*Rupert, the author's beloved pet and inspiration for the Pet Ash Glaze. Photo credit: Howard T. Sawhill*

PHOTO GALLERY

# Pet Ash Glaze

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Last November, we had to make the decision to put down our fourteen-and-a-half-year-old golden retriever, Rupert. It was a very sad moment and, one year later, I still feel the loss. Decisions regarding the final resting place for a beloved member of the family are highly personal. In my case, making the decision to have him cremated* and developing a glaze from his ashes was a way to ease the pain and honor his memory.


Figure 3

I went looking for guidance on glazes based on bone ash. I found many books with wood ash glaze recipes, but since bone ash is much higher in phosphorus pentoxide $P_2O_5$(about 37 percent versus less than 14 percent), using one would require multiple adjustments. I simply did not have enough precious pet ash to take this route. Although phosphorus pentoxide is a glass former like $SiO_2$ (silicon dioxide, also known as silica), its properties are different enough that I needed to find meaningful guidance. In his book *The Practice of Stoneware Glazes,*[1] Daniel de Montmollin shares the cone 10 melting zone for a phosphorus pentoxide-rich composition. He found the melting zone to be at significantly higher alumina levels than comparable $SiO_2$ compositions.

Bone ash is essentially a mixture of calcium oxide (CaO) and phosphorus pentoxide, with small amounts of other fluxes and refractories. I recently published a study of pure calcium-oxide fluxed --cone 10 silicon dioxide glazes[2] wherein a new tool for glaze development was introduced–adding the benefit of phase content and temperature isotherms to the familiar unity molecular formula (UMF) diagram. Based on these two studies, and with no knowledge of the chemical composition of my pet ash, I selected a UMF target in the middle of the melting zone described in *The Practice of Stoneware Glazes*.

### Unlocking the Code

R is Rupert the dog.

F is frit added.

L is lithium carbonate added.

The rest of the sample code RL-6W15, represent the UMF values from the graph used in reference 2.

*To the reader all this is just a numbering system, but it contains specific detail for me.*

I used the composition of synthetic bone ash to represent the composition of the pet ash in the UMF calculation. UMF values represent the molar ratios between the three constituents that make up a glaze: the flux (which is set to one, hence the term "unity" in UMF), the network modifiers (like alumina [$Al_2O_3$] – used to stiffen the glaze and prevent it from running off the pot), and the glass formers (silica being the most common for ceramic glazes). Both phosphorus pentoxide and boron trioxide ($B_2O_3$) are glass formers but act as fluxes at high temperature. This poses an issue for handling phosphorus pentoxide and boron trioxide for UMF calculations. Having found no definitive guidance on the subject, I chose to handle phosphorus pentoxide as a glass former and boron trioxide as a flux for the UMF calculations based on my own practical experience. Fearing the high alumina levels would cause my glaze to be too refractory, I added a small amount of additional flux to each of the glaze samples. I added boron oxide flux (contained in Ferro Frit 3124) in sample RF-6Q13 and added lithium oxide flux ($Li_2O$) (contained in lithium carbonate) in sample RL-6W15. The amounts added followed the rule of thumb (ref 3) for lowering glaze maturing points. I also added 0.6% cobalt oxide, Darvan 7 at 1% of the EPK weight, and water to make samples at 62.5% solids. The reason for tying the Darvan 7 to the EPK is that it acts as a dispersant to de-flocculate clay (EPK is a china clay). It does very little to the relatively large particles of $SiO_2$ in the glaze. Initial samples were mixed for one minute in a SPEX 8000D mixer/mill and were not sieved or filtered. Test tiles were dipped for four seconds into the glaze and fired in oxidation to cone 10. The recipes (in weight %) are shown in table 1.

| Glaze ID | $SiO_2$ | EPK | Pet Ash | Lithium Carbonate | Ferro Frit 3124 | UMF Ratios Flux-Modifier-Glass Former | Estimated CTE |
|---|---|---|---|---|---|---|---|
| RF-6Q13 | 13 | 50 | 24 | 0 | 13 | 1 - 0.66 - 2.65 | 4.05 |
| RL-6W15 | 15.5 | 60 | 18.5 | 6 | 0 | 1 - 0.84 - 3.03 | 3.39 |

Table 1

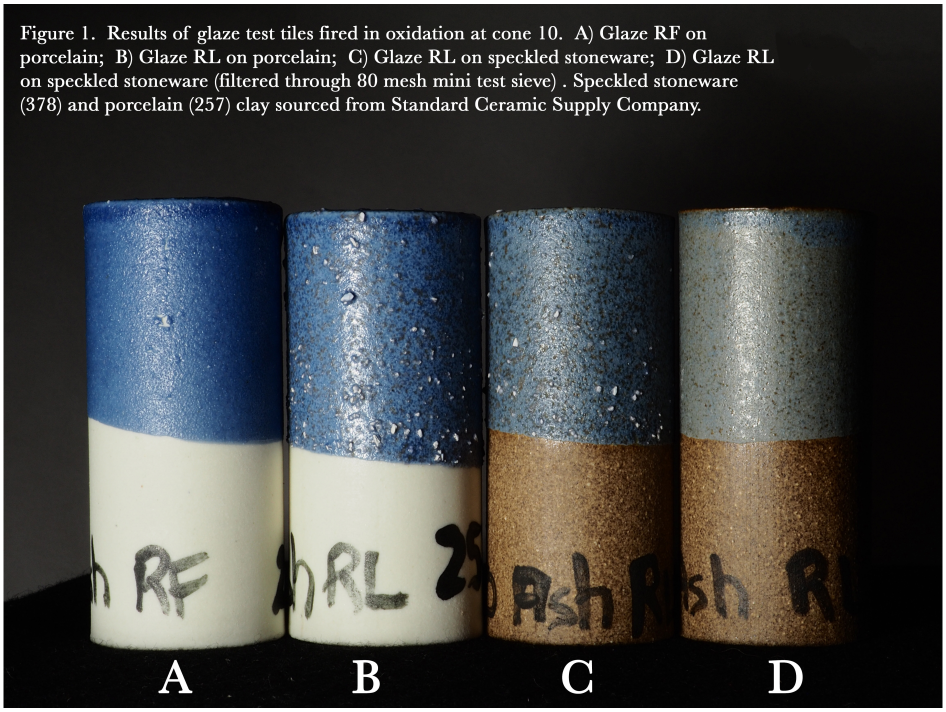
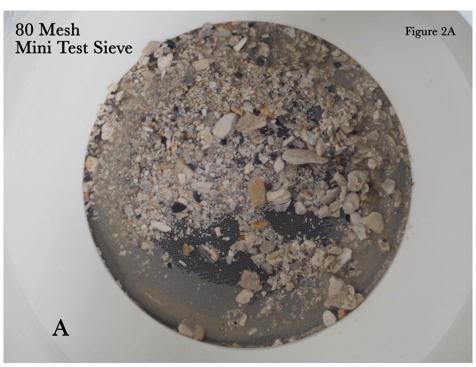
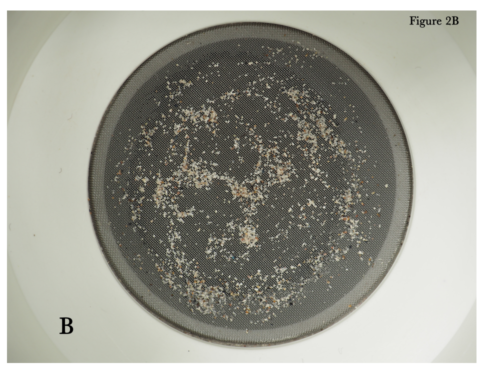



Figure 1. Results of glaze test tiles fired in oxidation at cone 10. A) Glaze RF on porcelain; B) Glaze RL on porcelain; C) Glaze RL on speckled stoneware; D) Glaze RL on speckled stoneware (filtered through 80 mesh mini test sieve) . Speckled stoneware (378) and porcelain (257) clay sourced from Standard Ceramic Supply Company.

The results of the two glaze samples are shown in Fig 1. I found the frit containing RF sample (Fig 1-A) to lack character. The sample containing lithium carbonate looked better over the iron-rich, speckled stoneware clay (Fig 1-C) than over porcelain clay (Fig 1-B). However, the coarse nature of the ash I received imparted a strong texture to these glazes – too strong for my taste. I tried pouring the glaze through an 80-mesh sieve to remove the coarse material. The resulting glaze (Fig 1-D) was anemic. It was clear to me, from the material removed by the 80-mesh screen (Fig 2-A), that I needed to put some energy into grinding the raw pet ash. So I put it through a small crusher, although similar results could have been obtained using a mortar and pestle. One pass through the crusher was sufficient to take away much of the coarseness of the initial sample (Fig 2-B) while still maintaining the desired character. The final piece containing the pet ash glaze, RL-6W15, fired in oxidation at cone 10 is shown in Fig 3.




I like how the glaze reminds me of our Rupert's warmth and his mottled look, complete with some imperfections, and how it offers some comfort during the quiet days in the studio.

**The local pet cremation service offered an individual vs group cremation for an additional fee. I chose the individual so I would receive only the ashes from my pet.*

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**Endnotes**

1. Daniel de Montmollin *The Practice of Stoneware Glazes: Minerals, Rocks, Ashes.* Editions *La Revue de la céramique et du verre*. 3rd edition 2005. ISBN 2-908988-21-6/ Translated into English by Brother Anthony of Taizé. The chapter containing his work on P2O5 glazes was originally published in French in 1997 in the book *Practique des Émaux de Cendres*. ISBN 2-908988-09-7

2. Howard T. Sawhill "UMF Phase Diagrams: Guidemaps for Ceramic Glaze Development." *Ceramics Art + Perception-Ceramics Technical* #113, pp130-135, 2019.

3. John Britt, *The Complete Guide to Mid-range Glazes: Glazing and Firing at Cones 4-7*. Lark Books, 2014. ISBN 978-1-4547-0777-6.