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Making metals in east Africa and beyond: archaeometallurgy in Azania, 1966–2015

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Making metals in east Africa and beyond: archaeometallurgy in Azania, 1966–2015

Louise Iles and Edwinus Lyaya

Abstract

Over the course of the last 50 years, the field of archaeometallurgy has grown dramatically, becoming firmly established within the realm of archaeological science. The archaeology and ethnography of African metallurgy has made a major contribution to this field, providing valuable information on the impressive range of raw materials and techniques that past metal producers and metalworkers used, as well as providing important insights into the socio-cultural settings that these technologies operated within. This paper summarises the role that Azania played in communicating some of this research, and charts the development of African archaeometallurgy through Azania's pages.

Keywords

Metal production, metalworking, iron, copper, Sub-Saharan Africa

Metallurgy in eastern Africa: a brief summary

Metals served a variety of roles within African societies, ranging from the functional and the decorative, to the symbolic and the communicative. The process of winning metal from an ore is a difficult procedure, reliant on the procurement of high-quality ores, ceramics and fuels, and the application of complex technical knowledge. It is a resource-hungry and time-hungry technology, which runs a high risk of failure, but when it succeeds it almost miraculously transforms stone into a substance with a new set of material properties. Perhaps for these reasons, rituals and symbolism often accompanied the activities surrounding metal production and metalworking, manifest in the items used to create or manipulate metal (furnaces, medicines, bellows, tuyères and tools) or the songs, movements and behaviours associated with the processes themselves. By studying the objects and the processes used to make them, the broader

socio-political aspects of the cultures in which these technologies occurred can be revealed.

The versatility of metals meant that they were used for numerous purposes by a wide spectrum of communities. Iron tools were – and still are – used to clear bush and till land, as well as in a multitude of craft and household activities. Arrows and harpoons, whether fashioned from locally-produced iron or from recycled imported metals (such as the reuse of aluminium sufurias to make arrowheads and other small objects), formed part of the repertoire of hunting and fishing paraphernalia (Musa-Mohamed 2004). Iron and steel weapons were used in raids on neighbouring territories or to defend against rival groups (e.g. Redmayne 1968) whilst also conveying the identity and status of the bearer (Larick 1985, 1986). Coins and metal bars or rods were used as currency throughout the continent, and many other metal artefacts were traded regionally or further afield, linking communities and scattering material culture (Juwayeyi 2010). In several examples, iron hoes marked the passage to adulthood as part of a bride price or dowry (e.g. Childs 1999), whereas the symbolic nature of iron and other metals is highlighted in their incorporation into items of regalia used during kingly coronations (e.g. Reid and McLean 1995), for decorative purposes (e.g. Robertshaw 1997) and in burial rites (e.g. Hodder 1982: 165–167; Giblin 2010).

In the east of Africa – where copper resources are relatively scarce – iron was particularly important, both as a utilitarian material and as a substance imbued with great symbolic wealth and power (Herbert 1995). Copper and its alloys were exploited throughout the rest of the continent (Herbert 1984), while other metals—gold, silver, tin, lead—were less widespread. Current archaeological knowledge suggests that the production of metals in Sub-Saharan Africa was established by the first millennium BC in the Horn of Africa and the Great Lakes region of eastern Africa (Killick 2009) and potentially—although somewhat contentiously—rather earlier in western Africa (Holl 2009). It was slower to reach into southern Africa, where metallurgy did not become fully established until the first millennium AD (Killick 2009). It is thus possible to confidently assert that metal objects have been part of the fabric of day-to-day life across the continent through much of the past two thousand years and into the present. Today, many examples of African metalworking have moved beyond their original intended uses to become iconic symbols

representing African cultures and craftwork to global audiences outside of Africa: the Benin bronzes, the iron spears of Maasai warriors and the gold objects of Mapungubwe convey new messages from within museum cases. By studying African metallurgy and metalworking we can learn more about the role of metals in human cultures, and the social organisation, belief systems and networks of those who made, worked with and used metal objects.

Understanding past metallurgy

The study of African metallurgy today employs various field- and laboratory-based methods, drawn not only from archaeology, but also from materials science and chemistry. However, early researchers studying metalworking and metal production were often limited to archaeological and ethnographic approaches that at best could seek to define typologies of artefacts and production remains. In many of these early cases, excavated metallurgical data were simply used to verify the presence of metal-using or metal-producing communities in a general cultural sequence (e.g. Phillipson 1972; Ambrose et al. 1984; Robertson 2000); this approach has tended to persist when resources or finances for robust archaeometallurgical analyses are limited. It remains the case that an assemblage of metal objects is often not given the same consideration as, for example, a ceramic assemblage, in part due to such financial or technical constraints, and in part due to the poor preservation of metals in acidic soils and humid conditions.

Ethno-historical accounts, from those who lived in or travelled through the continent in the nineteenth and twentieth centuries (e.g. Baumann 1891; Roscoe 1911), provide an invaluable resource with which to explore the metallurgical technologies of the past hundred years or so. Furthermore, they provide a wealth of information on the symbolism, taboos and rituals associated with these technologies. Later, ethnoarchaeological researchers (e.g. van der Merwe and Avery 1987; Rowlands and Warnier 1993; Huysecom and Agustoni 1997; Schmidt 1997; Childs 1999; Barndon 2004) returned to many of these regions to gather targeted data on the techniques, methods and beliefs that formed the basis of the technologies that endured into the twentieth century. Not only has their work been useful in an African context, it has served to inspire and inform archaeometallurgists and experimental archaeologists throughout the globe (Iles and Childs 2014). Few other regions in the world have been

able to access such a wide scope of recent 'traditional' metallurgical activity, providing a broad base of information on metallurgical processes in practice (e.g. Brown 1995). Similarly, attempts to reconstruct smelting, refining and forging methodologies in controlled conditions were another popular exploratory method in the early research phase (e.g. Avery and Schmidt 1979; Childs and Schmidt 1985; David et al. 1989; Killick 1990), again augmenting existing knowledge of how metals were produced, refined and worked. The study of these activities has expanded our understanding of the cultural value of these technologies, the extent to which they are embedded within cultural practice, and the complexity of these craft processes. It has also highlighted the dangers of being constrained by the western ideological values that underlie many studies of past technological processes.

In recent years, the application of scientific methods within archaeology has grown dramatically (Killick 2015). Archaeometallurgy has built upon strong foundations derived from materials science and geology (e.g. metallography and petrography) and embraced advances in chemical analysis (e.g. x-ray fluorescence, x-ray diffraction and spectrometry) to examine the microstructures and compositions of metal objects themselves and the waste products of the processes that made them. The combination of archaeological and archaeometric approaches has enabled both socio-economic and technical reconstructions of past metal producing and metal working technologies, an understanding of the different ingredients and processes that were used to produce metals and composite items, and an insight into the ways in which the metals were worked and manipulated into objects.

Of those studies that examine metals and metallurgical processes using an archaeological science approach, the greatest volume of research comes from institutions in Europe, and – more recently – Asia. Generally, institutions and individuals within Sub-Saharan Africa have more limited access to the resources, funding and training that is needed for metallographic or compositional analyses, especially in comparison to the research funding and facilities of those in Europe and elsewhere. This has led to a significant over-representation of archaeometallurgical research being published by non-African scholars. Azania has seen the inclusion of increasingly scientific approaches to the study of past technologies as time has gone on, especially in the past ten years (e.g. Nixon 2009; MacDonald et al. 2009; Giblin et

al. 2010; Iles 2013; Perkins 2014; Orton 2014), though it is notable that European-based scholars and laboratories have dominated these studies. Some US-based and US-trained scholars who have made major contributions to the study of African metallurgy have never published in Azania. Furthermore—in contrast to studies of ceramics, for example—Azania continues to predominantly attract empirical reports of field and laboratory research with a metallurgical component, rather than contributions to broader metallurgical debate or reviews of topical metallurgical discussions. Possible reasons for these trends will be considered in the conclusions of this paper, but first we introduce some of the major metallurgical themes that have prevailed throughout the 50-year career of Azania so far.

Metallurgical research in Azania: the first 25 years, 1966-1990

Metallurgy has tended not to comprise a major focus of Azania publications, especially in the fledgling years of the journal. Only 31 papers were published in the first 25 years of the journal's existence that discussed metallurgy to some extent (Figure 1), compared with approximately 70 that assessed ceramic assemblages (see paper by Ashley and Grillo, this volume) and just over 40 that explored lithic technologies. Many of the earliest appearances of metallurgical-related subject matter comprised descriptions and accompanying illustrations of metal objects, with occasional references to the waste products of smelting (e.g. Sassoon 1966; Chapman 1967; Robinson 1969; Phillipson 1970; Vogel 1970; Soper 1971; Mills and Filmer 1972; Ambrose et al. 1984). Although very little discussion accompanies these short descriptions, it is acknowledged that the primary objective in these early days was to begin to construct a corpus of metallurgical data upon which future analyses could be undertaken and broader discussions founded. Writing of iron tools from Zambia, Vogel (1970: 178) recognised this inherent limitation: 'while in no way altering our knowledge of Early Iron Age technology, they [the tools] do increase the numbers and types of implements known to have been produced in these early farming communities'. Phillipson (1972: 118) similarly noted that research during this formative period tended to be exploratory rather than investigative. However, at around the same time, Azania also began to report upon occasional targeted excavations of iron production sites in Zambia, Kenya, Malawi and Tanzania (Phillipson 1968; Posnansky and Grinrod 1968; Robinson and Sandelowsky 1968; Odner 1971; Siiriaïnen 1971). Of these articles, more general discussion of the

significance of these remains was again necessarily limited by a lack of comparative material from east Africa in a general sense, although the input of a non-archaeological specialist from the Royal Technical College, Nairobi (Posnansky and Grinrod 1968) contributed valuable information as to the technical parameters of smelting activity at North Kingangop: the first publication of an iron smelting site from Kenya.

FIGURE 1 ABOUT HERE

Figure 1. Map of Africa illustrating the frequency of metallurgical publications per country published in Azania between 1966 and 1990.

Soper and Golden's (1969) discussion of Rongo smiths in Mwanza, Tanzania marks the first extensive and wide-ranging discussion of ethnographic metal production that appeared within Azania's pages, swiftly followed by overviews of ethno-historical evidence from Pare and Irangi, also in Tanzania (in Odner 1971 and Liesegang 1975 respectively) and later by brief notes on recent iron production in southern Sudan (Hillman and Hillman 1984). The difficulty of associating archaeological remains with smelting and smithing groups of the more recent past was identified early on as a significant challenge (Siiriaïnen 1971), and one that has yet to be satisfactorily addressed even today (Iles and Lane 2015). However, the availability of ethno-historic and ethnographic data initiated more involved discussions of the symbolism of metallurgical activity – also frequently mentioned in these early Azania articles, and epitomised by Sassoon's synopsis of the symbolism of iron objects in the Great Lakes (Sassoon 1983).

Towards the end of the 1970s, several key publications on the spread of metallurgy across the African continent were published in Azania. The first—Phillipson's well known publication that brought together linguistic and archaeological data to address the 'Bantu expansion'—discussed evidence for the diffusion of early iron technology through eastern and southern Africa (Phillipson 1976). Phillipson suggested that knowledge of iron metallurgy ultimately derived from the Sudanic north, spreading south along western and eastern streams and leading to the establishment of regional Early Iron Age (EIA) industries in eastern and southern Africa. Although these

propositions have been contested over the years, this was the first archaeological voice heard in what was prior to that a discussion dominated by linguists and historians (e.g. Guthrie 1948; Oliver 1966; Heine et al. 1977). On a more limited geographical scale, with a tighter focus on metallurgy and with a higher resolution of archaeological data, van Noten refined this discussion, and contested Phillipson's hypothesis with an emphasis on the EIA of the southern Great Lakes (van Noten 1979). Detailed descriptions of newly excavated EIA furnace sites in Rwanda, Burundi and the DRC were compared with the technologies of the interlacustrine region and Meroë, building upon detailed discussions as to the origin of these early east African iron technologies, and whether knowledge of iron production had diffused from the north or was invented independently (e.g. Trigger 1969; Schmidt 1978). Within this new framework of a potentially indigenous development of early iron production in the southern Great Lakes, these papers heralded a shift towards studies of the EIA from the late-1970s onwards (e.g. Vogel 1975, 1984; Raymaekers and van Noten 1986; Fawcett and LaViolette 1990; van Grunderbeek 1992), replacing the previously relatively balanced mix between studies of EIA and Late Iron Age (LIA) iron working remains. This emphasis on early technology was to continue for a significant period, and was certainly established at this point as a leading research agenda in east African metallurgy.

From the 1980s, the geographical scope of Azania's metallurgical publications expanded to include what is now South Sudan (David et al. 1981; Phillipson 1981; Hillman and Hillman 1984) and Ethiopia (Gerharz and Spennemann 1985). However, in general during this earlier phase in the journal's history—as would be expected of a journal linked so closely with the British Institute of Eastern Africa (BIEA)—papers were largely limited to eastern and central Africa. It is understandable that because of this focus the metal primarily studied was iron, with only a few articles—all deriving from research in Zambia's copperbelt—discussing copper metallurgy (Phillipson 1970, 1972; Mills and Filmer 1972; Bisson and Horne 1974; Vogel 1975). Occasional papers on the Swahili coast (e.g. Brown 1988) and Ethiopia (e.g. Gerharz and Spennemann 1985) extended the range of metals considered, but iron continued to remain predominant.

Due presumably to the robustness of production remains (as compared to the relative vulnerability of iron objects to corrosion), Azania's early metallurgical coverage is also dominated by studies of metal production—through the excavation of furnace remains and waste products of smelting (including slag and ceramic remains)—followed closely by studies of metal working through the documentation of metal objects. Mining—obviously an important part of the metal production process, but beset by difficulties of identifying and investigating archaeological mining sites—is mentioned only very occasionally in these earlier years (e.g. Phillipson 1972; Lanning 1979).

Metallurgical research in Azania: the following 25 years, 1990-2015

Between 1990 and 2015, Azania published 34 papers on metal technology, ever so slightly more than in the preceding period. Of these, by far the greatest majority focused on east African archaeology, with the Horn of Africa, West Africa, southern, and central Africa also represented (Figure 2). The expansion of the journal in 2009 with a new editorial remit brought about an extended geographical scope, although the shift to encompass a broader reach had begun somewhat earlier, with metallurgical papers on Nigeria (Darling 2004) and KwaZulu Natal (Greenfield and van Schalkwyk 2003; Whitelaw 2005; Greenfield 2006) appearing prior to this point. Since 1990, of all 54 African countries, a total of 15 countries have been represented in published work related to metallurgy in Azania.

FIGURE 2 ABOUT HERE

Figure 2. Map of Africa illustrating the frequency of metallurgical publications per country published in Azania between 1991 and 2015.

Despite the increased geographical range in this period, these papers continued to report principally on the remains of iron smelting and forging, while copper working and production remains comprise only around a fifth of the papers from this period. Papers on silver, gold and tin are even less common. Excavation continued to be the primary means through which the metallurgical data were collected (the case in half of the publications in question), with ethno-historical inquiries and experimental iron smelting and forging also playing a major role. Primary ethnographic research—such a strong focus in earlier years of the study of metallurgy in east Africa—gradually

lessened as a consequence of the decreasing number of surviving informants with first-hand knowledge of precolonial metallurgical technologies.

Many of Azania's metallurgical papers from this second period focus on the importance of metal production and forging to African societies, particularly in terms of the relationship between metals and trade (e.g. Haaland 1994; Nixon 2009) and between metals and state formation (e.g. Phillipson 2006; Iles 2013). Others emphasise the socio-cultural and political importance of metals in terms of the need for weapons for warfare and tools for cultivation, and the role of metals in gift-giving and tribute (e.g. Haaland and Msuya 2000; Musa-Mohamed 2004; Juwayeyi 2010; Orton 2014; Perkins et al. 2014). A further dominant theme is the reconstruction of metal production technologies (e.g. Haaland 1994; Haaland and Msuya 2000; Mercader et al. 2000; Chirikure et al. 2009; Nixon 2009; Giblin et al. 2010; Iles 2013), with around a third of the data examined using archaeometric analyses (e.g. Mercader et al. 2000; MacDonald et al. 2009; Iles 2013) and a quarter undergoing thorough physical attribute analysis (Haaland 1994; Darling 2004; Iles et al. 2014). The symbolism, taboos and rituals of the metal production processes and the metal objects themselves, and the social status of smelters and forgers have also been explored (Robertshaw 1997; Haaland et al. 2004; Musa-Mohamed 2004; Giblin et al. 2010; Gronenborn et al. 2012). These themes have enabled those examining African metallurgy to consider the core socio-technical features of these technologies and particularly how these processes and metals were perceived by those who made and used them. However, it is significant that almost half of the gathered data have not been subjected to further analysis (e.g. Sutton 1993; Loukou et al. 2013), and are only briefly mentioned in reports of excavations or surface collections.

The spatial organisation of iron production and smithing has also received attention in these later Azania publications. While smelting activities were sometimes found to be secluded from living areas, forging activities regularly occurred in or around settlements (e.g. Greenfield and van Schalkwyk 2003; Darling 2004; Musa-Mohamed 2004; Whitelaw 2005; Wynne-Jones 2012). There are several cases where iron smelting took place within occupation areas (e.g. Haaland 1994; Haaland and Msuya 2000)—a theme noted also in papers from the preceding 25 years (Phillipson 1968; Vogel 1984)—yet an unanswered question is whether the smelting activities were

obscured from strangers and other viewers through means of a vegetation screen or other physical barrier (Haaland 1994; Iles et al. 2014; also see Anderson 2009). Other papers examine the location of metal production sites close to sources of ore, fuel and water (Reid 1994; Haaland and Msuya 2000; Robertson 2000; Musa-Mohamed 2004). The interplay between the need to locate smelting sites close to raw materials and resources, and potential socio-cultural reasons for physical seclusion from other community members is particularly interesting, and will no doubt continue to be explored in future scholarship.

Raw materials are also considered in terms of the potential relationships between the acquisition of fuel for smelting activities and possible trends in deforestation (e.g. Reid 1994; Darling 2004; Iles et al. 2014). Fuel consumption has been used to directly link iron production with deforestation in some regions (e.g. Schmidt 1994). However, it is worth noting that this causal relationship has been contested (Mapunda 2003; Lyaya 2011; Iles, forthcoming), due to a lack of supporting evidence and a failure to consider the fuel wood selection and woodland management strategies of past iron producers. Nevertheless, the production of hardwearing iron tools such as knives and axes could have accelerated the removal of trees for agricultural and settlement expansion, thus indirectly facilitating increased pressures on forest resources. The exploration of ecological components of archaeometallurgy (e.g. van Noten and van Noten 2004; Iles et al. 2014) has grown significantly in recent years, particularly within Africa, where there is a larger component of ethnographic information on fuel selection strategies that makes insights into these more intangible aspects of metallurgy possible (Lyaya 2013). There is still a need, however, for archaeometallurgists to work more closely with palaeoenvironmental specialists and geoarchaeologists so as to provide a deeper understanding of the historical ecology of different metal producing industries.

Discussion and future directions

Over the course of the 50 years that Azania has been published, there has been an undoubted shift in the methods used to collect and analyse metallurgical data, which has been reflected in the research papers published in Azania. Early papers generally presented metallurgy as part of excavation reports, with descriptions and illustrations of metal artefacts devoid of much context or broader discussion. These early scholars

were often limited to discussing cultural sequences in terms of the presence or absence of metal production or metalworking remains in the archaeological record. However, an ever-increasing volume of archaeological and archaeometallurgical data in conjunction with improving chronologies for metallurgical sites has enabled researchers to increasingly discuss pertinent issues relating to the origin and development of metallurgy in Sub-Saharan Africa and the wider cultural contexts and impacts of these technologies on local and regional scales. This has certainly been reflected in the trajectory of articles published in Azania. Until recently, metallurgical papers published in Azania tended to be more firmly focused on the reporting of research results than engaging with complex metallurgical debates, with archaeometallurgists tending to prefer other forums for publishing metallurgical data with a more discursive or theoretical component. This might in part be due to the relationship of Azania with the BIEA, which perhaps promoted a perception of the journal as being predominantly British, conservative and with a relatively narrow readership, limiting interest in the submission of more controversial papers. The relatively poor quality of published images in the earlier decades of Azania is also likely to have been a deterrent to archaeological scientists seeking to publish their research. For example, an article by Langdon and Robertshaw (1985) on the ceramic petrography of pottery from southwest Kenya is conspicuously devoid of photomicrographs to underpin the analytical results.

Nevertheless, more recent papers have illustrated the expanding thematic scope of the journal that will hopefully see Azania play a much more involved role in the development of the study of African metallurgy in the future. In addition to a continuation of ethno-historical and ethnoarchaeological approaches, there has been an expansion of the number of papers that deal with more sophisticated data analysis techniques. Results from such analyses are illustrating the high levels of technical accomplishment and ingenuity of past African metallurgists, and might eventually shed light on the as yet unanswered questions of the origin(s) and spread of iron production in the continent. It is significant to note that this trend in the representation of metallurgical methods in Azania papers is following a similar trajectory to the general implementation of metallurgical research in Sub-Saharan Africa (see Mapunda 2010): Azania has been welcoming of papers with a more scientific emphasis when the opportunity has arisen.

There has also been a gradual shift in the spatial coverage of the metallurgical papers published in Azania. Before the 1990s, the coverage was focused primarily on east and central African countries, with the core region comprising Uganda, Tanzania, Kenya, Zambia, Malawi and Rwanda (cf. Figure 1). After 1990, and especially after 2009, the geographical coverage extended into western and southern Africa (cf. Figure 2), bringing with it increased discussion of non-ferrous metals. However, at the same time, the core area where most papers are drawn from has contracted in this period—shrinking to just Uganda, Tanzania, Kenya and Rwanda—with the number of papers from Zambia and Malawi greatly reduced. Perhaps understandably considering the relatively low volume of metallurgical papers, gaps still remain in Azania's metallurgical coverage even in this core area. Conspicuous examples of this include the paucity of papers discussing the metals and metallurgy of the Swahili coast (see, however, Kusimba 1993, 1996) or Madagascar (see, however, Radimilahy 1988, Gabler 2005).

Throughout the past 50 years and especially in the earlier phases, papers published in Azania have given outstanding weight to the origin and development of metal production across the continent. Azania was at the forefront of discussions of metallurgy as part of the 'Bantu expansion' with a strong representation of early papers on the EIA of the southern Great Lakes. Nevertheless, as a consequence of imprecise dating techniques (centred around the flattening of the radiocarbon calibration curve at critical points in time), issues with locating these often more ephemeral early sites, as well as periods of socio-political unrest in the regions with the greatest potential for locating EIA sites, explorations of the spread of early iron production technologies appeared to reach a dead end (see Killick 2004). A movement towards the study of later iron industries developed in response to this, as reflected in the much smaller proportion of Azania publications after 1990 that dealt with the origins and early development of iron production, with a renewed emphasis on reconstructions of LIA technologies.

A further major theme that has consistently received due weight over the past 50 years of Azania has been an examination of the symbolism, taboos and rituals of iron production and working, building from the rich ethno-historical and ethnographic

resource base of Sub-Saharan Africa. This subject has helped archaeometallurgists understand the complex socio-cultural context of iron production and appreciate the full breadth of the African iron production record. However, due to the dwindling number of local practitioners who have first-hand experience of the metal producing technologies that were last practiced in the last century, it is likely that new perspectives on these topics will become even more reduced as time goes on (Childs and Killick 1993).

The diversity of research themes represented in Azania is indicative of the growing scope of metallurgical research as a way of understanding how societies sought power and wealth, how they interacted with other communities, and how they interacted with their environments. Although the discussions addressed within the pages of Azania may not reflect the entire body of literature on African metallurgy, the increasing coverage of metallurgical papers within Azania has vastly improved our understanding of African metallurgy and is symptomatic of the fast growing nature of archaeometallurgy in the region. Nevertheless, archaeometallurgy has often been side-lined in favour of more accessible material culture that does not require expensive analytical techniques. The capability of metallurgical research to engage with large-scale debates such as the 'Bantu expansion' or regional environmental change exists in tandem with its ability to illuminate the personal preferences, choices and actions of past individuals and groups. The research themes covered in Azania have contributed to the full range of metallurgical discovery, and we anticipate that this will continue into the future of the journal. African metallurgy has broadened global understandings of production activity through ethno-historical and ethnographic documentation, and by highlighting some of the more unusual production systems employed by past metallurgists. We hope that Azania will continue to support archaeologists and archaeometallurgists working in the continent—particularly African scholars—to further communicate these developing understandings of African metallurgy to continent-wide, if not worldwide audiences.

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References

Ambrose, S., Collett, D., Mudida, N. and Marshall, F. 1984. "Excavations at Deloraine, Rongai, 1978." Azania 19: 79–104.

Anderson, M. 2009. Marothodi: the historical archaeology of an African capital. Northampton: Atikkam Media Limited.

Avery, D. and Schmidt, P. 1979. "A metallurgical study of the iron bloomery, particularly as practiced in Buhaya." Journal of Metals 31: 14–21.

Barndon, R. 2004. An Ethnoarchaeological Study of Iron Smelting Practices Among the Pangwa and Fipa in Tanzania. Oxford: Archaeopress.

Baumann, O. 1891. Usambara und seine Nachbargebiete. Berlin: Beidelman.

Bisson, M. and Horne, S. 1974. "Probability sampling techniques for investigation of African Iron Age sites." Azania 9: 87–104.

Brown, H. 1988. "Siyu: town of the craftsmen." Azania 23: 101–113.

Brown, J. 1995. Traditional Metal Working in Kenya. Oxford: Oxbow.

Chapman, S. 1967. "Kantsyore Island." Azania 2: 165–191.

Childs, S. T. 1999. "'After all, a hoe bought a wife': the social dimensions of ironworking among the Toro of East Africa." In The Social Dynamics of Technology: practice, politics and world views, edited by M. Dobres and C. Hoffman, 23–45. London: Smithsonian Institution Press.

Childs, S. T. and Killick, D. 1993. “Indigenous African metallurgy: nature and culture.” Annual Review of Anthropology 22: 317–337.

Childs, S. T. and Schmidt, P. 1985. “Experimental iron smelting: the genesis of a hypothesis with implications for African prehistory and history.” In African Iron Working: ancient and traditional, edited by R. Haaland and P. Shinnie, 121–141. New York: Norwegian University Press.

Chirikure, S., Burrett, R. and Heimann, R. 2009. “Beyond furnaces and slags: a review study of bellows and their role in indigenous African metallurgical processes.” Azania: Archaeological Research in Africa 44: 195–215.

Darling, P. 2004. “Migrants, millenialists and mayhem: Kari-Kari, Ningi, Gwari, Kebbi, Kwatarkwashi and Zuru ‘enclaves’ in northern Nigeria.” Azania 39: 90–109.

David, N., Harvey, P. and Goudie, C. 1981. “Excavations in the southern Sudan, 1979.” Azania 16: 7–54.

David, N., Heimann, R., Killick, D. and Wayman, M. 1989. “Between bloomery and blast furnace: Mafa iron-smelting technology in North Cameroon.” The African Archaeological Review 7: 185–210.

Fawcett, W. and LaViolette, A. 1990. “Iron Age settlement around Mkiu, south-eastern Tanzania.” Azania 25: 19–26.

Gabler, S.C. 2005. Iron furnaces and future kings: craft specialization and the emergence of political power in central Madagascar. Unpublished PhD thesis, University of Michigan.

Gerharz, R. and Spennemann, D. 1985. “Northern Ethiopian bronze implements for left-handed individuals.” Azania: Archaeological Research in Africa 20: 163–167.

Giblin, J., Clement, A. and Humphris, J. 2010. “An Urewe burial in Rwanda: exchange, health, wealth and violence c. AD 400.” Azania: Archaeological Research

in Africa 45: 276–297.

Greenfield, H. J. 2006. “On the nature of Daga houses, kraals, metallurgy and intra-settlement spatial organization of EIA settlements in southern Africa: a response to Whitelaw.” Azania 41: 167–180.

Greenfield, H. J. and van Schalkwyk, L. 2003. “Intra-settlement social and economic organization of Early Iron Age farming communities in southern Africa: a view from Ndondondwane.” Azania 38: 121–137.

Gronenborn, D., Adderley, P., Ameje, J., Banerjee, A., Fenn, T., Liesegang, G., Haase, C.-P., Usman, Y. and Patscher, S. 2012. “Durbi Takusheyi: a high-status burial site in the western Central bil*ād al-sūdān*.” Azania: Archaeological Research in Africa 47: 256–271.

Guthrie, M. 1948. Classification of Bantu Languages. London: Oxford University Press.

Haaland, H. 1994. “Dakawa: an Early Iron Age site in the Tanzanian hinterland.” Azania 29-30: 238–247.

Haaland, G., Haaland, H. and Dea, D. 2004. “Furnace and pot: why the iron smelter is a big pot maker.” Azania 39: 146–165.

Haaland, H. and Msuya, C. S. 2000. “Pottery production, iron working and trade in the Early Iron Age: the case of Dakawa east-central Tanzania.” Azania 35: 75–106.

Heine, B., Hoff, H. and Vossen, R. 1977. “Neuere Ergebnisse zur Territorialgeschichte der Bantu.” In Zur Sprachgeschichte und Ethnohistorie in Afrika, edited by W. Möhlig, F. Rottland and B. Heine, 57–72. Berlin: Dietrich Reimer.

Helm, R. M. 2000. “Recent archaeological research on the iron working, farming communities of coastal Kenya.” Azania 35: 183–189.

Herbert, E. 1984. Red Gold of Africa: copper in precolonial history and culture. Madison: University of Wisconsin Press.

Herbert, E. 1995. Iron, Gender and Power: rituals in transformation in African societies. Bloomington: Indiana University Press.

Hillman, J. and Hillman, S. 1984. "Archaeological observations in Bangangai Game Reserve, south-western Sudan." Azania 19: 115–120.

Hodder, I. 1982. Symbols in Action: ethnoarchaeological studies of material culture. Cambridge: Cambridge University Press.

Holl, A. 2009. "Early west African metallurgies: new data and old orthodoxy." Journal of World Prehistory 22: 415–438.

Huysecom, E. and Agustoni, B. Inagina, the last house of iron. University of Geneva, Department of Archaeology [film].

Iles, L. 2013. "The development of iron technology in precolonial western Uganda." Azania: Archaeological Research in Africa 48: 65–90.

Iles, L. Forthcoming. "Iron metallurgy's role in changing woodlands: challenges in data and approaches." Journal of Archaeological Method and Theory.

Iles, L. and Childs, S. T. 2014. "Ethnoarchaeological and historical methods." In Archaeometallurgy in Global Perspective: methods and syntheses, edited by B. Roberts and C. Thornton, 193–216. New York: Springer.

Iles, L. and Lane, P. 2015. "Pastoralism and iron production on the Laikipia Plateau, Kenya." Azania: Archaeological Research in Africa (in press).

Iles, L., Robertshaw, P. and Young, R. 2014. "A furnace and associated ironworking remains at Munsa, Uganda." Azania: Archaeological Research in Africa 49: 45–63.

Juwayeyi, Y. M. 2010. “Archaeological excavations at Mankhamba, Malawi: an early settlement site of the Maravi.” Azania: Archaeological Research in Africa 45: 175–202.

Killick, D. 1990. Technology in its social setting: bloomery iron-smelting at Kasungu, Malawi, 1860-1940. Unpublished PhD thesis, Yale University.

Killick, D. 2004. “What do we know about African iron working?” Journal of African Archaeology 2: 97–112.

Killick, D. 2009. “Cairo to Cape: the spread of metallurgy through eastern and southern Africa.” Journal of World Prehistory 22: 399–414.

Killick, D. 2015. “The awkward adolescence of archaeological science.” Journal of Archaeological Science 56: 242–247.

Kusimba, C.M. 1993. The archaeology and ethnography of iron metallurgy on the Kenya coast. Ann Arbor, MI: University Microfilm International Dissertation Services.

Kusimba, C.M. 1996. “The social context of iron forging on the Kenya coast.” Africa 66: 386–410.

Langdon, J. and Robertshaw, P. 1985. “Petrographic and physico-chemical studies of early pottery from south-western Kenya.” Azania 20: 1–28.

Lanning, E. 1979. “Cylindrical pits in Uganda.” Azania 14: 143–147.

Larick, R. 1985. “Spears, style and time among Maa-speaking pastoralists.” Journal of Anthropological Archaeology 4: 206–220.

Larick, R. 1986. “Age grading and ethnicity in the style of Loikop (Samburu) spears.” World Archaeology 18: 269–283.

Liesegang, G. 1975. “Some Iron Age wares from central Tanzania.” Azania 10: 93–105.

Loukou, S., Huysecom, E. and Mayor, A. 2013. “L’occupation humaine de la vallée du Guringin (plaine du Séno, Mali).” Azania: Archaeological Research in Africa 48: 91–110.

Lyaya, E. 2011. “Bioarchaeometallurgy, technology, and spatial organization of ironworking at Mjimwema, Njombe Tanzania.” Papers from the Institute of Archaeology 21: 66–86.

Lyaya, E. 2013. “Use of charcoal species for ironworking in Tanzania.” In The World of Iron, edited by J. Humphris and Th. Rehren, 444–453. London: Archetype.

MacDonald, K. C., Vernet, R. and Martinon-Torres, M. 2009. “Dhar Nema: from early agriculture to metallurgy in southeastern Mauritania.” Azania: Archaeological Research in Africa 44: 3–48.

Mapunda, B. 2003. Iron Technology and Deforestation: myths and realities. AFRAS: University of Sussex.

Mapunda, B. 2010. Contemplating the Fipa Ironworking. Kampala: Fountain Publishers.

de Maret, P. 1994. “Pits, pots and the far-West streams.” Azania 29-30: 316–323.

Mercader, J., Rovira, S. and Gomez-Ramos, P. 2000. “Forager-farmer interaction and ancient iron metallurgy in the Ituri rainforest, Democratic Republic of Congo.” Azania 35: 107–122.

der Merwe, N. and Avery, D. 1987. “Science and magic in African technology: traditional iron smelting in Malawi.” Africa 57: 143–172.

Mills, E. and Filmer, N. 1972. “Chondwe Iron Age sites, Ndola, Zambia.” Azania 7: 129–145.

Musa-Mohamed, I. 2004. “Traditional iron technology and settlement patterns in central Darfur.” Azania 39: 177–192.

Nixon, S. 2009. “Excavating Essouk-Tadmakka (Mali): new archaeological investigations of early Islamic trans-Saharan trade.” Azania: Archaeological Research in Africa 44: 217–255.

Odner, K. 1971. “Usangi Hospital and other archaeological sites in the North Pare Mountains, north-eastern Tanzania.” Azania 6: 89–130.

Oliver, R. 1966. “The problem of the Bantu expansion.” Journal of African History 7: 361–376.

Orton, J. 2014. “The late pre-colonial site of Komkans 2 (KK002) and an evaluation of the evidence for indigenous copper smelting in Namaqualand, southern Africa.” Azania: Archaeological Research in Africa 49: 386–410.

Perkins, J., Fleisher, J. and Wynne-Jones, S. 2014. “A deposit of Kilwa-type coins from Songo Mnara, Tanzania.” Azania: Archaeological Research in Africa 49: 102–116.

Phillipson, D. 1968. “The Early Iron Age site at Kapwirimbwe, Lusaka.” Azania 3: 87–105.

Phillipson, D. 1970. “Excavations at Twickenham Road, Lusaka.” Azania: Archaeological Research in Africa 5: 77–118.

Phillipson, D. 1972. “Early Iron Age sites on the Zambian copperbelt.” Azania 7: 93–128.

Phillipson, D. 1976. “The Early Iron Age in Eastern and Southern Africa: a critical

reappraisal." Azania 11: 1–23.

Phillipson, D. 1981. "A preliminary archaeological reconnaissance of the southern Sudan, 1977-8." Azania 16: 1–6.

Phillipson, L. 2006. "Ancient gold working at Aksum." Azania 41: 27–40.

Posnansky, M. and Grinrod, B. 1968. "Iron smelting furnaces at North Kinangop." Azania 3: 191–195.

Radimilahy, C. 1988. *L'ancienne métallurgie du fer à Madagascar*. Oxford: Archaeopress, British Archaeological Reports International Series 422.

Raymaekers, J. and van Noten, F. 1986. "Early iron furnaces with 'bricks' in Rwanda: complementary evidence from Mutwarubona." Azania 21: 65–84.

Redmayne, A. 1968. "Mkwawa and the Hehe wars." Journal of African History 9: 409–436.

Reid, A. 1994. "Early settlement and social organization in the interlacustrine region." Azania 29-30: 303–313.

Reid, A. and MacLean, R. 1995. "Symbolism and the social contexts of iron production in Karagwe." World Archaeology 27: 144–161.

Robertshaw, P. 1997. "Munsa earthworks." Azania 32: 1–20.

Robertson, J. H. 2000. "Early Iron Age archaeology in Central Zambia." Azania 35: 147–182.

Robinson, K. 1969. "Iron Age excavations undertaken in southern Malawi during 1968." Azania 4: 147–148.

Robinson, K. and Sandelowsky, B. 1968. "The Iron Age of northern Malawi: recent

work." Azania 3: 107–146.

Roscoe, J. 1911. The Baganda. London: Macmillan and Co.

Rowlands, M. and Warnier, J.-P. 1993. "The magical production of iron in the Cameroon Grassfields." In The Archaeology of Africa: Food, Metals and Towns, edited by T. Shaw, P. Sinclair, B. Andah and A. Okpoko, 512–550. London: Routledge.

Sassoon, H. 1966. "Engaruka: excavations during 1964." Azania 1: 79–99.

Sassoon, H. 1983. "Kings, cattle and blacksmiths: royal insignia and religious symbolism in the interlacustrine states." Azania 18: 93–106.

Schmidt, P. 1978. Historical Archaeology: a structural approach in an African culture. Westport: Greenwood Press.

Schmidt, P. 1994. "Historical ecology and landscape transformation in eastern equatorial Africa." In Historical Ecology: cultural knowledge and changing landscapes, edited by C. Crumley, 99–125. Santa Fe: School of American Research Press.

Schmidt, P. 1997. Iron Technology in East Africa: symbolism, science and archaeology. Indiana: James Currey.

Siiriaïnen, A. 1971. "The Iron Age site at Gatung'ang'a, central Kenya." Azania 6: 199–232.

Siiriaïnen, A., Seitsonen, O. and Lauren, J. 2009. "Pastoralists in the northeastern Mara Plains, Kenya: archaeological investigations of the Pastoral Neolithic and the Pastoral Iron Age." Azania: Archaeological Research in Africa 44: 163–193.

Soper, R. 1971. "Iron Age archaeological sites in the Chobi sector of Murchison Falls National Park, Uganda." Azania 6: 53–87.

Soper, R. and Golden, B. 1969. “An archaeological survey of Mwanza region, Tanzania.” Azania 4: 15–79.

Sutton, J. E. G. 1993. “Further excavations and the Iron Age sequence of the central Rift.” Azania 28: 103–125.

Sutton, J. E. G. 2008. “Aksum: Goldfield or Vineyards?” Azania 43: 18–35.

Trigger, B. 1969. “The myth of Meroe and the African Iron Age.” African Historical Studies 2: 23–50.

van Grunderbeek, M.-C. 1992. “Essai de délimitation chronologique de l’Age du Fer Ancien au Burundi, au Rwanda et dans la région des Grands Lacs.” Azania 27: 53–80.

van Noten, F. 1979. “The Early Iron Age in the interlacustrine region: the diffusion of iron technology.” Azania 14: 61–80.

van Noten, F. and van Noten, E. 2004. “Two experimental iron smeltings (Congo and Rwanda).” Azania 39: 166–176.

Vogel, J. 1970. “Early Iron Age tools from Chundu Farm, Zambia.” Azania 5: 173–178.

Vogel, J. 1975. “Kabondo Kumbo and the Early Iron Age in Victoria Falls region.” Azania 10: 49–75.

Vogel, J. 1984. “An Early Iron Age settlement system in southern Zambia.” Azania 19: 61–78.

Whitelaw, G. 2005. “Comment on Greenfield and Van Schalkwyk’s article on Ndondondwane, Azania, 2003.” Azania 40: 122–127.

Wynne-Jones, S. 2012. “Exploring the use of geophysical survey on the Swahili

Coast: Vumba Kuu, Kenya.” Azania 47: 137–152.