

Special Section: Oregon Potters' Association Newsletter, April 2010

REPAIRING GREENWARE, BISQUEWARE and FINISHED WORK: Below are some formulas and ideas for repairing pesky cracks. Most of these are for greenware, although many of these can also be used to join seams in leatherhard or dry clay. Some of these are not explained thoroughly, but hopefully they give a general idea and you can experiment with them further. I apologize for not having the sources for many of these, some were from very old notes.

SPOOZE variation #1 (greenware): Dries very hard

dry clay	1 part
vinegar	1 part
corn syrup	1 part
peroxide	a few drops

SPOOZE variation #2: Use to attach anything, leatherhard, bone dry or bisqueware. Keep applying until cracks disappear.

Liquid sugar: any kind, honey, corn syrup, etc	1 part
vinegar	1 part
slip of your choice, any thickness	1 part

GREENWARE REPAIR: No amounts listed

zircopax
calcined kaolin
water
a few drops sodium silicate

FIX-ALL (green or bisque repair): Mix dry, then add water

dry clay body	100
gum (CMC, arabic, etc)	2
neph sy	2
bentonite	2

LEATHERHARD CLAY or GREENWARE REPAIR (no amounts listed)

sugar
dry clay
water

BISQUEWARE REPAIR

Sairset	1 part
calcined clay body	1 part
glaze (as goopy as possible)	1 part

BISQUEWARE REPAIR

powdered bisqued clay
grog
vinegar
a few drops of sodium silicate

GREENWARE REPAIR

dry clay body	2 part
soda ash or frit	1 part
corn syrup or vinegar	enough to make a paste

COLEMAN JOINING SLIP cone 6, *amounts are by weight*

Borax	5.26
talc	5.26
neph sy	15.79
OM 4 ball clay	26.32

EPK 26.32
silica (200 mesh) 21.05

MAGIC WATER from Lana Wilson: Use to repair greenware, use instead of a joining slip or add to bone dry clay for a deflocculated slip

water 1 gallon
sodium silicate (a liquid) 3 tablespoons (9.5 g)
soda ash 1.5 teaspoons (3 g)

SCORE-NO-MORE

Dry mix:

dry clay body 100g
custer feldspar 2 g
bentonite 2 g
gum arabic 2 g

add water to above mixture until it is a thick paste. Then add:

Darvan 1/8 to 1/4 teaspoon
Epsom salt solution 1/4 teaspoon

*Darvan is available at many ceramic suppliers.

*To make the Epsom salt solution, start with a small amount of water. Add Epsom salt until the water will dissolve no more salt.

Add water until you have a thick cream consistency. The gum arabic will rot if stored for a length of time, you may want to freeze Score No More when not in use.

HJALMARSON'S ADHERING SLIP "A" cone 10, *amounts are by weight*

kaolin 25
ball clay 30
feldspar20
silica 15
zircopax 5
borax 3
bentonite 2

Mix the dry ingredients with a liquid consisting of:

water 70%
glycerin 30%

For each pint of slip, add one teaspoon of CMC gum in a gel form (add dry CMC gum to water to make a gel)

CRACKED BISQUE REPAIR *submitted by Michelle Gallagher*: Mix a bit of crushed soft brick into a thick slip paste of the same raw clay body as the bisque fired piece, filling the crack and smoothing it over before applying glaze. This works especially well in joining areas such as handles and seams. I have even repaired glazed pieces in the same way and re-firing a second glaze with some success. If the piece is cracked and heading for the seconds shelf anyway it's worth a try.

MARX MAGIC MENDER, *submitted by Veronica Hughes*: I like Marx Magic Mender for repairing greenware up to the bone dry state. However, depending on the clay, it may or may not match the clay color after bisque firing. It's also useful for filling in small surface cracks on bisqueware. It's been successful at temperatures as high as Cone 10.

REPAIRING GLAZED WORK *submitted by Richard Armstrong*: Use an epoxy putty stick to adhere the broken parts. These can be found at any hardware store. They are about 4 to 5 inches long and 3/4 of an inch in diameter. Typically they are a two-part epoxy product that is reddish with a gray center. Cut through with an industrial knife and kneed until a uniform color. It is moldable for a few minutes and sands well. The next challenge is to match the glaze with paint. You can either paint the whole object or go for the match. The last stage is to spray it with a clear or satin cover, homogenizing the whole piece.

SIMPLE GREENWARE REPAIR *submitted by Jan Edwards*: Sometimes I've been able to repair a crack on greenware, leather hard or dry, by making a "paperclay bandaid" by immersing a strip of toilet paper into slip from your clay body, or making a thick paste of T.P. & slip. Use it & discard the leftovers. Paper clay gets to stink

when left around.

REPAIRING BONE DRY WORK *submitted by Kim Murton:* APT* mixed with dried clay, ground with the wooden end of a feeding knife, works pretty well for cracks that appear after the piece is bone dry. I open up the crack with a needle tool or sharp wooden pointy tool and then fill the crack with the APT mixture. Then I smooth it all out with a rib. *No water!*

Cracks sometimes appear where I've attached noses to faces, usually as the piece is drying. I noticed that I can burnish the crack away using a conical wooden tool, pressing and rolling over the crack. This works surprisingly well if I catch the crack before the piece is *too* dry but just a tad dryer than leather hard.

Cracks that happen after the glaze fire I just fill with grout. I found a color that matches my clay body fairly well. The crack is repaired but not hidden so I feel that anyone buying the piece can see what's what. I also feel that grout has a good relationship with clay so it seems OK to use.

*APT-2 Ceramic Enhancer is available at many ceramic suppliers. The following are instructions for using APT-2 from their website:

Preparing Slip Mixture for Mending and Attaching: Pour fresh slip into container; Add APT-II Ceramic Enhancer into slip until it begins to thicken to a consistency of cake batter; If Slip Mixture becomes too thick for attaching or mending, thin back with slip - not water (Adding water will increase shrinkage); Unused Slip Mixture may be stored in an airtight sealed container for several days. Add more slip if it becomes too thick; If Slip Mixture is left open to air, it will dry and become greenware.

REPAIRING ALREADY-FIRED WORK *submitted by Penelope Dews:* Here are some ways for fixing cracks in sculpture, permanently bonding sculpture that was made in more than one piece and fixing broken sculpture:

Broken sculpture that has clean edges that fit well together can be fixed by using 5 minute epoxy, that kind that comes in two tubes that you mix together.

Then to cover the crack, and also to fix cracks in other sculpture, I use DAP pre-mixed cement. It comes in a quart container and is grey in color.

I use acrylic paints to color the cement to match the sculpture clay, or glaze. It can take a little practice. Work the cement into the crack and let sit 2-3 minutes, then sponge away so only the crack is filled. If it is a really wide crack, say 1/2 inch, the cement may shrink a bit. Let dry a couple of days then reapply.

I have also attached separate pieces of sculpture together using the cement. Let dry about a week. The pieces will be very well bonded!

REPAIRING BONE DRY and BISQUED WORK *submitted by Mark Chapman:* I do not have a studio at home, I take Adult Education classes at PCC SE Campus. It is by nature a dangerous environment to attempt serious sculpture. As an artist I must be resigned that a lot of things are completely out of my control. This is not an indictment of PCC, the staff takes their responsibilities very seriously and I am almost amazed at the consistently good results possible.

I use the most forgiving clay body available. This is commercial Paperclay which is available at Georgies. Paperclay is a cone 6-10 stoneware that is 20 something percent wood pulp. It is a whole new material as claybodies go. Several times items have broken while bone dry or at/after bisque fire. All have been successfully repaired.

When a bone dry item breaks the repair is fairly easy. The broken areas are soaked. I usually immerse as little as possible of the items along the break. For instance, if the arm breaks off of a figure, soak the stump and soak the end of the arm where it broke off. I like scalding hot water for this because it is quicker. Within a few minutes the Paperclay is soft and the arm can be reattached.

When a bisque fired item is broken the repair is just as easy but a little more time consuming. Soak all the pieces in a bucket of water for a few hours. Take Paperclay out of the bag and add a little water until it becomes sticky and somewhere between white glue and putty for thickness. Start with the biggest fragment. Build a cradle of any old clay to hold the fragment while you are working on it. I often use plasticine for a cradle. Use Paperclay putty to stick pieces onto the cradled fragment. At first do not worry about getting a tight fit. Assemble as many pieces as possible, preferably all of them. If there are holes because some pieces are missing, fill the holes with Paperclay straight out of the bag. When its all together again, squeeze the pieces to wring out as much of the putty as possible. Then smear a bead of Paperclay putty on both sides of all cracks. Air dry. Using a fan is OK but do not dry on a warm kiln especially if you plugged a lot of holes. If a crack opens up while drying, work some more putty into the crack. When its dry, bisque fire again. Sand or grind the excess bead of Paperclay off ONLY after bisque firing. Fix any remaining cracks by soaking and puttying the crack and fire again as required.

I have used both methods to repair damaged sculptures and neither has ever failed for me. I am sure that

Paperclay can do more complicated repairs that I have not needed to attempt yet. See photos of a repair at my Fan Site:

<http://www.facebook.com/l.php?u=http%3A%2F%2Fwww.facebook.com%2F%3Fref%3Dhome%23!%2Fpages%2FMark-Chapman-Figure-Sculpture%2F167629773276%3Fref%3Dts&h=46401e89409153ff5c9776fc6633a5a2>. The official Paperclay website is <http://www.paperclayart.com/>

BETH CAVENER STICHTER'S REPAIR TECHNIQUES *submitted by Roxanne Hunnicutt, reprinted with permission from Beth Cavener Stichter:*

Fired Materials: Soldate 60 from Aardvark Clay Co. This is an incredibly plastic clay body with a heavy amount of ball clay and 60 mesh sand instead of grog. You can get Soldate 60 from Aardvark Clay Co or Laguna, but the Laguna mix is slightly different and seems to have a greater penchant for cracking during the drying and firing of larger sculptural pieces. The Aardvark Soldate is better for building, but has a real problem with forming salty deposits on the surface of your drying work, making it problematic for glaze and slip applications. I have also noticed the Aardvark clay have a problem with lime-contamination- which is extremely annoying and can cause spontaneous tiny pieces of your clay to pop off weeks or months after it has been fired.

Beth's Cone 5- 6 Porcelain Slip:

50 Grolleg

40 Nepheline Syenite

10 Silica (350 Mesh is best)

add 3% to 12% Mason Stain for colored slips

1,000 g. of dry material will require 2 tsp. CMC gum mixed dry, and then 800g of Water mixed with two tsp. sodium silicate to deflocculated the mixture.

**Mix as a deflocculated casting slip and then add a drop or two of gum or glycerin to help with brushability. Apply to low-fired bisque ware with a white nylon watercolor brush for best results. Usually 3-5 coats applied in thin layers works best. Will crack or pop off if applied unevenly or thickly.

Color: I add anywhere from 3%-12% Mason stain to color the slip. TEST, TEST, TEST! The color and amount of mason stain you add to the slip will change its firing temperature. After adding mason stain, the slip should be run wet through an 80 mesh sieve twice to make sure the color is distributed evenly. You may have to add a drop or two more Darvan (deflocculant) to keep the mixture from getting too thick.

For a fantastic article about making slips and applications, check out this article written by Pete Pinnell:

<http://www.claytimes.com/articles/glazeadjusting.html>

For repairing non-structural cracks: My general advice is to leave the cracks or breaks for post-firing repair. However, as long as the crack is not structural, I have had great success in healing them by packing them with bisqued clay dust and some sort of flux. *With every piece* I place a small amount of sieved powdered clay next to it in the kiln. After the bisque firing, the clay powder may be mixed with the glaze or vitreous slip and packed into the crack. After it has dried, wipe smooth and apply the normal surface treatment over the whole piece. I also fire the remaining bisqued powder with the piece through the second firing and use it again to mix with epoxy for post-firing repairs.

Unfired Materials: For gluing joints together or strength bonds: Devcon 5- Minute Epoxie Gel. This is some of the toughest stuff I have used. There are tons of other high strength epoxies out there, but I like to use one that I can easily find locally. Check to make sure it hasn't been sitting on the shelf of the hardware store for more than a year. Most glues have a shelf life and should be purchased as needed. Stronger than your clay, little to no yellowing, and no dripping. Make sure you mix it to death! I use Popsicle sticks and squares of tinfoil for mixing.

If I need to join large sections together, I sometimes use the one hour slow setting epoxy mix on the inside edge of the seam, and then tack it in place with the five minute gel on the outside edge of the seam. The slow setting epoxy will have a bit more bonding strength since it penetrates the pores of the clay more thoroughly.

For filling seams or cracks: Apoxie Sculpt two part kneadable Epoxy. I usually purchase the white so that I am able to tint it myself by kneading in mason stains and fired clay powder. This stuff is great for mimicking texture and color. Long working time- sets in 2-3 hours, with full strength in 12-24 hours. I order it from WASCO taxidermy supply at: www.taxidermy.com

If I am in a hurry, I have two other faster setting kneadable epoxies: East Valley kneadable Epoxy. Just like the material above, this is a two part epoxy mixed with clay, so that it is less likely to yellow or change color over time. It sets rock-hard in one hour and can be sanded, drilled, or painted. The company who sells this, also sells pigments you may mix with the epoxy to change the color to match your clay, glaze, or slip surface:

<http://www.eastvalleyepoxy.com/>. In an emergency, I also use the ACE Hardware Brand grey plumber's kneadable epoxy. It sets in five minutes, which is great, but it barely leaves me enough time to knead in the

mason stains and mix thoroughly before applying it to my surface. I usually use this on the bottoms of my pieces as 'bumpers' to level them off. Wax paper on the table helps to keep it from sticking.

For painted finishes: Sherman Williams Superpaint Flat Interior Latex and PrepRite Bonding Primer
Although I use the Sherman Williams primer and base, I use Martha Stewart's Signature color line (you can purchase the display in any Sherman Williams store, or you can view it on the store's website). I like this paint because it is composed almost entirely of calcined clays and glaze materials... so it has the look and feel of a fired surface. It is basically an unfired slip with a bit of acrylic binder to hold it together. Both the paint and the primer should be watered down and applied by brush in many thin layers to the vitrified clay surface for best results. I sometimes use Trewax or a matte spray to seal the surface of these pieces, but they are still prone to being scratched or soiled from handling.

In order to add depth to these painted surfaces, I occasionally use pastel dust, rubbed into the surface and then gently wiped off. This treatment is then sealed with a matte spray fixative.

Beth Cavener Stichter's website has more information,

<http://www.followtheblackrabbit.com/material.htm>. Glues are under "Other Materials"

Roxanne also remembers from Beth's workshop that she repairs cracks that are not structural by mixing glue with the actual clay she uses (in grog form)