

Beadmaking over an open fire – Work in Progress April 2011

This project is intended to gain a feel for producing beads under period conditions and attempt to explore likely period beadmaking techniques - which methods may have been used, which would be most effective, which can be applied now at SCA events etc. Over the last few years I have followed a range of re-enactors efforts with period beadmaking and have used their reports to make decisions about which methods to try first etc.

Several of these people have used *Ribe Excavations 1970-76, Text Volume 4 & 5* as a source of information about Viking beadmaking. This text is out of print and I have yet to obtain access to a copy (it is not available from the State Library in Vic), but I have read multiple references to this text in some of the various websites & articles listed below. At Ribe, a range of hearths were found, presumed for beadmaking. No actual covered furnaces have been found, and only one of the hearths was found with un-burnt clay fragments on the base.¹ Neil Peterson, the author of the Dark Ages Recreation Company website draws the conclusion that this could indicate that the furnace has collapsed and that the un-burnt clay comprises the remains of the furnace walls, whereas Torben Barthelmie states "... there is absolutely no evidence of a oven like construction" and that recreations in that vein are based on similar but much larger constructions still found in India.² After exploring the material available on both websites, weighing the pros and cons, and with my time limitations in mind, I decided to try an open fireplace first. The article *Viking Age crafts in Ribe - A summary* discusses in particular 2 hearths approximately 50-60cm x 25-30cm³ which is the size I used as a guide.

	Pro's	Con's
Covered Furnace	<ul style="list-style-type: none"> • Assume covered structure will help with heat retention • Covered structure will protect flame & beads in production from wind • Might protect beadmaker from heat of fire • Can be elevated to save back (but in period would have been on ground anyway) 	<ul style="list-style-type: none"> • More clay needed for larger structure. • Need to make Cobb clay for construction – horse manure, straw⁴ or sand⁵ also needed. • Furnace could take a week to dry properly. Not drying before firing can result in cracking and collapse. The likelihood of several days without rain in Melbourne at this time of year unlikely. • Difficulty of selecting design, as no period sources available. • Design of structure controls access to heat source – lack of flexibility as to what location/proximity will work best • No direct proof covered furnace used in period (although quite likely)
Open Fireplace	<ul style="list-style-type: none"> • Simple to construct • Limited resources required • Available for use immediately • Flexibility to experiment with proximity/angle to heat source • Reports of very successful results by Torben 	<ul style="list-style-type: none"> • Being directly on ground very uncomfortable for working (but so would furnace be if created on ground) • No protection from heat of fire for beadmaker • Later discovered a large amount of fuel used in the full sized fireplace

In the following pages I will document the process I went through and results obtained in this first experiment, with photographs. This document is primarily intended as a practical record of that experiment.

In the beginning of the process, I prepared the site for the fire, digging a hole, lining it with stones and filling any gaps with clay. This construction method was advised by Torben Barthelmie – “You simply dig a hole, line it with

¹ Peterson, Neil *Archaeology of Viking Era Bead Production* Dark Ages Recreation Company
<http://www.darkcompany.ca/beads/arch.php?submenu=B>

² 23/03/2011 Email communication with Torben Barthelmie Author of *Wie trägst DU denn deine Glasperlen?* and the website
<http://www.derglasperlenmacher.de/index2.php>

³ Bencard, Mogens, with assistance from Kristina Ambrosiani, Lise Bender Jørgensen, Helge Brinch Madsen. Ingrid Nielsen and Ulf Näsman. *Viking Age crafts in Ribe - A summary* <http://www.darkcompany.ca/articles/glasperlen.php?submenu=D#back19>

⁴ Peterson, Neil *Bead Furnace Burn May 2009* <http://www.darkcompany.ca/beads/beat0509/index.php?submenu=B> and *Bead Furnace Burn Sep 2008* <http://www.darkcompany.ca/beads/beat0908/index.php?submenu=B>

⁵ <http://www.fornidateknik.z.se/IFT/MNTarb/2000/glasparl/glasparl.htm> translated for me into English from the Swedish

stone's, fill the holes with clay and you can start working".⁶ In hindsight, this was the first mistake – on rereading *Viking Age Crafts in Ribe*⁷ I notice that all the hearths found were flat. Having the fire in a pit made it more uncomfortable to use and means that the mandrel must almost always be on a downward angle to reach the coals. This causes beads to be off balance, as molten glass will flow down the hill. On a modern torch, the mandrel is always held horizontally.



Due to the weather and time restrictions, I built a charcoal fire the next day, intended primarily to fire the clay (which was still quite wet at that stage). Although some cracking was possible, unlike a covered furnace, the clay was only acting as an additional heat reflection/containment, and did not need to be structurally sound. This initial fire was quite large, so as to fire all the clay, and while it was burning, my husband, who has blacksmithing skills, used the hot coals to forge some period style tapered mandrels. At Ribe, one tool has been found that is surmised to be a period mandrel. "An iron stick with conical tip and wooden handle is considered a scatter find; however, it might be possible that this is indeed a mandrel or other kind of tool from the bead maker's workshop."⁸ Conical steel mandrels are also still used in Anatolian Glass Beadmaking, which uses a furnace and techniques which are likely very similar to those used in period.⁹ Four of these mandrels were forged for my use, from mild steel. I also made a makeshift wooden handle for my modern mandrels, selecting a range of larger sizes. These are made from stainless steel. The tool found at Ribe was made from iron. It has been surmised that the iron tools may have rusted (perhaps accelerated by application of salt) and that the layer of iron oxide enabled the beads to be easily removed.¹⁰ Traces of ceramic slip can also sometimes be seen in Viking era beads to assist in releasing the bead when complete.¹¹ On steel mandrels a layer of ceramic slip, or 'bead release' is definitely needed, and I used my existing supply, which I make myself from a range of ceramic compounds available from pottery suppliers.

⁶ 23/03/2011 Email op cit

⁷ Bencard op cit

⁸ ibid

⁹ Professor Onder Kucukerman *Glass Beads: Anatolian Glass Bead making: The final Traces of Three Millenia of Glass Making in the Mediterranean Region* p 64

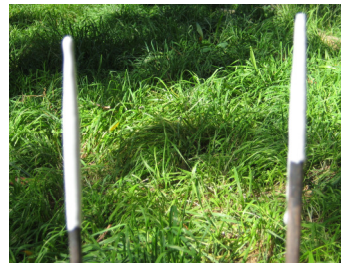
¹⁰ Peterson *Archaeology of Viking Era Bead Production* op cit

¹¹ Peterson, Neil *Bead Furnace - October & November 2007 - Experiment Round #1*

http://www.darkcompany.ca/beads/bead1107/index.php?submenu=B#_edn4



When the mandrels were completed, I did try and make a bead with no bead release, in case the tapered shape made it possible to remove a bead more easily. The glass stuck fast, and I resigned myself to needing to coat the mandrels (this is also when I decided to use some modern mandrels also, due to only having 4 of the 'period' design).



At this point I should backtrack and explain the air supply I have decided to use. Like the Dark Ages Recreation Company in their first attempt, I decided to use a modern air supply, in this case a portable blacksmith's forge fan, so I could concentrate on other aspects of the process. I do not currently have a set of bellows to use and I am also limited by not having a range of assistants to drive the bellows for me for hours. While the traditional style bead furnaces still in use in Anatolia prove you can create a furnace without the need to pump air in but it is a fairly large and complex design, and not practical for recreationists.¹² I laid a metal pipe under ground to appear at the centre of the fire-pit, and the fan allows me to control the quantity of air being delivered. I used it on the full setting for almost the entire time.



During this first firing, I also experimented briefly with how I would apply and heat the glass. I had been unable to source any flat glass sheets at this time (2 suppliers did not have any available), but I did experiment with heating small pieces of rod on a piece of charcoal, as the DARC group describe doing with tesserae (small flat pieces of glass). The rods were unstable and frequently rolled into the fire. I flattened one end of the rod, but problems persisted, as the charcoal it was resting on sometimes broke down and deposited it into the coals. The documents cataloguing the finds at Ribe and other sites show that glass rods were also in use, (with large quantities of both rods and tesserae found at Ribe¹³ for e.g) so I decided to stick to using rods, which is a method more familiar to me anyway.

¹² Kucukerman op cit p 46

¹³ Peterson, Neil *Archaeology of Viking Era Bead Production* op cit

At this stage I should mention cooling the beads. One of the advantages of a furnace structure, is the possibility, depending on the design, to cool the beads (and even anneal them) within the furnace. The Anatolian beadmakers for e.g. knock their beads off the mandrel directly into a 'cooling area' of the main part of the furnace, where they stay warm all day, and cool overnight once the fire is out.¹⁴ Other re-enactors have placed crucibles over chimneys on the furnace¹⁵ or placed lidded ceramic crucibles on top glowing coals.¹⁶ While I suppose this last method could be adapted for an open fire, I chose to cool my beads in vermiculite, once again, so I could concentrate on the actual beadmaking process at this stage.

At the conclusion of this first test firing I drew the following conclusion; that the fire pit was too large for my purpose. It was wasteful of fuel and hard to keep a suitable temperature for extended periods. The next day, due to the limited time I had available (I spent every day fearful of the rain returning, as I had to wait a week to get started, it had been so wet) I used some fire bricks to create a smaller working area within the pit, around the air outlet. I then built a much smaller fire, which was easier to keep hotter for longer, used less fuel, and allowed the coals to be more accessible with less risk from the general heat being generated. The fire-pit also contained a consistent layer of ash, from the coals that had burnt completely away overnight. While I did brush away some of the larger fragments, I did not attempt to clean away all of the ash.



I discovered that it was quite hard to keep my hand steady with such long, heavy mandrels – tremors in my hands sometimes caused me to bump the charcoal, leaving ash deposits on the glass bead. As I continued, especially the next day, I discovered resting part of the length of the mandrel on a piece of charcoal, the edge of the fireplace, or on my foot helped steady my hand. I also discovered that working above coals burnt quite low created a very good heat, and made it less likely to bump charcoal. However, as the charcoal burnt low it produced a lot of ash, which deposited on the glass, regardless of contact. There may also have been some ash blowing around in the fire from the previous day's coals. It was extremely interesting to note that these ash deposits on the beads look exactly like surface of historical beads found in archeological digs. (See example in one of my beads above). I have always assumed the surface texture was caused by ageing, but now I believe it may well have been on the beads since they were created, due to ash deposits during production.

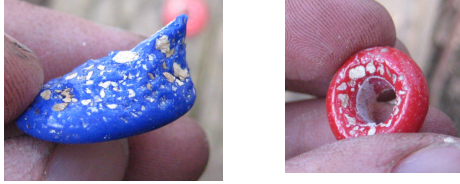
Some other issues that became apparent were (as mentioned earlier) that working down into the fire pit caused issues with making even beads – the molten glass will run down the mandrel. I also had some issues on this first day of serious beadmaking with judging the temperatures of the beads in full sun. Several beads got misshapen when adding them to the vermiculite for cooling, as they were still too hot. In an indoor studio, you can see the glow. While I frequently demonstrate outside, I was not yet used to how much heat the coals were providing compared to my portable torch. I made a bead on each of the 'period' mandrels, but only 2 did not break. All stuck to the mandrel, but 2 survived being knocked off quite roughly, while the other 2 shattered. All of the beads on my modern mandrels came off successfully. There are issues with even shape – due to the angle, not only sloping into the pit, but also because with such a long mandrel, it is very hard to work in front of the bead as I am used to. Coming in from the side meant it is hard to see the side of the bead furthest from you. That results in one side being much neater than the other. I did manage to try some surface decoration in the form of dots, but the level of control – both heat control and steadiness of hand, is harder. The base bead was frequently hotter than I imagined – I was concerned about them getting too cool if pulled away from the fire to work on, but instead, the base bead was sometimes too hot when I tried to apply dots. The procession of beads made throughout this day, however, show a steady improvement as I got used to the conditions on an open fire.

¹⁴ Kucukerman op cit p 64

¹⁵ Peterson *Bead Furnace Burn May 2009* op cit

¹⁶ <http://www.fornitideknik.z.se/IFT/MNTarb/2000/glasparl/glasparl.htm> translated for me into English from the Swedish

Beads made during test firing:



Beads made on first day of beadmaking:



Using a 'period' mandrel on Day 1

Before lighting the fire on the second beadmaking day, I cleaned out all of the ash from the previous firing. While the beadmaking process continued to improve, and I made a few useful discoveries (eg working in a small 'cave' of coals produced an ideal heat and allowed several beads to be made in succession, but it could collapse and totally change the working conditions, and cause ash to fly about) I had a frustrating time with beads sticking to mandrels. I have come to the conclusion that the 'period' large tapered mandrels were very unsuccessful. None of the beads made on them over the 2 days were able to be removed freely – all had to be knocked off, and all but 2 broke in the process. I am not yet sure if that is due to slightly less even surface (as hand drawn by blacksmith), the fact that they are mild steel rather than stainless, or something else. One of my best beads on the second day stuck fast to one of my modern mandrels also, so there may be another issue. A common cause of this is the bead release breaking under the bead, but there is little evidence of this inside the broken beads – the holes appear evenly lined with white slip. It became apparent on the second day of beadmaking that I could conserve fuel well in the smaller fire-pit, and the 'cave' of coals was an excellent working temperature, but I ran out of dipped mandrels and time as I had an appointment that afternoon. So I only made a few beads on this day. The red tube bead (broken in half) and the blue large round stuck on their mandrels, but show an improvement in the shape and surface condition of the beads (very little ash inclusions). I'm still hoping to work the blue bead off the mandrel....

Beads made on second beadmaking day:

(The red tube is broken in half, the grooves on the blue bead were added intentionally, with a knife blade)



Making beads on the final day

I have several different ideas regarding which way I may go in the next step... I could build a smaller fireplace, with a flat base, and steeper walls (perhaps built on a mound for comfort) or I could attempt a covered furnace (in which case there are many choices regarding which design to make). I may also make a small furnace area with fire bricks, on a bench top, just to practice the skills of melting glass over charcoal.

References:

- <http://www.darkcompany.ca/beads/index.php>
- *Viking Age crafts in Ribe - A summary* by Mogens Bencard, Ribe with assistance from Kristina Ambrosiani, Lise Bender Jørgensen, Helge Brinch Madsen. Ingrid Nielsen and Ulf Näsman
- Email communication with Torben Barthelmie, Author of *Wie trägst DU denn deine Glasperlen?*
<http://www.derglasperlenmacher.de/index2.php>
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- *Glass Beads: Anatolian Glass Bead making: The final Traces of Three Millenia of Glass Making in the Mediterranean Region* Professor Onder Kucukerman