The PATINA May meeting featured **Steve Mankowski** from Colonial Williamsburg's Anderson Blacksmith Shop. Steve has been blacksmithing for 28 years and has been working as a smith at Colonial Williamsburg (CW) for about 19 years serving an apprenticeship under Peter Ross. One luxury of working in a research oriented shop is the opportunity to examine smith made objects discovered in the tidewater region to understand materials and methods used in earlier periods. Steve pointed out that archeological fragments provide important clues about techniques blacksmiths used to fashion tools and other hardware commonly used in colonial and later periods. He brought several hand forged examples of how a hammer head is formed showing each step. The work he does at CW is mostly for use within the museum where he makes reproduction hand tools for all trades as well as hardware for buildings and furniture. He is at present working on some stirrups for the saddles that were made at CW, as well as on a kitchen roasting spit.

The shop at CW uses mild steel made from wrought iron recycled from old buildings and marine scrap. Occasionally, wrought iron survives devastating fires in old buildings which can produce blister steel. Steve described the transformation of wrought iron to blister steel as follows: Using a coffin-shaped fire proof container bring up a fire with charcoal made from beech logs. Lay flat pieces of wrought iron across the top of the fire box taking care that the iron does not touch one another. Over a 2 to 3 day period all the carbon from the charcoal migrates through the iron transforming iron into to high carbon steel. If the iron gets too hot, however, it will melt and puddle into cast iron. Once transformed to high carbon steel, the blister steel can be melted to make cast steel improving its ability to bend and not break. This was an important technique allowing for the production of springs and watch parts.

Steve has also experimented smelting iron from local ore attempting to replicate colonial activities centered near Richmond and Accokeek, Virginia.

Steve said that iron making began in Virginia at the beginning of the 18th century. Although most high quality steel products were imported from England archeologists have discovered evidence of iron smelting and iron tool fragments form that era.

Figure 1 – 16th Century Lock and Hinges

As a collector of early blacksmith tools and locks, Steve asked that PATINA members bring examples for their collections to share. Mike Weichbrod and Tom Soles provided examples for Steve to assess and comment on. First, Tom Soles brought some gems from his collection to share with the group. One item was an elaborate 16th century cabinet lock appraised in 1982 by Alfred Habberman, Head of Antiquities in Yugoslavia and a long time Blacksmith at $8,000. Habberman thought it was either Spanish or German and should be in a museum. Steve considered the lock and hinges would be valued above $10,000 dollars. Lee Richmond thought it might be Spanish or Portuguese.

The second piece Tom brought was a very fine door knocker made by Samuel Yellin, the preeminent American blacksmith of the 20th century. (See more about Yellin at -- http://www.samuelyellin.com/index.html)

Hand forged pieces by Yellin are generally considered priceless, and Steve placed the door knocker Tom brought to show the group squarely in that league.

Figure 2 - Samuel Yellin Door Knocker

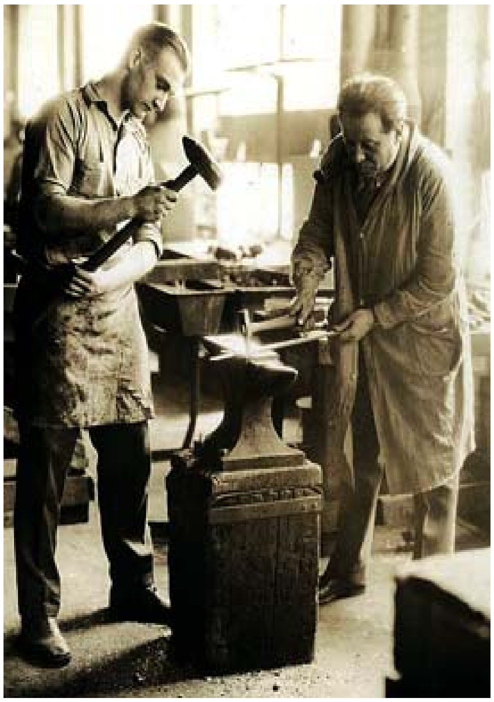

Figure 3 - Yellin and Striker ca 1930's

Mike Weichbrod sent a tool box full of door locks along for Steve to consider. All blacksmith made, the locks ranged from the 18th century to the civil war era. The first example was an early English style lock likely an 18th century work. (Figure 4) There were two examples of early German or Pennsylvania Dutch design which Steve distinguished by the shape of the box and decorative file markings. Generally, the more rounded corners of the lock box indicate later work, with early design noticeably square in shape.

Figure 4 - Early English Style Lock

Below are two examples of the German design. Figure 5 and Figure 6 depict handmade locks from the 18th and 19th century respectively. Notice the square edges on the box in Figure 5 and the more rounded corners on the example shown as Figure 6. The later example also has what appears to be manufactured screws and nuts. Both examples were likely made by German blacksmiths probably in Pennsylvania in the late 1700's and up to around the Civil War era. Mike said he found the locks around Lancaster County Pennsylvania.

Figure 6 - Civil War era German style lock

Figure 5 - Early German style lock

Steve commented on two other locks with distinctive form and construction provided by Mike Weichbrod. These locks were thought to be of Spanish or Mexican origin and likely of 19th century period work.

Figure 7 - 18th Century Spanish style lock

Figure 8 - 18th Century Spanish style lock

Steve estimated the value of the German and Spanish style locks at $50 to $75 each, noting that lock collecting is a specialized niche with prices determined mostly on ornamentation and style.

W hat Happened at the Forge… by the ***EDITOR***

After the formal part of the lecture was presented by Steve, the attendees repaired to a small portable forge which was set up in the parking lot. There they could observe a demonstration of Steve's blacksmithing skill as he produced a number of nails and a small chisel, all from wrought iron bar stock of various sizes. The production of the nails was fairly straightforward. Steve used a thin piece of bar stock, heated it in the forge (Steve declined all offers to crank the handle of the "bellows"), and then drew the heated metal out to the desired thickness by use of a hammer and anvil mounted on a short section of tree trunk. Once the stock was drawn out to the proper size, it was inserted into a special orifice on the face of the anvil – a hardy hole – then Steve beat the protruding portion forming the nail head.

Figure 9 - Steve Mankowski Fires the Forge

The production of the chisel was considerably more complex. Using a larger piece of wrought iron bar stock, he first drew down a section of the bar to form the shank of the chisel, then he began on the formation of the socket after he had cut the bar off at the proper length. To form the socket he had to draw the metal out until the worked metal took on a fan-shaped appearance. Then he had to turn the sides of the fan into a conical shape to round out the socket. Forming the fan presented a problem in that as the wrought iron bar grew thinner it began to split along the grain. These splits had to be welded together again into a continuous fan. All of the welding operations were performed by copious use of a flux (akin to rosin core solder in soldering copper wire).

The flux he used to perform these welds was a mixture of two parts boric acid and one part of 20-mule team borax (sodium tetraborodecahydrate, in the jargon of the chemist). The purpose of the flux is to act as reducing agent to keep the metal surfaces form oxidizing so the two halves of the melted metal can flow together. After the socket was formed, the next step was to weld a piece of steel to the other end of the drawn-out bar of wrought iron to produce a hard section of uniform thickness from which a cutting edge would be ground. The same technique, referred to as swaging, is used to weld steel to the end of plane irons to produce a cutting edge. The iron section was heated first to get it to the right temperature, and then the steel was placed over it (the steel works at a lower temperature). When the weld was made and the chisel formed, the metal had to be tempered. This is the process of hardening metals, especially steel, by which a desired balance is obtained between the hardness and the toughness depending on the end use of the finished product. The metal is first hardened by heating it o a high temperature and then quenching it in water (or oil). It is then reheated to a lower temperature which decreases the hardness and improves the toughness. A thin film of iron oxide is formed on the steel that is being heated and this film develops different colors, (from a pale yellow to a dark blue with various intermediate shades), as the temperature of the metal rises. This color change indicates the degree of hardness/toughness of the metal at a given color (temperature). The temperature can also be monitored by using a pyrometer, an instrument for measuring surface temperature. Anyway, when the blade of the chisel is properly tempered, it will be harder at the cutting end and softer in the socket. So ends the lession in metallurgy!

Special thanks to Tom Soles and David Murphy for contributing to the meeting summary and providing photographs.