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The Composition of Copper Recovered from Contact Native American Sites in the Lower Piedmont and Southern Ridge and Valley, Virginia

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ABSTRACT

Excavations at three Native American Late Woodland village sites along the Roanoke (Staunton) River in the Piedmont and Ridge and Valley of Virginia yielded artifacts of copper. Associated with European glass beads and iron trade goods, the origin of the copper, whether American or European, would have far reaching cultural implications. Copper analyses on specimens from two of the sites using a scanning electron microscope indicated that the copper was a smelted alloy and of European origin. Comparison with other Virginia sites suggested an ornamental use of copper at the tribal level of social organization in the western part of the Commonwealth as opposed to use as status markers in the chiefdom level societies to the east. The minimal effect of the trade goods on Native American cultures in the Piedmont and to the west during the period of European contact was underscored.

INTRODUCTION

Cultures in contact have always been an inspiring topic in anthropology. Within the context of Virginia, much time and many studies have focused on the first serious interactions of the state level English colonials at Jamestown and the indigenous chiefdom level Powhatans (eg. - Fausz, 1985; Turner, 1976, 1982, 1985; Potter, 1982, 1990; Feest, 1978; Rountree, 1989, 1990). As Jones (1989) points out, within a week of the selection of Jamestown Island as the second English settlement in the New World, the colonials documented first contacts with the Indians of the interior. The next historic reference to these tribal groups occurred after a 63 year hiatus when a German doctor, John Lederer, was commissioned to travel into the unknown wilds of Virginia in 1670 (Alvord and Bidgood, 1912). Following closely behind were Batts and Fallom in 1671 who were in search of the western waters and likely traveled as far as the New River (Alvord and Bidgood, 1912; Barber and Barfield, 1992) but may have reached what is now West Virginia (Briceland, 1987). In any case, the ethnohistoric information for the Native Americans of the interior during the seventeenth century is meager at best. Hence, it falls to the archaeological study of the remains of material culture to provide for an understanding of the period in areas to the west. Recent discoveries in the lower Piedmont and southern Ridge and Valley of the Commonwealth along the Roanoke (Staunton) River include three sites (44PY144, 44RN39, and 44RN21) dating to the contact period. These sites have led to a better understanding of the dynamics of the period (Klatka, 1992, 1993; Barber, 1988, 1993).

The recovered European trade assemblages from the sites have been previously discussed (Barber, 1994) and include glass beads, iron artifacts, shell disk beads, and copper tags, beads, and scrap fragments. It is the purpose of this paper to present the preliminary results of the chemical examination of one of these artifactual materials, copper.

RESEARCH DESIGN AND METHODOLOGY

In general, the compositional study of copper recovered from the Hurt Power Plant Site (44PY144) in the Piedmont of Pittsylvania County and that collected form the Ridge and Valley Thomas-Sawyer site was undertaken to lend insight into the cultural nuances in operation during the period of contact. Research questions can be expressed as follows:

1. Were the recovered copper artifacts of Native American or European origin? Their association with glass beads suggests a European source; however, recent studies at other Virginia sites (ie.- Pasbahegh ,JC308) has proven that a mix of American and European copper cannot be ruled out.
2. Is the copper homogeneous in nature on the contact sites or is variation inherent? Are the copper trade goods chemically consistent on individual sites?
3. What are the cultural implications for the chemical make-up of the copper artifacts at the regional and global levels?
4. What methodology might be the most appropriate for the study of copper artifacts? Various study techniques have been brought to bear on these artifacts with various results; which techniques have the highest potential for the production of relevant data?

In order to ascertain at least some of the answers to the above questions, a methodology was implemented which involved the study of the copper artifacts using a Scanning Electron Microscope (CamScan S.E.M Series 2, HNU System, EDS System 5000) for elemental analysis. The copper material was first examined in a natural state with no alteration of the artifact. Results were limited to the artifact surface and determined that the surface of the artifact was copper sulfate - in essence, a naturally forming patina. As it was information on the overall composition which was required not just the oxidated exterior, a regime of preparation was opted for which would expose the artifact interior for testing. The copper artifacts were first examined for stability and those of a fragile nature currently eliminated from testing. Should the data from these artifacts prove necessary for the study, various reversible embedding techniques can render the artifacts stable enough for analysis.

Preparation involved carefully removing the patina from a small portion of the surface and exposing the base material. This was accomplished through grinding on fine grade emery cloth with further polishing with one micron diamond dust. Usually an edge was polished with the patina removed from an area less than 5 mm in length. The artifact was than mounted and placed within the SEM for composition analysis. Although the normal examination provides for bulk elemental analysis, certain elements which the authors felt were of importance were programmed for minute consideration. These included copper, zinc, tin, lead, silver, nickel, antimony, and arsenic. In theory, this approach would provide for the widest range of natural and added elements. A minimum of 4 readings were taken for each artifact. SEM readings were programmed to provide for a 100 live second analysis. This was opted for in order to eliminate dead time, regularize the time of readings, and to provide adequate time for sampling. The majority of readings were taken as spot readings with the microscope focusing on one minute area of the artifact. Bulk reading were also taken sporadically but provided similar results. Due to the nature of the SEM, it should be cautioned that results are possibly more qualitative than quantitative; however, consistent readings suggest that results have an accuracy adequate for this type of study.

As the SEM allows for magnification to roughly 3000 times, inconsistencies in artifact composition can be noted. In the case of copper, non-incorporated inclusions could be identified. Composition readings were taken on those particles as well as the more homogenous parent body.

RESULTS OF ANALYSIS

Two sample artifacts were run for the Thomas/Sawyer Site (44RN39). This site is located in Salem, Virginia, and has a minimum of 6 occupation episodes. The last was a proto-historic hamlet occupation with radiocarbon dates of A.D. 1600 ± 90 and A.D. 1630 ± 90. One glass bead, 5 pieces of iron wire, one iron needle, and 7 pieces of copper were found within an undisturbed Native American context. Elemental readings are presented in Tables 1 and 2. Copper was consistently the highest in composition with circa 66% to 69%. Zinc was next accounting for roughly 28% to 29%. Lead made up from 1.58% to 2.14%. Remaining elements were incidental. The inclusions are of interest and are high in lead content - 24% to 40% overall. Hence, the make-up of the copper artifacts recovered from the Thomas/Sawyer site is roughly 2/3 copper and 3/10 zinc with particles of lead within the matrix. As Klatka (1992) relates, this mix of copper and zinc is identified as the alloy yellow brass.

At present, 8 copper artifacts from the Hurt Power Plant Site have been analyzed. The major village site likely dates to the period later than the Thomas/Sawyer site , probably resting between A.D. 1630 and A.D. 1650. Two copper compositional patterns were found: the first included 6 artifacts and the second 2 artifacts. Within the first group, as seen in Tables 3 and 4, copper accounts for 95% to circa 97% of the alloy. Zinc and lead compete for the second most frequent element at usually 1% to 2%. Inclusions were also noted within this category. Of interest, the particles noted were high in antimony - 63% to 66%. Antimony is an additive which aids in the temperature contraction and expansion process. In addition, in two of the examples, the antimony formed elongated stringers the result of a rolling process of manufacture.

The second pattern closely resembles the Thomas/Sawyer copper as presented in Table 5. Copper content rests at circa 65% with zinc at roughly 33%. Inclusions are lead with a reading varying from 24% to 44%. Hence, the Hurt Power Plant Site contains copper of a yellow brass as well as a purer variety copper containing particles of antimony.

DISCUSSION

The copper artifacts recovered from the earlier Thomas/Sawyer Site (44RN39) are of a brass with a two-thirds copper and just less than one-third zinc composition. The artifacts from the slightly later Hurt Power Plant Site (44PY144) exhibit 2 patterns: the first and most numerous were of an almost pure copper with a low content of zinc and/or lead with inclusions of antimony. Artifacts of the second category exhibit the Thomas/Sawyer pattern of two-thirds copper and one-third zinc with lead inclusions.

TABLE 1. SEM Analysis of Copper Artifact CU2 from Thomas/Sawyer Site (44RN39).

44RN39 FEATURE 5 (West 1/2, Level 2) CU2		
Copper artifact - Triangular in shape (21.60 mm L, 7.25 mm W, 0.57 mm T)		
SEM POSITION	ELEMENT	WEIGHT %
SURFACE	Cu	67.99
	Zn	28.76
	Pb	2.14
	Ni	0.61
	Al	0.33
	Mg	0.17
SURFACE	Cu	65.82
	Zn	28.21
	Pb	2.86
	Mg	1.99
	Ni	0.67
	Al	0.45
INCLUSION	Cu	36.60
	Pb	24.37
	Zn	17.27
	S	10.16
	Al	4.18
	Si	3.82
	P	2.94
	Ni	0.66
INCLUSION	Pb	40.88
	Cu	29.86
	Zn	17.61
	S	9.04
	Al	2.61

While it is obvious that the analysis has determined that 2 different manufacturing techniques for copper alloy are present, the implications remain a bit murky. As with most aspects of archaeological study, the important variables are time, space and technology. Are the different alloys tied to different production origins with varied raw material availability? Or it is possible that production innovations through time led to metallurgical advances which altered recipes? And finally, were different alloys used in different products? While this is obviously true in the range of functional artifacts produced by Europeans for their use, what were the "products" from which the rolled beads and tags were manufactured? If these hypotheses are to be tested, it is required to extend the study through Jamestown to England and the rest of Europe in order to reconstruct manufacturing patterns during the late sixteenth and seventeenth century.

TABLE 2. SEM Analysis of Copper Artifact CU3 from Thomas/Sawyer Site (44RN39).

44RN39 FEATURE 5 (East 1/2 Level 2) CU3

Copper Artifact - Rectangular in shape (21.17 mm L, 8.46 mm W, 0.53 mm T)

SEM POSITION	ELEMENT	WEIGHT %
SURFACE	Cu	68.96
	Zn	28.71
	Pb	1.58
	Ni	0.66
	Al	0.07
	Fe	0.02
INCLUSION	Cu	31.68
	Pb	27.19
	Zn	20.56
	S	8.59
	Al	6.92
	As	2.81
	Si	2.25
INCLUSION	Pb	37.60
	Cu	34.87
	Zn	20.75
	Al	4.28
	Si	2.48
	P	0.01

When considering patterns within a Virginia context, two other analyses of copper are of interest. The first included 5 samples recovered in a sealed Native American context at the third-quarter seventeenth century contact occupation at the Graham/White site, Ridge and Valley village site found in Salem, Virginia, within one-half mile of the Thomas/Sawyer Site. These artifacts were analyzed for elemental composition through inductively coupled plasma emission spectronometry. This technique has the advantage of high resolution, accurate results but the disadvantage of complete artifact destruction. The Graham-White specimens were found to contain between 64% and 70% copper with a zinc content between 26% and 33% (Klatka, 1992). This "yellow" brass appears to be very close in make-up to the material at Thomas/Sawyer and the minority copper at the Hurt Power Plant Site.

Copper analysis was also implemented on 31 artifacts from the Governor's Land excavations at 44JC308. This site was the prehistoric and contact village of Pasbehey on the James River. The copper assemblage tested was made up of 28 tubular beads, 1 ring bead, and 2 pendants. Of interest here is the analytical technique of Proton-Induced X-ray Emission (PIXE) spectronometry. Due to high copper purity, 8 artifacts were determined to be of Native American origin. The remaining 23 artifacts are also high in copper purity but contained lead, antimony, and nickel impurities. Fleming

TABLE 3. SEM Analysis of Copper Artifact CU51 from Hurt Power Plant Site (44PY144).

44PY144 Feature 89 (North 1/2 Level 2) CU51		
Copper artifact - Rolled bead (5.48 mm L, 2.75 mm W)		
SEM POSITION	ELEMENT	WEIGHT %
SURFACE	Cu	95.25
	Pb	1.76
	Zn	1.30
	Ni	0.78
	Al	0.74
	Mg	0.44
SURFACE	Cu	97.18
	Zn	1.23
	Al	0.63
	Pb	0.54
	Ni	0.42
INCLUSION	Sb	63.21
	Cu	21.59
	Pb	9.80
	Ca	2.24
	Zn	2.08
	Al	0.70
	Ni	0.37
INCLUSION	Sb	52.59
	Cu	32.73
	Pb	9.41
	Zn	1.99
	Ca	1.89
	Al	0.90
	Ni	0.49

and Swann (1994) indicate that the "compositions and ranges" so closely resemble European patterns for smelted copper that they are surely of European origin. The composition for the European artifacts compares favorably to the majority group from the Hurt Power Plant where copper content is in the 95 to 97 percentile with lead and nickel in low percentage and antimony inclusions noted. The presence of circa 1.0% of zinc, however, may eventually place the Hurt artifacts in a different category.

The trade of copper at the Governor's Land on the coastal plain consisted of smelted copper, the artifacts recovered in the lower Ridge and Valley brass, and those recovered in the southern Piedmont of brass and purer copper. Studies of sixteenth century Iroquoian artifacts have led to the recognition of similar mixes of brass and purer copper with ties to 2 trade networks, the Basque purer copper trade and the Norman brass trade (Bradley and Childs, 1991). Although these sources are of interest, the varied history

TABLE 4. SEM Analysis of Copper Artifact CU32 from Hurt Power Plant Site (44PY144).

44PY144 Feature 28B (West 1/2 Level 3) CU32		
Copper artifact - Scrap (38.65 mm L, 7.24 mm W, 0.40 mm W)		
SEM POSITION	ELEMENT	WEIGHT %
SURFACE	Cu	97.65
	Zn	1.02
	Al	0.82
	Ni	0.32
	Pb	0.15
	As	0.05
SURFACE	Cu	97.26
	Zn	1.04
	Al	0.88
	Pb	0.52
	Ni	0.30
INCLUSION	Sb	66.84
	Cu	21.70
	Pb	4.85
	Ca	2.49
	Zn	1.56
	Al	1.39
	As	1.04
	Ni	0.13
INCLUSION	Sb	61.44
	Cu	22.42
	Pb	11.03
	Ca	2.34
	Zn	1.81
	Al	0.81
	Ni	0.14

of European settlement along the Atlantic seaboard suggests that alternate sources of trade goods would be in play in a Virginia context.

CONCLUSION

The copper and copper alloy artifacts recovered from the Hurt Power Plant site and the Thomas/Sawyer site are definitely of European origin consisting of smelted copper and brass. While only brass has been identified at Ridge and Valley Thomas/Sawyer and Graham-White, purer copper as well as brass was present at the Piedmont Hurt Power Plant Site. Studies to the north suggest that different trading networks may have brought artifacts of different composition. While in the latter seventeenth century this might reflect differences in commerce between the Virginia trade and the Carolina trade, the earlier periods would likely be tethered to indirect

TABLE 5. SEM Analysis of Copper Artifact CU22 from Hurt Power Plant Site (44PY144).

44PY144 Feature 2 (West 1/2) CU22		
Copper artifact - Scrap (6.72 mm L, 2.72 mm W, 0.45 mm W)		
SEM POSITION	ELEMENT	WEIGHT %
SURFACE	Cu	64.77
	Zn	33.62
	Al	0.84
	Pb	0.61
	Ni	0.16
SURFACE	Cu	64.61
	Zn	33.93
	Pb	0.82
	Al	0.41
	Ni	0.24
INCLUSION	Pb	44.18
	Cu	29.39
	Zn	20.37
	Al	5.17
	Si	0.90
INCLUSION	Cu	37.40
	Pb	24.16
	Zn	23.92
	Al	5.81
	Si	3.71
	P	2.82
	As	2.16
	Ni	0.02

trade to Jamestown. As such, the Virginia Company and later Jamestown sources as well as products deemed appropriate for trade with the Native Americans are of interest.

A varied battery of techniques are being brought to bear on the analysis of copper artifacts in order to determine chemical composition. While these techniques are all applicable in differentiating European from Native American copper, the varied analytical techniques lead to varied sets of data. These sets are not particularly comparable and, hence, certain similarities and contrasts may not be apparent. Some techniques are likely better than others. For example, plasma emission spectronometry requires that the artifact be liquified leading to complete destruction. As PIXE analysis relies heavily on surface composition, it is not particularly well geared for an analysis of base metal composition. Likewise, the scanning electron microscope has its draw-backs as it is felt to be more qualitative than quantitative. Future work with the electron microprobe may prove of highest accuracy. In any case, archaeologists, geologists, and metallurgists dealing with archaeological remains will need to swallow the bitter potion and regularize their analytical approaches in order to produce comparable data in the future.

Scholars have long examined the role of and the evolution of copper exchange within the Commonwealth. More recently, Potter (1989) has demonstrated the importance of copper artifacts as symbols of status for the late prehistoric Native Americans on the coastal plain of Virginia. Hantman (1990) has made a case for the exchange of copper from the interior of Virginia (and possibly beyond) by a Monacan chiefdom to the Powhatan. Whether traded by the Monacan or others, the prehistoric flow of copper in prehistoric times was from west to east. At contact, however, the pattern reversed with small amounts of European copper making its way into the interior. While the ornamental copper pieces never reached the social importance seen at the chiefdom level to the east, copper was a sought after accoutrement by the tribal groups of the interior. An increased understanding of its chemical composition can only lead to an increased understanding of trade networks and cultural contact through time.

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