THE MATERIALITY OF POLITICS: TRACKING THE PRODUCTION AND CIRCULATION OF SHELL ARTIFACTS IN THE ALGONQUIAN CHESAPEAKE (A.D. 900-1680)

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ABSTRACT

Objects of bodily adornment played an important role within Chesapeake Algonquian sociopolitical systems during the Late Woodland and early colonial periods (A.D. 900-1680). Recent scholarship has provided valuable insight into the circulation of copper throughout the broader region (Lattanzi 2007, 2008), however, little is known about shell bead production and exchange despite the recovery of these objects in significant numbers from archaeological sites in all provinces of Maryland, Virginia, and North Carolina. This paper presents the results of a study aimed at assessing the viability of laser ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS) for identifying shell bead production locales throughout the southern Middle Atlantic. The central goal of the study is to identify unique geochemical signatures keyed to individual tidal river systems and determine whether beads of *Mercenaria mercenaria* (hard clam), retain elemental compositions that can be faithfully linked to their waterway of origin.

Sixteenth and 17th century European accounts describe coastal Algonquian-speaking societies of the Middle Atlantic as organized into multi-community polities structured by hierarchical political authority, centralized decision-making and pervasive inequality (Lewis and Loomie 1954; Quinn 1985; Smith 1986a; Strachey 1953). However, the hallmarks typically associated with chiefly political organization—monumental architecture, settlement hierarchies, and widespread differentiation in mortuary symbolism—are almost non-existent in the region's archaeological record (Turner 1986; Gallivan 2003). Early colonial accounts of Tidewater Virginia's Powhatan chiefdom, however, hint that items of bodily adornment, particularly shell beads and copper sheeting, circulated through networks of chiefly lineages (Hantman 1990; Potter 2006). Such highly-valued objects underscored sociopolitical difference and actively negotiated relationships of authority and subjection. Their recovery from unique archaeological contexts (e.g., burials, shell middens, central hearth areas) supports these political and economic dynamics, indicating that these objects likely played a central role in public performances and aggregative events aimed at negotiating, renewing, and mitigating sociopolitical power relations.

This paper outlines a shell bead sourcing pilot study which represents the first step within a larger research project aimed at exploring the relationship between the production of wealth objects and the development of chiefly political authority within the Late Woodland and early colonial period southern Middle Atlantic (A.D. 900-1680). The central goal of the pilot study was to assess the viability of laser ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS), a powerful materials characterization technique, for identifying shell bead production locales and tracking the movement of these objects across the broader region. In general, archaeological sourcing studies have considered the long-distance exchange of shell artifacts between societies separated by thousands of miles (Claassen and Sigmann 1993; Lowery *et al.* 2014; Grimstead *et al.* 2013; Eerkens *et al.* 2005). The results of the current study, however, indicate that in certain environmental settings, sourcing at the scale of the micro-environment may be possible (i.e. distinguishing between shells derived from adjacent river systems).

Despite the ubiquity of shell beads on archaeological sites throughout the region, it remains unclear whether these objects were produced locally or entered the region from elsewhere. John Smith identifies

the Eastern Shore village of Cuscarawaoke as one location where, in the early 17th century, shell beads were being manufactured (Smith 1986b:168). Archaeological sites such as Posey on the Maryland side of the Potomac, Great Neck in Virginia Beach, and Jamestown have all yielded possible evidence of shell bead production (Figure 1). Shell blanks, or roughly hewn shell disc beads with partial or no central bore hole have been recovered from both Posey (Harmon *et al.*1999) and Jamestown (Kelso and Straube 2008), potentially representing unfinished beads from various stages of the production process. At Great Neck, avocationalist Floyd Painter reported several contexts of powdered and crushed shell yielding micro-drills of jasper and flint, worked whelk columnellas, and two wide, thin, sandstone bead grinding slabs worn smooth on both faces (Painter 1989:17). In addition, the identification of a burial accompanied by nearly 30,000 shell beads a short distance from the possible "bead-making workshop" suggested to Painter (1980) and his team that beads were, indeed, being produced on-site.

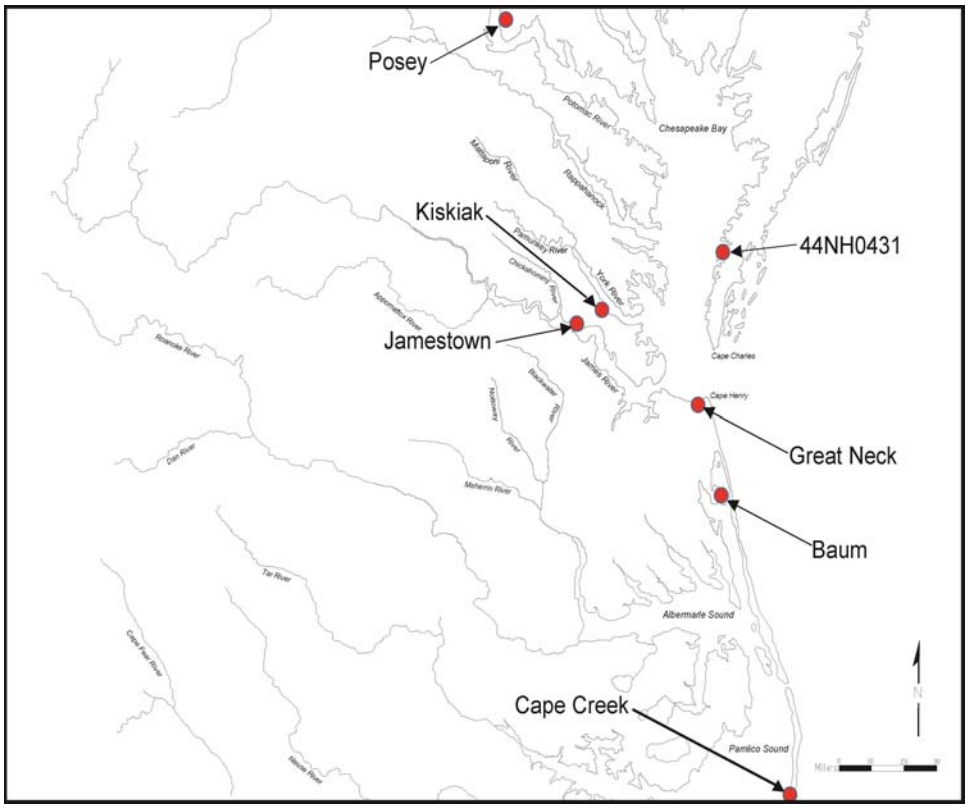

Figure 1. Map showing approximate locations of archaeological sites that yielded shell artifacts analyzed during the current study.

Although several types of shell beads are regularly recovered from sites across the greater Chesapeake, this study focuses on the type most frequently cited within the regional archaeological literature. Called *roanoke* in the early colonial period, this small disc shaped bead generally averages between two and four millimeters in diameter, with an average thickness of one to two millimeters (Figure 2). Based on archaeological and ethnohistorical evidence, beads of this type were strung on long strands and hung over the shoulders, they were central components in complex embroidery on clothing, and they adorned the hair of elites and political dignitaries (Smith 1986a; Painter 1980; Fesler *et al.* 2001). The extreme modification of these beads during the production process, however, makes species identification a challenge. There are, however, two types clearly evident in the archaeological record—one ribbed, likely *Geukensia demissa* or the ribbed mussel, and one smooth, in both purple and white varieties, likely *Mercenaria mercenaria*, commonly called quahog and hard clam. This study focuses primarily on the latter species.

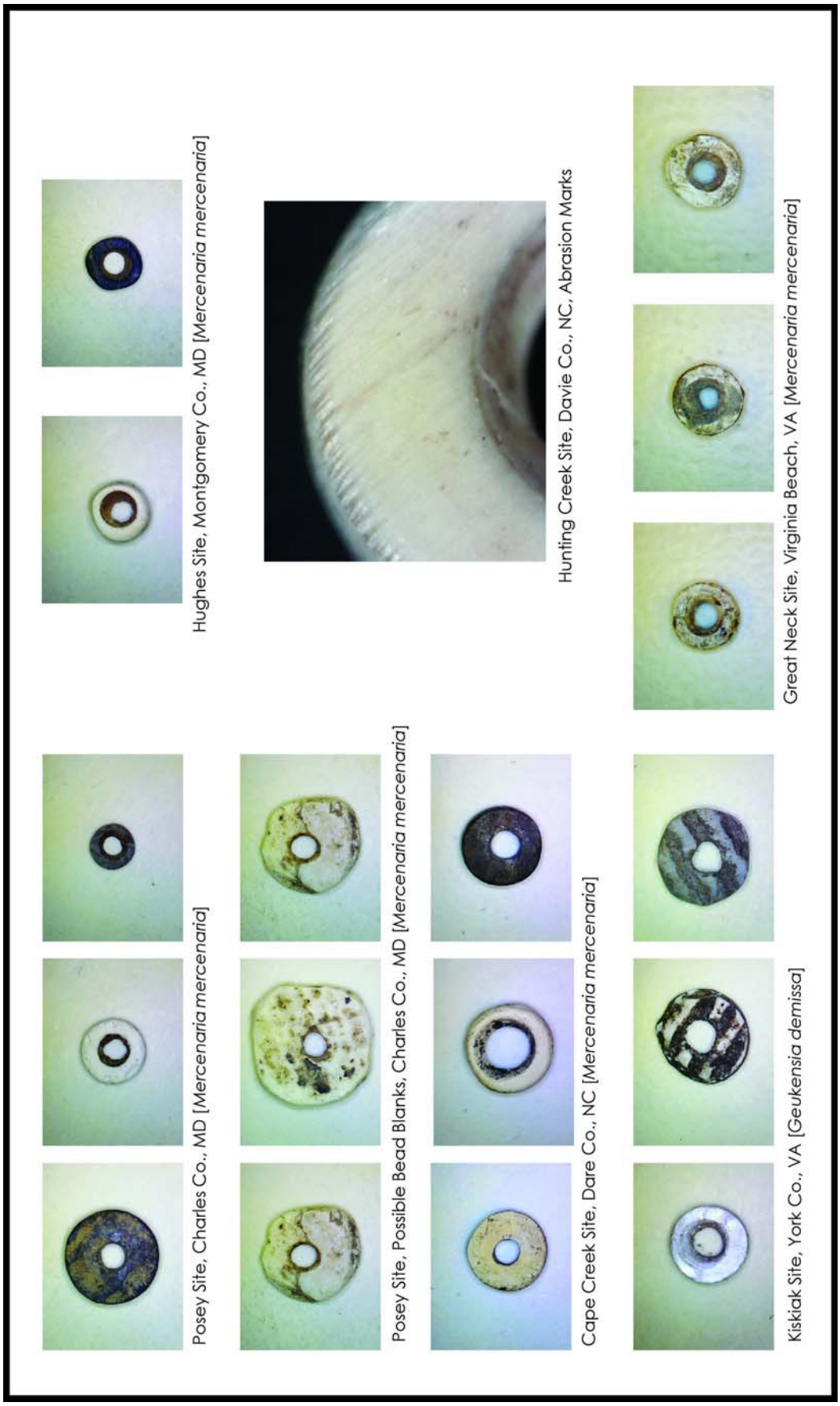

Figure 2. Examples of shell disc beads recovered from sites across the broader southern Middle Atlantic region.

PREVIOUS EFFORTS TO SOURCE SHELL ARTIFACTS

Surprisingly few shell chemical sourcing studies have been undertaken by archaeologists. Efforts to track the exchange of shell across the Americas have generally linked invertebrate species to their modern distribution (Ceci 1977; Kozuch 2002). The limitation of this methodology is that it is imprecise, with many mollusks species spanning hundreds, if not thousands of miles across coastal regions. Additionally, the modern range of a species may not adequately represent that which existed in the past (Eerkens *et al.* 2007:168).

Recent advances in materials characterization technologies have allowed for greater precision in invertebrate sourcing. Using neutron-activation analysis (NAA) and atomic-absorption spectroscopy (AAS), Miller's (1980) analysis of *Mercenaria mercenaria* from Late Woodland period sites in Maine, Massachussetts, New York, and Georgia correctly sourced 83 percent of shells based on concentrations of six elements. Her study (Miller 1980:95) found significant differences between the elemental composition of modern and archaeological shells, indicating that modern shells may be inadequate for establishing an environmental baseline for shellfish sourcing. These differences, she suggests, may be attributed to sedimentation from shifting land-use practices and the introduction of modern pollutants into watersheds. In a study using atomic absorption spectroscopy (AAS) to analyze shell objects recovered from Midwestern and southeastern sites, Claasen and Sigmann (1993:342) found that species, body part, and geological age were not factors that significantly affected the clustering of samples or the definition group membership. Their results, instead, suggest that growth location is the strongest determinant of a shell's elemental composition (1993:343).

The resurgence of shell sourcing studies over the past ten years is largely the result of advances in two analytical techniques—stable isotope analysis and inductively coupled plasma mass spectrometry (ICP-MS). Sourcing studies using oxygen and carbon stable isotope ratios along the Pacific coast of North America have successfully sourced shell beads to regions, and in some cases subregional zones (Eerkens *et al.* 2005; Grimstead *et al.* 2013). Comparing the effectiveness of both ICP-MS and stable isotope analysis in sourcing *Olivella* beads from coastal and inland sites in California, Eerkens *et al.* (2007) contends that the latter technique holds the most promise for sourcing West Coast *Olivella*. Lowery *et al.* (2014) has also proven the efficacy of this technique here on the East Coast. Despite relatively large source zones, Eerkens *et al.* (2007:188) argues that the analysis of stable isotopes lacks the drawbacks of ICP-MS, which include,

1) High regional inter-shell elemental variability,
2) Post-depositional leaching or replacement of existing minerals within prehistoric shell, and
3) Low concentrations of most elements within shell matrices.

He admits, however, that some of these drawbacks could relate to nearshore seawater chemistry and the particularities of the California coastal environment. Inductively coupled plasma-mass spectrometery, he contends, may have the ability to discriminate between micro-environments where, for example, "shells growing near certain rivers with peculiar geological watersheds…may have unique chemical compositions relative to other rivers within the macro-region" (Eerkens *et al.* 2007:189). In other words, ICP-MS might provide more promising results in a setting like the Chesapeake Bay, which is fed by multiple large-scale riverine systems, each underlain by unique geological outcroppings.

SHELL GEOCHEMISTRY, LITHOLOGY, AND ELEMENTAL UPTAKE IN MOLLUSKS

The geochemical composition of shell is influenced by a number of environmental factors including local geology, water salinity and temperature (Boon *et al.* 1968; Chave 1954), and a shell's calcite: aragonite ratio (Harriss 1965; Edmond *et al.* 1995; Blum *et al.* 1998). Although scholars such as Cronin *et al.* (2005) have successfully reconstructed past environmental fluctuations in the Chesapeake through shell chemistry, the current study is particularly interested in investigating the extent to which the

lithology of river systems creates identifiable chemical signatures within mollusks inhabiting brackish estuarine environs. Theoretically, as catchment areas, underlain by geologic beds of unique mineralogical composition erode, dissolved ions become incorporated into the water column (Viers *et al.* 1997; Puckett and Bricker 1992). These minerals then become trapped in the bottom sediment where bivalves feed, respire, and burrow.

Mollusk shells are mainly composed of calcium carbonite, although elemental impurities substitute for calcium in the crystal structure (Klunder *et al.* 2008). As new shell is laid down in annual growth bands, various elements are deposited within new shell growth becoming a permanent part of the shell structure (Carrell *et al.* 1987). Although the components needed for shell mineralization come from particles ingested during feeding and respiration, two membranes, the inner and outer mantle epithelium, actively discriminate against certain elements (Klunder *et al.* 2008:89). Thus physiological factors such as seasonal periods of dormancy and growth cessation influence elemental uptake in new shell growth (Stretcher *et al.* 1996; Schone 2008). Water temperature and salinity vary temporally and spatially (Prichard 1952) and significantly impact shell geochemical composition, providing a high-resolution record of seasonality, past climate change, and fluctuating weather patterns (Carrell *et al.* 1987; Elliot *et al.* 2003; Cronin *et al.* 2005). Differences in elemental concentrations that vary according to these environmental parameters allow for the sourcing of shell at the level of the macro-environment and are generally less conducive to distinguishing shell origin at smaller geographic scales (Claassen and Sigmann 1993).

THE CHESAPEAKE GEOCHEMICAL ENVIRONMENT

The water chemistry of major river systems feeding the Chesapeake Bay clearly reflects geologically distinct watersheds. The James River, for instance, drains roughly 9,700 square miles in southern Virginia and is influenced in its composition by crystalline rocks of the eastern Appalachians over which its major tributaries flow. The largest tributary of the Potomac River, the Shenandoah River passes through an area rich in limestone which is reflected in a high dissolved calcium content even downstream near its convergence with the Bay (Clarke 1924).

Mercenaria mercenaria, however, thrive in polyhaline estuaries—those which have a salinity level between 18 and 30 parts per thousand (Roegner and Mann 1991:5.1). These zones are inundated with Chesapeake Bay waters, whose volume varies based on tidal influx and freshwater discharge rates among river systems (Kuo and Neilson 1987:282). For instance, the Potomac River freshwater discharge rate is much higher than that of the York (due to its greater watershed area)—a fact that greatly influences the concentrations of salt and freshwater at the mouth of each river (Landis 2014:9). Thus, we will never encounter a *Mercenaria* shell that yields an unadulterated ionic signature representative of an individual freshwater river system, as the mixing of fresh and saline water is necessary to support its life. Theoretically, however, some river systems might yield shellfish whose composition is more representative of the "pure" freshwater signature depending on the nature of fresh/saltwater mixing within the individual polyhaline estuary.

SOUTHERN MIDDLE ATLANTIC SHELL SOURCING PILOT STUDY

In May and October of 2014, a total of one hundred and sixty (160) shell artifacts from the southern Middle Atlantic were analyzed at the Elemental Analysis Facility at the Field Museum of Natural History in Chicago. Here, I present results of the one hundred and ten (110) samples taken from archaeological sites across the Coastal Plain—samples derived from Piedmont sites will be presented in a future publication (Figure 1, Table 1).

Two questions drove this pilot study. First, are there detectable chemical signatures within archaeological shell that might allow us to distinguish their original provenience based on the unique lithological environs of Chesapeake riverine systems? To answer this question I gathered unmodified

TABLE 1. AN OUTLINE OF THE SITES AND SAMPLES ANALYZED DURING THE CURRENT STUDY

Site Name	Site Number	State	Watershed	Beads (n=l0)	Raw Shell (n=l0)	Repository
Great Neck	44VB7	VA	Atlantic	X	X	Virginia SHPO
Kiskiak	44Y0687	VA	York	X	X	College of William and Mary
Posey	18CH281	MD	Potomac	X	X	Maryland Arch. Conservation Lab
Jamestown		VA	James	X	X	Jamestowne Rediscovery
Nassawadox Creek 1	44NH431	VA	Chesapeake Bay		X	Virginia SHPO
Baum	31CK9	NC	Currituck Sound		X	North Carolina SHPO
Cape Creek	31DR1	NC	Pamlico Sound		X	East Carolina University

Mercenaria mercenaria shells from seven site collections—ten shells per site—all recovered from intact Late Woodland or early colonial period feature contexts. These shells were presumably gathered by indigenous occupants of each site from local waters and were discarded in middens or living surfaces as food refuse. If lithological differences between river systems are reflected in Chesapeake shell geochemistry, unmodified shells would provide a means of considering the extent to which shell beads could be faithfully sourced to their river of origin.

The second major question I sought to answer was: were shell beads being produced at any of these sites or did they derive from elsewhere? From the Posey, Kiskiak, Great Neck, and Jamestown site collections, I analyzed both unmodified shells and beads—ten of each type from each site. The rationale behind my methodology is that if shell beads were being produced from local shell, both unmodified shell and shell beads should possess the same (or similar) elemental signatures.

SAMPLING

Unlike homogenous materials like glass (Dussubieux *et al.* 2009), elemental concentrations in shell vary with each seasonal growth band. Thus, it was necessary to take readings at ten ablation points across separate growth lines. At each ablation point, nine readings of fifty-two elements were recorded. The first three readings were discarded to account for potential contamination of exterior surfaces of each artifact. Average elemental concentrations (in ppm) were then calculated (from the remaining six readings) for each ablation point and then average measurements from all ten ablation points were again averaged to provide concentrations representative of each artifact as a whole. While other sampling methodologies, such as crushing the shell in an agate mortar and pestle (see Eerkens *et al.* 2007) would provide a bulk composition for each artifact, many of the beads being tested are displayed in museums or represent a majority of beads recovered from a site or context. My sampling strategy represents an attempt to balance both methodological accuracy and preservation concerns.

RESULTS

In an effort to determine which, if any, elements discriminated by river system, z-scores or standard scores were calculated for each element. Z-scores offer a way to compare a group of values based on their relationship to the mean. A z-score of zero is equal to the group mean, while, for example, a positive 1 represents a value one standard deviation above the mean and negative 1, one standard deviation below. Elemental values that appear elevated in unmodified shells from particular riverine settings likely reflect

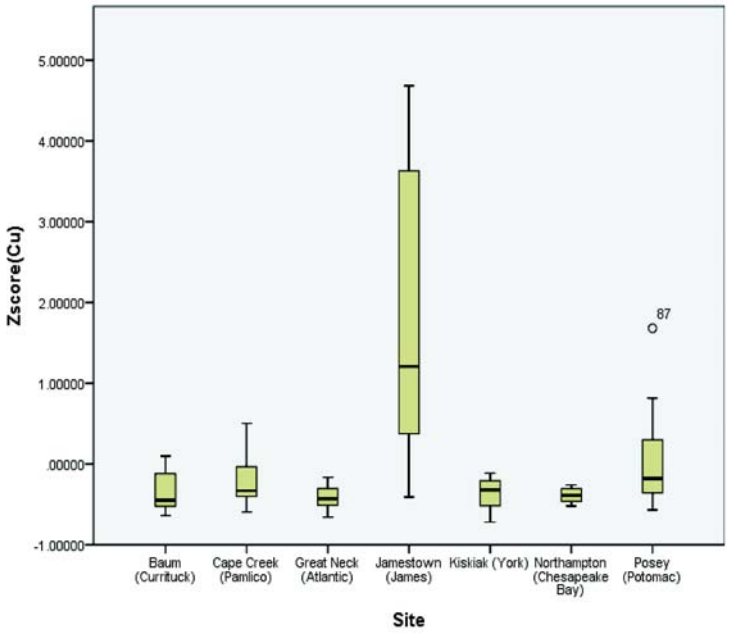

Figure 3. Z-score boxplot of Copper (Cu) concentrations in unmodified shell samples, grouped by site.

differences in the underlying lithology of the surrounding river systems. Figure 3 shows a boxplot representing z-scores derived from copper (Cu) concentrations from unmodified *Mercenaria mercenaria* recovered from each site. The values derived from shell recovered from Jamestown are significantly elevated, while values from all other sites hover near the group mean. The median manganese (Mn) value from the Posey site along the Potomac River (indicated by the horizontal black line within the dark vertical bar, which represents the interquartile range in Figure 4), is roughly two standard deviations above the group mean. Samples from the Chesapeake Bay, the Currituck, and Pamlico sounds generally exhibited less dramatic deviations from the mean as compared to riverine samples, perhaps the result of the deadening of lithological signatures due to the mixing of fresh and tidal marine waters in close proximity to sites along these waterways.

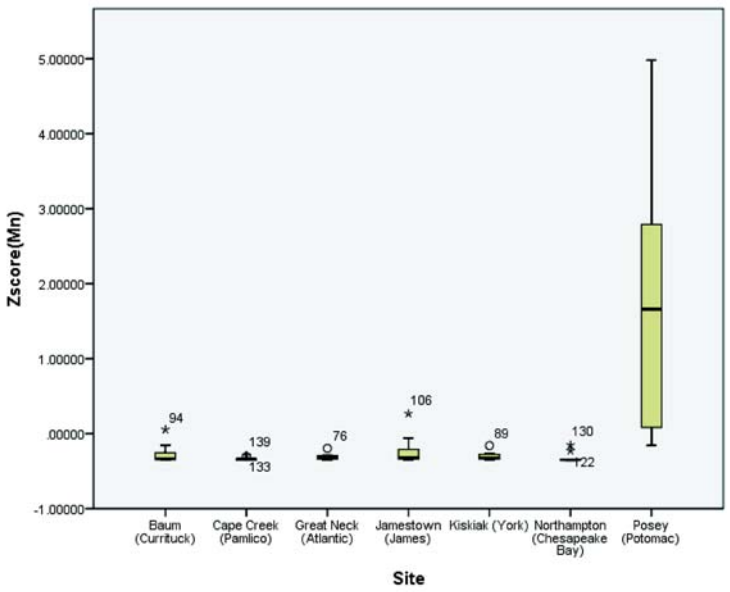

Figure 4. Z-score boxplot of manganese (Mn) concentrations in unmodified shell samples, grouped by site.

Using z-scores and several other statistical methods, eight major and trace elements stood out as discriminating between environmental contexts. These include aluminum (Al), manganese (Mn), copper (Cu), strontium (Sr), uranium (U), magnesium (Mg), barium (Ba), and boron (B). A canonical linear discriminant analysis—an analytical technique that builds a predictive model for group membership based on predictor variables—was performed on unmodified *Mercenaria mercenaria* data based on the eight previously mentioned elements. Post-hoc predictions of group membership correctly assigned 87% of unmodified shell to their waterways of origin based on the derived predictive model. A plot of the concentrations by waterway shows that chemical compositions cluster based on geographic source location (Figure 5). The values representing the James and York rivers appear more similar than those derived from Potomac samples, which could be a function of geographic proximity of the James and York as adjacent river systems and/or similarities in underlying watershed lithology. As expected concentrations derived from shell recovered from sites along the Atlantic Ocean and Currituck Sound, the Great Neck site and Baum site, respectively, appear somewhat clustered. In these significantly saltier environs, elemental discrimination may be the result of salinity and temperature variations, which are known to significantly impact levels of dissolved boron (B), magnesium (Mg), and strontium (Roopnarine *et al.* 1998; Harriss 1965; Cronin *et al.* 2005) and affect their uptake in molluscan skeletal material.

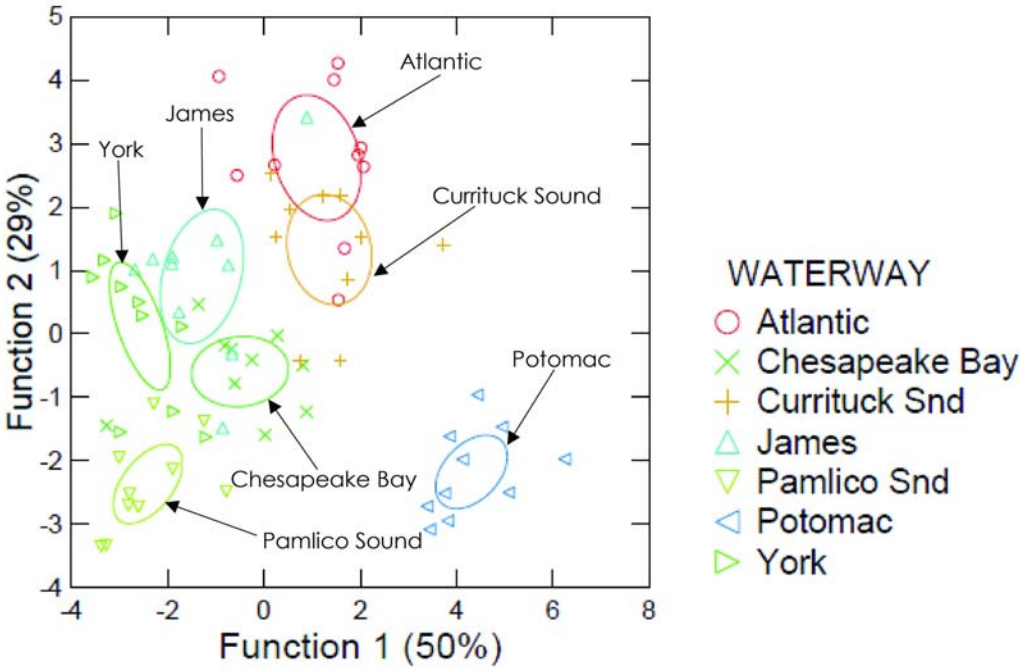

Figure 5. A discriminate analysis plot of unmodified shell samples showing the distinct separation of samples by waterway. Ellipses represent 90% confidence intervals around centroids.

In order to assess whether shell beads were being produced from local shells at any of the four sites where both shell beads and unmodified shells were collected and analyzed (Kiskiak, Great Neck, Jamestown, and Posey), a canonical linear discriminant analysis was performed based on concentrations of aluminum (Al), magnesium (Mn), copper (Cu), strontium (Sr), uranium (U), barium (Ba), and boron (B) (Figure 6). Magnesium (Mg) data, despite discriminating source location by watershed in the previous discriminant analysis, proved unable to meet expectations of normality for this analysis and was thus omitted. *A priori* predictions of group membership assigned 100 percent of the beads recovered from both Jamestown and Great Neck—along the James River and near the mouth of the Chesapeake Bay, respectively—to the unmodified shell groupings associated with each site. In other words, there is a high likelihood that shell beads at these locales were being produced from local shell. The Posey and Kiskiak sites, along the Potomac and York rivers, respectively were generally assigned to the Chesapeake Bay

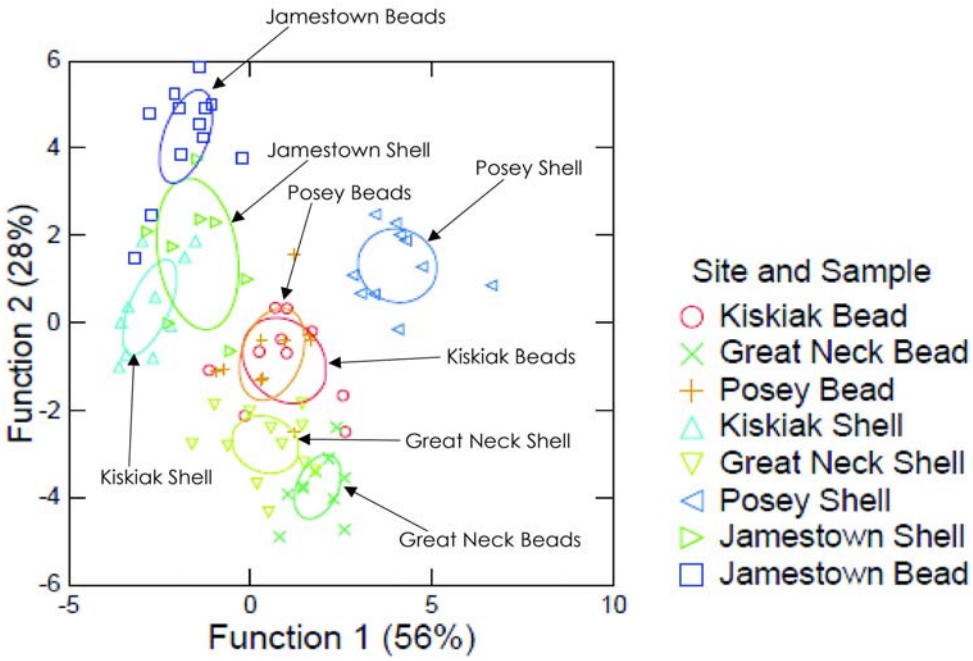

Figure 6. A discriminate analysis plot of unmodified shell and beads from four coastal sites grouped by artifact type and site. Ellipses represent 90% confidence intervals around centroids.

grouping. In other words, their chemical compositions appeared more similar to unmodified shells derived from Chesapeake Bay waters, specifically those from Great Neck, than the sites where they were recovered archaeologically.

Interestingly, the discriminant plot shows that shell beads from Kiskiak and Posey (along the York and Potomac rivers, respectively) are significantly clustered. This overlap could indicate that beads recovered from these two sites were being produced at a central location before being exchanged or gifted to the villages where they were eventually deposited into the archaeological record. Alternatively, unmodified shell for manufacturing beads may have been the medium of exchange, with finished goods being produced in close proximity to where these objects were used and eventually deposited.

CONCLUSION

This study confirmed a distinct separation of unmodified shell chemical compositions based on their origins in distinct river, bay, and ocean source locations through trace element analysis using inductively coupled plasma-mass spectrometry. Also, it supported the proposition that lithology may allow for shell sourcing on a smaller geographic scale (i.e., the ability to discern between shell from adjacent river systems) based on the unique geological provinces that they drain. Distinct elemental signatures for samples derived from areas of greater salinity (i.e., the Chesapeake Bay, Currituck/Pamlico sounds, and open ocean locales) were attained, however, they appeared less distinct than those derived from samples recovered from tidal rivers.

Statistical analysis of shell beads from four sites within the region suggests local production at two sites (Jamestown and Great Neck) and non-local production for the remainder (Kiskiak and Posey). Recognizing the interpretive limitations of this small sample size, these preliminary findings appear to affirm historical accounts which suggest that during late prehistory, shell beads were produced on the Eastern Shore, and potentially in other oceanside coastal areas such as modern day Virginia Beach. Although evidence suggests production at Jamestown, these activities may represent a colonial disruption of traditional Algonquian production and exchange practices.

Indeed, the importation of non-local objects may have been a seminal component of the Chesapeake world-system and the development of chiefly polities within the region (Hantman and Gold 2002; Klein and Sanford 2004; Hall and Chase-Dunn 1999). The geographic expansion of the Powhatan in the late 16th century, for instance, likely provided new material possibilities for mediating relationships of authority and subjection. The value of foreign objects in the Tidewater thus, may have derived not from localized control over means of production but in the promise of "an escape from the demands of production altogether" (Keane 2001:83). Alternatively, there may have been a large-scale shift during the Late Woodland period, in which shell bead producers initially acted independently, but ultimately became attached to burgeoning political institutions whose economic strategies became increasingly focused on funding political infrastructure to support ever-expanding bases of power.

Moving forward, an increased sample size would allow for the refining of analytical techniques used to interpret elemental data and provide a better understanding of the organization of coastal Algonquian craft production and exchange. One of the most significant gaps in our understanding of the pre- and post-contact Chesapeake political economy comes from a lack of dated shell artifacts and their associated recovery contexts. Recent research has vastly improved and refined methods of measuring ^{14}C and calibrating radiocarbon dates derived from local shell (Rick *et al.* 2012). Since so little is known about shell beads and their role within the Algonquian political economy prior to the colonial era, chronology is essential to understanding these political dynamics. Ultimately, my hope is that this line of research will contribute to broader understandings of the development of centralized political authority within the region and further clarify the nature of its relationship with an indigenous economy based on the production, exchange, and redistribution of wealth objects.

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