

# Norse Garter Belt Buckle Set

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**[Summary](#)**

**[Historical Documentation](#)**

[Norse Buckles](#)

[Garter Buckles](#)

[Brass Casting](#)

[Metal Working](#)

[Finishing](#)

**[Materials and Tools](#)**

**[Method of Construction](#)**

[Making the Model](#)

[Preparing the Mold](#)

[Melting and Pouring](#)

[Finishing](#)

**[Lessons Learned](#)**

**[Bibliography](#)**

## Summary

Belts and straps have long been a basic accessory of clothing and armor, and the various forms of buckle have changed little from the Viking Age to the present day. Buckles ranged from basic iron to highly decorated silver or gilded bronze, with enamel or gemstones. Buckles also varied in size to suit their purposes. The Norse culture enjoyed decorating its metalwork, as did the cultures in close contact with it, and highly decorated belt buckles were favored by those who could afford them. One particular grave find shows that a wealthy Norse man wore small buckles below his knees, which are commonly interpreted as garters.

When my Laurel bestowed my apprenticeship belt at Pennsic XXXI, after taking me as an apprentice at Pennsic XXIX, I cut the belt down to a more period width of one inch. This left me with a half-inch wide, very long strip of leather. I decided to turn this strip of leather into garters to keep my leg-wrappings from falling down, and designed and cast buckle sets for the garters.

This entry is a copy of that buckle set in brass, mounted on a short strap for easy display (for those who have asked, my knees are not that small). I will eventually find a permanent use for this buckle set. I had fun and learned much in researching and making this project.

## Historical Documentation

*Norse Buckles*

There is plenty of evidence for buckles of various types in the Viking Age Norse culture. This simple belt buckle (WOV 3100) is a lead-alloy buckle found in Viking Age York, which was under Danelaw at the time. It is made of lead alloy, has an unusual shape, and displays decoration along the buckle and the pin. The pin is attached by being bent around the base of the buckle.



This example of a decorated pin, attached by forming it around the base, helped inspire my pin design.

This belt set (WOV 3006) dates to Viking Age Norway and was found at Borre. It consists of a buckle, strap retainers, strap ends, and many decorative mounts. Some of the leather is preserved, indicating that some of these items were attached to a strap or belt.



This set is an example of how a wealthy Norseman could afford highly decorated buckles and related gear.

Shown to the near right is WOVS 3022, a belt set from the Gokstad ship burial in Norway. The buckle set includes a buckle, strap end, and keeper. This buckle set also shows exquisite decoration, done in the Borre style that was prevalent in the 8<sup>th</sup> to 9<sup>th</sup> Century.

This buckle is designed such that the pin (now lost) is cast as part of the buckle back, which fits into holes on the side of the buckle. This sort of construction is inherently weaker than the York example above, because the stress is placed on the joints between the back and sides of the buckle. While such a design would work fine with iron, brass, or bronze, I chose not to use it for my buckle.



### ***Garter Buckles***

Shown here is WOV 3375, a set of buckles found in a male grave at Lejre, Denmark. The set includes buckles, keepers, and a strap end. These items are made of bronze and highly decorated.

The positioning of the artifacts in the burial suggests that the set was used with garters worn just below the knees. Such garters could be used to secure boot tops or leg wrappings, or merely for decorative purposes.



The exact size of these buckles is not clear from the information available, but the set includes two of each item. It is also not clear whether the keepers are integrated into the buckles or are separate items. Some design features that are visible, however, include a pin with some decoration, and a belt end that was attached to the strap with rivets.

### ***Brass Casting***

The archeological evidence for metal casting in 10<sup>th</sup> Century Denmark is extensive. However, some question remains as to whether the Norse craftsmen employed sand casting, or exclusively used fired clay molds.

Evidence of casting in fired clay molds is widespread. At the museum in Ribe, Denmark, I saw hundreds of clay molds that had been pieced back together, some of which are shown in the photo to the right. These reassembled mold fragments showed that the craftsmen of Ribe could cast metal into many types of tools and jewelry, including buckles. Traces of metal in clay crucibles found there show traces of bronze, brass, lead, silver, and gold (Jensen 31). Furthermore, the mold fragments found in any one location show that individual craftsmen routinely cast the entire variety of objects, rather than specializing in keys, brooches, and so on (Jensen 33).



The archeological digs at the Coppergate site in York, England, dated to Viking Age, also provide information about clay casting. These included many crucibles, ingot molds, and cupels (Bayley, 799). The crucibles show evidence of being used to melt all

manner of copper alloys (Bayley 803), including brass and bronze, as well as silver (Bayley 799). Likewise, a wide variety of copper-alloy items were found in York, including strap-ends, buckles, brooches, and finger-rings (Hall 103-105).

The process of clay casting is, in theory, simple. A "master," or original, is carved from wax, including a wax sprue or gate to pour the metal. This master is carefully packed in clay, which is fired to pour out the melted wax and harden the clay. While the molds are hot, the metal can be melted and poured in. Finally, when the casting has cooled, the clay mold can be broken apart to free the metal item for finishing (Theophilus, 106). Clay mold casting can create nearly any shape including intricate shapes with undercuts, but requires one wax master for each item cast.

The use of the sand casting technique is more difficult to prove, because a mixture of fine sand and clay is not recognizable in an archeological dig as a casting component. However, sand casting produces a rougher surface on an unfinished piece than clay mold casting. A sand-cast piece has tiny pits and bumps which, in my own experiments with clay versus sand casting, do not occur with a fired clay mold. Some artifacts show this type of bumpy surface and could, therefore, have been cast in sand. Sand casting is documented by Biringuccio in the 16<sup>th</sup> Century (324-328), but Theophilus in the 12<sup>th</sup> Century makes no mention of it. Thus, it is possible that it was available to 10<sup>th</sup> Century Danish metal smiths, but I have not been able to prove it.

Sand casting is different from clay casting, in that the mold is made from two halves of packed sand, mounted in frames that fit together. One half of the mold is packed and dusted with powder to prevent it from sticking to the master or the other half of the mold. The original is pressed into the mold and dusted again. Then, the second frame is set in place and the second half of the mold is covered with sifted sand and then packed down around the master. Finally, the two halves are pulled apart to extract the master and cut the sprue and vents. Sand casting can create any shape that does not have undercuts, can make many castings from the same master model, and usually requires more finishing work because of the parting line left between the mold halves. However, the effort of packing the sand can gradually damage the master.

In either case, it is believed that the mold masters were usually made from wax originals, because beeswax was readily available, easy to carve, and has an advantage over wood or bone in that its lack of grain makes detailed carving easier. A copy of the wax master, of clay, lead alloy, or other durable material, was usually made as a basis for future castings (Jensen 33). Such a lead master could be used with clay to mold wax masters for clay molds, or directly in sand-casting.

### ***Metal Working***

Forming, or bending, is an important step in many types of jewelry, including attaching the pin to the buckle, and forming the legs of the keeper, for a design like this. The craftsmen had various types of pliers to accomplish this. At the Danish National Museum we saw an assortment of tongs, pliers, hammers, chisels, files, gravers, and other tools that were likely to have been used in carpentry but some of which could also be used in metalworking. The museum display did not provide any information as to where these tools were found, but the display was in the Viking Age wing of the museum. The Mästermyr find, from Sweden, also has similar tools (Arwidsson 12-17).

Works from later time periods such as the writings of Theophilus and Biringuccio, can fill the gaps in our knowledge. The technology of metalworking is believed to have changed little during the Middle Ages. The main advances during that time were in the use of chemicals for parting, assaying, and pigments (Agricola 354), so it is likely that most tools and techniques from later periods could be applied to the Viking Age.

Forming, or bending, is an important step in many types of jewelry, including the pin holder on brooches and the hook portion of a necklace hook. The craftsmen had various types of pliers to accomplish this. Working metal this way causes it to become hard and brittle. The hardening varies with the type of metal. To restore malleability and ductility to the metal, a metalworker can conduct a process called annealing. Theophilus mentions annealing as being done at each stage of working silver (102, 138). His failure to define or describe the annealing process in a work that is otherwise very detailed is evidence that the concept of annealing was commonly known to metalworkers in the 12<sup>th</sup> Century. Biringuccio describes the process of annealing copper-silver alloy using a charcoal fire (362), and reiterates the importance of annealing after hammering (367). Alloys of gold, silver, and copper are quite different from ferrous metal in their reaction to heat. Annealing consists of heating the metal to a faint orange glow and quenching it to cool quickly, which softens the metal, allowing it to be further worked.

### ***Finishing***

Finishing jewelry consists of shaping, smoothing, and polishing. There were many abrasives available in period, chosen by their availability and relative effectiveness on the material being worked. Theophilus describes the process of shaping with a flat hone (102) or flat sandstone (189). He describes a variety of files (93) and wire brushes (86) for shaping and smoothing harder metals such as brass and bronze. He describes smoothing as done with a piece of oak covered in ground charcoal (102) or fine sand and cloth (152). He describes polishing with a cloth covered in chalk (102) or powdered clay tiles and water (128), or saliva-moistened shale followed by ear wax (115). Biringuccio describes shaping as done with files, smoothing with cane dipped in powdered pumice (366) or sand and water (390), and polishing using tripoli powder (366, 374), or a wheel of copper or lead with powdered gems (122), emery (123), or lime (372).

### **Materials and Tools**

I used brass for this project, because it is affordable, has a beautiful appearance, and casts at a high temperature that makes it just as challenging as silver. I purchased the brass from a jewelry supply outlet, because I lack the necessary experience to safely alloy my own metals. I carved the original master models from beeswax, which is cheaper than modern formulated carving wax and likely to be the wax used in period, and made pewter masters from the wax original as was done in period.

The tools needed are:

- Carving tools to carve the original or "master" model (I made some from 10-gauge wire)
- Casting sand, talcum powder, mold frame, and palette knife, to make the molds
- Crucible with tongs and a heat source that can heat the crucible to 2000° F
- Fire extinguisher, fire-resistant apron, and safety glasses

- Brass, bronze, pewter, or silver raw material, and flux (boric acid crystals)
- Graphite spoon and/or rod for stirring molten metal in the crucible
- Oven or kiln with controllable temperature capable of 300° F
- Wire cutters or jeweler's saw to remove the sprue and vents
- Scrap wood, and 10 to 16-gauge wire of the same material as the casting
- Tools to file and polish the cast piece
- Dust filter mask for polishing
- Heavy welding-type insulated gloves for handling crucible tongs, hot molds, and metal
- Light leather gloves for holding items while grinding and polishing

## Method of Construction

### *Making the Model*

The design for the buckle set is one of the first free-form designs I have made. That is, I drew it on paper once and then proceeded to carve it without the need for tracing or transfer. The design is based on snakes in the Jelling style. I chose snakes because the small size of the castings means that the animals are not very detailed, and there was no room for legs that other beasts would require. Each side of the buckle shows two intertwined snakes, meeting at the center. The keeper shows a single snake, and the strap end shows a two-headed snake.

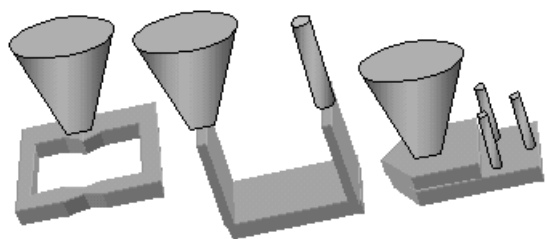
I made a thin slab of beeswax by pouring melted wax onto a tin plate, from which the wax easily separates after it hardens. I then carved the original models of the buckle, keeper, and strap end. Unfortunately, beeswax is so soft that I was unable to get the level of detail I wanted.

The final step in making a wax original is to fire-polish it. This is done over a small heat source, such as an alcohol lamp, and requires great care. Hold the model over the flame, always moving it to keep the temperature under control. To do this properly, it helps to be able to see the underside where the heat is acting on the wax. The idea is to melt the wax enough that its surface becomes smooth, and gravity pulls it into a nice rounded form. Fire-polishing takes a great deal of practice, because overheating the wax or holding it at the wrong angle can ruin the design. Beeswax in particular is difficult to fire-polish, because it goes from solid to liquid in an instant, and is thus much less forgiving of fire-polishing errors than the modern carving waxes. If the fire-polishing goes poorly, however, you can get out your carving tools, solder on more wax, and repair the design.

### *Preparing the Mold*

Put the flat side of the mold frame on the bench, fill it with sand, and pack it down firmly. Then, turn the frame over, powder it, and press the master, non-detailed side down, into the sand. Powder the master a bit, and sift the sand over it. Once the buckle is covered with a layer of finely crumbled sand half an inch thick, fill the frame with sand and pack it down hard. Separate the halves and carefully remove the original.

The diagram shows how to cut sprue channels, legs for the keeper, and vents, to make each item work. The decorated side faces away from the sprue, so that cutting away the sprue and vents does not damage the decoration. The keeper needs two "legs" made with a flat thin object, such as a dental pick or strip of wood. One leg connects to the sprue and the other to a vent. Instead of rivets, I decided to cast integral clinch nails on the strap end by cutting vents as shown. Gently tip any loose sand out of the mold. Put the mold halves together and set the mold up to pour.



### *Melting and Pouring*

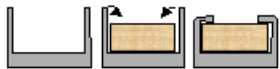
Heat the metal in the crucible, using a kiln, oven, or torch. Silver, brass, or bronze should be heated to about 2000° F. It will have a "sheen" on the top and glow bright orange when the metal is above its "flow" point. Pewter can be heated to about 600° F. Most metals develop an oxide crust on top, which you should scrape away. With any metal, it is ready to pour when it reaches "flow" temperature, that is it should be as liquid as water or mercury. If the temperature is too low, the metal will not flow properly and may not enter all the recesses of the mold. If the metal is too hot, it may oxidize or implode by cooling unevenly. When the metal is at or slightly above flow temperature, pour it into the mold. Pour it all in one smooth motion into the sprue channel, taking only about one second to do so. This also takes practice to do well.

After the visible top of the sprue cools to a darker color, carefully separate the mold halves, take out the casting (it will still be very hot), and tap the sprue on the bench to remove the burned sand. Then, polish the casting a bit to see if the pattern came out well. If it did not, you can melt it down and try again. If it came out well, cut off the sprue with the jeweler's saw and the vent with wire cutters.

### *Finishing*

Rough shaping is required to remove the flash, the bits of metal where the mold halves met. I used hand files and a Dremel-size coarse sandpaper drum, held in a drill press, for this process. While the power tools made shaping easier, it did not seem to get the job done any faster than the hand tools, and certain detailed and interior areas had to be done by hand. I shaped the easy-to-reach areas, such as the flat sides of the keeper and strap end, with a 600-grit belt sander.

After rough shaping is done, form the keeper. Slip a block of wood inside the keeper, with a thickness equal to the leather strap plus the strap end, and bend over the legs, as shown to the right.



With a thin brass wire (about 14 gauge), form a pin for the buckle, bend the end into a  $\frac{3}{4}$  circle, slip it over the buckle base, and gently crimp the pin shut with pliers, so it is permanently attached to the buckle. For a pewter or silver buckle, use nickel for a stronger pin. In normal use, the joint should not be subject to any stress. If the buckle is brass or bronze, you could use a vent tube for the buckle pin, in which case it should be about 10 gauge.

Brass is somewhat hard, so I was able to polish it reasonably well with a fine wire brush wheel followed by a medium buffing wheel with the black polishing compound. I then used a succession of the white, black, blue, and green polishing wheels. The result was somewhat better than the wire brush and buffing wheels, and these high-tech polishers are excellent on pewter and silver. While such polishing wheels are designed for a handpiece or Dremel tool, I use them in my drill press at a slow speed (1100 rpm), which is safer and gives good results.

If desired, you can accent the design by filling the recesses with niello or enamel, use acid to darken it, or fire-harden and surface-polish the buckle. I did none of these with the buckle, because the depth of the decoration is such that no additional enhancement is needed.

## Lessons Learned

Since my personal color scheme prefers silver metals to gold, I wear garters with pewter buckles, keepers, and strap ends for everyday use.

It took me 1 hour to design the buckle, 2 hours to carve it, half an hour to cast and smooth the pewter master, one hour to cast and assemble the brass buckle set, and two hours to finish it.

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Theophilus, trans. John Hawthorne and Cyril Smith, On Divers Arts, Dover Books, New York, 1979, ISBN 0-486-23784-2. This translation of an early twelfth-century treatise on painting, glassworking, and metalwork is one of the foremost period sources for researchers of these arts.

Various museums in Denmark. In the summer of 2000, my lady and I traveled to Denmark and visited the National Museum in Copenhagen, the Viking Ship Museum in Roskilde, the Viking Museum in Ribe, and the research/reconstruction sites at Fyrkat, Trelleborg, Jelling, and Lehre. We

took many photos, saw many artifacts, and spoke to an archeologist or two. What we saw on this trip gave us ideas and research for years of arts and sciences projects. Our only complaint is that we had to take our own photos, which did not always come out well when taken through the glass that protected the artifacts. None of the museums sold information or photos of individual artifacts.

York Archaeological Trust and the National Museum of Denmark, [The World of the Vikings](#) (CD-ROM), Past Forward Limited, undated. This CD contains thousands of photos of artifacts, but the photos are described only as the item, the place it was found, the museum where it is located, and sometimes the date the item was originally buried.



[Back to Danr's A&S page.](#)