

John Bartholomew's Bronze Workshop 'Playing with Fire' 2nd August 2014

On my arrival at Home Farm at 9.30am I found that a furnace was already set up and there was an air of anticipation in the barn. Today we were going to witness the magic of making an artefact in bronze. Firstly, John gave a talk on different types of furnaces and how they work. This included a discussion on refractories; the clay crucibles, moulds and tuyeres, which are designed to not crack or crumble under the enormous heat shocks involved. This is done by adding sand and organic materials to the clay body.



Now the fun started. The crucible furnace sat on clay tiles and sand and was made in a horseshoe shape with the clay crucible positioned on the base of the furnace. Twin bellows joined into a clay tuyere which was placed to push air vertically downwards onto the crucible. Pieces of scrap bronze were added to the crucible. Charcoal was placed on this which was lit and left to heat up, with occasional bellow pumping, for about an hour. A temperature of around 1100 degrees was going to be needed.



We then moved outside to the field where Neil and Nick constructed a 'bowl' furnace in the bonfire area: the hole was approximately 40cm diameter x 20cm deep. This was lined with wet clay and two clay tuyeres were set into the ground on opposing sides of the bowl. The tuyere faced downwards at an angle of about 20° and the bowl furnace was filled with charcoal, lit and left to dry itself out for about an hour. Then an experiment was conducted to test if wind could heat the furnace by a funnelled 'sail' cloth attached to a tuyere. The sail was made from thick cotton cloth bound to a wooden half hoop by modern twine with the wooden ends pushed into the soil making a funnel shape. Sail size was 82cm wide and 58cm high. The open sail end was placed into the wind and the funnel of the sail was attached to the tuyere. The wind levels were intermittent but the cloth billowed on wind gusts which in turn did have an effect on the glowing coals. It didn't take long to conclude that wind power may work but higher wind speeds and a larger

catchment apparatus would be needed. Goat skin pot bellows were attached to a tuyere and used to heat the charcoal, as wind power alone was not sufficient to get a high heat.



Suitably refreshed after lunch, we went back to the crucible furnace. More charcoal was added and bellows restarted. A clay axe head mould was placed on the top of the furnace coals to heat as this would help with temperature shock when the molten bronze was poured into it. When we could see molten bronze pulsing in the crucible the clay mould was moved to a sand box, the crucible removed from the furnace and liquid bronze poured into the mould. A willow stick was used to stop impurities entering the mould on pouring.

The bronze cooled very rapidly and started to set before the mould could be completely filled.

I had made a wax ring and covered it in wet clay and this now went straight into the crucible furnace. Within a few minutes we could smell the melted burning wax. While this was heating the bronze filled axe mould was plunged into a bucket to cool and a few moments later, with the mould steaming, was cracked open. The axe head weighed 48.56gm and was pretty good.



My ring was next to look at. All the wax had burnt out of the clay mould and after filling the ring cavity with molten bronze I held my breath for the moment of truth. Did it turn out ok? Well, it was sort of circular but a bronze leak had occurred and it wasn't very even in width. It was a learning curve but isn't that what experimental archaeology is all about!

The bowl furnace was now revisited. A modern graphite crucible was placed in the furnace and tuyeres repositioned slightly. Bellows started again but within minutes a large bang made us all jump and sherds of exploded crucible landed up to 2m away. Glowing pieces were smouldering and several holes had appeared in the cotton sail. Bellow pumping continued; a clay crucible containing bronze scraps was heated and a clay axe head mould added to the top of fire coals to heat. The procedure followed the same pattern as that from the crucible furnace and at last the mould was broken open with a good result. Finally we excavated the bowl furnace as if it were archaeological remains.

We finished an hour and a half late not having had time to compare the mould fragments created during the day with ancient fragments that Richard had brought along. It was an interesting day with some eventful episodes and thanks must go to John Bartholomew for arranging it all.

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