

## Medieval Blacksmithing

The medieval world was a world of iron. The Age of Bronze was over for much of the world, and the Age of Steel had yet to fully come. This paper investigates the role of blacksmith in medieval history.

During the Age of Bronze most metal tools and weapons were made of this alloy of copper and tin. It could be melted and cast into many shapes, it could be worked relatively easily, would take an edge, and was actually harder than pure iron. The two metals, copper and tin, could be refined with relative ease from ore. In fact, it was this refining process which may have been the origin of “magic”, where one common substance could be changed into another, more valuable substance through mysterious and hard to understand methods.

The word “smith” comes from the same root as the word “smite”, and refers to someone who makes a living by hammering metal. A “blacksmith” was one who hammered iron (“black copper”), as opposed to tin, copper, gold, or silver. Helmet makers, armorers, sword makers, and blacksmiths inhabited and helped define the medieval world.

Iron was known from prehistoric times in the form of meteoric iron. This was a nickel-iron alloy with very good properties. King Tut had a small meteoric iron dagger on him when he was buried, and the Eskimos made tools from iron obtained from a meteorite (this meteorite was subsequently stolen by Admiral R. Peary). This “magical” metal was far superior to bronze, but no one yet knew how to make it. A thousand years would pass before experimentation and accident would lead to the smelting of iron from ore. This happened at different times in different places, allowing the Age of Bronze and the Age of Iron to co-exist for centuries.

Iron ore was obtained from alluvial deposits and only rarely from digging. One favorite type of ore was “bog iron”, a deposit of iron oxides that was created when bacteria would metabolize iron compounds, excreting pure iron. This iron would oxidize and get deposited on water plants in bogs. This 'bog iron' was smelted almost exclusively by charcoal (the production of charcoal was a major factor in the deforestation of Europe). To smelt the iron ore a pit would be dug on a hilltop, then charcoal and ore were layered in the pit, which was sealed at the top with earth. The mass was then fired.

Ore was usually refined, or “smelted”, close to the source of the ore. Unlike copper and tin, iron was not easy to refine. Early medieval fires could not melt iron. Instead, the solid ore (composed of iron oxides and impurities) would be reduced to metallic iron “sponge” by heating it in a fuel-rich fire, producing a “bloom” that was a mix of pure iron, various impurities, and occasionally small amounts of steel. Steel is an alloy of iron and carbon, and is harder, tougher, and harder to melt than iron. Most methods produced iron that had some carbon in it, making it a 'mild steel'. Unfortunately, the metal would vary in character depending on the accident of carbon mixing in the smelter. A more reliable method of introducing carbon into the iron was to heat the iron in the presence of carbon and allow the carbon to diffuse into the iron.

Sometimes, in the process of smelting the ore, too much carbon would be introduced to the iron. This would actually reduce the melting point of the iron to a range that medieval fires could manage. Instead of a hard mass of sponge iron, the furnace would produce a white hot pool of what we know as “cast iron”. This metal had a lower melting point than pure iron, but was also more brittle than iron. It could not be forged, and was suitable only for castings.

If all went well, the bloom of sponge iron that the smelter produced would be broken into chunks, which were then taken to the blacksmith to be forged. This was a technique that would further refine and shape the metal. It consisted of heating the metal to a red heat, then hammering it. This hammering would squeeze the impurities out from between the grains of iron, allowing the grains to fuse or “weld” together. The heating would be done with the blacksmith’s furnace. The blacksmith's furnace was table high with a back and a hood and burned charcoal. An apprentice plied a pair of leather bellows while the smith turned the iron with a long pair of tongs. When it was sufficiently heated the two men dragged it out of the furnace to the floor and took it to the anvil, which was mounted on an oak stump or other suitable foundation. They would pound the metal until it was too cool to work, then return it to the fire, wait for it to get hot again, take it out for more pounding, and return it once again to the fire until they had finished working the piece. When sponge iron was worked this way it would form “wrought iron”.

Sometimes they would make sheets of the iron. Pieces of ironwork were made of these great hand-hammered sheets. Although this may seem like nothing intricate could be made this way we need only to look at the metal work of the Celts and Vikings to see this is not true. Wire was made by twisting small flat pieces of iron together and then smoothing them with a hammer.

Because the iron varied in quality, it would be sorted into categories. The iron that could be used to make armor and weapons were sent to the armorers and sword makers while the iron that was too soft for armor and weapons were used to make everyday objects. Part of being a blacksmith was learning how to discern which iron was useful for what. An important technique a blacksmith needed was the making of steel from iron by diffusing carbon into the heated iron. Another technique was the hardening of the steel. Introducing carbon into the iron allowed the resulting steel to be hardened, often by heating it and then rapidly cooling, or “quenching” it. Finally, it was important for a smith to know how to “anneal” the steel. This was a combination of reheating, slow cooling, and continued

hammering that drew some of the brittleness out of the steel, allowing it to regain some of the flexibility of the iron while retaining most of the hardness of steel.

A special application of ironwork was swords and blades. A sword needed to be tough and flexible, and yet hold an edge. Steel was expensive and rare, but could hold an edge. Iron could reliably be made, but was soft. Often a sword would be made with a core of flexible but soft iron and with an edge of hard steel welded on. Another technique was to weld a bar of iron to a bar of steel, then to flatten and fold the resulting blend until the product had thin layers of iron alternating with thin layers of steel. This was referred to as “damascing” the iron. It was called this because it was (inaccurately) believed that this was the technique used to make Damascus steel, the best steel known to the medieval blacksmith (in reality Damascus steel was better because it was made from “Woots” steel, which accidentally had impurities that improved the flexibility of the steel).

Because iron was so much superior to bronze, civilizations with it could subjugate those without it. For example, a sword of bronze would often bend if struck (or while striking). A blade of iron (or better, steel) would not, yielding a significant tactical advantage. This made a blacksmith a very valuable person. The secret of making iron was even kept a state secret in parts of the Middle East. Because ironworking was labor intensive, a blacksmith rarely worked alone. True, a large farm would have a forge and anvil, for the farmer to fix implements on, but true blacksmithing was an art practiced in a group. A master smith would work with several journeymen and many apprentices. An apprentice would start by loading charcoal and carrying water, then work his way up to working the bellows, wielding the tongs, and simple forging. After completing an apprenticeship he would become a journeyman, traveling to other shops and learning from other master smiths. When he had built his knowledge and clientele he would settle, build his own shop, and become a master smith.

Over time, and with the growth of civilization, blacksmithing changed. With the larger cities being closer together, as in Britain, the iron makers tended to specialize. Some would make nails only. Others would make only horseshoes. These smiths would also function as veterinarians. Where there was water for power, bellows would be mechanized, allowing hotter fires that could actually melt the iron. There were even blowers based on induction of air into water falling through a tube. In the 1300's the Germans would create a machine to make wire and coal would come into use. Eventually, blacksmithing would leave the medieval world behind and would become the blacksmithing still use today. The “magic” was replaced with science, as in all disciplines. Steel became more common, and more reliable. Blacksmithing faded into a niche market of artisans and re-enactors. The Age of Iron became the Age of Steel.

Sources:

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