10th Century Norse Drinking Horn

(Work in Progress)

by Danr Bjornson

January - February 2005

Summary

Archeology and surviving art provide strong support for the idea that Norse men, and possibly women, used cow horns as drinking vessels. These drinking horns were often richly decorated. On a trip to Denmark, I saw two drinking horns on display that inspired this project.

The design for this horn is based partly on drinking horn artifacts and partly on my knowledge of other forms of Norse metalworking. Where those failed to provide proper guidance, I had to fill in the gaps with what seemed the proper way.

My materials consisted of a sanded cow horn that I have carried for years, decorated only with a sheath of smooth leather, sheet brass, brass rod, and beeswax. I also made myself a set of chasing tools from iron nails, so I could decorate the brass. My tools consisted mainly of saws, files, sandpaper, torch, and ball-peen hammer. This was the first decorated horn I have made, though I have experimented with the chasing technique before on a smaller scale. I look forward to making another decorated drinking horn for my lady.

Historical Documentation

Decorated Drinking horns

Sagas and legends describe hearty Norsemen drinking mead from cow horns at celebratory feasts. Artifacts and artwork show that some horns, at least, were highly decorated. In this detail

from the Bayeaux Tapestry, King Harold's warriors feast and drink from bowls and drinking horns. The drinking horns are shown decorated with a band around the rim and, on the horn to the left, a terminal of indeterminate shape on the tip.

Likewise, legends spoke of Valhalla, where the brave spent their days fighting and their nights drinking, in preparation for Ragnarok, the last battle. This famous brooch pin, found in Birka and on display at Statens Historiska Museet in Navavagen (WOV 3886), Sweden, shows a woman holding a drinking horn. It is believed to represent a Valkyrie offering a horn of mead to a fallen warrior as he enters Valhalla.

At the Danish National Museum, I saw a matched pair of drinking horns on display, shown here.

Photo by Isabel Ulfsdottir (Lisa Willadsen)

It was not clear from the display whether these were reconstructions based on the metal fittings, or if some of the horn or leather was original. These horns had simple metal rims with a figure-8 cross-section, a conical terminal with a detailed cow's head, and a short strap slung between the rim and terminal. All the metalwork was of a copper alloy, perhaps bronze. The strap is very short, too short to wear the horn over the shoulder, but just right for holding in the hand or attaching to a belt. It was not clear from the display whether the strap length was based on evidence, such as surviving straps, or simply speculation.

A closer view of the terminals shows the cow heads to be very detailed, and of a lifelike quality that was unusual for Viking Age artwork. The rest of the terminal is a simple cone fit over the end of the horn. The strap fittings are simple loops, with sheet metal rolled into a cylinder over the rounded leather strip. With the artifact in a glass case, I was not able to determine whether the terminals were cast in this form, or whether the cone was formed of sheet metal then soldered onto the cow heads.

Photo by Isabel Ulfsdottir (Lisa Willadsen)

A very famous drinking horn artifact comes from Århus, Denmark (WOV 2904), shown here. It is made of bronze and depicts a bird in Ringerike

style. The decorative technique appears to be engraving, in which the metal remains flat and pattern lines are carved out, or chasing, in which shaped punches make marks in the surface. The bottom edge is cut in a scalloped pattern, the scallops serving as a decorative place to mount rivets to hold the metal in place. The rim is of particular interest, because it shows a circular cross-section at the very edge, and a thinner strip supporting where it connects to the sheet metal portion of the rim. The pattern in which corrosion decayed the rim, the milled strip, and the main sheet of bronze suggests that each may have been a separate piece of metal.

I believe the rim was constructed from three pieces of metal: a wide strip which was etched with the bird pattern, a narrow strip which was scalloped, and a slightly wider strip which was pulled through a drawplate to shape it into something just short of a tube, with a cross-section like the letter "C." This near-tubular piece was slipped over the edge of the wide sheet and the scalloped reinforcing strip laid along the seam. These pieces were then soldered together, before the entire assembly was bent into a circle and riveted to the horn. I was not able to devise a way to reproduce this structure for my horn project, at least not with my current budget and available tools.

WOV 1560, to the right, shows a reconstrucion of the Århus horn shown above. It has the characteristic rim, riveted to the horn, and a strange bit of metalwork in the center that is reminiscent of a shield boss. My available sources do not explain the purpose for this piece. This reconstruction also lacks a terminal.

WOV 1562 gives a closer view of the same reconstruction. The metalwork is a very faithful reproduction of the Århus horn, down to the complex construction of the rim.

I would like to see the inside edge of the rim for more clues as to how it was built. On my next trip to Denmark I intend to visit the Forhistorisk Museum in Moesgård to see this reconstruction and learn more about it.

The last artifact to show is this bronze terminal from Ballinaby in the Hebrides of Scotland (WOV 1977). This bronze terminal has a simple shape and is decorated with "twist" patterns of simple design unlike the commonly known Norse art styles. This artifact suggests that decorated drinking horns were not unique to the Norse culture.

Metalworking Processes

Theophilus, a 12th-century monk, described how to make files (93) and chasing punches (92) by forging, grinding, and case-hardening iron (91, 94, 95). He also describes chasing and repousse', where sheet metal is placed on a yielding surface and struck with a punch to produce indentations (156-157). Chasing produces sharp marks and indentations in the front surface of the metal, while repousse' ("push out") produces raised areas from the back side of the metal. Combining the techniques can result in an effect much like a relief carving, but in sheet metal. Theophilus describes how to make and use chaser's pitch (129-130), a mix of pitch, wax, and a mineral powder such as powdered tile. Thick leather on a smooth anvil works nearly as well, though it lacks the ability to hold the work steady that pitch offers. Theophilus also describes hammering metal into sheet metal (150, 156), a labor-intensive process that I was unwilling to attempt for this project.

An example of the Norse culture's use of chasing and repousse' is shown in this silver bowl from Terslev in Sjælland, Denmark (WOV 2105). This view shows the repousse' side, or the back of the metal. The chasing tools create, on the back side, sharply-defined raised areas. The repousse' technique was used to push out smooth areas around the chased lines, producing deep relief and emphasizing the design.

Another view of the same bowl (WOV 2107) shows the chased, or front, side of the metal. The marks made by the chasing tools are sharply defined, and are repeated to create lines and patterns. The repousse' produces smooth raised areas.

As metal is punched, bent, or hammered, it hardens. Continued pressure causes it to become hard and brittle and can result in metal fatigue. To restore malleability and ductility to the metal, a metalworker must conduct a process called annealing. Theophilus mentions annealing as being done at each stage of working silver (102, 138), including several times during the process of conducting chasing and repousse'. 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 12th Century. Biringuccio describes the process of annealing copper-silver alloy using a charcoal fire (362), and reiterates the importance of annealing after hammering (367). Annealing consists of heating the metal to a faint red glow and quenching it. This allows the molecular structure to realign and relieve the internal pressure. After annealing, the metal is soft and able to be bent, hammered, or punched further. Annealing repeatedly during chasing and repousse' process allows the artist to achieve great depth in the pattern.

Pickling, mentioned by Biringuccio but not Theophilus, is a process by which an acid solution is used to clean oxides and other foreign substances from the surface of a metal. Biringuccio describes this "blanching liquor" (360) as being made of tartar, salt, water, and urine. Variations of these ingredients are used for gold (361), silver (364-365), and copper alloys (369). Pickling is needed after soldering, annealing, or other events which expose the metal to heat. This technique may not have been known in earlier times, but it certainly saves a lot of time polishing.

Theophilus describes cutting sheet metal with shears (155). At the Danish National Museum, I saw an assortment of shears, pliers, hammers, chisels, files, engravers, saws, and other tools that could be used in metal working. 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).

Finishing metalwork consists of shaping, smoothing, and polishing. There were many abrasives available in period, chosen by their availability and effectiveness on the material being worked. For example, Theophilus describes the process of shaping with a whetstone (102) or sandstone (189). He describes a variety of files (93) and wire brushes (86) for shaping and smoothing metals. He describes smoothing with oak covered in charcoal (102) or fine sand and cloth (152). He describes polishing with a cloth covered in chalk (102), powdered clay tiles and water (128), or saliva-moistened shale followed by ear wax (115). Biringuccio, a 16th century source, describes other materials: shaping with files, smoothing with cane dipped in powdered pumice (366) or sand and water (390), and polishing with tripoli powder (366, 374), or a wheel of copper or lead covered with powdered gems (122), emery (123), or lime (372).

Jelling Art Style

Most styles of Norse art contains zoomorphic interlacing. Unlike Celtic interlacing, Norse interlacing is usually asymmetrical. Of the six major art styles known to Norse culture, the one that appeals to me and was widely used during my persona's life (10th Century) was the Jelling style. It was named for the silver cup found in Jelling, Denmark.

To the right is a close view of this cup (WOV 2896). In the Jelling style, the animals tend to have several common features. Noses are usually curled. Head, foot, and ear shapes are indistinct and make it difficult to identify the species of animal depicted. The eyes are round. The body tendrils are wider than limb, ear, and tongue tendrils, and the bodies are decorated with stylized patterns of repeating geometric shapes. The limbs are clearly jointed where they join the body.

This scabbard tip (WOV 2808) from Saari, Finland, is another example of Jelling style. It crosses over to the Borre style a bit, as the head is depicted from the top or front and the tendrils have a lengthwise groove. The rest is classic Jelling, though, with wide bodies and narrow limbs, joints marked by circles and spirals, bodies decorated by simple repeating patterns, etc.

Finally, WOV 2836 shows a brooch from Hedeby (an identical brooch comes from Iceland and another from Norway, but that is another discussion). It also hints back to the Borre style of a century before, in that the feet grip other tendrils, which are grooved. Otherwise, it is pure Jelling style, with curled noses, round eyes, spirals at the joints, narrow limbs, and bodies with simple

decoration. Unlike many examples of Norse art, this brooch displays a radial symmetry that fits the oval shape of the brooch very well.

Bronze or Brass?

The metal artifacts pictured above are described as being made of bronze. My theory is that the metal used was probably brass. The proportion of lead, tin, and zinc determines the nature of copper alloys. High levels of tin create bronze, while high levels of zinc create brass. Long-term burial of copper alloys coats them with green copper oxide and other forms of corrosion. The differences between brass and bronze are no longer apparent without chemical analysis. The alloy names could also become confused in translation.

I believe brass would be the metalworker's choice because, in my experiments, I have found that brass is softer, less brittle, and requires less frequent annealing than bronze. I asked an archeological metallurgist about this, who sent me his article which clarified that copper alloy artifacts from Sweden and Denmark were predominantly brass, not bronze (Söderberg). Analysis of crucibles from Coppergate, another Norse site from the same time period, have shown that craftsmen tended to use whatever alloy they had, but brass was much more common than bronze (Bayley, 807). Therefore, for both metallurgical and linguistic reasons, I believe that most "bronze" metalwork was actually brass.

Materials and Process

Materials

I already had the horn. It is a large sanded cow horn I bought from Tandy Leather and have carried to SCA events for 6 years, my Drinking Horn of Unusual Size (DHOUS). When I got the horn long ago, I was concerned about how thin it was because it came to me already sanded, so I coated the inside with 2-part epoxy to strengthen it, and coated that with beeswax for a period appearance and taste. Thus I began this project by removing all the wax from the inside of the horn and trimming the top down a bit where the layers were separating. There was no practical way to remove the epoxy, but neither is it visible in the finished horn. I also rubbed the outside of the horn with beeswax, heated the wax over a candle flame, and polished it into the outside surface with a linen cloth.

I used sheet brass and 1/8" brass rod for the metalwork. I intend to finish the horn by casting a brass animal head and soldering it to the terminal. I used 7 oz leather for the straps.

Tools

I also used some #10 common nails to make the chasing tools. I hammered, ground, and filed them to shape, then case-hardened them by heating them to an orange glow and quenching them in water.

From right to left is my first set of chasing tools: a 3mm straight chisel, a rounded chisel, a sharp point, a small round tip, and a large round tip, the last one used for repousse' only. As I worked after this photo was taken, I also found the need to make a 1 mm chisel tip for making tighter-curving lines and a 3mm unsharpened chisel for doing repousse' along the tendrils. I also made a set of wooden punches from maple dowels in a triangular and chisel shape, which I used to flatten the background around the pattern without marking the metal.

I used files and a belt sander to shape the chasing tools. For rough cutting of the sheet metal I used a band saw. For finer cuts in the sheet metal I used a jeweler's saw. For finer shaping I used files. For smoothing I used sandpaper, which is easier to work with than the period whetstones and other methods. I used a propane-air torch as a heat source for case-hardening and annealing. I used my homemade chasing punches and a ball-peen hammer for chasing and repousse', with 7-oz leather and an anvil as my chasing surface. I used the hammer, jeweler's saw, and pliers to make the rivets, rings, and hook from brass rod. I used a jeweler's pump drill for drilling pilot holes, and a drill press for the 1/8 inch holes using the pilot holes for accuracy. Finally, I used a strap cutter, shears and a leather punch for the leather straps.

Design

The first step in the process was to design the horn fittings. This was fairly simple for the most part. I decided to use a short strap, much like the horns I had seen in the museum, but with some changes. I avoided the rounded leather strap because I have never practiced the technique of using a draw plate to reshape leather strip into a round strap. This also simplified the chain fittings. I also decided to mount a hook on the strap's central fitting and to locate the central fitting off-center. I did this so the horn would hang at an angle, suspended from a belt. This arrangement allows me to walk around with a half-full horn on my belt without spilling, which is practical for avoiding dehyration. It will also hang well from a belt separator, my next project.

The difficult part of the design process was the horn rim. As already discussed, the Århus horn rim was very complex and (as far as I can theorize) requires tools, such as a drawplate with a large range of holes, that I cannot afford right now. It would also require skills I have not yet developed. The horn rims I saw in the Danish National Museum were simpler, but too simple for the decorative look I sought. So I decided to take a shortcut by

simply cutting the rim edge into tapered "fingers" that I could easily bend over and crimp. These fingers would be concealed, more or less, by the wax that would coat the inside of the horn, while still providing a strong metal edge to grip the horn rim and prevent wear and delamination of the horn material.

Designing the artwork was easy for this project. I took a design I had previously created and adapted it to the shape of the metal I was decorating, by rerouting tendrils and stretching it to fit.

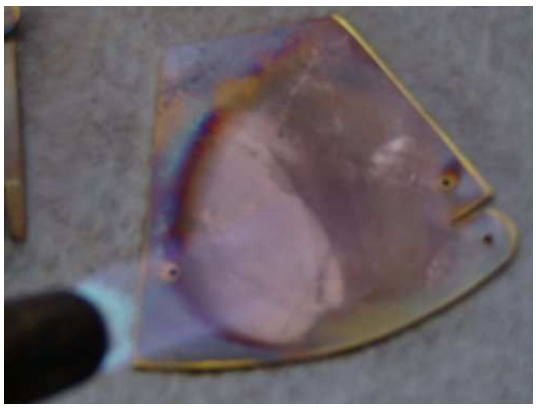
Metal Fittings

The first step was to make patterns for the metal fittings. I wrapped paper around the horn at the rim and the terminal, drew some lines where I would cut, and cut the paper to create the pattern. I then traced this onto the brass. I cut it out with the bandsaw and made the more detailed cuts with the jeweler's saw. I did the same with the terminal on the end of the horn. As part of the pattern, I included lugs for the rivets and tabs to bend outward and connect to the strap rings.

I annealed the brass rod. I then wrapped the brass rod around a mandrel into a spiral and cut the rings out of this spiral. I also cut a length of wire and bent it into a simple hook. This step can be done at any time, so long as the rod is annealed before you start making rivets.

Decoration

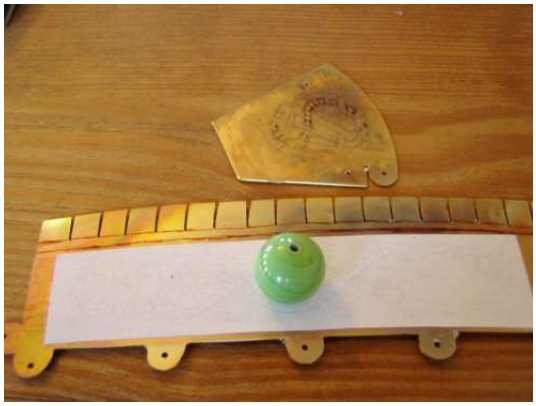
The first step in decorating the metal was to anneal it. The process of rolling it into sheet at the factory had work-hardened it. My equipment did not allow me to anneal the entire sheet of metal, though that would have made cutting it easier, so I had to anneal after sawing out the metal. Likewise, the heat from annealing burns away any markings, so you must anneal before transferring the pattern. The photo to the right shows the pink color of brass when it is at the proper temperature for annealing. I held it at this temperature for 30 seconds, allowed it to cool until it no



longer glowed, then quenched it in water. Annealing softened the metal so it could be chased more easily and without risk of metal fatigue.

I then dropped the metal in a pickling bath to clean away the oxides on the surface. For a pickling solution, I used modern jeweler's pickling acid, which is faster and more pleasant-smelling than the acids used in period for this purpose. The reason for pickling at this early stage was to give a clean surface for marking the pattern.

The next step was to transfer the art pattern to the metal, in order to see the pattern when doing the chasing and repousse'. First, I put the design on paper using a soluble ink. In my case I used an inkjet printer, but graphite or charcoal would work. Then I coated the metal with something to capture the ink, by rubbing it vigorously with a candle. Finally, I put the pattern face down and rubbed the back of the paper with a hard smooth object while holding the paper perfectly still. I used a large glass bead but a glass or metal burnisher, if you have one, would be ideal.



I was then ready to begin chasing the pattern. I used a thin piece of leather on the anvil as a chasing surface. This was my third attempt at chasing. The pattern is much more complex than my previous work, but the results are much better than my earlier chasing work. Still, I intend to get a pitch bowl for future chasing, as it saves a lot of trouble by holding the work steady.

To perform this technique, hold the chasing tool almost perpendicular to the surface. If you are continuing an existing line, the tool will have one edge just on the line already chased. Strike the tool with the hammer to make an impression in the surface that continues the line you are working on. Too much force can punch through the metal or push it down too far, while too little force can make a faint mark that must be redone. The wax coating you used to transfer the pattern will make the metal slippery. As you chase along a line, the metal around that line will be forced downward, creating a curved surface that makes it harder to control the chasing tools. For sharp curves, use a curved chasing tool and/or a narrower chisel. For the animal eyes, I used the sharp point and followed it with the small round point. For the round dots that decorate the bodies, I used the small round point. These were particularly difficult to place properly, because by that time there were lines on each side, rendering the surface of the bodies somewhat rounded and requiring the tool to make a mark on the top of a slippery curved "ridge." I also made a few errors in the pattern of overlapping tendrils or exact placement of the tool, which are hopefully not too noticeable. Unlike many arts, errors in chasing are very hard to conceal. You can push the area out again, but the cut in the metal made by chasing tool takes a huge amount of work to close with tedious rubbing by a burnishing tool. The best advice I can give is to proceed carefully, take breaks when your fingertips go numb or your hands start to shake, and overlap marks as needed to get a well defined line.

This photo shows the front side of the terminal piece, partway through the first stage of chasing. The metal bends downward around the chased lines, and the lines themselves are sharply defined cuts in the metal's surface. This also illustrates the disadvantage of chasing on leather, versus a surface of pitch. As the metal gets more concave, it becomes difficult to hold it steady and apply the chasing punches without slipping.

This shows the back of the same piece of sheet metal partway through the first stage of chasing. I used some steel wool to shine the raised areas a bit. It will be easy to locate where the pattern needs to be pushed out with the repousse' technique.

After all the lines are chased, anneal the metal and put it back on the chasing surface, face down.

Rub the surface with steel wool to brighten the chased lines. Use the large round punch and the smooth (unsharpened) chisel punch to push out areas of the pattern that you want raised. Unlike chasing, this will not leave sharply-defined marks on either side, it simply pushes out convex areas between the chased lines.

Anneal the metal again, put it on the chasing surface face up, and refine the pattern. Re-chase any lines that were raised too far by the repousse', then turn the metal over and gently push out any areas that are too deep. Finally, put the metal on a flat anvil face up and flatten the "background" areas. I tried using the large round punch to flatten around the pattern on the terminal piece, but did not like the marks it made. For the rim piece I used wooden punches instead, which did not leave any marks on the metal and did well flattening the background.

Assembly

I annealed the metal one last time and pickled it, so it would be easier to form it to its final shape. I then redrilled the rivet holes to the proper size, and filed the "fingers" on the rim so they

tapered slightly to better fit together when folded over. Wrapping the rim around the horn was easy enough, and I trimmed the area where it overlapped to fit. It was difficult to hold the ends in place, so I drilled a hole in the center of the overlapping area. The photo to the right shows how the rim looked at this point.

I then placed one rivet on the overlapping portion of the rim to hold the ends together. This made it much easier to slip the rim over the horn from the small end.

Installing the rivets on the rim was a bit of a challenge. One rivet hole at a time, I drilled a pilot hole with the pump drill and drilled the hole to size with the drill press. I then cut a short piece of annealed brass rod, held it in pliers on the anvil, and formed a rivet head on one end with the hammer. I slipped this through the hole from the inside and, putting the rivet over the horn of the anvil, I carefully formed the outside rivet head, taking care to pull the metal rim and horn tightly together without being so tight as to stress the horn. I named this first rivet to be 12 o'clock, and did the rivet at 6 o'clock, 3 o'clock, 9 o'clock, etc. By placing the rivets in this sequence, I ensured the rim was on straight and that it was evenly attached.

I next folded over the "fingers" of the rim, one at a time, and crimped each one down over the edge as I went. The process of folding the metal does two things. It work-hardens, making it resistant to unfolding, and it deformed the edges slightly, creating raised edges on each finger where it folded over the rim. I filed these down carefully, then sanded them until they were smooth.

Folding the terminal into a cone was the most challenging part of the assembly process. Even though it was annealed, the metal resisted being folded that far, and I had to anneal it again halfway through the process. It helped a great deal that I had predrilled overlapping rivet holes.

When the cone was close to its final shape, I slipped a length of rod, with one end formed into a rivet head, into the holes to hold the cone at that size while I worked the other end down. This is shown to the right. Note that the edge of the cone with the hanging loop is under-lapped.

It was important to pad the anvil and cone with leather to avoid making marks in the metal. I finished the terminal by drilling through the horn and out the other side, and

sinking a long rivet to hold it in place.

I cut some 3/8 inch straps, rounded the ends, punched holes with a leather punch, and installed the rings and hook.

I then poured hot beeswax into the horn and poured it back out, turning it as I poured to ensure the inside was well coated and sealed, particularly the rivets and inside rim. I put two coats of wax inside in this way. The beeswax seals the inside and lends a nice taste and smell to the horn. The photo to the right shows how the wax seals the rivets and rim.

Conclusion

The horn took 18 hours to decorate and assemble. I learned a lot making this horn, which will allow me to work more efficiently next time. To finish the horn, I intend to cast a brass animal head and solder that to the terminal. I anticipate another two hours to remove the terminal, cast the animal head and solder it onto the terminal, and reattach the terminal.

Bibliography

Agricola, Georgius, trans. Herbert & Lou Hoover, De Re Metallica, Dover Publications, NY, 1950, ISBN 0-486-60006-8. This book covers the 16th-century techniques of metallurgy.

Arwidsson, Greta, and Berg, Gösta, The MasterMyr Find: A Viking Age Tool Chest from Gotland, Larson Publishing, Lompoc CA, 1999, ISBN 0-9650755-1-6. This book describes all the tools and objects from this extraordinary find.

Bayley, Justine, Non-Ferrous Metalworking from Coppergate, from The Archeology of York, Vol 17 The Small Finds, Fasc. 7 Craft, Industry and Everyday Life, Council for British Archeology, York, 2000. ISBN 1.872414.30.3. This small book in the Archeology of York series focuses on the evidence for gold, silver, copper, lead, tin, and alloy crafts.

Biringuccio, Vannoccio, trans. Cyril Smith and Marth Grundi, Pirotechnia, Dover Books, New York, 1959, ISBN 0-486-26134-4. This translation of a sixteenth-century work contains a great deal of information on metallurgy and casting.

Söderberg, Anders, Analyses of some Scandinavian early medieval cast objects, Sweden, 2000. In response to an inquiry, he sent this article to me. It originally appeared on his web site, http://members.chello.se/vikingbronze

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 an excellent period source.

Various museums in Denmark. In the summer of 2000, my lady and I traveled to Denmark and visited many museums and research centers. We gained ideas that have kept us creating new things for years.

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 quality photos of artifacts, but the information about each artifact is quite limited.

 Back to Danr's A&S page.