# Chains of Currency: Manilla Money Bracelets, Early Modern Africa and the Ties That Bind

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**ABSTRACT**
Manilla money bracelets emerged during the early modern period (ca. fifteenth century AD) as a form of currency between western Europe and West Africa, and continued to circulate until the early twentieth century. While there has been little formal scholarship on manillas, narratives abound: some histories cast the bracelets as the blood money of the transatlantic slave trade; others highlight them as the copper source used to make the Benin Bronzes; and still others uphold the manilla as a symbolically important West African cultural object in and of itself. This study begins with a history of the manilla, from its rapid proliferation to its eventual obsolescence. The term "metastasizing symbol" is proposed to describe objects like the manilla, whose propagation is underwritten by unsustainable systems of cultural difference, and thereby contains within itself the seeds for the object's transition to disuse. The authors also describe a portable X-ray fluorescence (pXRF) analysis of nine manilla bracelets from the Yale University Art Gallery (YUAG). When compared to manilla composition data from previous studies and projected into PCA space, the nine YUAG manillas appear most similar to specimens produced in England during the mid-nineteenth century and traded extensively in British West Africa throughout the colonial period.

**KEYWORDS**
Manilla Money Bracelets; pXRF; Transatlantic Slave Trade; Europe; West Africa; Early Modern Period; European Imperialism; Provenance

## INTRODUCTION

Deep in the bowels of the Yale University Art Gallery's (YUAG's) West Haven storage facilities, tucked amid a Pynchonian warren of windowless hallways which Yale purchased from Bayer Pharmaceuticals in 2007,[1] sit nine metal bracelets, barely big enough to fit around a human arm. The shape of all nine is roughly the same: open at the wrist, flared at the ends, a bit like a very small horseshoe (**Figure 1**). These are "manillas": a vague term, likely arising from the Latin word for hand, possibly by way of the Portuguese.[2] Today, the word "manilla" is used to describe any one of the millions of open-wristed metal bracelets that have been circulating among Central Africa, West Africa and Western Europe since the fifteenth century, when they emerged as a form of currency.[3]

The nine YUAG manillas are currently classified by the museum as "iron jewelry". All nine came to the YUAG as part of a donation in 2010.[4] In scores of museum collections and university archives across Europe and North America, the story is similar: tens, sometimes hundreds of these rusty metal bracelets are sitting on shelves and tucked away in cabinets, most of them deemed too unremarkable for gallery display. Meanwhile, throughout the post-colonial Global South of sub-Saharan Africa, manillas adorn the wrists of village elders, military personnel and religious leaders alike.[5]

How, then, did this happen? How did such an unassuming, apparently superfluous object get stuck so firmly, like a speck of dirt, beneath the fingernails of the modern world? The answer is a story of empire and cultural interchange in the early modern Atlantic; it is a story about chattel slavery, about the making of history, and about what will from this point onward be referred to as "metastasizing symbols" — those images, objects and ideas that flow back and forth between peoples, places and times, undergoing a million little tweaks along the way, until in the end they belong to everyone and no one, everywhere and nowhere, the present and the past, all at once.

What follows, therefore, might be framed as a sort of "object biography",[6] written in two parts. The first part is historical: it uses primary sources and existing literature to describe the evolution of the manilla from an anthropological perspective (i.e. a perspective driven by an awareness of "culture", in the sense of an emergent property of human groups arising from the interactions of individuals with each other and with their environment).[7]

The second part is chemical and involves a composition analysis (via X-ray fluorescence) of the nine manillas in Yale's collections. The results of this analysis are compared to composition data from 153 other manillas, from previous studies.


**Figure 1.** Nine manilla bracelets from the collections of the Yale University Art Gallery. For the purposes of this study, the bracelets have been numbered using the last three digits of each specimen's museum accession number, all of which start with "2010.6." (e.g. 2010.6.192 = 192, 2010.6.193 = 193, etc.).

*BACKGROUND*

While manilla-like bracelets seem to have emerged simultaneously throughout western and Central Africa during the early fifteenth century, the idea of "the manilla" as we know it today — i.e. a mass-produced bracelet currency, historically recognized in large portions of both Africa and Europe — probably first appeared somewhere in western-central Africa during the mid-fifteenth century, most likely as a result of political interaction between the Kingdom of Kongo and the newly arrived Portuguese. One of the earliest appearances of the Portuguese word, *manylha*, for example, is in a letter between the royal courts of Portugal and Kongo, dated to 1514 and mentioning the shipment of 1500 copper manillas northward to Europe, along with 150 slaves.[8] Already the contents of this early inventory — manillas and people — previews the bracelet's many precarious entanglements among the brutal horrors of that region during the early modern period, as well as its importance in the plethora of political chess games played out in resistance to early European imperial strategy.[9]

Interestingly, the only manillas known to have been produced in central Africa (**Figure 2**) — in the modern-day Democratic Republic of Congo, within the borders of the region's erstwhile Kingdom — bear striking resemblance to the earliest mass-produced European examples, which were brought to Africa by the Portuguese in the fifteenth century. While precise dating of the indigenous Congolese manillas in **Figure 2** remains difficult given their muddled museum provenances (documents at the Musée du quai Branly in Paris suggest that one of them may have been made as recently as the early twentieth century), they are nonetheless the most visually similar of any African-made manillas to the earliest European-made ones.

There is of course a fair amount of doubt surrounding the chronology of the manilla's Kongolese origin story. Trading documents assembled by the art historian Eugenia Herbert suggest that Dom Afonso, King of Kongo, was already sending copper manillas to Portugal as early as 1506, in order to cement an alliance between the two states.[10] The first appearance of the word "manilla" in the written record is also difficult to discern: early usage could date as far back as 1455, when the Venetian merchant Luís de Cadamosto appears to use a version of the term. In a post-facto account of his trading voyages in West Africa on behalf of the Portuguese crown, Cadamosto notes that when he reached the mouth of the Senegal River in northern West Africa, two local Wolof men asked him for "two manilhas of tin each" in return for relaying a message to his crew.[11] While the undoubted language barrier between Cadamosto and his interlocutors makes it difficult to evaluate the specifics of the men's request, the fact that Cadamosto uses the word *mauille* in the original Italian lends weight to the possibility that the Portuguese had already coined the term *manylha* by this early date, as the travel notes upon which Cadamosto based his memoir were originally meant to be readable by agents of the Portuguese royal court.[2] Regardless of any chronological discrepancies, however, the fact remains that the manilla as a means of intercontinental exchange seems to have strong roots in the fifteenth century relationship between the Kingdoms of Portugal and Kongo.


**Figure 2.** Examples of manillas produced in Kongo. Left: object number 71.1951.73.338.1 from the Musée du quai Branly in Paris; right: object number Af1950,16.16 from the British Museum in London. Images courtesy of the Musée du quai Branly and the British Museum.

Thus, while the metaphorical "liminal space" that existed during the early modern period between the politics of Europe and those of western Africa is often forgotten in light of Europe's subsequent colonial domination over the African continent, it was precisely in the context of this liminal space that the term "manilla" first appeared. Far from being a quirk of history, this liminality can instead be read as the beginning of the process (culminating in the eventual rise of the transatlantic slave trade, and the massive loss of life that followed) by which "Europe" and "Africa" went from arbitrary geographic units to culturally meaningful entities. In other words, this was the process by which Portuguese, Spaniards, Frenchmen and Englishmen all came to think of themselves as "European", in the sense of (among other things) "not African". It was also the process by which Edo, Yoruba, Bamum and Kongo people came to think of themselves as "African", in the sense of (again, among other things) "not European". Such processes of definition-by-opposition can be applied at many scales (consider, e.g., the ontologies discussed by the writer Frank B. Wilderson III,[12] or the identity politics discussed by the anthropologist Gregory Bateson),[13] but when considered at a scale like this one, involving entire continents and cultures, the anthropologists David Graeber and David Wengrow have recently proposed the use of the term "schismogenesis", meaning the creation of a cultural identity in opposition to a foreign culture or group.[14] With this vocabulary in mind, the manilla can in turn be read as a sort of "vestigial organ" of schismogenesis: a bivalent Euro-African form, holding the continents together.

To better understand this idea, it is necessary to further examine the history of early manilla production. Following the first shipments of manillas northward from Kongo to Portugal,[8] the Portuguese court quickly realized that their access to the high-quality copper ores of central Europe could be an important piece of leverage in their trade with the sub-Saharan kingdom. From at least the second decade of the sixteenth century, Portugal began commissioning the large-scale production of its own manillas for use on all trading voyages to western Africa,[2] mostly via copper mines and merchant houses in Flanders and Germany.[15] In the three years between 1519 and 1522, the number of Portuguese manillas delivered to the West African trading post of Elmina alone surpassed 150 thousand.[16] By 1531, Portugal was exporting an average of well over 100 thousand manillas per year.[17] Thus, while the manilla was viewed on both continents as a primarily "African" form (often to the point of confusion about the bracelet's origins),[18] it was nonetheless a form produced by Europe, according to European perceptions of African desires.
In the context of this profound entanglement, it was not long before a full-fledged institutional framework sprung up around the manilla trade. By the mid-sixteenth century, Portuguese manillas seem to have been assigned fixed values at various ports along the West African coast,[2] where the Portuguese traded them for gold and ivory,[10,19] but also for something much more consequential, from the perspective of the individual and the *longue durée* alike: large numbers of enslaved Africans.[15,20]

By the time European manilla production hit full swing in the early sixteenth century, the storm of transatlantic chattel slavery had long been brewing on the horizon.[21] The conquest of the Canary Islands by Portugal and Spain in 1496 (following decades of hard-fought anti-colonial resistance),[22] combined with the Portuguese colonization of the island of São Tomé in 1486 had given Europe a taste for violent overseas empire, which they promptly began exporting to the Americas on a much larger scale.[23,24] Crucially, it had also given Europe a taste for sugarcane, which quickly proved itself to be an extremely valuable crop on the Canary Islands and São Tomé alike.[22] As the working classes across Europe became increasingly addicted to the high-calorie, easy-to-store nature of processed sugar,[25,26] the burgeoning plantation model for sugar production was likewise exported to the Americas, where the decimation of local indigenous populations at the hands of European pathogens and genocides meant that a large supply of foreign labor was required.[27] Beside the bodily perils of enslavement, the kind of slavery that was needed to power Europe's New World sugar plantations — i.e. intergenerational chattel slavery — also required a particularly severe kind of "social death", in Orlando Patterson's famous phrase.[28,†] While recent scholarship by historian David Eltis and others suggests that it may have been significantly cheaper for Europe to source slaves from within its own populations,[27] in the context of the schismogenesis that was occurring at that moment between Europe and the rest of the world (and, as discussed above, between Europe and Africa in particular), European empires ultimately turned to sub-Saharan Africa in order to obtain the type of non-human "other" suitable for plantation labor. As New World colonies continued to refine the model for plantation production throughout the seventeenth and eighteenth centuries,[29,30] profits and productivity only increased, and soon all of Europe's empires were engaged in the transatlantic slave trade.

Among other things, this placed a massive stress on Africa's population dynamics. Conservative estimates place the number of people taken from the continent between the fifteenth and nineteenth centuries at around 12 million via the Atlantic ocean,[31] plus several million more via the Indian Ocean and North Africa.[22] This demographic drain is thought to have reduced Africa's population to half of what it would have been by 1850, had the slave trade not occurred.[32]

The effects of such a catastrophe on cultural identities and political structures within western Africa have been well-documented.[32,33,34] The cycles of warfare and unrest driven by the slave trade (for instance in the Kingdom of Kongo)[35] can be thought of as having accelerated schismogenesis between Africa and Europe in a positive feedback loop: as entire African political economies formed and dissolved purely around the export of slaves, and the idea of "Blackness" became an increasingly legitimate anchor for identity across western Africa,[22,36] new cultural accoutrements were needed — ideally ones legible on both sides of the newly defined Black/non-Black dichotomy. In short, the stage was set for the manilla to worm its way into ubiquity. The bracelets did just that, quickly becoming a *de facto* currency of the slave trade. Over the next three and a half centuries following the first large-scale production of manillas by the Portuguese crown in the early 1500s, manilla production diversified roughly in accordance with the market pressures and imperial politics of the slave trade. The Portuguese controlled most manilla production until the mid-seventeenth century; at this point, following a short transitional period dominated by the French, the English eventually rose to full control of manilla exports. This tripartite timeline is the bedrock of a recent manilla typology developed by the researcher Rolf Denk, which divides manillas into three broad categories (**Figure 3**). Denk's typology is by far the most expansive to date and warrants a brief review.

The first manilla in the typology, which Denk calls the "tacoais" type,[2] is the largest of the three, regularly weighing up to 300 grams.[37] These manillas were commissioned and exported by the Portuguese, but produced mainly in Germany and central Europe, usually using copper ore from the Rhineland.[15,‡] They are the thickest of the three manilla types and are recognizable by their flared but rounded ends. Tacoais-type manillas are generally characterized by extremely high-quality copper, and are thought to have been highly prized among blacksmiths along the West African coast for use as copper ingots. A recent compositional analysis of tacoais manillas by Skowronek et al.[15] suggests that these were the main source of copper used to cast the famous Benin Bronzes during the fifteenth century. †

The next manilla in Denk's typology is known as the "popo" type, possibly in reference to the former slaving port of Grand-Popo, in the modern-day country of Benin. Popo manillas tend to be slightly smaller than tacoais manillas, with the ends tapered rather than flared. Unlike the tacoais, casting seams are often visible on popo manillas, speaking to the general downward trend in the quality of European manillas over time, both in terms of the copper used and the production process. Popos first appear in the archaeological record of West Africa in the mid-seventeenth century, mainly in trading regions dominated by the French. While Denk originally proposed the popo as an exclusively French enterprise (i.e. produced in France, and traded in French West Africa), new compositional analyses suggest that many popo manillas seem to have been produced in Britain.[15,41] More recently,[41] Denk has suggested that the popo might simply represent a short-lived, highly variable transition period between the earlier tacoais type and the later "Birmingham" type — in other words, popo manillas might represent a historical moment, rather than a particular supply chain or sphere of imperial influence.

The final category in Denk's typology, which he calls the "Birmingham type",[2] is perhaps the most easily recognizable, and almost certainly the most abundant in the archaeological record.[42] As their name suggests, these manillas were produced almost exclusively in Britain, mainly in early industrialized cities like Birmingham, Liverpool, Bristol and Swansea.[43] Excavations at a bell foundry in Exeter suggest that production of these manillas was occurring in England as early as 1625,[44] but large-scale production and trade only began in the mid-eighteenth century, following the expansion of English imperial interests and the

† While slavery by definition necessitates the dehumanization of the enslaved, the argument has been made that previous examples of slavery throughout human history have not always required the same sort of absolute social death that characterized the transatlantic slave trade.[14]

‡ Indeed, the term "tacoais" (being the plural — the singular is "tacoal")[2] is a Portuguese word, apparently created from whole cloth, exclusively to describe this type of manilla. The word first appears in Portuguese notary receipts from Antwerp trading houses in the mid-fifteenth century, although it is unclear whether those documents were referring to traditional copper manillas or other, similar objects (Strieder 1932:254).[38] Denk suggests in his 2020 monograph that the word "tacoais" may derive from the root word "taco", meaning "plug" or "heel", perhaps in reference to the bracelet's flared ends.

industrialization of British cities.[45,46] Birmingham-type manillas are the smallest of Denk's three manilla types, and are characterized by flat, dramatically flared ends and highly visible casting seams. Indeed, unlike the tacoais or the popo, many Birmingham-type manillas were too small to be worn as jewelry and too brittle to be used as casting metal, effectively limiting their function to that of specie.[47] Stylistically, the nine manillas in Yale's West Campus storage collections (**Figure 1**) are all "Birminghams".


**Figure 3.** The Denk manilla typology. The image for the tacoais type has been adapted from photographs by Skowronek;[48] images for the popo and Birmingham types were adapted from photographs by Denk.[2]

What, then, makes Denk's simple typology so valuable, other than as a tool for dating and provenancing individual specimens? There are two important answers to this question. Firstly, the typology is helpful in understanding that manilla production and use directly reflected contemporary imperial power dynamics. This fact is best illustrated by the graph in **Figure 4**, which overlays a rough timeline of Denk's manilla typology with the number of slaves embarked from Africa by Portugal and England during that period. While the French slave trade has not been included in the figure given the uncertainty surrounding the production and general significance of popo manillas, the graph nonetheless tells an interesting story. The disappearance of tacoais-type manillas in the mid-seventeenth century is matched by a precipitous drop in the number of slaves embarked by Portuguese ships.[§] Furthermore, Birmingham-type manillas only begin to appear in the early eighteenth century, precisely when the British empire begins to institutionalizes the slave trade.[45] In short, changes in manilla style and production pathways were clearly tethered to the changing imperial power dynamics of the transatlantic slave trade.

Secondly, though, a careful reading of the Denk typology also provides important insights about the end of European empire, and the rise of the modern nation-state framework during the nineteenth and twentieth centuries. This line of reasoning starts with the fact that the Denk typology accounts for change in the Birmingham manilla over the course of the nineteenth century: in Denk's seriation, Birmingham manillas become progressively smaller and more heavily leaded (i.e. lower quality) over time.[2] This progression was closely tied to the rapid industrialization occurring in urban England at the turn of the nineteenth century, particularly in the metalworking industry.[51] On the one hand, this meant that by the time the so-called "Industrial Revolution" hit its acme in the mid-nineteenth century, Britain was pumping out more manillas than ever before. One contemporary source estimates that in 1855, the city of Birmingham alone was producing more than 300 tons of manillas per year for export to West Africa[52] (this translates to as many as 3 million manillas annually, assuming an average weight of about 100 grams per bracelet).**

On the other hand, however, this industrialized proliferation of the manilla also resulted in a progressive loss of its value, from both a monetary and cultural perspective. In order to hit the sorts of output numbers seen in Birmingham in 1855, most manilla producers during this time stopped using brass and bronze and began using a cheaper leaded copper alloy, with lead concentrations of up to 25 percent by weight,[15] and higher levels of antimony.[53] Starting at the beginning of the nineteenth century, this cheapening triggered a race to the bottom. Smaller, lower-quality manillas meant less purchasing power in West Africa; this in turn drove British manilla producers to make even smaller, even cheaper manillas in an effort to maintain profit margins.[52] Indeed, one British source reports that by 1858 in Bonny, in modern-day Nigeria, a Birmingham-type manilla was worth only three pence.[54] That is equivalent to less than five U.S. dollars in 2023.[55]

Parsed carefully, this negative feedback loop in British manilla production can be read as an allegory for the downfall of what the American historian Caroline Elkins and others call "liberal imperialism" — the political philosophy best embodied by Britain but

§ While the Portuguese slave trade roared back to life in the early eighteenth century following the end of the Angolan Wars and the expansion of Brazil, the Portuguese colonies arguably had more autonomy by that time, altering the political power structures governing the trade.[49,50]

occurring throughout modern empires of the Global North, which derives an empire's ruling mandate from its inherent moral and cultural superiority. This is essentially the "white man's burden" argument set forth by the English writer Rudyard Kipling in his famous poem of 1899:[56] the idea that violence against indigenous groups is justified, as long as the end goal is to re-make the victimized populations in the image of Western liberal democracy. As Elkins points out in a recent book, however,[45] liberal imperialism necessarily contained within itself the seeds of its own destruction. By presuming to westernize its foreign subjects, the British and other similar European empires were also implying that those subjects would one day become westernized enough to govern themselves — in short, British liberal imperialism always came with a promise of freedom and self-determination for the oppressed. This promise was not sustainable, for obvious reasons, but it had to be made to continue performing the mental gymnastics necessary to justify the large-scale exploitation of human capital occurring in, say, the sugar plantations of nineteenth century Jamaica.[34]

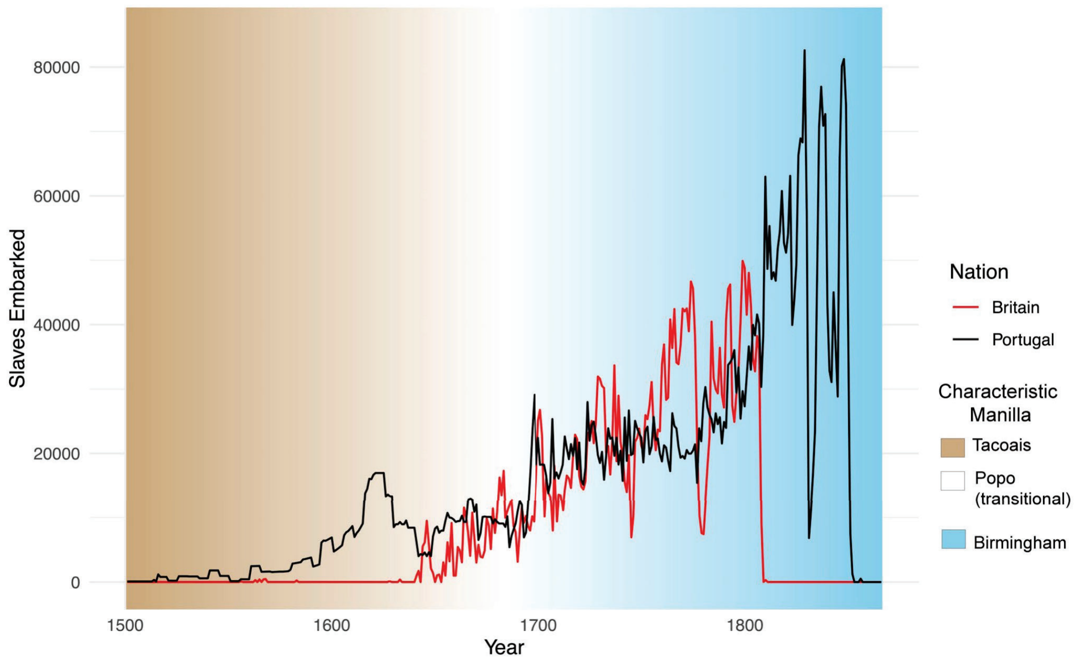


**Figure 4.** Number of slaves embarked from western Africa by Portugal and Britain between 1514 and 1866, overlaid with the chronological progression of Denk's manilla typology. All data from the Trans-Atlantic Slave Trade Database.[55]

Here is where we return to manillas. In 1807, against a political backdrop dominated by liberal imperialism, Britain outlawed the transatlantic slave trade at the height of its profitability, with an eye towards maintaining moral superiority over its imperial rivals in Europe and its colonized subjects abroad (this of course being one of many complex reasons). [21,**] While this moral gamble arguably paid off for British imperial interests in the medium-term,[30] it also destroyed the lynchpin of the manilla's cultural and economic significance (i.e. as a token of the slave trade), fueling the ensuing race to the bottom and the subsequent consignment of manillas to relative uselessness.

The manilla did not simply disappear, to be sure. In the same way that the transatlantic slave trade continued well into the 1840s,[57] the production and circulation of manillas continued throughout the nineteenth century. The plethora of manillas at a "juju house" in Allabia, in Southern Nigeria, when the building was raided and razed by the British traveling commissioner for the region in 1904 attests to their continued significance among the Andoni people.[59,††] Notably, when use of manillas as currency was outlawed in British colonial Nigeria in 1911, more than 32 million bracelets were redeemed across the country for use as scrap metal, underscoring just how ubiquitous manillas continued to be in West Africa since the end of the slave trade.[16] Setting aside these caveats though, in a sense one might say that the British rendered useless their own mints. Just as the hypocrisy of liberal imperialism spelled the end of the British empire in South Asia and South Africa alike, leaving convoluted nation-state governments and disputed borderlands in its wake,[60] so too did that hypocrisy spell the end of the manilla bracelet as a culturally bivalent form.

** The early nineteenth century was also not the end of British financial involvement in the slave trade, and certainly not the end of manilla production in Britain.[57,58]

†† Indeed, judging by descriptions provided by Apter and Derby, several of the manillas from that building appear to have been of the tacoais type, raising interesting questions about the lifespan of larger, higher-quality manilla bracelets.[59]

How, then, do we understand the story of the manilla, from a material perspective? Or perhaps, more to the point, how can we understand why the story of the manilla is so difficult to understand in the first place. After all, as discussed in the introduction above, it is a story seldom told, and one that sounds slightly different with each telling. Is the bracelet a prestige good and a source of pride (e.g. among its wearers in West Africa)?[5] Or is it a shameful blood money and a reminder of the suffering caused by the slave trade?[20,40] The answer to these questions brings us back to where we began, and to the idea of "metastasizing symbols". Just as a liberal-imperial empire spells out its own demise, metastasizing symbols like the manilla inevitably become stretched too thin by the malevolent processes responsible for their proliferation in the first place. For the manilla this was the slave trade, and European imperial interests in western Africa more broadly. Another example of a metastasizing symbol might be the money cowries harvested in the Maldives and exchanged in West Africa, also as part of the transatlantic slave trade, throughout the sixteenth and seventeenth centuries.[61] Still other examples might include English Premier League football jerseys in postcolonial Africa,[62,63] or the global proliferation of the Timberland work boot, following its adoption by the New York hip hop community of the early 1990s.[64,65] The point is that materially, the production of these items depends on processes of exploitation that are not sustainable.[‡‡] But symbolically, their stories are like energy — neither created nor destroyed, only reshaped and told again, eroded into finer and finer grains of sand, deposited on far-away beaches along the oceans of time until another diagenesis occurs.

## METHODS AND PROCEDURES

It is here that we return to those nine metal bracelets, sitting in a storage facility in West Haven. Having considered the manilla as an abstract object, it is now possible to interpret the elemental composition of these individual specimens. The following analysis attempts to do this by comparing X-ray fluorescence (XRF) composition data from the nine YUAG manillas to compositional data derived from eleven previous studies, with the aim of characterizing the YUAG manillas and commenting on their possible origin. Our aim is not to match the manillas to a specific copper ore source or mining site. There are likely too many factors, from combining copper and tin from different deposits to corrosion forming new compounds on the exteriors, for us to make such an identification nondestructively. Instead, archaeological chemist Mark Pollard's concept of "processual provenance" offers a means for us to interpret the compositions of metal objects.[75,76] This framework focuses on chemistry revealing different behaviors in the past, such as choosing bronze recipes based on social factors like economics (e.g., the costs of certain raw materials) or preferences regarding performance characteristics (e.g., the ease of casting, the final appearance). Pollard argued that such factors would differ across space and time and yield a tangible record within the resulting objects.

Compositional data for the nine YUAG manillas were collected, without any alteration of the items, using an Olympus Vanta M-Series portable XRF (pXRF) instrument. A modern pXRF instrument is essentially a state-of-the-art energy-dispersive XRF (EDXRF) system that fits into a small form factor. Quantitative analysis and identification of alloys is one of the major commercial uses of pXRF, a situation that has led to metals having better identifications in scrapyards than in most museums. However, the influence of corrosion on artifacts has been a concern even since the early days of wavelength-dispersive XRF (WDXRF) in archaeological chemistry.[77] Because XRF is essentially a surface technique (i.e., the X-rays penetrate less than a millimeter past the surface of most metals),[78] pXRF measurements have the potential to become skewed by products of corrosion. Bronze, as a non-ferrous metal, does not rust like iron. As shown in Figure 1, several of the YUAG manillas exhibit a tarnished brown color of simple oxidation, while others exhibit a green patina indicative of copper hydroxides, chlorides, and carbonates, among other related compounds.

For more than a decade, there have been studies with and tests of pXRF measurements of archaeological copper alloys,[79–87] including scrutiny by specialists in archaeological metallurgy.[88–90] Given that reliable and nondestructive measurements are possible using EDXRF,[91] there is little reason for pXRF to be any worse in this respect. Many of the assessments have been cautiously optimistic, especially when concentrating on the major and minor elements such as Ni, Zn, Sn, Sb, and Pb.[90,92,93] For example, Roxburgh et al. discerned pre-Roman (high Sn) and Roman (high Zn) bronze broaches in the Netherlands and concluded that their data were comparable to previous studies.[94] Some have been more skeptical in their assessments,[85] with one having gone so far as to call pXRF a "curse" for archaeometallurgy due to its popularity and uncritical use.[95] Our use here, though, should not be regarded as uncritical but instead as informed by those studies that have tested and implemented effective applications of pXRF.

‡‡ In the case of English football, as global broadcast rights become increasingly expensive (often selling for billions of dollars)[66] and neo-feudal autocracy becomes the only viable football governance structure (consider, e.g., the rise of figures like Gianni Infantino, or Sheikh Mansour),[67] the existence of the Premier League itself is becoming ever more precarious (Bosher 2023; Brannagan et al. 2022).[68,69] In the case of Timberland shoes (among other symbols of early New York hip hop),[70] the commodification of hip hop by global capital,[71] combined with the disappearance of large swaths of its New York City homeland via processes of urban gentrification,[72] has effectively diluted the brand.[73,74]

| Source | Method | Number of manillas |
|---|---|---|
| YUAG manillas | pXRF (Olympus Vanta handheld) | 9 |
| Caley and Shank 1966 | Solution analysis (see Caley 1964:81-97 for detailed procedure) | 2 |
| Craddock 1985 | AAS§§ (Perkin Elmer series 306) | 34 |
| Craddock et al. 1997 | ICP-AES*** (machine unspecified) | 2 |
| Craddock and Hook 1995 | ICP-OES (machine unspecified) | 15 |
| Denk 2020 | pXRF (Niton XL3t GOLDD+) | 10 |
| Denk et al. 2020 | pXRF (Niton XL3t GOLDD+) | 3 |
| Denk et al. 2019 | pXRF (Niton XL3t GOLDD+) | 1 |
| Kuntz et al. 2002 | Energy dispersive XRF (Kevex Spectrace Quanx spectrometer) | 17 |
| Riederer 2013 | AAS (machine unspecified) | 1 |
| Skowroneck et al. 2023 | ICP-MS (Thermo Fisher Scientific ELEMENT XR) | 67 |
| Werner 1978 | ICP-OES (see Riederer 2013:109 for procedure) | 1 |

**Table 1.** Data used in this study. The analysis included composition data from a total of 162 manillas.

One recommendation to come out of previous assessments is to measure larger areas and take multiple measurements.[86,90] Additionally, the resulting pXRF data may reveal which spots exhibit more or less corrosion. Detecting large amounts of chlorine, for example, can reveal that a measurement was taken on an especially corroded spot and that it should be excluded. Five 20-second pXRF measurements were taken of each YUAG manilla on areas that appeared least corroded. An effort was made to spread the measurements out across the entirety of each bracelet, in case of any heterogeneity in corrosion. Furthermore, when it was immediately clear during testing that a measurement was mostly describing corrosion products (i.e. extremely high levels of light elements, etc.), that measurement was dropped and re-taken. The measurements were calibrated for accuracy using a set of 12 certified standards designed for historical copper alloys and produced by MBH Analytical.[96] In order to compare the nine YUAG bracelets to other manillas of known provenance, a database of additional composition data was assembled from the peer-reviewed literature, following a survey of search engines including Proquest, Google Scholar, JSTOR and others, as well as a survey of several catalogs from museums across England and Germany. The resulting "database" (summarized in **Table 1**) included a total of 153 manillas, from 11 different publications. For the purposes of the following analysis, most specimens from the database were assigned to one of the three categories from the Denk typology (i.e. tacoais, popo or Birmingham). Several of the 153 manillas from the database could not be classified using the Denk typology, however. For this reason, three categories were added to Denk's typology prior to my own analysis. These were "Birmingham-mkporo," "King" and "pre-contact". "Birmingham-mkporo" is Denk's shorthand for what he and others believe to be very early Birmingam-type bracelets, probably dating to the late seventeenth through early eighteenth centuries.[2,97] "Mkporo" manillas (named for a term used loosely throughout several language groups in eastern West Africa to describe manilla bracelets, but also money more generally)[47] are similar in shape to other Birmingham types, but are identifiable mainly by their larger size and higher copper content.[2] While the provenance notes attached to several mkporo manillas in the British Museum collections suggest that they may have been produced in Nigeria rather than Britain (i.e. that mkporos may be purely indigenous to West Africa), the category nonetheless remains useful for analysis. The "King" manilla category was used to describe four manillas analyzed by Craddock in 1985,[98] as well as Kuntz et al. in 2002.[43] The term, used by the authors of both studies, appears elsewhere in the literature and in common usage to describe any manilla produced in West Africa (rather than Europe) with a diameter greater than about 20 cm.[2,16,43] The four King manillas included in this study are currently in the British Museum collections, and are believed by Craddock to have been produced in Bende, Nigeria, in the late nineteenth century.[98]

§§ Atomic absorption spectroscopy, i.e. inferring the abundance of specific elements by measuring which wavelengths of light are absorbed by a sample.
*** ICP here refers to "inductively coupled plasma" spectroscopy. Varieties include ICP-AES (atomic emission spectroscopy), ICP-OES (optical emission spectroscopy) and ICP-MS (mass spectroscopy). All three methods use a plasma to ionize the elements in a sample, before measuring their abundances via spectroscopy.

The final new category, “pre-contact”, was used to describe a single manilla excavated during the 1960s from the archaeological site of Igbo-Ukwu, in southeastern Nigeria.[42] The specimen, also currently housed in the British Museum (object number Af1956,15.4), is roughly the size and shape of a Birmingham-type manilla, but is knotted in the middle, and is more than 98 percent copper, supposedly weighing more than a kilogram.[98] Excavation reports list it as coming from stratigraphic layers with radiocarbon dates calibrated to the tenth century (hence the designation “pre-contact” — in other words, before the arrival of the Portuguese on the West African coast), raising the possibility that this is an example of an ancestral form, from before the nexus of manilla production moved to Western Europe in the 1500s. The remarkable provenance of the Igbo-Ukwu manilla is called into question, however, by the bracelet’s listing in the British Museum catalog, where it is entered as having been given as a gift (presumably to the excavating archaeologists at Igbo-Ukwu, based on its description in the excavation reports)[42] by Frank W. Carpenter, a local British district commissioner. While its inclusion in Shaw’s 1970 excavation report makes it seem as though it may still have come from tenth century contexts, it was likely not formally excavated. Regardless of this confusion, for the purpose of the below analysis, the “pre-contact” manilla was still stylistically distinct enough from all the other specimens to be given its own category.

The studies included in the database span several decades, with the earliest one published in 1966 and the most recent in 2023.[15,99] The studies also encompass a wide variety of methods, with varying degrees of error and uncertainty — even within individual publications. For example, Craddock’s emission spectroscopic data exhibited, as would be expected for any analytical technique, low measurement error (approximately ±1%) for all major elements, but as much as ±20% for trace elements.[75,100] To this end, only specimens with weight percentages listed for key major elements — copper, lead, tin, antimony and zinc — were included in the following statistical analyses (i.e., 139 of the total 153 gathered from the previous studies). Of course, our data collected from the nine YUAG manillas is not immune to uncertainty either, as we note above. However, based on previous tests of pXRF on archaeological copper alloys, the major elements also yielded the most reliable results. Nevertheless, the data included in this study can be thought of as semi-quantitative and do not precisely reflect either the ores or recipes used by the craftspeople involved. Corrosion products, even when not evident by eye, are still present, given the detection of a few percent sulfur for each manilla. We employ our data as percentages and process them using statistical methods, but the final results are perhaps best interpreted qualitatively (e.g. “these two bracelets have very similar compositions” versus “these two bracelets have less similar compositions”). Accordingly, our approach is similar to that of Martinón-Torres and colleagues, who identified different casting batches of bronze arrows among warriors of Emperor Qin Shi Huang’s Terracotta Army.[88]

## RESULTS

**Figure 5** shows the composition data collected from the nine YUAG manillas (see also **Table 2**). Immediately, a preliminary survey of the results makes clear that all nine are cast from leaded copper alloy, rather than bronze, as many earlier Birmingham-type manillas were, particularly during the late eighteenth century.[48] In any case, they are certainly not iron, as the YUAG collections database suggests.

In order to properly understand the pXRF data from the YUAG manillas, however, they must be compared to composition data from the other manillas in the database. When all the data are visualized together — firstly in a principal component analysis (PCA; **Figure 6**), and secondly in a ternary diagram for lead, tin and zinc concentrations (**Figure 7**) — a few points become apparent. Firstly, if we are to deploy the categories of the Denk typology, then the PCA in **Figure 6** would suggest that the Birmingham-type manilla represented a clear break in supply chains and production processes. Principal component 1 in the PCA (PC1, i.e. the X axis in **Figure 6**) serves mainly to divide Birmingham- from non-Birmingham-types, indicating that the composition of most Birmingham-type manillas included in this analysis was profoundly different from the compositions of both the tacoais- and popo-type manillas, which were relatively similar to each other by comparison (save for about seven popo manillas, which fall in a sort of transition range between the tacoais and Birmingham samples). This divide in the PCA could also be driven by the spread of the manilla categories across the different data sources — notably, the composition data for a majority of the tacoais manillas in the dataset come from a recent study by Skowronek et al., and most of them come from the same source (a shipwreck off the coast of San Sebastian, in Spain).[15] But the fact that these San Sebastian tacoais cluster so far from any of the Birmingham-type manillas (including those also sampled by Skowronek et al.)[15] is nonetheless meaningful. Additionally, the fact that a strong Birmingham-tacoais divide is also visible in the ternary diagram in **Figure 7** suggests that it is not simply due to the transformations involved in mapping out the first two principal components.

Secondly, the initial visualization of the entire dataset in **Figures 6** and **7** also underscores the divide between Birmingham “mkporos” and other Birmingham-type manillas. In the PCA, the two categories are separated out mostly along PC1, suggesting a large amount of variation between them. In the ternary diagram, the two groups appear to be slightly more closely related, but the

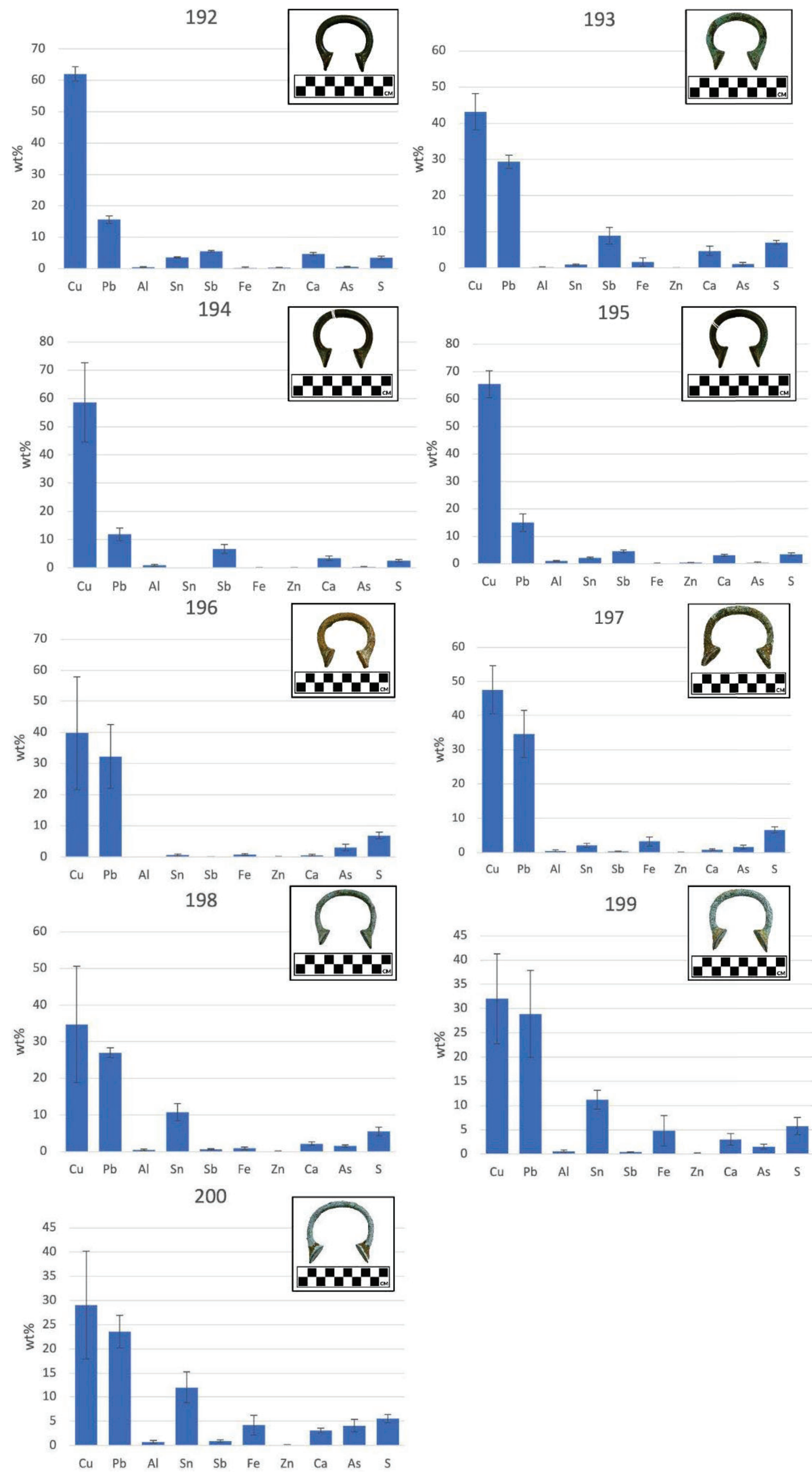


**Figure 5.** Average composition of the nine YUAG manillas, calculated from five pXRF readings for each bracelet. Error bars show one standard deviation.

mkporo manillas display much greater variation in their composition and tend to show lower levels of lead. The “pre-contact” manilla from Igbo-Ukwu, meanwhile, clusters suspiciously closely to several mkporo-type manillas on both the PCA and the ternary diagram, further calling into question its tenth century provenance. Regardless of its age, though, if the “pre-contact” manilla was indeed produced in West Africa, then its similarity to the mkporos could instead indicate that the "mkporo" designation indicates production within West Africa. This is supported by the similarity between the mkporos and the one King manilla included in the statistical analyses: since the King manilla is known to have been produced in southern Nigeria near the end of the nineteenth century, the fact that it clusters with the mkporos lends strength to the hypothesis that mkporo manillas may have been produced in West Africa as well. Either way, these initial results suggest that "mkporos" deserve their own category in the Denk typology. Indeed, on this note, the "Kongo manillas" discussed above — typified by large, thick bodies and undecorated ends (**Figure 2**) — may also represent an important new category. Or, at the very least, they seem to be worth investigating via further composition analysis. However, they also appear to split into two distinct groups along the right hand side of the ternary diagram, with accession numbers 192 through 195 (see **Figure 1** above for reference) clustering in the bottom-right corner, and accession numbers 196 to 200 exhibiting much greater variation in lead concentration. These groups are also visible along PC2 in the PCA: when nonparametric density contours are drawn around the YUAG manillas on a two-dimensional scatter plot of the first two principal components, the two clusters separate out at about the 50 percent interval, indicating a noteworthy (if not exactly clear-cut) division. From a common-sense perspective, these two groupings within the composition data also make sense visually. Specimens 192-195 are smaller and slightly more circular, with less variation in size (average diameter = 6.16 cm; $\sigma = 0.134$), while specimens 196-200 are larger, more elliptical, and more varied in their shape and size (average diameter = 6.95 cm; $\sigma = 0.576$). Specimens 196-200 are also more heavily corroded, raising the possibility of a different provenance, or at least a different use-history.

Several attempts have already been made by European authors at categorizing different types of Birmingham-style manillas.[52,54] One such example, a typology assembled by the Swedish amateur ethnographer Sven-Olof Johansson, might be useful here.[47] YUAG specimens 192-195 are very visually similar to what Johansson calls "okpohos", a small currency manilla used widely throughout British colonial West Africa. Specimens 196-200, meanwhile, are much closer to what Johansson calls "onoudus", an oval-shaped bracelet most common in modern-day Cross-River state, in southern Nigeria.

Interestingly, when the PCA plot is color-coded by origin (**Figure 6**), the okpoho group (specimens 192-195) cluster quite closely with several mid-nineteenth century Birmingham manillas from the wreck of a British ship off the coast of the Scilly Islands in 1843 (the group falls within the 60 percent interval when the entire dataset is used to generate nonparametric density contours).[†††] The onoudu group, however (YUAG specimens 196-200), do not seem to cluster within any of the specimens from previous studies, and indeed exhibit a much larger amount of diversity among themselves. While this difference could be due to their worse preservation (as mentioned above, they are clearly more corroded than the manillas in the okpoho group), the slight variety in their shape and size suggest that it may also be due to different production histories.

With these general observations in mind, it is possible to return to the nine YUAG manillas. They cluster with the other Birmingham manillas in the PCA, the ternary plot and the bar graphs in **Figure 8**, as expected based on their shape and size — within the parameters of the Denk typology, they are definitely "Birmingham" manillas.

## DISCUSSION AND CONCLUSIONS

Following the initial analysis described above, in the interest of identifying a precise production location for the nine YUAG manillas, a spatial analysis was also undertaken. To start, all manillas with known provenance were plotted as points in ArcGIS Pro, along with their lead and zinc concentrations. The ArcGIS inverse distance weighting (IDW) function was then used to interpolate likely lead and zinc concentrations for hypothetical manillas produced in those areas (i.e. "landscape maps" for lead and zinc). While it should not be assumed that there is any sort of predictable correlation between production location and manilla composition over vast distances (it would not be possible, for instance, to interpolate expected lead concentrations for manillas in Senegal based only on those in Bende), an interpolation can at least be used to visualize places where the sampled manillas were most similar to those from the YUAG. Several IDW models were tested; a second-order polynomial, with a cell size of 10 $km^2$, generated the least discrepancy between known and interpolated concentration values for the manillas with known production locations (the discrepancy between actual and predicted values for this model was 4.02 percent for lead, and 0.680 percent for zinc).

**Figure 9** shows the result of the IDW analysis: the only spot where the interpolated values for both lead and zinc match the observed range of concentrations for those elements in the YUAG manillas is in northwest England, near Liverpool, where the *Douro* is thought to have sourced its manillas before sinking in 1843.[101] This makes sense — as mentioned above, YUAG specimens 192-195 cluster with the manillas from the *Douro* wreck in the PCA plot (particularly specimen 193, whose composition

††† From the perspective of PC1 on the PCA plot, the okpoho group (specimens 192-195) also appears to cluster quite closely with manillas recovered from a much earlier wreck (from 1717) off the coast of Cape Cod, in Massachusetts. But when the raw composition data is considered — e.g. in the lower bar graph in **Figure 10** — the manillas from the Cape Cod wreck are revealed to be quite different from their YUAG counterparts.

matches the average element concentrations in the *Douro* manillas almost exactly). The *Douro* sank off the coast of the Scilly Islands on the night of Thursday, January 26, 1843. According to contemporary newspaper reports, the ship was sailing from its home port of Liverpool to Porto, Portugal, apparently as the first leg on a longer voyage to West Africa.[101,102] The wreck was discovered by amateur divers from the Scilly Islands in 1972, when they reported finding hundreds of manillas.[15] Many of these ended up in private collections across England;[103,104] it is not an impossible leap to imagine that some of the manillas in the YUAG collections could even have come from this shipwreck.

| YUAG Accession Number | Average wt% (standard deviation in parenthesis) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cu | Pb | Al | Sn | Sb | Fe | Zn | Ca | As | S |
| **2010.6.192** | 62.1 (2.3) | 15.7 (1.2) | 0.5 (0.2) | 3.6 (0.2) | 5.6 (0.2) | 0.3 (0.2) | 0.4 (0.02) | 4.7 (0.5) | 0.6 (0.1) | 3.5 (0.5) |
| **2010.6.193** | 43.2 (5.0) | 29.4 (1.8) | 0.2 (0.04) | 0.9 (0.2) | 8.9 (2.3) | 1.6 (1.1) | 0.1 (0.02) | 4.7 (1.3) | 1.1 (0.4) | 7.0 (0.5) |
| **2010.6.194** | 58.6 (14.1) | 11.9 (2.3) | 0.9 (0.4) | 0.04 (0.01) | 6.7 (1.6) | 0.1 (0.02) | 0.1 (0.03) | 3.5 (0.8) | 0.4 (0.2) | 2.5 (0.5) |
| **2010.6.195** | 65.4 (4.9) | 15.0 (3.2) | 1.0 (0.1) | 2.2 (0.3) | 4.6 (0.5) | 0.2 (0.1) | 0.5 (0.03) | 3.1 (0.4) | 0.3 (0.2) | 3.4 (0.5) |
| **2010.6.196** | 39.8 (18.2) | 32.3 (10.2) | Not detected | 0.7 (0.2) | 0.1 (0.02) | 0.8 (0.3) | 0.1 (0.1) | 0.6 (0.2) | 3.1 (1.0) | 6.9 (1.1) |
| **2010.6.197** | 47.6 (7.1) | 34.6 (6.9) | 0.5 (0.4) | 2.1 (0.6) | 0.4 (0.1) | 3.3 (1.3) | 0.1 (0.02) | 0.8 (0.3) | 1.6 (0.6) | 6.7 (0.9) |
| **2010.6.198** | 34.7 (15.9) | 27.0 (1.3) | 0.5 (0.2) | 10.7 (2.4) | 0.6 (0.2) | 0.9 (0.4) | 0.1 (0.1) | 2.1 (0.5) | 1.5 (0.3) | 5.5 (1.2) |
| **2010.6.199** | 32.1 (9.3) | 28.9 (9.0) | 0.6 (0.2) | 11.2 (2.0) | 0.4 (0.1) | 4.8 (3.2) | 0.1 (0.1) | 3.0 (1.2) | 1.5 (0.5) | 5.8 (1.8) |
| **2010.6.200** | 29.1 (11.1) | 23.6 (3.4) | 0.7 (0.3) | 12.0 (3.3) | 0.9 (0.3) | 4.2 (2.0) | 0.1 (0.03) | 3.1 (0.5) | 4.1 (1.2) | 5.5 (0.8) |

**Table 2.** PXRF data for the nine YUAG manillas. Listed weight percents are averages of the five measurements taken for each bracelet.

The map in **Figure 9** is not meant to be exact, of course. Precise sourcing of manilla production locations within England is difficult, and the coverage provided by the database is quite thin for an IDW analysis (fewer than 70 of the 153 manillas had known production locations, and the accuracy of interpolated values generally tends to decrease with fewer or less well-distributed reference points). A more holistic sourcing attempt would arguably also involve lead isotope analysis, a destructive sampling

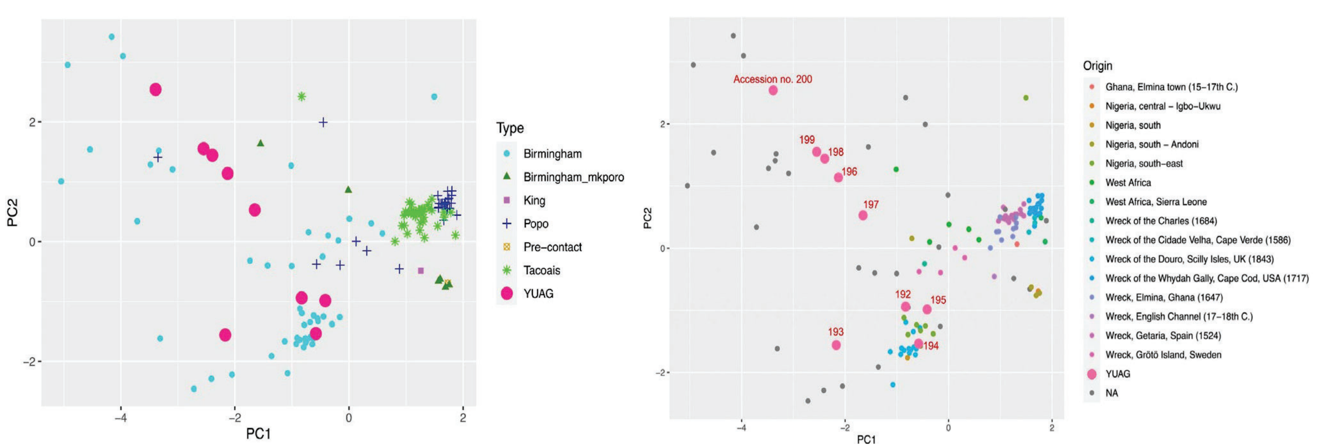


**Figure 6.** Plot of the first two principal components from a PCA of composition data from the nine YUAG manillas and 130 others. The PCA included weight percentages for As, Cu, Pb, Sb, Sn and Zn. Left: points coded by type; right: same PCA plot, but with points coded by provenance. The YUAG manillas in the bottom plot are labeled with their accession number.

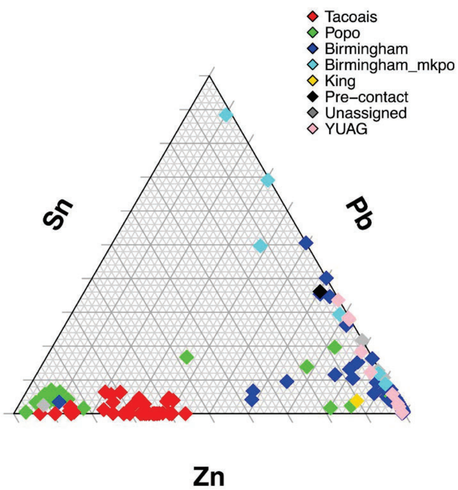


**Figure 7.** Ternary diagram relating concentrations of Pb, Sn and Zn in the nine YUAG manillas and 130 others. These three elements were on average the most abundant across all 162 specimens (other than copper).

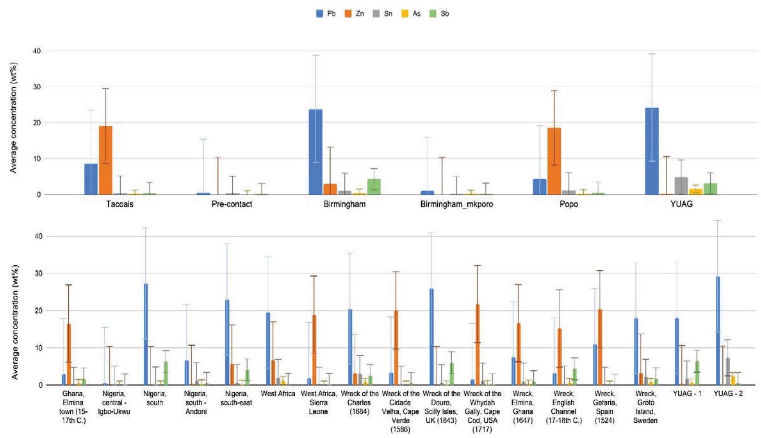


**Figure 8.** Bar graphs comparing the average composition of the nine YUAG manillas to manillas from previous studies. Top: manillas grouped by typology; bottom: grouped by provenance. Error bars show one standard deviation. The "YUAG 1" and "YUAG 2" groups in the bottom plot refer to the two groups visible along PC2 in the PCA plot in Figure 8 above (YUAG 1 = specimens 192-195; YUAG 2 = specimens 196-200).

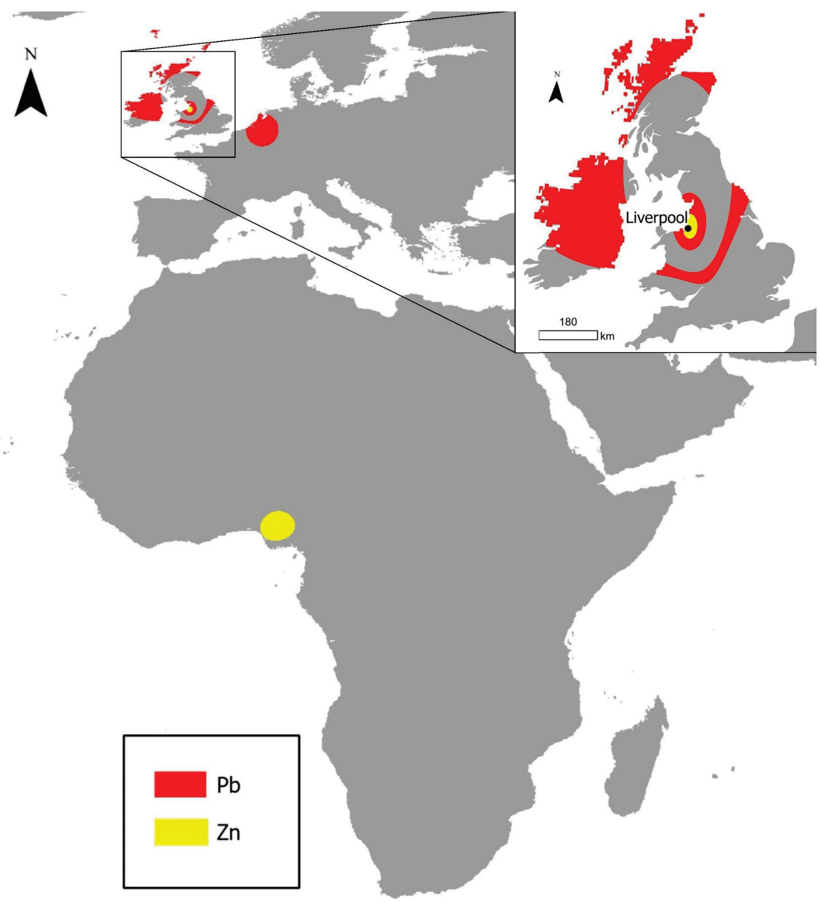


**Figure 9.** Places where the metal used in manilla production was likely to have had compositions falling within the range exhibited by the nine YUAG manillas. Pb and Zn maps were interpolated based on manillas from previous studies with known Pb and Zn concentrations and known production locations (n = 68), using inverse distance weighting (IDW), with a second order polynomial.

technique not permitted by the YUAG's collection policies. All lead isotopes except $^{204}Pb$ are radiogenic; the fractionation of lead isotopes in a sample of archaeological metal (usually measured via mass spectrometry of lead sulfide, precipitated from a small amount of swarf) can thus describe the geologic age of the original ore. By comparing lead isotope ratios in the manillas to lead isotope ratios in British ore deposits known to have been used during the nineteenth century, one could in theory pinpoint the geographic source of the metal used to cast the bracelets and, from there, use primary sources to reconstruct a geography of their production. Skowronek et al. recently employed this method for a large collection of manillas, including several Birmingham-type bracelets with known provenance.[15] A comparison between those lead isotope data and data from the YUAG manillas could be particularly fruitful.

Nonetheless, when the IDW analysis in **Figure 9** above is taken together with the stylistic attributes and weight percentage concentrations of YUAG specimens 192-195, the map is at least a useful tool in envisioning a possible provenance for some of the YUAG's manilla bracelets.

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## ABOUT THE STUDENT AUTHOR

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## PRESS SUMMARY

Metal, horseshoe-shaped bracelets known as manillas emerged during the early modern period (ca. fifteenth century AD) as a form of currency between western Europe and West Africa, and these items continued to circulate on both continents until the early twentieth century. Today, narratives about the bracelets abound. For some, they are most significant as the unofficial blood money of the transatlantic slave trade. For others, they are even more significant as the copper source used to make famous works of West African art, such as the Benin Bronzes. Meanwhile, still others uphold the manilla as a symbolically important form of West African jewelry in and of itself. In this article, we offer a history of the manilla, from its rapid proliferation to its eventual obsolescence. We propose that the term "metastasizing symbol" can be utilized to describe objects such as the manilla, whose propagation is underwritten by unsustainable systems of cultural difference and, thereby, contains within itself the seeds for the object's transition to disuse. Using X-ray fluorescence (XRF) data from nine manillas at the Yale University Art Gallery, we also demonstrate how chemical analysis can be used to augment the socio-cultural geography of the manilla.