal proportions used as a deflocculant, usually with soda ash. Don Bendel says it “makes water wetter!”

SOFT PASTE PORCELAIN: softpaste. *see* BONE PORCELAIN. A porcelain clay used in manufacturing and termed "soft" because of its lower firing temperature. It was an early attempt to replicate Chinese Porcelain.

SOLUBLE: Susceptible to being dissolved in water.

SPECIFIC GRAVITY: *see* RELATIVE DENSITY.

SPODUMENE: F,A,G. ($Li_2O \cdot Al_2O_3 \cdot 3SiO_2$). A lithium alumino-silicate similar in behavior to petalite. Used in glazes and in flameproof bodies. Substitute for feldspar; helps correct crazing.

STAINS: Inorganic coloring agent for adding to clay bodies, slips, washes, and glazes.

STANNIC OXIDE: *see* TIN OXIDE. O.

STEATIDE: *see* TALC. F,G.

STIBIUM SESQUIOXIDE: *see* ANTIMONY OXIDE.

STONEWARE: A hard and vitrified ware fired to a high temperature; so named for its resemblance to stone. 2266°F - 2491°F (Δ6 – 14).

STONEWARE CLAYS: Clay that mature between Δ5 – 11, and vary in plasticity.

STRONTIUM CARBONATE: F. ($SrCO_3$). A rare alkaline earth used as a flux in clay and glaze and a source of strontium oxide.

STRONTIUM OXIDE: **F**. (SrO). An active flux increasing the fluidity and thermal expansion in glaze.

SYNTHETIC HEMATITE: *see* RED IRON OXIDE. F,O,C.

SYNTHETIC MAGNETITE: *see* BLACK IRON OXIDE. C.

SYNTHETIC MALACHITE: *see* COPPER CARBONATE. F,C.

T–Z

TALC: magnesium silicate, french chalk, soapstone, steatide. F,G. ($3MgO \cdot 4SiO_2 \cdot H_2O$). A secondary flux in glazes promoting buttery surfaces. In earthenware, it reduces crazing. A source of magnesium oxide for clay and glaze.

TERRACOTTA: *see* EARTHENWARE. Italian, meaning "fired earth."

TERRA SIGILLATA: terra gig, sig. Latin for "sealed earth". A slip that has been refined by levigation. It has an extremely fine particulate structure and is usually burnished to a high polish. Best if fired between Δ08-02 to keep its burnished results.

THERMAL EXPANSION: *see* COEFFICIENT OF EXPANSION.

THERMAL SHOCK: The stress created in a ceramic object by temperature change resulting from the expansion and contraction of the claybody causing the ware to crack.

THIXOTROPHY: Tendency of a mixture in suspension to gel after setting for a time and to re-liquefy after agitation.

THOMAS BALL CLAY: *see* Ball Clay.

TILE #6: *see* Kaolin. A type of kaolin mined in Georgia.

TIN DIOXIDE: *see* Tin Oxide.

TIN OXIDE: white tin oxide, tin dioxide, stannic oxide. O. (SnO_2). The most widely used opacifier and whitener. It is very refractory.

TINCAL: *see* Borax. F.G.

TITANIUM DIOXIDE: C,O. (TiO_2). A colorant in glaze used for matte surfaces; forms crystals when slow cooled.

UNDERGLAZE: Slip or wash that is usually applied to bisqueware underneath the glaze.

URANIUM OXIDE: yellow uranium oxide. C. (U_3O_8). A coloring oxide giving yellow, orange and red. It has very low radioactivity; however, the final glaze too will be slightly radioactive.

VANADIUM OXIDE: vanadium pentoxide. F,O,C. (V_2O_5). A rare metal oxide giving weak colors. Is used to produce yellow in clay and glaze.

VEEGUM: VeeGum T, VGT, VeeGum Pro, Veegum CER. Is not a "gum" but a material much like bentonite. It is a complex colloidal, extremely plastic magnesium aluminum silicate. You must mix with water before adding into glazes or clay. It is used as a suspension agent and hardener in glaze and adds plasticity (add up to 5%) in clay bodies.

VINEGAR: (CH_3COOH) Is a liquid consisting of between 5-20% acetic acid and water. The acid is produced by the fermentation of ethanol by acetic acid bacteria.

VITRIFY: The hardening, tightening, and partial glassification of clay, giving fired clay its hard, durable, dense and rock-like properties.

VOLATILIZE: To change from a liquid or solid into a vapor.

WASH: *see* Section on Wash. A wash is more of an action then a product. We refer to our inglaze or overglaze stains as our "wash".

WATER: (H_2O). A necessary ingredient in clay and glaze. It passes through several stages in the clay process. Clay is made of up to 40% water.

SHRINKAGE WATER: Evaporates during drying.

PORE WATER: Remains when greenware has reached stasis with the atmosphere.

HYGROSCOPIC WATER: Is removed when heated above room temperature.

CHEMICALLY BONDED WATER: Is driven off at temperatures up to 900°F.

WATER GLASS: *see* Sodium Silicate. F.

WAX RESIST: *see* Section on Resist. Resist made of wax that can be used to apply to the bottom of bisqueware or ontop of a glaze or slip for to resist in the decoration process.

WEDGING: The preparation of clay involving thorough mixing to expel air and make homogeneous.

WHITE GLUE: elmer's glue, polyethenyl ethanoate, school glue ($C_4 H_6 O_2$). An aliphatic rubbery synthetic polymer.

WHITE GOLD: *see* Lustre.

WHITE LEAD: lead carbonate. ($2PbCO_3 \cdot Pb(OH)_2$). A source of lead for glaze though not in use as it is highly toxic.

WHITE TIN OXIDE: *see Tin Oxide*. O.

WHITING: *see Calcium Carbonate*. Added to earthenware to counteract crazing.

WOLLASTONITE: calcium metasilicate. F,G. ($CaO \cdot SiO_2$). A natural calcium silicate used to replace whiting and flint. It reduces firing shrinkage and adds thermal shock resistance in clay and glaze. Makes a satin type glaze and added to earthenware to counteract crazing.

WOOD FIRING: Firing clay using wood as a source of fuel.

XX SAGGAR: *see Ball Clay*. Finely grained secondary clay which flashes in the wood kiln.

YELLOW URANIUM OXIDE: C. *see Uranium Oxide.*

ZINC OXIDE: F,O. (ZnO). A useful mid-to-high-temperature flux which produces brilliant, glossy, trouble-free glazes. It has a low coefficient of expansion which reduces crazing. High amounts gives a crystalline texture.

ZIRCOPAX: zirconium silicate. F,G,O. ($ZrO_2 \cdot SiO_2$). A flux and opacifier more stable than tin oxide and used to produce white glazes.

ZIRCONIUM OXIDE: O. (ZrO_2). An opacifier three times the strength of tin oxide.

ZIRCONIUM SILICATE: *see Zircopax*.

REPAIR REFERENCE CHART FOR TRADITIONAL CLAY

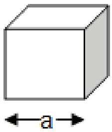
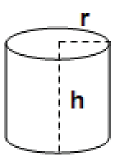
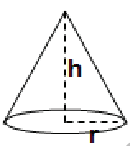
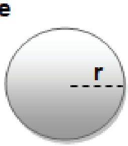
GHP CLAYBODY		
Apt II Enhancer (High Fire)	Use same slip as piece you are repairing, add Apt II until slip thickens, apply Apt II to dry areas to be fixed; while wet, apply slip mixture and press parts together. Cleanup excess. Tip: Use Apt II to thicken glaze when glazing a piece.	
Apt II Enhancer (Low Fire)	Use same slip as piece you are repairing, add Apt II until slip thickens, apply Apt II to dry areas to be fixed; while wet, apply slip mixture and press parts together. Cleanup excess with a tool. Tip: Use Apt II to thicken glaze when glazing a piece.	
Aztec Hi-Fire Mender	Fill to ridge above label with matching slip, or dry clay, mix well. With a brush, apply to edges to be repaired (bisque or dry greenware). (Do not apply water). While mender is still wet press parts together and hold until they stick together.	
Magic Mender (Aztec)	Do not wet clay. Use like glue. Fire to 04.	
Magic Water	Not recommended for dry repairs. Use for wet attachments only.	
Paperclay	Use same slip as piece you are repairing. If clay has grog, sieve. Slip should be thick like yogurt. Dissolve toilet tissue in hot water until it's pulp, strain excess water but do not squeeze. Use 3 parts slip to one part pulp. (Looks like oatmeal.) Wet clay before patching.	
Patch-A-Tatch (Duncan)	Greenware: roughen up surface with needle tool, moisten surface to be fixed with water, apply one layer of Patch-A-Tatch then put broken edges together while still wet. For bisque: wet edges, apply one layer of Patch-A-Tatch. Let dry and fire. Cleanup with water if needed. Lowfire use only.	
Thermeez 7020 Putty	Apply to bisque, use like glue to join parts. Use soft rib to smooth. Fires to cone 10. After firing has black specs so if leaving unglazed or using a transparent glaze cover with underglaze before glazing. Can be used to fill cracks after glaze firing. Refire. Let dry before glazing.	
Vinegar	Wet broken surfaces to mend with vinegar, make light slurry on surface of break. Put parts together hold until bonded. Not a reliable method.	
Vinegar, clay & syrup	Mix dry clay with vinegar to thick consistency. Add a little syrup (1-2 tsp to ¼ cup slip), mix well. Use like glue. Not tremendously reliable but with some care it can work. There are many other better choices. Will not repair bisque.	

	Earthenware	Porcelain	T1	Throwing Clay	White Stoneware
		○ ●	○ ●	○ ●	○ ●
	○ ●				
		○ ●	○ ●	○ ●	○ ●
	○ ●				
	○ ●	○ ●	○ ●	○ ●	○ ●
	○ ●				
		● ◊	● ◊	● ◊	● ◊
	○	○	○	○	○
	○	○	○	○	○

○ Dry Greenware Repairs ● Bisque Repairs ◊ Glaze Fired Repair

RESEARCH CONDUCTED BY LISA CHICOYNE 2018

PLASTER CHART: FORMULA FOR VOLUME

Figure	Formula	Variables
Cube 	a^3	a = length of edge
Rectangular prism 	$l \times w \times h$	l = length w = width h = height
Cylinder 	$\pi \times r^2 \times h$	r = radius of circular face h = height
Cone 	$1/3 \times \pi \times r^2 \times h$	r = radius of circular base h = height from tip to base
Sphere 	$4/3 \times \pi \times r^3$	r = radius

PLASTER CHART: BATCH FORMULA

CUBIC INCHES	PLASTER	+	WATER
20	11 oz	+	8 oz
40	1 lb 6 oz	+	1 lb
60	2 lbs 1 oz	+	1 lb 8 oz
80	2 lbs 12 oz	+	2 lbs
100	3 lbs 7 oz	+	2 lbs 8 oz
120	4 lbs 2 oz	+	3 lbs
140	4 lbs 13 oz	+	3 lbs 8 oz
160	5 lbs 8 oz	+	4 lbs
180	6 lbs 3 oz	+	4 lbs 8 oz
200	6 lbs 14 oz	+	5 lbs
220	7 lbs 9 oz	+	5 lbs 8 oz
240	8 lbs 4 oz	+	6 lbs
260	9 lbs	+	6 lbs 8 oz
280	9 lbs 11 oz	+	7 lbs
300	10 lbs 6 oz	+	7 lbs 8 oz
320	11 lbs 1 oz	+	8 lbs
340	11 lbs 12 oz	+	8 lbs 8 oz
360	12 lbs 7 oz	+	9 lbs
380	13 lbs 2 oz	+	9 lbs 8 oz
400	13 lbs 13 oz	+	10 lbs
420	14 lbs 8 oz	+	10 lbs 8 oz
440	15 lbs 3 oz	+	11 lbs
460	15 lbs 14 oz	+	11 lbs 8 oz
480	16 lbs 9 oz	+	12 lbs
500	17 lbs 4 oz	+	12 lbs 8 oz

ORTON CONE CHART

	Self Supporting Cones						Large Cones				Small
	Regular			Iron Free			Regular		Iron Free		Regular
	Heating Rate ° F/hour (last 180° F of firing)										
Cone	**27**	**108**	**270**	**27**	**108**	**270**	**108**	**270**	**108**	**270**	**540**
022		1087	1094				N/A	N/A			1166
021		1112	1143				N/A	N/A			1189
020		1159	1180				N/A	N/A			1231
019	1213	1252	1283				1249	1279			1333
018	1267	1319	1353				1314	1350			1386
017	1301	1360	1405				1357	1402			1443
016	1368	1422	1465				1416	1461			1517
015	1382	1456	1504				1450	1501			1549
014	1395	1485	1540				1485	1537			1598
013	1485	1539	1582				1539	1578			1616
012	1549	1582	1620				1576	1616			1652
011	1575	1607	1641				1603	1638			1679
010	1636	1657	1679	1600	1627	1639	1648	1675	1623	1636	1686
09	1665	1688	1706	1650	1686	1702	1683	1702	1683	1699	1751
08	1692	1728	1753	1695	1735	1755	1728	1749	1733	1751	1801
07	1764	1789	1809	1747	1780	1800	1783	1805	1778	1796	1846
06	1798	1828	1855	1776	1816	1828	1823	1852	1816	1825	1873
05½	1839	1859	1877	1814	1854	1870	1854	1873	1852	1868	1909
05	1870	1888	1911	1855	1899	1915	1886	1915	1890	1911	1944
04	1915	1945	1971	1909	1942	1956	1940	1958	1940	1953	2008
03	1960	1987	2019	1951	1990	1999	1987	2014	1989	1996	2068
02	1972	2016	2052	1983	2021	2039	2014	2048	2016	2035	2098
01	1999	2046	2080	2014	2053	2073	2043	2079	2052	2070	2152
1	2028	2079	2109	2046	2082	2098	2077	2109	2079	2095	2163
2	2034	2088	2127				2088	2124			2174
3	2039	2106	2138	2066	2109	2124	2106	2134	2104	2120	2185
4	2086	2124	2161				2120	2158			2208
5	2118	2167	2205				2163	2201			2230
5½	2133	2197	2237				2194	2233			N/A
6	2165	2232	2269				2228	2266			2291
7	2194	2262	2295				2259	2291			2307
8	2212	2280	2320				2277	2316			2372
9	2235	2300	2336				2295	2332			2403
10	2284	2345	2381				2340	2377			2426
11	2322	2361	2399				2359	2394			2437
12	2345	2383	2419				2379	2415			2471
13	2389	2428	2458				2410*	2455*			N/A
14	2464	2489	2523				2491*	2530*			N/A

"THERE IS NO OTHER PLACE LIKE GHP IN NYC. GHP WELCOMES ALL PARTICIPANTS TO EXPERIENCE WORKING TOGETHER AS AN OPTIMISTIC SOCIAL GATHERING. I SEE GHP AS AN AMAZING SOCIAL SPACE."

Pam Lins, Resident 2013, 2018


GREENWICH
HOUSE
POTTERY