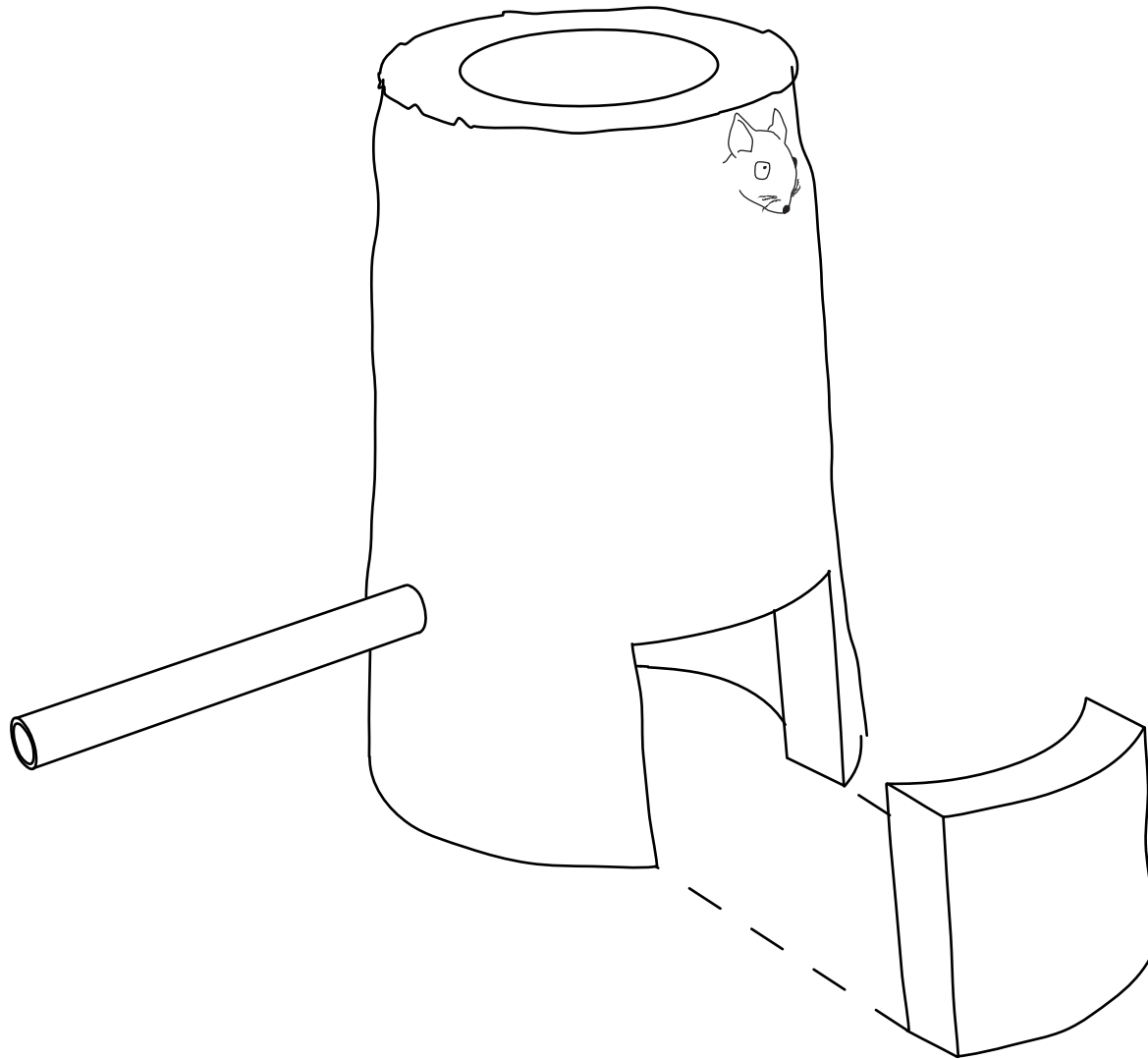


Arch 'n Craft- Week 6

EXPERIMENTAL SMELT PREPARATIONS

Bloomery Builders



Clay Preparation

Tempering materials are often added in order to enhance the mechanical properties of pure Kaolin clay both during and after firing. Aplastic fragment inclusions (sherd) serve to decrease the plasticity of the clay during formation of the body, and increase its ultimate tensile strength post-firing. According to Rapp, "Many pottery clays often contain fine-grained quartz, which provides the refractory infrastructure during firing." Quartz, an anhydrous sherd material decreases the risk of fracture as the pot approaches the boiling point, and later the sintering point by increasing the mechanical strength of the clay while maintaining homogeneous thermomechanical properties. In low-temperature, non-uniform firings, the addition of organic temper creates a fiber matrix that holds the body together during non-uniform thermal strains. It is important to ensure that any organic material incorporated into the clay has low moisture content so that it does not contribute to fracturing as the body approaches the boiling point. We attempted to follow these guidelines and added to the raw kaolinite clay a significant quantity of both kitty litter and dried grasses and leaves. Before adding these two inclusions, we started off by taking the raw clay and wedging it repeatedly. This removed many of the air bubbles present in the matrix that, upon heating, will expand according to the Ideal Gas Law and potentially shatter the semisolid pottery. In order to ensure that those bubbles still present in the clay were not catastrophic, we added kitty litter, a mixture of dried clay, quartz, and various minerals, to the body. This broke up the structure of the clay, provided drying processes through the inclusion of high-fired kaolinite to absorb some of the water, and added to the clay mass available to work with. Finally, we also added some dried organic matter which, if cracks do appear, should provide some structural rigidity and also create spaces where air could harmlessly expand.

Rapp, G. 2002 Ceramic Raw Materials. Chapter 8 in Archaeomineralogy, p.182.

DIMENSIONS

We decided that we would make the largest reasonably sized bloomery that we could construct with the 25lbs of clay that we had. This gave us about 350 cubic inches of raw clay to work with per bloomery. Our other concern was that the walls were still thick enough to be structurally sound. To that end we decided on a furnace that is intermediate in size between the Teeny-tiny Bloomery and the Little Princess Bloomery described on the Rockbridge Bloomery website (<http://iron.wlu.edu>). Our design has a 12 inch tall shaft and an internal diameter of 6 in. at the base tapering to 4 in. at the top in a roughly linear way. The volume of this design, then, would be 239 cubic in. We wanted the walls to be 1.25in. thick on average, meaning that the shaft of each bloomery requires 295 cubic inches of clay to build. As of now the sizes and locations of the opening for slag removal, the viewing hole, the tuyere shaft hole, and the base that we will put under it are TBD, based on which variable(s) we want to change between the two furnaces and the input of the supply and airflow groups.

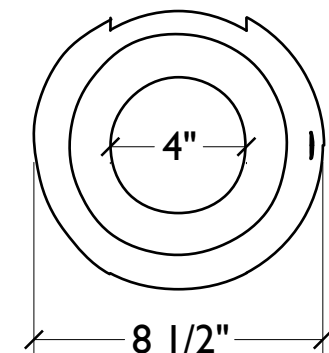
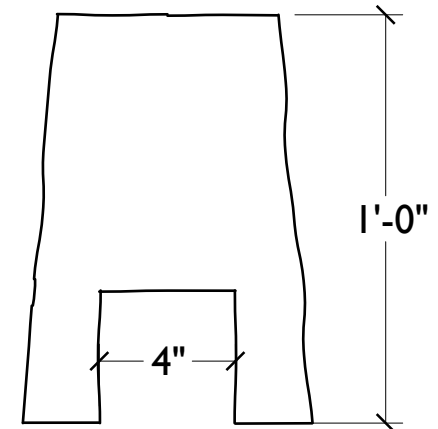
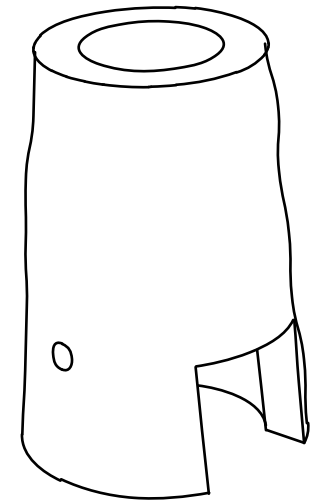
CONSTRUCTION

To preface building we should mention the clay was wedged and mixed in with grass and kitty litter. After this the clay was rolled into long cylinders of about 2 inch diameter. After this we mapped out the base size (6in diameter) of the bloomery we used to line the table, we then placed a wire-mesh lined tray on top.

We then slightly pounded the clay pieces to flatten them at the sides where they would be joined into rings. Then we joined our clay pieces into rings and secured them onto our wire-mesh surface one by one. After one ring was made we would make another slightly smaller one to place on top. In order to do this successfully we had to score each new ring and applied slip before placing it on top of the previous one. Since the outer and inner walls were quite uneven and had gaps, we closed these gaps by inserting clay bits and smoothing the inner and outer walls using slip and the the rib tool. we would periodically measure the height as well as the diameter of the top-most opening, until we had reached around 11-12 inches in height and a 4 inch diameter on the top opening.

After this had been done we did a final check of the surface to make sure there were no holes, gaps or other imperfections.

For one of the furnaces vertical supports were added on opposite sides of the outer wall using two of the rolled-out clay pieces which were scored, slipped and joined to the furnace wall. Our last step was to place figures of a cat and a mouse made of clay on top of each furnace.



Post-Assembly Finishing

After the clay coils were stacked into the bloomery shape, additional small strips of clay were used to seal the joins and ensure an even one inch thickness even at the interface between coils. Slip was applied to the outside and inside surfaces of the stack, with a second check for even wall thickness. Decorations were added to the bloomeries at this time, including reliefs (not substantial enough to affect bloomery heat retention) and cat or mouse figureheads. Finally, the bloomeries were stored with a bag of kitty litter inside of them to dehydrate the clay in preparation for baking. After they attained leather-hardness, the bloomeries were fired for a few hours in an open pit fire in Krysta's backyard. After attaining a temperature of 950-1150 degrees Fahrenheit, the clay would harden into ceramic. This slow firing process drove out any water remaining in the clay and prepared the clay to withstand higher temperatures during the smelt and not crack.