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INTRODUCTION

Igbo-Ukwu at 50: A Symposium on Recent Archaeological Research and Analysis

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Abstract As an introduction to several papers from the "Igbo-Ukwu at 50" symposium in September 2021, this article reviews the history of the discoveries and excavations, the early debates over chronology, and more recent research contributions that refine and expand our understanding of this unique site. These include new field investigations at Igbo Ukwu, new radiocarbon dates, textile analysis, chemical analyses of glass, and carnelian beads plus lead isotope analyses of leaded bronze and copper artifacts to identify source areas, and metallographic studies.

Résumé Comme introduction à plusieurs articles du symposium "Igbo-Ukwu at 50" en septembre 2021, cet article passe en revue l'histoire des découvertes et des fouilles, les premiers débats sur la chronologie et les contributions de recherche plus récentes qui affinent et élargissent notre compréhension de ce site unique. Il s'agit notamment de nouvelles enquêtes sur le terrain à Igbo-Ukwu, de nouvelles datations au radiocarbone, d'analyses textiles, d'analyses chimiques de perles de verre et de cornaline ainsi que d'études métallographiques et d'analyses isotopiques du plomb d'artefacts en bronze au plomb et en cuivre pour identifier les zones sources.

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This issue presents several papers emerging from the symposium "Igbo-Ukwu at 50" at the Society of Africanist Archaeologists (SAfA) 2021 biennial meetings. Originally scheduled for 2020, but postponed by the COVID-19 pandemic, the session commemorated the 50th anniversary of Thurstan Shaw's landmark 1970 publication of his excavations at Igbo-Ukwu. Even after the passage of five decades, the site remains one of the most iconic, enigmatic, and sumptuous sites ever documented in West Africa. Its astonishing corpus of 75 kg of copper and bronze artifacts, many displaying "strange rococo, almost Fabergé-like virtuosity" (Fagg, 1963, p. 40), plus over 165,000 glass and carnelian beads, has generated decades of debate on the possible origins of these materials and their technology and likely chronology. Shaw's meticulous attention to excavation and description and curation of excavated materials has been central to the possibility of meaningful re-study and analysis of the Igbo-Ukwu corpus. The symposium focused on recent archaeological, archaeometric, radiometric, and analytic studies that advance our understanding of the context and connections of Igbo-Ukwu, and provide insights into its local and global intersections. While not all the presenters submitted their papers, I include references to their contributions; readers can

access the archived presentations from this session on the SAfA YouTube channel (https://youtu.be/rzb0UTLQOww).

Brief Overview of Discoveries at Igbo-Ukwu and the Material Corpus

The earliest known unearthing of material from Igbo-Ukwu dates to 1938, when Isaiah Anozie was digging a water cistern at his compound (Fig. 1). He recovered a number of stunning bronze vessels and ornaments, some of which were subsequently dispersed among neighbors. Several months later, Mr. J. O. Field, Assistant District Officer for the area, heard of the discovery and purchased several of the bronzes from Anozie (Field, 1940; Shaw, 1960, 1973). Other bronzes also presumed to be from Isaiah Anozie's compound were collected by District Officer F. W. Carpenter in 1939 and Surveyor of Antiquities Kenneth Murray in 1944 and 1954 (for the registration numbers and location of these artifacts at that time, see Shaw, 1970, p. 18). Field's collection was presented to the Nigerian Department of Antiquities when it was established in 1946 and accessioned by the National Museum Lagos. A few objects collected by Carpenter were given to the British Museum (for the history of these accessions, see Wang et al., this issue). As Shaw (1960, p. 162) noted, the entire corpus was "utterly unlike the work of either Benin or Ife … their age and affinities and the reason for their burial in the ground remained…a mystery." To shed some light on this, Shaw was invited in 1958 by the Nigerian Department of Antiquities to excavate. From November 1959 to February 1960, Shaw excavated in Isaiah Anozie's compound (Igbo Isaiah), adjacent to the area where the 1938 digging was located, as well as in Richard Anozie's neighboring compound (Igbo Richard) where cistern digging had also previously turned up metal artifacts (Fig. 2).

Excavation in Igbo Isaiah revealed a mass of bronze, copper, ceramic, and glass artifacts resting in situ 40–70 cm below the surface. These had been protected from disturbance by an overlying compound wall that was removed just before excavation commenced. The similarity of these finds to the 1938 finds, which were encountered at the same depth, led to the conclusion that all had been originally gathered in a single context. Shaw (1970, p. 263; Shaw, 1977) suggested that it was a storehouse or shrine for ritual

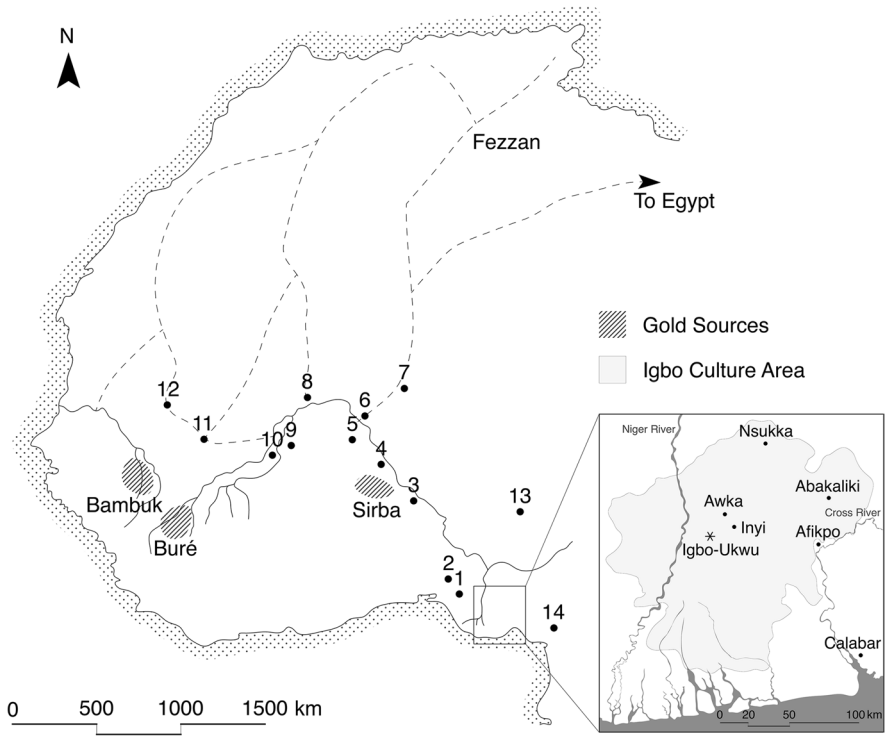

Fig. 1 Igbo Ukwu and Igboland (inset) with sites mentioned in the text and early trans-Saharan trade routes. Numbered sites: 1. Benin City; 2. Ile-Ife; 3. Birnin Lafiya; 4. Bura; 5. Kissi; 6. Gao; 7. Essouk-Tadmekka; 8. Timbuktu; 9. Douro-boro; 10. Jenné-jeno; 11. Kumbi Saleh; 12. Awdaghost/Tegdaoust; 13. Nok; 14. Lake Barombi

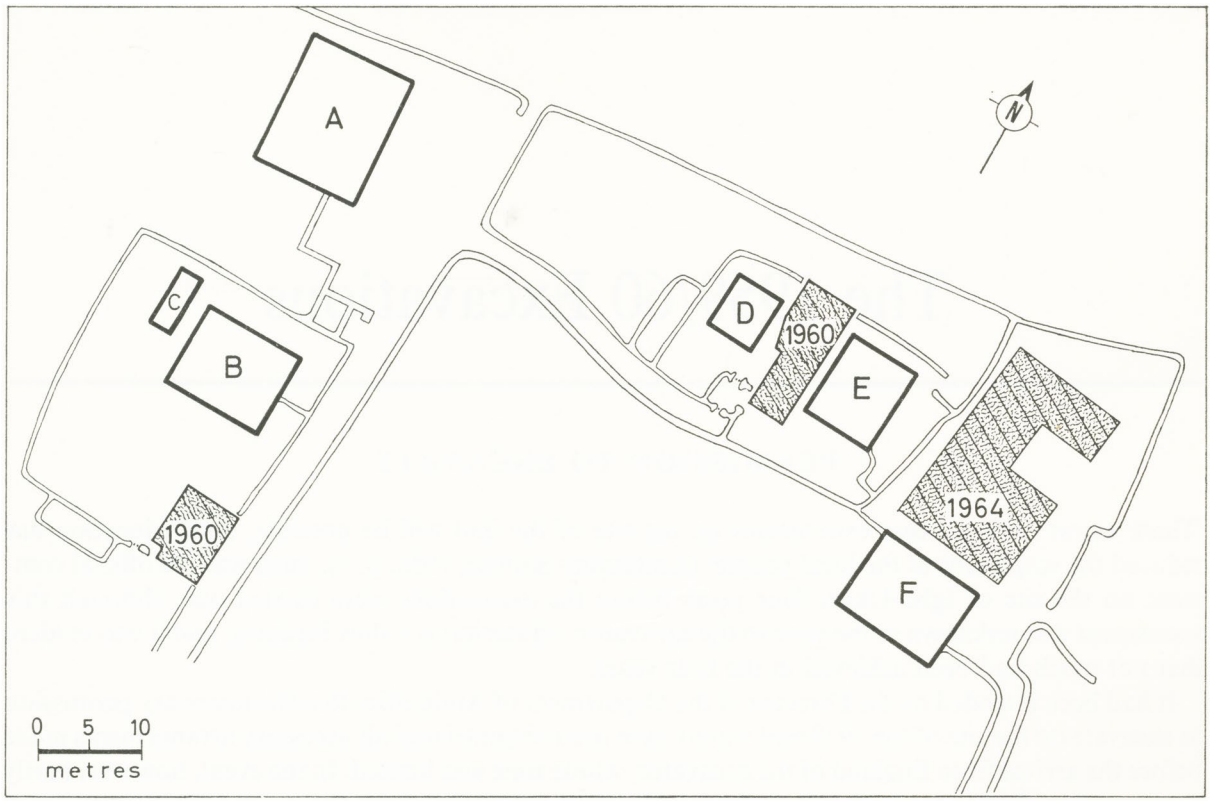

Fig. 2 The Anozie compound in Igbo-Ukwu, showing the locations (shaded) of Shaw's excavations in 1960: Igbo Richard (left), Igbo Isaiah (center), and Igbo Jonah (right). Originally published in Shaw (1970, Fig. 2); reproduction courtesy of P. J. Smith and the Thurstan Shaw Estate

or ceremonial objects and regalia. The sheer mass of material is astonishing—over 64 kg of cast bronze and smithed copper, plus over 63,000 glass and carnelian beads (Table 1).

Table 1 Counts of copper/alloy artifacts and beads from Igbo-Ukwu (from Shaw, 1970, p. 106–7, 297–8, 314–5)

Copper and bronze	Igbo Isaiah	Igbo Richard	Igbo Jonah
Receptacles	25	–	–
Spiral bosses and handles	148	12	2
Pendants, anklets, wristlets, belt	64	18	35
Crotals, bells, chains, chain links	> 250	–	4
Staff heads, ornaments	13	1	6
Crown, associated Cu plates and pectoral		8	–
Weapons (scabbards, hilts)	9	2	–
Fan Holder		1	–
Wood Stool with Cu spiral bosses		1	–
Miscellaneous (wires, bars, fragments, brackets)	18 + many wire pieces	7	42
Approximate total weight	64 kg	8 kg	2 kg
Carnelian beads	11,192	3651	0
Glass beads	52,266	98,654	3

In Igbo Richard, some 30 m to the southwest, an excavation unit measuring 5 m × 7 m encountered several cisterns and pits, plus a concentration of broken pots. In the southeast corner, between 1.75 m and 2.5 m depth, Shaw recovered human bone from several individuals and associated beads and two bronze bracelets. Sixty centimeters below these, in the same area, was a rich set of artifacts associated with bones from a single individual who was apparently interred seated upright on a wooden stool at a depth of 3.5 m. In light of the extravagant personal adornment, including beaded wristlets and anklets, a pectoral, and a copper crown or diadem (Table 1), this has been variously interpreted as the burial of a priest-king analogous to the current and historical office of Eze Nri (Ray, 1988; Shaw, 1970, 1977), a wealthy Ozo man or Okpala title holder (Okpoko, cited in Ray, 1988, p.101; Onwuejeugwu, cited in Shaw, 1977, p. 99), or some other person of ritual importance. Again, notwithstanding the difference of opinion on specifics, all interpret the burial within a framework of Igbo prestige burial, whether Eze Nri or other title.

Igbo Jonah, the third and last unit excavated (1964), was also the largest at approximately 19 m × 11 m. Yet, it produced the smallest amount of Igbo-Ukwu-type material, most of it contained in an ancient pit cut into by a more recent pit. The ancient pit yielded a brilliant example of Igbo-Ukwu ritual pottery with its characteristic deeply sculptural surface treatment of concentric circles and various animals, but it also contained charcoal, animal bone (mostly wild), and some bronzes consistent with the style found in the other two excavations. The circumstance of deposition is difficult to interpret, but the pit may have been dug expressly to deposit ritual material (Shaw, 1977, p. 69).

The sheer quantity of copper and bronze from a single site, not to mention the extravagant number of beads, remains unique in West African archaeology even after five decades. The intricacy and virtuosity of the cast bronzes still astonish. Writing in the 1960s, Shaw had no local archaeological sequences to provide a broader context for Igbo-Ukwu. Nor was anything known of the movement of metals or other trade goods in the forest before the arrival of Europeans on the Guinea coast in the fifteenth century. The chronology of Igbo-Ukwu was initially a matter of speculation: "perhaps a date in the sixteenth or seventeenth century is most likely, but we must be prepared to modify this guess if an earlier or later date is indicated by further…work" (Shaw, 1960, p. 165).

The publication of five radiocarbon dates in 1970 did not fully resolve the issue of chronology. One of these dates was on wood from the stool in Igbo Richard; the other four were on composite charcoal samples from two pit features in Igbo Jonah. The charcoal samples from Igbo Isaiah were destroyed when a laboratory apparatus malfunctioned. Four of the dates clustered tightly between 1075 and 1110 BP (each with a large standard error between ± 110 and ± 145, as was common in the early decades of radiocarbon dating). One of the Igbo Jonah dates was notably late (505 ± 70 BP) (Shaw, 1970, p. 260). Based on the then-widespread assumption that radiocarbon and calendar years were approximately the same, Shaw considered that the four clustered dates exhibited a "striking congruence…in the ninth century AD" with the fifth date an "odd man out in the fifteenth" (Shaw, 1970, p. 260; Shaw, 1975 attributed the later date to contamination by more recent charcoal from a modern pit that intruded into the ancient pit). Surprised by the opposition to the early dates by some historians, archaeologists, and especially the art historian Babatunde Lawal (1973), Shaw (1975) systematically examined their objections and judiciously countered nearly all of them. He acknowledged that the lack of evidence at that time for long-distance trade as early as the ninth century in West Africa was not congruent with the large number of glass trade beads and copper (for which no local source was known to Shaw at the time), but noted that "the question will only be settled with the acquisition of more archaeological evidence" (Shaw, 1975, p. 515, 517).

In his 1975 and 1977 discussions of the radiocarbon dates, Shaw acknowledged the development of dendrochronological calibration and the statistical importance of the standard error, which combined to produce a range of the seventh to twelfth centuries for the four early dates, with a one in twenty chance (at 2 s.d.) that each of the four radiocarbon dates might fall outside that extensive range. Nevertheless, the ninth century date, rather than the full 2-sigma date range, is still commonly cited as the date of Igbo-Ukwu. The significance of this date was summarized by the prominent Igbo historian, A.E. Afigbo (1996, p. 10):

> "The most critical of [Shaw's] contributions lay in the return of a ninth century A.D. radio-

carbon date for the artifacts from Igbo-Ukwu, the association of the artifacts with an extant Igbo group, the Nri, and the demonstration of the artistic beauty and technological ingenuity associated with the finds. Since the above date made Igbo-Ukwu about three or four centuries earlier than the date accepted for Ife and Benin, it threw theorizing on the culture history of Southern Nigeria as a whole into the melting pot."

Afigbo (1996) outlined the dominance of Ife-Benin in the historiography of Nigeria in the 1950s and 1960s. The Ife-Benin axis was commonly identified as the source of migrations and the introduction of advanced cultural elements such as bronze-casting and title-taking in the lower Niger region. The publication of *Igbo-Ukwu* (Shaw, 1970) and the chronological distance that the radiocarbon dates appeared to create between received notions of Igbo and Yoruba-Edo history took on profound significance at the end of the four-year Nigerian civil war in 1970. Igbo-Ukwu gave impetus to an Igbo-centered historiography and provided a cultural rallying point in the post-civil war period. The 1970s saw renewed scholarship on Igbo history, culture, and sociopolitical organization that dramatically reshaped the earlier, colonial narratives for Nigerian history and prehistory. It energized and expanded archaeological, ethnographic, and historical studies in the lower Niger and "released the bottled-up intellectual capital of central-south Nigeria" (Afigbo, 1996, p. 10). Important new studies of lower Niger material culture, technology, and archaeology were published in the 1970s and 1980s (e.g., Alagoa et al., 1988; Anozie, 1985; Chikwendu & Umeji, 1979; Craddock, 1985; Hartle, 1980; Neaher, 1976b, 1979a, 1979b; Nicklin, 1982; Nzewunwa, 1980; Okpoko, 1984; Onwuejeogwu, 1981; Ray, 1987). Many of the more recent investigations reported in this special issue build on those foundations.

New Chronological Considerations

New radiocarbon dates reported in this issue provide insights into the chronology of Igbo-Ukwu. The chronology of the Igbo Isaiah shrine deposit has been significantly clarified by the AMS dating of a textile fragment to the eleventh/twelfth century CE, as reported by McIntosh and Cartwright (this issue). It opens the possibility that some or all of the Igbo Isaiah bronzes and beads are somewhat younger than previously believed, but certainly pre-date European coastal contact by several centuries. The recent excavations by Daraojimba et al. (this issue) produced three radiocarbon dates ranging from the tenth to the thirteenth centuries CE for deposits containing pottery with the elaborate, grooved decoration and bifid (grooved) lip characteristic of early Igbo-Ukwu, further affirming a chronology at the upper end of the date range for Shaw's (1970 dates. These dates do not, of course, narrow the date range for the Igbo Richard burial, or illuminate the key question of its temporal relationship to Igbo Isaiah and Igbo Jonah. Until now, there has been a tendency in the literature to regard the three sites as contemporaneous. However, the new dates reported by Daraojimba et al. (this issue) suggest that Igbo-Ukwu may have been in use for several centuries. Keith Ray's careful reconsideration of depositional events and sequences (this issue) likewise signals "cultural dispositions over an extended time period," while acknowledging that some elements in the three sites are undoubtedly contemporaneous.

Shaw (1970, p. 257) recognized that the differences in the pottery from his three sites could reflect functional or chronological differences. At Igbo Richard, the deposits in a cistern dug within recent memory (Nwangwu's cistern) contained modern trash, permitting Shaw to identify the vessel forms and decoration of the recent pottery assemblage, which differed significantly from the elaborately decorated ware in early contexts there and at the other two sites.

The distinctiveness of the two assemblages can be clearly seen in Shaw's (1970) "Appendix VII: Find-places of pottery, by types." The early contexts are dominated by water pots (groups A1-A8) with everted, bifid rims, narrow necks, and a variety of incised, comb dragged, and fingertip impression, in some cases on cordons applied at the neck; these contexts are also characterized by deeply everted, bifid-rim bowls/jars (Group C) with deeply incised, parallel grooving in motifs that include concentric circles or ovals, spirals, straight or alternating angled fields, and bosses and other appliqué motifs (Shaw, 1970, p. 207). The late assemblage is dominated by cooking pots and bowls with carinated, ledged, and thickened rims (Groups B1b-d, B3, B4, and B8) and decorations

with roulette or netting, often accompanied by grooving (Fig. 3). Bifid rims are present in only one B group (B1a-i) and only two of these were registered. The late assemblage from Nwangwu's cistern includes six sherds of deeply grooved C1a pottery at different levels, raising the question of whether these represent the mixing of earlier material as the cistern was filled, or whether a tradition of grooved decoration persisted at Igbo-Ukwu over time. High relief grooved motifs such as concentric circles are present on Igbo ritual vessels collected in the twentieth century by Leith-Ross and Jeffreys (see Cole & Aniakor, 1984, p. 8–9). These decorative techniques are still used by potters in Inyi, as Ibeanu (1989) reported, leading him to propose that the pots at Igbo-Ukwu were manufactured there. Ray's survey of available information on Igbo pottery from a variety of sources (Ray, 1988, p. 209), including his own field observations and visits to regional potting centers, resulted in a distribution map of numerous centers where elaborate ritual and prestige pots continued to be produced by Igbo potters into the twentieth century.

As Ray (1988, p. 214) noted, the question of comparability between Igbo-Ukwu early ware and more recent, elaborately decorated pottery still needs to be addressed, with the goal of identifying spatial and temporal variations. This will require systematic analysis to generate data sets that can be compared across and within different sites with well-contextualized radiocarbon chronologies. Very few excavations of pre-fifteenth century sites in southeast Nigeria have produced detailed description and illustration of the recovered pottery (but see Chikwendu, 1998; Okpoko, 1984). Daraojimba et al. (this issue) illustrate one approach to a recording system that (1) facilitates intra- and inter-site comparison of formal variables of paste, firing, form, and decoration, and (2) permits statistical analysis of co-occurrence of diverse attribute states of those variables and avoids the "tyranny of typologies" (Boozer, 2014). Daraojimba et al. also illustrate the need for compositional analyses to identify whether different production centers were providing wares to Igbo-Ukwu centuries ago. An expanded compositional study going forward could usefully analyze clays from different historical potting centers to determine to what extent these can be differentiated, either by chemical composition or mineral constituents. While the use of grooving and concentric circles may provide evidence for historical relationships linking early Igbo-Ukwu and recent Igbo ritual/ceremonial pottery, these motifs do not, by themselves, provide diagnostic evidence for either the distribution of early Igbo-Ukwu culture or ostensible "intense local interactions" between Igbo-Ukwu and other sites in the ninth and tenth centuries (Okpoko & Ibeanu, 2005, p. 190–191). In most cases, the pottery claimed to be comparable is undated. For insights into Igbo-Ukwu's interactions and influence, we need "above all…excavation of more ordinary sites of the same date" (Shaw, 1995, p. 79), and full analysis and publication of the results. It is possible that early Igbo-Ukwu pottery was created and used primarily in ritual/ceremonial contexts, and we have yet to identify contemporaneous domestic pottery.

Sorting out temporal sequences and relationships going forward will depend on the ability to identify individual deposition contexts, especially if they are intrusive, such as pits. The forest soils do not

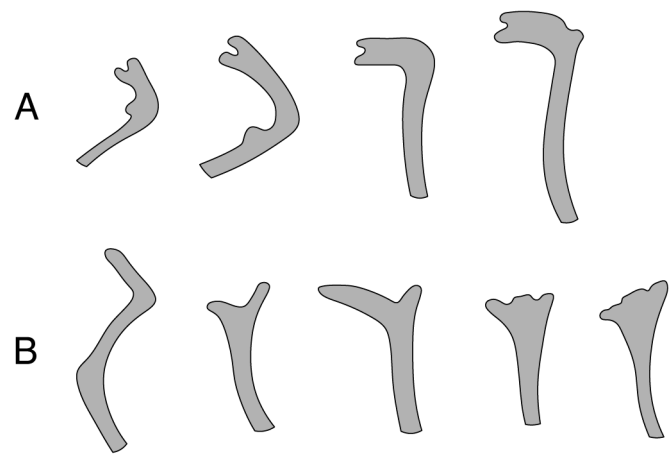

Fig. 3 Rim profiles of Shaw's Groups A and C pottery associated with early deposits and Group B pottery from recent cistern fill

facilitate this, as Shaw (1970, p. 53, 56) noted, and Daraojimba et al. (this issue) acknowledge. Primary contexts (e.g., the ritual deposit at Igbo Isaiah, the burial at Igbo Richard) were outnumbered by secondary contexts (e.g., cistern and various other pit fills) in Shaw's excavations. Primary use and deposition contexts could not be identified with any certainty by Daraojimba et al. but their program of shovel testing and targeted excavation represents an important initial step in understanding the spatial layout and character of Igbo-Ukwu beyond the Anozie compound. Ray (this issue) notes the significance of pits dug into areas otherwise devoid of cultural features (e.g., Igbo Jonah)—these signal the existence of spaces without occupied structures. He provides a thought-provoking view of Igbo-Ukwu as a dynamic space of recurrent ritual activity, involving complex depositional processes and timescales.

For the question of Igbo-Ukwu's precursors, however, we effectively lack any temporal sequence for a site with material culture closely related to Igbo-Ukwu extending back into the second half of the first millennium CE. Two sites excavated by Ekpo Eyo in Calabar have elaborately decorated pottery with grooved concentric circle motifs, and date to between the sixth and tenth centuries cal CE (Slogar, 2007). However, vessel forms and other decorative elements are very different from those at Igbo-Ukwu. Convincing precursors to Igbo-Ukwu's distinctive material culture in bronze and pottery have yet to be identified.

Forest Ecosystem Dynamics and Demographic Change

The number of other sites in the Nigerian forest that have produced definite first millennium CE radiocarbon dates is exceptionally small and contrasts noticeably with the number of first millennium BCE and second millennium CE dates. To be sure, later sites that have attracted particular interest (e.g., Benin City, Ile-Ife) have generated a disproportionate number of the second millennium CE dates. However, in research programs devoted to regional sequences, a first millennium CE gap is present: In the Niger Delta, excavations at six sites secured 32 radiocarbon dates, of which 28 had all of their 2-sigma range in the second millennium CE; two of the rest were in the early to mid-first millennium CE (Nzewunwa, 1980, 1983). In northern Igboland, excavations on four iron smelting sites produced radiocarbon dates between 500 and 200 BCE for early smelting, and the ninth/tenth century CE and onward for later smelting (Daniel et al., 2022; Eze-Uzomaka, 2013; Okafor, 1993). Elsewhere in Igboland, relatively few site investigations have included radiocarbon dating, but of those, early iron-using sites cluster in the first millennium BCE, and later Iron Age sites produced dates in the second millennium CE. The lone potential first millennium date, from Ugwuagu Village site (Afikpo), has a standard error of ± 150, and calibrates at 95.2% to 534–1125 CE; four other dates for the site are thirteenth–sixteenth century cal CE. (Chikwendu, 1998, p. 19–22). Although Afikpo has been cited as evidence that Igbo-Ukwu's "stylistic vocabulary" was established by the mid-first millennium CE (Okpoko & Ibeanu, 2005, p. 191), the Afikpo monograph does not identify or describe the apparently sparse pot sherds associated with that early date (Chikwendu, 1998, p. 51–87).

While the dearth of first millennium dates in southeastern Nigeria may be a sampling artifact of the small number of excavated and dated sites, we might also consider the growing archaeological evidence for population collapse in the rainforest of Western Central Africa (WCA) in the mid-first millennium CE (Saulieu et al., 2021; Seidensticker et al., 2021). Extensive, long-term archaeological investigations in the Cameroonian and Congo Basin rainforest have made possible a georeferenced database of over 1100 radiocarbon dates associated with recognized pottery styles at hundreds of sites dating to the past 4000 years. After a period of marked demographic expansion in the first millennium BCE and maximal site activity early in the first millennium CE, population density in most regions declined dramatically between 400 and 600 CE. This "boom and bust" pattern seems to track vegetation changes that point to fragmentation of the rainforest in the first millennium BCE and its gradual re-establishment in the first centuries CE (Nash et al., 2016). The expansion of forest-savanna mosaic would favor oil palm and agriculture, leading to population increase. Population decline occurred as mature rainforest was again in place, though there is no clear explanation of why forest clearance would not have been maintained. There is ongoing debate as to whether the source of

the forest disruption was climatic (Maley & Brenac, 1998; Maley et al., 2018) or anthropogenic (Garcin et al., 2018); proxy data from Lake Barombi cores in southwest Cameroon are integral to both sides in the debate. There is some evidence for a similar vegetation sequence at Obayi Lake, Nsukka, with recovery of the rainforest beginning in the first to third century CE, but the sequence is otherwise not well dated (Njokuocha, 2012). Demographic expansion in WCA resumed circa 900–1000 CE, possibly influenced by a drying trend associated with the Medieval Climate Anomaly dating to 900–1250 CE (Seidensticker et al., 2021, p. 7).

Whether climate or human activity was the main source of forest fragmentation, population movements were potentially involved. The rapid and broadly contemporaneous spread of iron into diverse regions throughout West Africa in the first millennium BCE suggests either population mobility, effective interaction networks, or both. It was accompanied by demographic growth, which continued as the rainforest re-established itself in the early centuries CE and then collapsed between 400 and 600 CE. The cause(s) of the collapse is (are) not known, but it was widespread throughout Western Central Africa. Did populations die out, or did they migrate elsewhere? We don't know the answer. But the primary question here is: Did this demographic pattern affect the southeast Nigerian forest as well? As a possible alternative to the narrative of continuity of occupation since the Late Stone Age, what implications might this hold for the development of cultures and technologies in the later first millennium before Igbo-Ukwu makes its archaeological appearance? The first millennium *fin de siècle* may have been a time of dynamic mobility and interaction, and subject to a wide range of "panregional interconnections and cultural exchanges" (Ogundiran, 2005a, 2005b, p. 24), including migrations, trade relations, intermarriages, and ritual practices (Oriji, 2011). Certain cultural elements may have forest origins beyond Nigeria. For example, pottery assemblages in southwest Cameroon that date to the first centuries CE have several of the morphological and decorative elements present in early Igbo-Ukwu, including bifid, deeply everted rims, and grooving and cross-hatching as primary decorative motifs (Saulieu et al., 2017, p. 40–42).

Interaction and Exchange

The masses of glass and carnelian beads at Igbo-Ukwu have always been a potent clue to its participation in long-distance networks. Over the past two decades, a substantial database of glass bead chemical compositions and morphologies has provided rich insights into the reach of these networks and the chronology of the bead trade. The compositional analyses presented at the "Igbo-Ukwu at 50" session by Robertshaw et al. (2021) comprised 97 beads from among the excavated beads and selected by Marilee Wood to include different colors and bead types identified by Shaw (1970, p. 225–230), plus an additional seven beads selected by Tunde Babalola. A number of the beads are multicolored, and each color was analyzed separately, sometimes revealing more than one glass type in a single bead. Several different glass types were identified, some of which could be matched to known raw glass production areas based on chemical composition, while other source areas remain indeterminate. Additional elements were added as colorants or opacifiers in bead production workshops that may have used raw glass imported from elsewhere. In the same session, Fenn's (2021) glass bead presentation reported on lead isotope analysis aimed at identifying the ore sources for some of these added materials. The diversity of glass types and source areas of the raw glass and colorants used testifies to the complex, highly developed networks linking glass producers, bead makers, and consumers.

The most common glass among the 138 analytical results for Igbo-Ukwu beads is soda-lime glass produced using plant ash (vNaCa, $n=80$). Most of these were made from glass produced in Mesopotamia and more easterly areas in Iran, as well as the eastern Mediterranean. Lead colorants/opacifiers closely match the isotopic signatures of Iranian ores. Beads of this type were moving along an eastern Niger corridor route that included Essouk-Tadmekka, Gao, Kissi, Bura, Ile-Ife, and Igbo-Ukwu by the ninth/tenth century, if not earlier (Table 2). Exploitation of the Sirba gold deposits may have contributed to the development of this route. This supports Insoll and Shaw's (1997, p. 20) proposal that a "north–south route along the River Niger and via Gao" was a primary conduit for long-distance exchange at Igbo-Ukwu. Some of the beads

Table 2 Glass composition groups for analyzed beads from medieval West African sites: Essouk (Lankton et al., 2017a, 2017b; Nixon & Lankton, 2017); Kissi (Brill & Stapleton, 2012; Robertshaw et al., 2009); Bura (Magnavita, 2016); Ile-Ife (Babalola et al., 2018a; Davison, 1972); Igbo-Ukwu (Fenn et al., 2011); Kumbi Saleh (Davison, 1972); Jenné-jeno (Brill, 1995, 1999); and Douro-boro (Giachet et al., 2020)

Sites and dates CE	# analyzed	v-Na-Ca	m-Na-Ca	HLHA	Pb-Si	m-Na-Al	v-Na-Al
Essouk/Tadmekka	53						
900–1100 CE		x	x				
1100–1350 CE		x		x	x	x	x
Gao sites	100						
Eighth–tenth century		x	x	x			
Tenth–eleventh century		x	x	x	x		
Twelfth–fourteenth century		x		x		x	x
Kissi	53						
Early first millennium		x					
End first millennium		x		x			
Bura	8						
First millennium–eleventh century		x		x			
Ile-Ife	92						
Tenth–fifteenth century		x		x			
Igbo-Ukwu	97						
Between ninth and twelfth century		x	x	x		x	
Kumbi-Saleh	4						
Tenth–fourteenth century		x					
Jenne-jeno	8						
First millennium		x	x				
Early second millennium		x				x	
Douro-Boro	12						
Late first millennium		x					

matched the morphology and chemistry of southern African Zhizo-type beads, indicating their far-flung distribution (Dussubieux 2017). High aluminum glasses (HLHA and LLHA) comprise another group ($n=25$); these have a distinctive chemistry linked to a source area in and around Ile-Ife, Nigeria (Babalola et al., 2017, 2018a, 2018b; Lankton et al., 2006; Ogundiran & Ige, 2015). These beads became widely distributed along the eastern Niger route between the tenth and fifteenth centuries. HLHA and LLHA beads were not analyzed for lead isotopes.

Source areas for two other glass types have not been determined. Soda-lime glass fluxed with a mineral alkali (mNaCa, $n=12$) does not match the well-characterized mNaCa glasses produced in Egypt and Syro-Palestine using Egyptian natron. Fenn's initial analysis of strontium (Sr) and neodymium (Nd) isotopes in three of these beads does not provide a definitive match to known source areas, although North Africa (Sabra, Tunisia) is a possibility; the Lake Chad basin's natron deposits may suggest a possible West African source area, yet to be identified. Lead isotope analysis of colorants/opacifiers match Tunisian ores (Fenn et al., 2011). Samples of soda-aluminum glass (v/m/NaAl, $n=17$) are also of indeterminate source. This is a diverse group in terms of aluminum content (4–11%) and certain trace elements, but none of the beads plot with the vNaAl glasses found in Nubia, southern Africa, and the east coast of Africa. According to Fenn (2021), lead isotope analyses of Igbo-Ukwu v/m/NaAl beads indicate lead colorants/opacifiers that are similar to Indian ores, but other possible lead ore sources include Morocco and Israel.

Far less research has been undertaken to characterize carnelian sources, often assumed to derive from India. Insoll et al.'s (2004) early efforts to discriminate between well-known Indian sources in Gujarat and carnelian beads in West Africa explored

LA-ICP-MS analysis; the two Igbo-Ukwu beads in the study did not match a Gujarat source. More recent compositional research has more definitively characterized Indian sources and differentiated their composition from that of carnelian artifacts recovered from Garamantian sites (first to fourth centuries CE) in the Libyan Fezzan (Gliozzo et al., 2014). Likely sources are near the Fezzan, perhaps in the Tibesti mountains, but characterization of Saharan source areas remains to be undertaken. Al-Bakri noted that a source for a red banded stone (probably agate, often found in the same geological contexts as carnelian) was located about two weeks' travel from Tadmekka en route to Ghadames (Levtzion & Hopkins, 1981). Tadmekka itself is proximate to a carnelian source/workshop identified by Gaussen and Gaussen (1988, p. 247). These data, while sparse, are consistent with north–south carnelian exchange networks from Saharan sources.

The sources of the copper, tin, and lead used to create the large corpus of Igbo-Ukwu bronze and copper artifacts have been partially clarified by the analysis of copper-zinc and lead ores from the Benue Rift system to the east of Igbo-Ukwu. A total of 30 leaded bronze and copper artifacts have been analyzed for lead isotope ratios (Willett & Sayre, 2006, incorporating earlier analyses by Craddock et al., 1997; Goucher et al., 1976; Joel et al., 1995). Willett and Sayre (2006) divide the results into Group 1, Group 2, and Intermediate. Analysis of ores from recently active mines in the Abakaliki area of the Benue Rift east of Igbo-Ukwu proved to be a close match for the artifacts of Group 1 (Chikwendu et al., 1989; Craddock et al., 1997). Furthermore, the presence of silver in the Abakaliki copper ores suggests that these were a source for copper and bronzes with a silver content greater than 0.1%. (Chikwendu & Umeji, 1979; Craddock et al., 1997; Wang et al., this issue). Willett and Sayre (2006) broadened the study of lead isotopes, analyzing additional Igbo-Ukwu artifacts and comparing all 30 results with additional lead ore samples from known sources in North Africa and from Zurak located north of the Benue River in the Benue Rift. The Zurak and Abakaliki ores plotted together and were treated as a single ore group; lead isotope ratios for nine of the Group 1 Igbo-Ukwu bronzes ($n = 17$) overlapped or were close to these ores. The lead isotopes for Group 2 artifacts ($n = 10$) were closely matched by Tunisian ores (Willett & Sayre, 2006, p. 58). The Intermediate Group ($n = 3$) was thought to be a mix of the metal from both groups (Willett & Sayre, 2006). Fenn's (2021) recent work presented at the symposium includes a much larger set of datapoints for North African ores (Tunisia, Morocco, and Egypt). The Group 2 artifacts continue to plot robustly with Tunisian lead ores, as do metals and crucible residues from the copper-working ateliers at Marandet, anchored by new dates of the seventh–eighth centuries cal CE (Cuénod, 2020, 222). Castro's (1974) analysis of crucible residues showed that a range of alloys, including tin-bronze, leaded tin-bronze, and brass, were in use at Marandet. In addition, lead isotope ratios for four copper-based ingots from Marandet overlap both Moroccan ore sources and the Igbo-Ukwu bronzes of the Intermediate Group. While there are unanalyzed West African ore sources (e.g., the Aïr) that may provide an even better match for some of the Igbo-Ukwu bronze and copper, the possibility of sources beyond the Sahara cannot be excluded, though Craddock (1985) rightly points out that the main copper alloy traded from North Africa in Late Antiquity and the Islamic period was brass.

In summary, there is robust evidence that Igbo-Ukwu was connected at multiple scales to networks of raw materials and finished goods. Regionally, a significant amount of copper and lead was procured from source areas as close as 100 km away in the Benue Rift. Interregionally, tin could be obtained from the Jos plateau area or more broadly from the extensive tin-bearing pegmatite belt of western and northern Nigeria. There are also small tin ore deposits near Calabar (Chikwendu & Umeji, 1979; Ogunyele & Akingboye, 2018). The presence of high alumina glass beads indicates connections with the glass-producing areas in or around Ile-Ife. Other beads, carnelian, and some metal arrived via long-distance links with the Sahara and North Africa. Whether these traveled to Igbo-Ukwu directly, through trade for valued local goods such as ivory, or indirectly, as gifts or offerings via alliance networks, is not known and perhaps is not knowable in the absence of historical documents. Beads especially may have moved along a variety of pathways and been used in different cultural contexts before ultimate consumption and deposition at Igbo-Ukwu. How such an extraordinary concentration of valued

items came to be accumulated and deposited there is the subject of continuing speculation.

Igbo-Ukwu Technology and Technological Choice

The technology of the bronze artifacts at Igbo-Ukwu presents a long-acknowledged enigma: No crucibles or casting molds have yet been recovered from Igbo-Ukwu or anywhere in southern Nigeria before the thirteenth-century evidence at Benin City (Connah, 1975, p. 147). So how and where were these "masterpieces of the casters' art" produced (Herbert, 1984, p. 82)? And how do we understand the emergence of such technical virtuosity without the evidence for an antecedent period of technical and artistic experimentation? A great deal can be discerned about the technology from the artifacts themselves, but there is currently no evidence relevant to the question of technical and artistic development and production locations.

Igbo-Ukwu copper-based technology is distinctive in several aspects (Chikwendu et al., 1989; Craddock et al., 1997):

- The use of leaded bronze and unalloyed copper to the complete exclusion of brass
- The exclusive use of lost-wax casting for leaded bronze including items of sheet metal, such as bowls, that elsewhere would have been produced by hammering and smithing, with smithing and chasing reserved for unalloyed copper
- The use of anachronistic molding methods to create hollow cores (see Chikwendu et al., 1989, p. 29–30; Shaw, 1977, p. 18);
- The extraordinary level of skill in creating wax and/or latex molds of breathtaking intricacy and detail.

It is in this last aspect that the Igbo-Ukwu bronzes are extraordinary, and some would say "without parallel in any other part of the world… local or distant, ancient or modern" (Sutton, 1991, p. 149), although the technical mastery of Renaissance Italian casters might challenge this. There can be no doubt that the symbolism and iconography of the bronzes is entirely local in inspiration and idiom. Stylistically, the Igbo-Ukwu bronzes are singular in the profusion of detail executed with great precision at frequently miniature scale. Several of the most iconic pieces, such as the modelled heads of humans, rams, and elephants designed as pendants, measure less than nine centimeters in length (Shaw, 1970, pl. 258–283). The mounted horseman on the hilt from Igbo Richard measures less than six centimeters (Shaw, 1970, pl. 365).

Several aspects of the technological choices made by the Igbo-Ukwu smiths merit closer consideration. Why, for example, would they employ hammering and chasing only on unalloyed copper, when bronze is also malleable and suitable for smithing? The metallographic analyses by Wang et al. (this issue) reveal that several of the analyzed copper and leaded copper artifacts were created by twisting cast rods that were round in section (#31, #43) and with cast-in decoration (#26), suggesting that they were produced by lost-wax casting, rather than in open-cast molds. They were hammered and annealed only on their terminal ends. This raises the question of casting's significance: why employ lost-wax casting for even simple items such as rods? The answer could lie in the significance of the modeling agent used to create the mold.

There is evidence to suggest that Igbo-Ukwu smiths used latex exudate from one or more trees to create cast sheets as thin as 0.3 mm (Wang et al., this issue) and gossamer-fine threads layered upon them in a characteristic profusion of delicate coiled spirals, dots reminiscent of granulation, and string and lace-work designs (Neaher, 1976a; Williams, 1974; but see Peek, 2020 and Herbert, 1984 who argue for the use of beeswax). Two of the latex-producing trees used ethnographically by Nigerian smiths have potential significance for Igbo-Ukwu: *Detarium senegalense* (Aremu, 2005, p. 144) and *Ficus* (Shaw, 1970, p. 273). The former is the source of the wooden *ofo* staff, the sacred wand held by Igbo lineage heads as a symbol of authority and a link to the ancestors. Peek (2020, p. 62–64) discusses *ofo* in some detail, and reminds us that "all sacred instruments must be ritually activated in order to function effectively." *Ofo* are activated by a small bundle of cord wound around a twig of the sacred *ogirisi* tree (*Newbouldia laevis*) which provides the animating spiritual force (Dalziel, 1955, p. 444). *Ficus* is the source of the bast fibers in the textile used to wrap the sacred objects/regalia in the Igbo Isaiah shrine.

McIntosh speculates that the fibers as well as the wood of spiritually powerful trees might have been used to activate protective or healing forces (see McIntosh & Cartwright, this issue). Wrapping with cord is a prominent motif in Igbo-Ukwu bronzes. As Shaw (1970) noted, the bronzes themselves are in many cases skeuomorphs of items created in another medium (wood, calabash, and possibly ivory) that were wrapped with fiber netting or woven raffia (bronze bowls and bells), twine, or rope (roped pot, canine teeth, staff heads, serpent ornaments, Janus-headed ornament, and horseman hilt). Modeling the shrine items in the latex of sacred trees may have been essential to activate cast objects and imbue them with power. Although admittedly speculative, this approach identifies potential linkages between two technologies at Igbo-Ukwu—lost wax casting and the use of fibers, including for woven textiles—and connects them with Igbo beliefs and practices. It also accounts for the preference for casting rather than smithing and locates it in the context of social and ritual practice, identifying it as a technological style (Lechtman, 1977). This argument would be considerably strengthened by evidence of ethnographic use of latex by Igbo smiths, but by the twentieth century they primarily worked iron (Talbot, 1969 [1926], p. 927).

If Williams (1974, p. 184) and Neaher (1976a, 1976b, p. 160–1) are correct that latex rather than beeswax is the modeling agent uniquely able to produce the ultrafine-gauge designs on Igbo-Ukwu bronzes (a potential experimental archaeology project suggests itself here), then lost-latex casting may be a significant invention of Nigerian smiths that spread as an innovation still in use in northeastern Yoruba-land (the Obo school [Williams, 1974, p. 183–188, 211–217]) and among various Benue River people, including the Tiv (Kandert, 1990, cited in Peek, 2020, p. 29). Neaher (1976a, 1976b, p. 161) sees latex as a manifestation of northern craftsmanship, based mainly on the distribution of latex-producing plants and trees used ethnographically. She raises the possibility of trade in latex to the south, noting that it is both lightweight and re-usable. Whether or how lost-latex casting may have spread among smithing communities contemporary with Igbo-Ukwu or earlier is entirely speculative in the current state of archaeological evidence.

Williams (1974, p. 266) has suggested that the extravagantly decorated surfaces of many Igbo-Ukwu bronzes may have been inspired by encounters with gold jewelry lavishly decorated with filigree, granulation, and quatrefoil. These techniques are of considerable antiquity in the Mediterranean world, but Williams had Islamic jewelry in mind (see examples in the Metropolitan Museum collection [Jenkins & Keene, 1983, p. 37–88]). The Igbo-Ukwu leopard casting (Fig. 4) shows how the latex/wax was layered on, just as granulation and filigree were applied to a base of smooth metal in jewelry-making. While

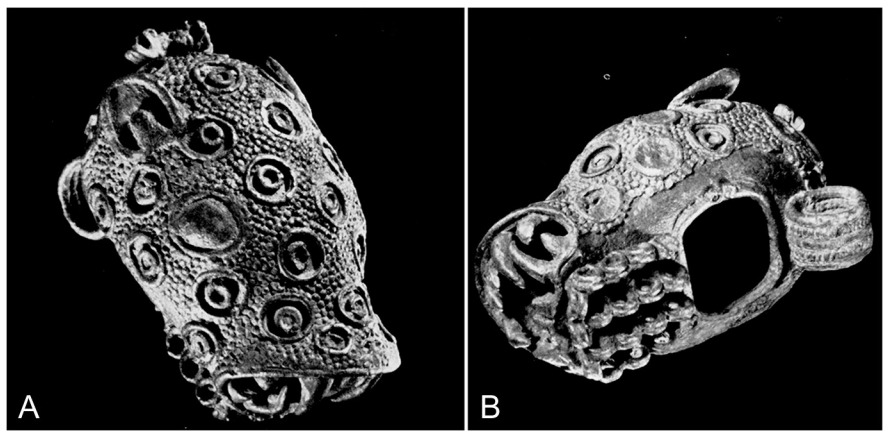

Fig. 4 **A** Bronze leopard head pendant, 7.4 cm long, presumed from Igbo Isaiah, showing surface detail of close-packed dots reminiscent of granulation. **B** View from the bottom showing how surface details were layered on the latex/wax model, analogous to the manner in which a jeweler layers granulation and filigree on a metal base. Each individual dot is approximately 1 mm in diameter. Reproduced from Shaw, 1970: Plates 266 and 267 courtesy of P.J. Smith and the Thurstan Shaw Estate

Williams (1974, p. 108) envisioned the possibility that African apprentices working in northern jeweler's workshops brought this aesthetic to Igbo-Ukwu, they would certainly have been familiar with drawplates for gold and silver wire; the absence of drawn copper wire at Igbo-Ukwu argues against this. A more plausible scenario might be the procurement of some of these pieces of jewelry in Igbo-Ukwu, inspiring inventive local smiths to devise a technique for creating a similar effect in cast bronze. It is likely that a process of this kind occurred at Ile-Ife, where glass trade beads inspired the invention of a novel, local recipe for the production of raw glass (Babalola, 2021; Babalola et al., 2018a; Lankton et al., 2006). It is also possible (though we shall probably never know for sure) that the Igbo-Ukwu smiths were faithfully recreating in molded latex/beeswax intricate carvings in wood or ivory, festooned with other media such as fiber and beads.

Exactly how the various multiscalar networks in which Igbo-Ukwu participated may have influenced the development of cast bronze technology at Igbo-Ukwu, or its further spread, remains largely unknown. Historically, metalsmithing in Igboland has been both highly specialized and localized. Three Igbo communities specialized in metalsmithing at the time of Neaher's (1976a) seminal study, but Awka was preeminent. In the past, Awka smiths worked iron and also cast bronze using the lost-wax method, but both metals declined during the colonial period. Of particular note was the wide-ranging itinerancy of the Awka smiths: "the orbit of Awka perigrinations was vast, limited only by the existence of rival smithing groups, such as the Hausa to the north of the Benue and by the necessity to return to Awka annually…Their long-distance contacts enabled the smiths to engage in trading ventures as well" (Neaher, 1976b, p. 48). Numerous researchers have emphasized the evidence from oral traditions for migration, contact, trade, intermarriage that may extend back in time to Igbo-Ukwu (Oriji, 2011, p. 81). If such circumstances obtained at the time of Igbo-Ukwu, we might expect its bronze technology and style to spread along the routes of itinerant smiths. This is not what the currently available evidence indicates. There is in fact a remarkable dearth of true Igbo-Ukwu-style bronzes documented from sites outside of Igbo-Ukwu itself. This may reflect the paucity of sub-surface investigation in surrounding areas. However, if more intensive research confirms this pattern, it may indicate an early instance of attached specialists producing bronze ritual items in secrecy for a powerful ritual leader. Onwuejeogwu and Onwuejeogwu (1977, p. 179) noted that artisans making ritual cloth and cast bronze worked in secret workshops in forest groves.

The announcement by Wang et al. (this issue) of the commitment by the British Museum to a "programme of collaborative research on copper alloy casting traditions, including archaeological excavation and scientific analysis, with a focus on southern Nigeria" is very welcome news. We may hope that investigators will return to the Benue Rift to search for the early phases of copper and lead exploitation there. We might surmise that smiths first encountered those ores in the course of iron smelting, which is well-documented in the first millennium BCE (Okafor, 1993). Investigation of mining areas near Abakaliki revealed evidence of large-scale workings in the copper and lead deposits, but the slags—one of which produced a date of 1080 ± 60 BP—were from smelting iron, not copper or lead (Craddock et al., 1997; Okafor, 1995).

Additional evidence relevant to the chronology and context of early bronze would also be welcome. There is evidence for bronze in the first millennium CE at and around Marandet in Niger (Castro, 1974; Grébénart, 1985), and bronze artifacts dated to the seventh to tenth century CE have been recovered at Jenné-jeno and Akumbu in Mali (McIntosh, 1995; Togola, 2008). The evidence for exploitation of the same ore sources by smiths at Marandet and Igbo-Ukwu has been previously mentioned. What this may mean in terms of potential information flows and technology appropriation in either direction cannot be determined without more evidence from first-millennium CE sites in Nigeria, Niger, and beyond. Any new evidence for lost-wax/lost-latex casting in the forest, especially in the first millennium CE into the first half of the second would be potentially foundational in building a timeline for this technology and tracing its various developments. Such evidence may reveal stylistic links to the Lower Niger Bronzes, which exhibit only limited stylistic continuity with Igbo-Ukwu (Neaher, 1976a, 1976b, p. 162) at the same time demonstrating the persistence of a preference for bronze east of the Niger River (Peek, 2020, p. 87).

Conclusion

The papers in the "Igbo-Ukwu at 50" symposium address the evidence now available for some of the key questions identified by Shaw some 50 years ago. High-precision radiocarbon dates place the final use of Igbo Isaiah in the eleventh–twelfth century and date materials in recently excavated pit contexts to the tenth–thirteenth century. However, the temporal relationships of the Igbo Richard burial, the ancient pit contents at Igbo Jonah, and the creation and use-life of the Igbo Isaiah bronzes have not been resolved. Nor have subsequent archaeological investigations yet revealed any evidence of artisanal production areas or domestic activities at the site or in the immediate vicinity, although promising subsurface deposits have been shown to exist. The continuing dearth of well-documented first millennium CE sites in southern Nigeria limits efforts to understand Igbo-Ukwu within a local and regional sequence of cultural and technological development. The extraordinary craftsmanship, style, and refined aesthetic of both the cast bronzes and the textiles remain unique and without known precedent.

Analyses of glass beads, carnelian, and metals have identified likely source areas, placing a focus on mobility and the movement at multiple scales of goods and people. These data are emerging as archaeological narratives are increasingly concerned with identifying interaction networks. For West Africa, trade and exchange networks are frequently prioritized in historical scholarship, reflecting the interests of written sources. But Igbo-Ukwu prompts a consideration of political networks of alliances and gifting based on wide-ranging ritual power. Renewed research programs offer the opportunity to recover the data needed to both explore these questions and generate new ones.

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Declarations

Conflict of Interest The author has no competing interests.

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