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Old World Industries and New World Hope: The Industrial Role of Scrap Copper at Jamestown

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1. Introduction

Jamestown scholars have long believed that during the first ten years of the Virginia Colony (1607-1617), settlers attempted to elude starvation by trading European copper with local Powhatans in exchange for foodstuffs. Contemporary reports, such as those written by John Smith, document this bartering, and recent archaeological discoveries of over 7,000 pieces of scrap sheet copper within James Fort seem to substantiate the existence of this commerce (Figure 1). Although much of this waste metal was undoubtedly associated with the exchange of goods between the English and Powhatans, this study suggests that significant amounts of Jamestown's scrap copper were also related to contemporary English copper industries and an anticipation of metallurgical resources in the New World.

During the late 16th century, the Society of Mines Royal and the Society of Minerals and Battery Works were formed to mine English metals, produce copper-alloy products, and promote English metallurgical self-sufficiency. Many shareholders of these metals companies financially invested in the Virginia Company and, because of restricted supplies in England, might have promoted metallurgical endeavors at Jamestown through the supply of both artisans and English copper scrap. This analysis first discusses physical characteristics of Jamestown's scrap copper in an attempt to demonstrate how some of the copper found at James Fort strongly resembles scrap from English industry. Studies of copper waste are then coupled with metallurgical remains recently uncovered at Jamestown in an attempt to illustrate a possible industrial function of copper within the colony. Jamestown's archaeological evidence is ultimately viewed against a background of documentary sources that reveal industrial and biographical ties between the Virginia Company and English copper companies. These connections likely contributed to various metallurgical pursuits in Virginia. Overall, this study endeavors to enhance understanding of the industrial nature of Jamestown's copper and show how the activities of the Virginia Company were influenced by the pursuits of English manufacturing.

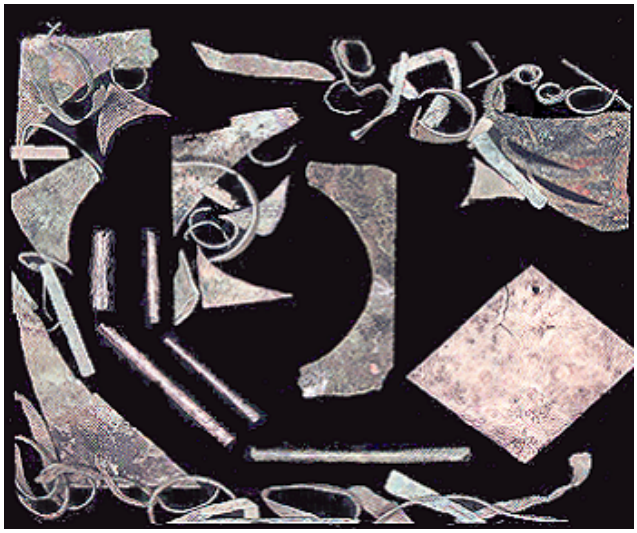

Figure 1. A sample of scrap waste selected from copper found at Jamestown.

2. Jamestown's Scrap Copper

Examinations of the scrap copper found in *Jamestown Rediscovery's* five largest Fort-Period features—Pit 1, Pit 3, Structure 165, SE Bulwark Trench, and Feature JR 731—reveal that a significant percentage of the copper bears manufacturing evidence that can be credited to coppersmithing industries in England. Several examples of copper that possess the markings of English industry are shown in Figures 2, 3 and 4, and relate to the making of copper wire, buckles and kettles respectively. These examples were only partially constructed, having been discarded during production. The wire in Figure 2 is the byproduct of the wire drawing process. The buckle in Figure 3, lacking any sign of wear, is missing a fourth hole that would have been crucial in fastening it to a belt or strap. Why these examples were discarded from the coppersmith's bench is unknown. Many straps, rims, and rivets from the construction of copper kettles are also present in the Jamestown assemblage. The support straps in Figure 4 appear to have had rivet holes punched through their edges and, therefore, would have been useless to the coppersmith.

Additional reflections of English industry are off-cuts left over from punching and cutting items out of sheet copper. Figure 5 depicts an off-cut found at Jamestown, which was formed from the construction of inexpensive sheet copper buckles. The hypothetical outline of the produced buckles can be seen on either side in Figure 6.

Much of Jamestown's scrap copper does not possess such definitive evidence related to the manufacturing of particular products; however, characteristic geometrical shapes can be attributed to contemporary artifacts. Instances of this

are scrap copper off-cuts that maintain a concave angle (Figure 7). These could be off-cuts related to the production of circular domestic products such as copper strainers, kettles, bowls, pans, or lanterns. Production centers for these items would not have likely been present in early colonial Virginia. As a result, it is evident that a significant amount of Jamestown's copper came from established workshops, undermining the notion that all of the copper was transported to the New World in the form of raw sheets of copper.

Figure 2. Drawn wire waste.

3. Copper waste and metallurgical remains

There is ample metallurgical evidence of copper-alloy processing within the archaeological confines of James Fort. Numerous triangular Hessian-type crucibles have been found and one example contains copper residue (Figure 8). Further evidence of working copper at James Fort can be seen through the discoveries of copper slag and melted copper masses. In fact, one uniquely shaped piece of melted waste fits perfectly into the round bottom of a contemporary Hessian crucible (Figure 9). Although not found in the same context, the connection between these two artifacts, along with the crucible containing interior copper residue, reveals the working and testing of copper alloys within James Fort.

Figure 3. Partially made buckle.

Processing copper alloys is not clearly represented in the first-hand accounts of early Jamestown, and these finds accordingly lead to new questions concerning the motivations of those involved in the Jamestown venture. What were the James Fort metallurgists trying to make or develop with copper? Was this copper from England or Virginia? Did copper experimentation within James Fort have anything to do with the surplus scrap copper found on site and in many of the same contexts? One line of inquiry that addresses these questions concerns possible English attempts at discovering lesser-known minerals in the New World.

At the beginning of the 17th century, one of the most highly desired metals in Europe was brass. Brass consists of an alloy of zinc and copper that has a lower melting point and higher tensile strength than copper. Consequently, brass is more malleable than copper as well as better suited for creating cast objects such as cannons, cauldrons, and bells. Until the late 16th century European brass was chiefly produced in what are now Belgium and the Rhineland region because of a nearby supply of zinc-yielding calamine stone (Donald 1961:180; Tylecote 1976:96). It was not until the end of the mid-1500s that a source of calamine stone was discovered locally in England. This source in Somerset had a high lead content, a limited supply, and problematic legal issues that emerged soon after discovery (Tylecote 1976:96). These factors left English investors and metallurgists yearning for additional supplies of zinc in order to make native English brass. As a result, Virginia adventurers had ample reason to hope for the New-World discovery of calamine stone or another ore containing zinc. It would have led to a mass production of brass in England, the profitability of which could have rivaled the discovery of gold in an American colony.

Archaeological evidence indicates that experimentation with copper alloys did occur within James Fort and the production of brass might have been the anticipated result. For those living at James Fort, producing brass through the cementation process would have been fairly easy once a source of zinc was found. The zinc ore would have first needed to be crushed and then heated in a closed crucible with pieces of copper and crushed charcoal. After the proper temperature had been reached (1,083° C), zinc vapor would diffuse into the copper and form brass (Tylecote 1976:96). Although demanding high heat, such an elementary process would have been relatively simple to perform in Virginia.

Figure 4. Kettle support straps.

Figure 5. Waste from constructing sheet copper belt buckles.

Crucibles with copper residue and melted copper are likely the results of such experimentation and the scrap copper brought to James Fort would have been more than adequate in such testing for three reasons. First, the copper came in waste form and would have been relatively inexpensive. Second, being obtained from a known industry, the scrap copper would have a known chemical composition. This is imperative, as pure forms of copper and zinc are beneficial in the production of a strong brass alloy. Third, scrap sheet copper could easily be manipulated to fit into a crucible and would have absorbed zinc ores quickly because of the copper's large surface area.

4. Documentary evidence

The Society of Mines Royal and the Society of Mineral and Battery Works originated more than 40 years prior to the English settlement of Jamestown Island. Born out of the desire for English self-sufficiency, and most importantly, the ability to produce native military ordinance, these monopolies were the first and only companies formed to manufacture finished goods in Elizabethan England (Donald 1961:vii). Many of the Englishmen who were directors and shareholders in these metals companies contributed to the formation of the Virginia Company in 1606. Historical evidence suggests that this link in interest and capital had a major effect on metallurgical endeavors in the New World. An assessment of the connections between the Virginia Company and the Society of Mines Royal and the Society of Mineral and Battery Works intimates common colonial and industrial objectives.

Queen Elizabeth I's Secretary of State William Cecil initiated the formation of England's copper industries by recruiting the interest of the German merchant house Haug & Company to help develop England's mines. Twenty-two English and German shareholders bought into the Society of Mines Royal. By 1567, several copper mines were opened, and a smelting headquarters had been erected at Keswick (Donald 1961:105). At the same time, William Humfrey, assay master of the English mint, and Christopher Schutz, manager of the zinc mining company of St. Annenberg in Saxony, established the Society of Mineral and Battery Works in the hopes of producing native English brass and manufacturing brass and copper battery wares (Donald 1961).[1] Because the company expected to carry out little mining other than that of calamine stone, it anticipated using the raw copper produced by the Company of Mines Royal within its production of brass. Many shareholders of the company of Mineral and Battery Works also owned shares in the Company of Mines Royal and it was thought that by forming a trade partnership as such, profits could be brought to both ventures.[2]

This, however, was not the case. The Society of Mineral and Battery Works struggled from inception as it had a hard time finding a proper source of zinc yielding calamine stone necessary for the production of brass (Hamilton 1967:19). The English calamine stone possessed a high amount of lead, which resulted in a weak brass alloy (Tylecote 1976:96). Simultaneously, the mining and refining efforts of the Society of Mines Royal were generating a problematic surplus of raw copper without a proper market. Originally anticipated as a chief client, the Society of Mineral and Battery Works had purchased little from the Society of Mines Royal as a formula for producing strong English brass had yet to be perfected. This led to both inadequate production on the side of the Society of Mineral and Battery Works and a lack of demand for the Society of Mines Royal's copper

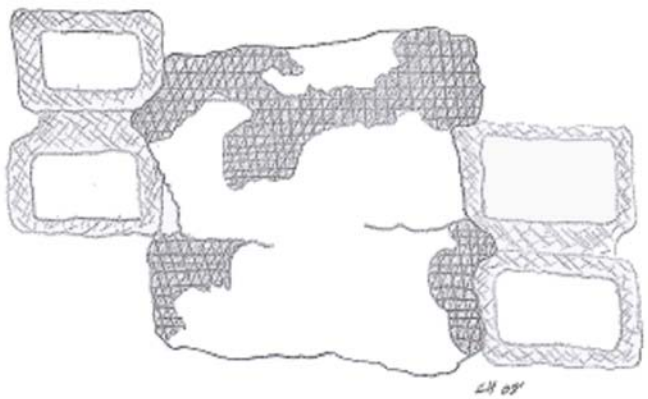

Figure 6. Drawing of waste from constructing copper belt buckles.

Figure 7. Scrap copper with concave angles.

supplies. An answer to the Society of Mines Royal's predicament was to expand horizontally with the introduction of battery engines and the creation of copper sheet and battery domestic wares such as kettles (Hamilton 1967:26). With this move the company finally began to reach a market through vessel production, and in due time the Society of Mines Royal looked to make a profit. However, when renewed charters were granted to the Society of Mines Royal and the Society of Mineral and Battery works in 1604 and 1605 respectively, work continued to move at a dawdling pace. The Society of Mines Royal continued to have a surplus of copper but no market, and the Society of Mineral and Battery Works kept struggling to produce high quality brass from inferior English zinc supplies (Hamilton 1967:37-38). This dearth of earnings and quality materials undoubtedly influenced the shareholders of these ventures to search for alternative business schemes.

In 1606, two shareholders of the Society of Mines Royal and the Society of Mineral and Battery Works—Sir John Popham, Lord Chief Justice of England, and Sir Robert Cecil, the newly created Earl of Salisbury—initially organized the Virginia Company. Popham and Cecil are known to have patronized several of the early private voyages to North America, and participation in these small-scale expeditions may have exposed the men to the possible metal resources of Virginia. For example, Thomas Hariott identified "allum, nitrum, alumen plumeum and white copresse" during his New World journey in 1585 (Barbour 1969:50). Although incorrectly identified by Hariott, white copperas was thought to contain zinc and could have been viewed by those with metallurgical interests as an alternative ingredient in brass production.[3] As a result of such promising reports, the limited metal supply in England, and a contemporary legal scare, it is not surprising that organizers, financers and many of the early settlers of the Virginia Company had connections to the Society of Mines Royal and the Society of Mineral and Battery Works.

Shareholders in the Society of Mines Royal and the Society of Mineral and Battery Works contributed a significant amount to the Virginia Company. Sir Thomas Smythe, who had ties to the copper companies through both his father and brother, was principally in charge of Virginia Company fundraising. He is known to have secured several large investments from shareholders in the Society of Mines Royal and the Society of Mineral and Battery Works. Examples of this support are financiers and Virginia Council members Sir Francis Popham, Richard Martin, and Thomas Middleton.[4] As Master of Customs and therefore the most powerful commercial figure in the city of London, Smythe is additionally known to have received a large financial backing from the merchants of London and also to have personally recruited many of the first settlers (Kelso 2000:7; Haile 1998:10-12). Discerning whether the majority of these investors and colonists had ties to the English copper companies prior to the landing at Jamestown is difficult, as few detailed manuscripts exist for those who both physically and financially invested in the Virginia Company.

Nonetheless, examining the accounts which came from the Virginia Company's settlement at James Fort helps to illustrate how influential the English copper companies may have been in terms of who settled in Virginia and the duties they held. From these reports we can see that out of the 239 named individuals who are recorded to have landed on Jamestown Island and settled in the fort between May of 1607 and October of 1608, more than 25% of those with occupational descriptions were associated with the working of metal. Goldsmiths, refiners and blacksmiths largely made up this group.[5]

Examining first-hand accounts from James Fort and comparing settlers and their recorded activities against contemporary records of the English copper companies expose family ties and common interests which accordingly exhibit how

Figure 8. Sherds of a Hessian-type crucible.

Figure 9. Hessian-type crucible with copper waste.

those activities in the New World were influenced by European commercial interests. For example, George, John, and Captain John Martin were gentlemen settlers at James Fort and the sons and grandson of Sir Richard Martin. Sir Richard Martin was a shareholder in the Society of Mineral and Battery Works, Lord Mayor of London, Prime Warden of the Goldsmiths Company, and Master of the Mint. In addition, Sir Richard Martin granted his eldest son Richard Martin the title of joint Master of the Mint with himself (Donald 1961:46). Commonly listed within the settlement as a gentleman but also referred to as "master of battery works," (Haile 1998:433) Virginia Council member Captain John Martin was known to have been "the authoritie consisting in refining" at James Fort (Smith 1612:394). Within the first year of the James Fort settlement, several accounts noted how Martin was involved in metal testing, and Walter Cope even reported Martin's desire for some supplies from his father which were necessary in furthering his "tryalls" (Barbour 1969:111).

That the Society of Mines Royal, the Society of Mineral and Battery Works and the Virginia Company were closely connected through common shareholding and organization is supported by documented financial and biographical ties. By the time the first settlers landed on Jamestown Island, many of England's most powerful men played a part in both the copper companies and the settling of Virginia. Taking into account the lack of earnings by the copper companies and anticipated success in Virginia, it is likely that copper industries in England saw New World resources as possible relief for their floundering business. Consequently, they probably influenced the Virginia Company by promoting a search for a source of zinc. In theory, all of the companies involved would have been able to reach their anticipated markets and profit.

5. Scientific analyses of Jamestown's scrap copper and copper waste

In order to support the hypothesis that Jamestown's copper was supplied at least in part by specific English industries for metallurgical endeavors in the New World, scientific examinations are currently being undertaken in two manners. First, an attempt is being made at determining the copper's geographical provenance, and more specifically, whether the copper originated from the Society of Mines Royal and the Society of Mineral and Battery Works. Inductively coupled-plasma atomic emission spectrometry (ICP-AES) is being used to analyze a large sample of Jamestown's copper in order to expose its trace elemental compositions. The results will be compared against Native American and various European copper ore sources to determine the geographical origin of the material. Based on the minor and trace elements lead (Pb), copper (Cu), cadmium (Cd), antimony (Sb), silver (Ag), arsenic (As), zinc (Zn), tin (Sn), nickel (Ni), gold (Au), and iron (Fe), preliminary analysis has already shown that a sizable portion of Jamestown's copper derived from English provenances rather than from the copper ore sources of North America or continental Europe. As all English copper mined and processed during the late 16th and early 17th centuries was supplied by the Society of Mines Royal and the Society of Mineral and Battery Works, any copper with an English origin can be assumed to originate from these companies.

Second, an investigation of the possible industrial uses of copper at Jamestown includes ICP-AES analysis of archaeological copper slag, melted copper waste, and residue from crucibles. Revealing the elemental signature of this material will determine whether Jamestown's metallurgists were working with North American copper or European metals. The slag, melted copper waste, and crucibles containing copper residue will also be subjected to optical microscopy, energy-dispersive X-ray florescence (ED-XRF) and scanning electron microscopy with an energy-dispersive spectrometer (SEM-EDX). These techniques will shed light on the metallurgical techniques that copper was involved in at Jamestown and additionally indicate what minerals from the New World might have been employed within alloying attempts. As a source of zinc was never discovered during the early years of the Virginia colony, zinc is not expected to be present in any significant quantities. However, local Virginian minerals that the settlers might have been experimenting with should be represented. Overall it is expected that

most of the scrap copper from Jamestown can be associated with an English provenance, and that the copper slag, melted copper waste and copper residue from crucibles will also be shown to have English associations.

6. Conclusion

Documentary and archaeological research suggests that the presence of scrap copper at Jamestown represents more than English/Powhatan exchange. Jamestown's archaeological assemblage includes unfinished and mis-constructed copper products and characteristic off-cuts, intimating that English industry at least in part supplied Jamestown's copper. The close relationship between the Virginia Company and England's copper companies reveals that this material was likely supplied and used in pursuit of New World metal resources, as well as for previously reported instances of intercultural trade. Current scientific analyses of the copper and metallurgical waste uncovered at James Fort are helping to test this theory and deepen insight into the relationship between English industry and colonization.

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