The Politics of Knowledge Production: Training and Practice of Archaeological Science in Africa

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Abstract Numerous doctoral degree holders were trained in African archaeometallurgy in the Global North as well as on the African continent. African archaeometallurgy continues to attract a significant number of researchers from Europe and North America. This paper is based on our lived experiences as resident African archaeometallurgists. We argue that out of frustration because of unequal power relations and lack of access to archaeological science laboratories and funding, most African archaeometallurgists are now pursuing other research areas and careers altogether. We propose some solutions to ensure sustainability in the training and practice of archaeological scientists on the African continent. We conclude that African scholars need to develop home-grown and long-term research capacities and strategies.

Résumé De nombreux docteurs ont été formés en archéométallurgie africaine dans le Nord global ainsi que sur le continent africain. L’archéométallurgie africaine continue d’attirer un nombre important de chercheurs d’Europe et d’Amérique du Nord. Cet article est basé sur nos expériences vécues en tant qu’archéométallurgistes africains résidents. Nous soutenons que, par frustration en raison des relations de pouvoir inégales et au manque d’accès aux laboratoires de sciences archéologiques et au financement, la plupart des archéométallurgistes africains poursuivent désormais d’autres domaines de recherche et carrières. Nous proposons quelques solutions pour assurer la pérennité de la formation et de la pratique des scientifiques archéologiques sur le continent africain. Nous concluons que les universitaires africains doivent développer des capacités et des stratégies de recherche locales et à long terme.

Keywords Archaeological science · Archaeometallurgy · Parachute science · Research facilities · Decoloniality

Mots-clés Science archéologique · Archéométallurgie · Science du parachute · Installations de recherche · Décolonialité

“Africa was a breeding ground for Ph.D. students from Europe and North America in all the social sciences and historical sciences.” (Andah, 1995, p. 151)
Introduction

From the 1960s onwards, archaeologists began to embrace a plethora of techniques from physical sciences. However, decades later, some critics pointed out that archaeological science was resulting in the “dehumanisation of archaeology” (Marciniak & Raczkowski, 2001, p. 12) and that “[a]t the heart of the notion of archaeology as science is a retreat from society” (Shepherd, 2003, p. 844). The topic of whether the discipline of archaeology should be humanity, social science, or natural science is beyond the focus of this paper. Here it suffices to say that archaeological science has been securely entrenched over the past four decades. Certain archaeological questions cannot be tackled without recourse to techniques from the earth and natural sciences. Some scholars claim that archaeological science has exposed archaeologists to new ideas, questions, and interpretive frameworks through the competence of archaeologists in analytical techniques that were previously a preserve for chemical scientists and geologists (Britton & Richards, 2020; Sealy, 2016; Tite, 1991).

The maturity of archaeological science is demonstrated by the surge of publications in this sub-discipline. However, notable geographical disparities show that Europe, North America, and East Asia (especially China) account for most archaeological science publications (Morales et al., 2018; Torrence et al., 2015). This is not surprising since knowledge production is often informed by asymmetrical power relations along racial lines and gender dynamics (Bryant, 2014; Fongwa, 2018; Tilley, 2011). For example, the Global North, with its political and economic power, dominates archaeological science. Ndlovu (2009) once lamented that South African archaeology was a predominantly white discipline in which black South Africans were victims of exclusion. Certain contexts of doing research reinforce dominant hierarchies and inequalities which are now dubbed “academic colonialism,” “parachute science,” and “academic dependency” (for critiques, see Atalas, 2003; Mignolo, 1993; Sengupta, 2021; Stefanoudis et al., 2021; Woodall et al., 2021). Stefanoudis et al. (2021) characterize “parachute science” as a practice that involves international scientists, usually with access to substantial research funds, who carry out research in low-income countries without investing in building local research capacity and infrastructure. African scholars often find themselves entangled in unequal power dynamics when collaborating with Global North scholars. Fongwa (2018, p. 128) laments that some collaborations keep African scholars and scholarship “in its perpetual childlike state.” Some scholars from the Global North look down upon research by African scholars, especially when their results are at variance with their opinions. Resonating with these sentiments, Dabashi (2015) published a book with a rhetorical question entitled, “Can Non-Europeans Think?.” African scholars often become mere conduits in negotiating access to archaeological collections and sites without necessarily becoming fully fledged archaeological scientists and research partners. Global North scholars often have “passport privileges, making it easier for them to conduct research anywhere in the world” (Albayrak-Ayedemir, 2020). However, African scholars find it difficult to access research facilities in the Global North because of cumbersome visa requirements (this problem preceded the emergence of the COVID-19 pandemic).

African archaeologists have embraced techniques from the physical and earth sciences with some success (for commentaries, see Hubbard & Chirikure, 2008; Killick, 2006). This article reflects largely on our lived experiences as resident African archaeometallurgists. Archaeometallurgy is now securely established in the family of archaeological science. Our interest is in the products and by-products of pyrotechnological processes associated with metal production. Here we discuss challenges in pursuing a career as archaeometallurgists in Africa. We attempt to answer the following questions: where are the centers of excellence in the instruction of archaeometallurgy in Africa? Is archaeometallurgical research sustainable for Africans based on the continent? How can we further strengthen institutional and individual capacities in African archaeometallurgy? This paper was prompted by the request to the first author to join the panel discussion organized by Oxford University and its partners on “Archaeological Science in Africa and the Diaspora: Present and Future Prospects,” which took place virtually on the 23rd of April 2021.
History of Archaeometallurgy

The interest in metal objects from archaeological contexts is probably as old as the discipline of archaeology itself. However, with time, attention was also given to slag, matte, and technical ceramics, including furnace linings, crucibles, and tuyeres (Goodway, 1991; Thornton, 2009). Chirikure et al. (2013) noted that archaeometallurgy has always responded to prevailing sociopolitical contexts, theoretical nuances, and advances in instrumentation. We will broadly divide research trends in African archaeometallurgy into two categories. Firstly, there is the colonial-era research, largely informed by racial ideologies (Shepherd, 2002; Trigger, 1989). Secondly, there is research associated with the attainment of political independence in most African countries from the late 1950s to the 1990s (Stahl, 2014). These sociopolitical contexts produced contrasting trends in archaeological research, and archaeometallurgy is no exception. However, we acknowledge that our periodization of colonial and postcolonial practice is rather too simplistic, given that there are some unremorseful beneficiaries of colonial racism and patronage networks in postcolonial African archaeology (Ndlovu, 2009).

Colonialism and African Archaeometallurgy

African archaeology initially developed under the burden of racial ideologies associated with European conquest and domination. In many instances, ideologies discrediting Africans of technological innovation capabilities informed the earliest archaeological publications. Scientific racism was promoted in Western scholarship by individuals like Hume (1758) and Hegel (1840), who dismissed the possibility of advanced culture, science, and technology among precolonial African societies. Much later, scholars like Grahame Clark (1968, p. 3) also argued that southern Africa was a cul-de-sac only receptive to new ideas rather than a disseminator of new cultural discoveries. Racial ideologies, therefore, influenced earlier discussions around the origins and spread of metallurgy in Africa. Several scholars asserted that precolonial African iron technology came from outside the continent (Miller & van der Merwe, 1994; Sassoon, 1963). They argued that the discovery of iron technology in Africa was unlikely because the continent lacked prior experience in the pyrotechnology of softer metals like copper, which they presumed a precursor to ironworking (Kense, 1985; Kense & Okoro, 1993; Wertime & Muhly, 1980). Arguably, the proponents of the external origins school of thought premised their views on stereotypes rather than any scientific inquiry on the diversity, extent, and uniqueness of Africa’s archaeometallurgical record (Chirikure, 2015; Mapunda, 2010). The categorization of Africa as a technological backwater was done without any scientific rigor in the form of archaeological field surveys, excavations, and laboratory analysis of archaeometallurgical finds.

The approach of archaeologists in the colonial period was replete with some gross misrepresentation of the capabilities of African people. Remarkable achievements such as the Great Zimbabwe drystone walls, including ceremonial gold, iron, and bronze objects from the site, were considered products of exotic authorship (Bent, 1892). During this period, spectacular archaeometallurgical artifacts were treated in isolation from the broader categories of other African material culture (Chirikure et al., 2013). Much later, in the 1960s, Africanists like Nikolaas J. van der Merwe began integrating ethnoarchaeological studies and archaeometric analysis of ancient African metallurgy into the archaeological interpretation. Chirikure (2004) asserts that this period witnessed the proliferation of publications that described furnace types and offered anthropological views of metal technology.

African Archaeometallurgy Research in the Postcolonial Period

As African countries attained political independence, it became necessary to debunk racial theories in academic practice. The archaeological record was re-interpreted to deal with previous distortions (e.g., Shepherd, 2002; Stahl, 2014). Unfortunately, archaeologists initially devoted far less attention to precolonial African metallurgy. In East Africa, for example, leading archaeologists of the time devoted far greater attention to the Swahili towns (Chittick, 1963, 1974, 1984; Garlake, 1966). Mapunda (1995) notes that while archaeologists named the Iron Age period after iron technology, corresponding research interest in iron metallurgy did not immediately gain traction. Progress in the study of African metal technology remained slow because of the shortage of trained
archaeometallurgists, lack of suitable laboratory facilities in African universities, and scarcity of funding for chemical and metallurgical analyses.

Notable progress was soon achieved across the continent in shedding more light on precolonial African metal technology. For example, Schmidt (1978) and Schmidt and Avery (1978) used historical and experimental archaeology strategies to better understand indigenous iron metallurgy in East Africa. New chronometric dates, with better resolution, were used to suggest that the antiquity of African iron technology was more than 2000 years (Schmidt & Childs, 1985). Most postcolonial African archaeologists became bolder in interpreting and presenting what they thought were indigenous achievements in Africa. Chirikure (2004, p. 163) notes that from the 1980s, there were concerted efforts by Africanists to demonstrate that African metallurgy was sophisticated compared to pre-industrial Europe.

This period also witnessed the revival of the origins of the African metallurgy debate, which was prompted by new radiocarbon dates. Dates of more than 2000 BCE from Lejja in Nigeria and 2000–1800 BCE in the Central African Republic (Zangato & Holl, 2010), for example, suggest that iron metallurgy in West and Central Africa had started much earlier than previously thought. These new dates generated heated debate, with those against these dates citing the possible old wood effect (Clist, 2012; Craddock, 2010). Other scholars (e.g., Killick, 2015; Killick & Fenn, 2012) saw claims of the oldest dates and independent inventions, like preheated air blast (see Schmidt and Avery, 1978), as nationalist overtones in postcolonial African archaeometallurgical practices and an overreaction to racial ideologies of the colonial era.

Commendably, African archaeometallurgy took advantage of the call for multidisciplinary approaches to study the remains of metallurgical processes (Chirikure & Rehren, 2004; Schmidt, 2009). The African ethnographic record remained an important addition and point of departure from archaeometallurgical practice elsewhere. For example, an understanding of Njanja iron technology from ethnohistorical data and archaeometallurgy enabled Chirikure (2006) to link historical craft specialization to the Early Iron Age period of southern Africa.

Finally, African archaeometallurgists took an interest in a wider range of other metals like gold, copper, bronze, and tin (Swan, 1994). For example, the growing corpus of research on copper and tin production demonstrated their high archaeological value for understanding African social complexity (Bandama, 2013; Bandama, 2013; Killick et al., 2016; Thondhlana & Martinón-Torres, 2009; Thondhlana et al., 2016). The momentum gathered by African archaeometallurgists over the last three decades is commendable, and one would only wish for sustainability. The use of archaeological science approaches firmly rooted in culture further allowed African scholars to engage with issues at the center of technology, environment, and ideology (Chirikure, 2015; Lyaya, 2013; Mtewara, 2017).

Training in African Archaeometallurgy

Today there are many institutions of archaeological instruction in Africa but only a few offer specialist training in archaeometallurgy. Archaeological science is frequently associated with wealthier nations that can afford to establish and maintain expensive research infrastructure (Iles & Lyaya, 2015; Killick, 2008). Western universities have played a critical role in training African archaeologists and archaeometallurgists. Due to several factors discussed in this section, the Global North has been the favorite destination for aspiring African archaeological scientists. A sizable number of African archaeometallurgists received their formal training in Europe and North America.

Archaeological science requires extensive training and specialized equipment, which is not readily available in most African countries. Postgraduate African students have benefited from financial support from the international community. Murimbika & Moyo (2008) noted that foreign funding sustained the training and practice of archaeology in most African countries. For example, the Swedish International Development Agency (SIDA/SAREC) played a crucial role in the capacity building of archaeologists in Southern and East Africa. Paul Sinclair, with funding from SIDA/SAREC, should be credited for training many African archaeologists in those regions (Kusimba, 2016; Ogundiran, 2016). Ogundiran (2016) describes the SIDA/SAREC archaeological initiatives as the golden and exemplary model in North–South and continental cooperation. Thilo Rehren, then at the
Wolfson Archaeological Sciences Laboratory at the University College London, also played a critical role in the capacity building of African archaeometallurgists. In 2000, Rehren began assembling a formidable international research group of postgraduate students from Africa, South America, and China. He secured research grants from African multinational mining companies to support postgraduate students. Such opportunities allowed African archaeologists to establish networks and access the research infrastructure needed for archaeological science projects.

Iles and Lyaya (2015, p. 483) assert that “[i]nstitutions and individuals within Sub-Saharan Africa have limited access to the resources, funding, and training needed for metallographic or compositional analysis.” There is a need to provide further contextual information to explore why most Sub-Saharan countries have limited capacity to train archaeometallurgists. Most institutional arrangements in Africa do not promote the effective development of archaeological science. African archaeology, in most cases, started as an appendage of History. In Zimbabwean universities, for example, archaeology remains firmly embedded in History Departments. Killick and Young (1997) also noted that archaeology departments in most African countries are housed in the faculties of humanities and social sciences. With such institutional arrangements, science-based archaeology is almost non-existent (Marciniak & Raczkowski, 2001). The result is antipathy towards science approaches among many African archaeologists. Exceptional cases include the Department of Archaeology and Anthropology at the University of Ibadan (Nigeria) and the Department of Archaeology at the University of Cape Town (South Africa), which are currently housed under the Faculties (Colleges) of Sciences. These departments are notably strong in Archaeosciences like archaeobotany, geoarchaeology, and archaeometallurgy. Elsewhere in Europe, natural scientists from geology, biology, and chemistry often get incentives to pursue archaeology (Marciniak & Raczkowski, 2001). Tite (1991) noted that these scientists often bring the latest scientific approaches to answer archaeological questions. There is no substitute for hands-on training in well-equipped laboratories when it comes to archaeological science.

South Africa has made huge strides in training archaeological scientists and archaeometallurgists. The Department of Archaeology at the University of Cape Town (UCT) has been the major hub of activity for archaeological scientists. Thanks to the pioneering efforts of Nikolaas van der Merwe who started the formal training of archaeometallurgists in the 1970s at UCT. The institutional relocation of the Department of Archaeology from the Faculties of Arts and Social Sciences to the Faculty of Science at UCT further strengthened its position in archaeological science training (Shepherd, 2003, p. 841; Shepherd, 2005, p. 124). Sealy (2016) observed that “[f]aculties of science are usually better resourced than faculties of humanities.” UCT archaeologists have been at the forefront of developing new scientific techniques, including using light stable isotopes as ecological and dietary tracers (Killick, 2006). UCT has been actively involved in archaeometallurgical research for the past 40 years. In Africa, the Archaeology Materials Laboratory at UCT remains “(...) the only research laboratory employing a modern materials science approach dedicated to the study of the history of African indigenous technology” (UCT, 2021a). The laboratory has facilities for specimen preparation and analytical equipment, including microscopes, optical refractometers, and a portable XRF machine. The Department of Archaeology at UCT also has a state-of-the-art Stable Light Isotope Laboratory (UCT, 2021b). In addition, UCT archaeologists have access to microscopy and spectroscopy facilities in the Department of Geology. Consequently, UCT has provided a sanctuary for archaeological scientists from various African countries who cannot access equipment in their home countries.

The number of Africans with formal training in archaeological science continues to grow. By 2006, there were at least thirty resident African archaeologists with practical skills in metallography, petrography, and chemical compositional analysis of archaeological materials on the continent (Killick, 2006). Kusimba (2016) noted that the number of Black African metallurgists increased significantly with the arrival of Shadreck Chirikure at the UCT Archaeological Materials Laboratory. A cursory look at postgraduate research projects by African archaeometallurgists shows a wide coverage which includes copper, copper alloys, gold, tin, and iron (Bandama, 2013; Chirikure, 2005; Kiriama, 1986; Kusimba, 1993; Lyaya, 2013; Mapunda, 1995; Mtetwa, 2011, 2017; Okafor, 1992; Thondhlana, 2012). However, the biggest question is what became of these
archaeological scientists after receiving formal training? What has been their impact on the further development of archaeometallurgy in Africa? Is it possible to sustain the research interest of resident African archaeometallurgists? The answers to these questions are complex and differ on a case-by-case basis depending on the destination of graduates after their training. For some, the skills gained after many years of doctoral training usually diminish upon returning to their home countries. Their acquired skills are often rendered obsolete by lack of access to laboratories, while other skills were superseded by advanced technologies.

Sustainability of African Archaeometallurgy: Challenges in Knowledge Creation, Dissemination, and Consumption

Resident African archaeometallurgists face numerous challenges which undermine their professional growth. The long-term sustainability of archaeological science projects remains a big challenge due to the lack of funding and unavailability of laboratory equipment. Archaeological research, both fieldwork and laboratory work, requires substantial financial resources that are usually beyond most African researchers’ reach. Resident African archaeologists often have difficulty securing funds for field and laboratory research (Posnansky, 2009, p. 143). Barham and Mitchell (2008, p. 448) also argue that endemic funding constraints in developing economies continue to limit the capacity of research institutions to undertake fieldwork and to engage in often expensive post-exavation analyses. As a result, major archaeological expeditions on the African continent are directed by international researchers who often have access to large sums of research funding (Haour & N’Dah, 2017). Funding for research in archaeometallurgy remains limited and usually does not cover the procurement of laboratory equipment.

African archaeologists have tapped into funding opportunities from the Global North. Murimbika and Moyo (2008) noted that donors, associations, and philanthropists played a critical role in the initial development of archaeology in Africa. For example, in East Africa, the establishment of the archaeology program at Makerere University depended largely on funding from the Rockefeller Foundation (Posnansky, 2009). The British Institute in East Africa (BIEA) has also left its footprint regarding the training and financing archaeological research in Southern and East Africa (Lane & Thorp, 2005). In some cases, international foundations supplemented the salaries of expatriate staff who taught archaeology in African universities (Posnansky, 2009). However, the major challenge of depending on donor funding is that research priorities will largely be influenced by the benefactors (Labadi, 2020).

Archaeometallurgy requires hands-on experience with microscopy and spectrographic approaches. The laboratory is, therefore, a very crucial space for knowledge production. Unfortunately, the cost of procuring the much-needed laboratory equipment and consumables is exorbitant for most African institutions. Sengupta (2021) argues that location has a bearing on the opportunities available to researchers. Archaeometallurgists from poorer African nations have no access to basic scientific techniques. Sooryamoorthy (2015), who assessed scientific research in South Africa, notes that large economies usually invest proportionately in research and development. Archaeological samples from Africa are frequently shipped to overseas laboratories for further analysis. Resident African archaeological scientists find it difficult to reach their full potential without partnering with overseas colleagues. Unequal access to archaeological science facilities restricts the ability of resident African researchers to initiate independent research projects. This deeply entrenched dependency on foreign funding, and international researchers can be frustrating. Research output by most resident African archaeometallurgists is now going towards other areas which are relatively inexpensive. The ones who remain actively involved in African archaeometallurgical research have gravitated towards countries and institutions with better salaries and world-class research facilities.

Due to the constraints outlined above, research outputs by resident African scholars in various disciplines, not just archaeology, are generally suppressed. Previous bibliometric analyses have shown that Africa lags behind other continents when it comes to knowledge production (Fongwa, 2018; Thondhlana & Garwe, 2021). Bryant (2014) noted that in 2001, only 0.9% of international journal articles came from the African continent. Of this small contribution, South African researchers accounted for 0.6%.
Much recent bibliometric analysis by Beaudry et al. (2018, p. 14) also shows that South African researchers continue to dominate. Most African archaeological publications employing material science and chemical analyses come from institutions in Europe and Asia (Iles & Lyaya, 2015; Morales et al., 2018). Often, resident African archaeometallurgists find it very difficult to produce and keep up with recent literature and research trends. Gatekeeping tendencies by some dominant figures also make it very difficult to publish archaeological science results, contrary to the received wisdom that is often recycled in many published pieces. Africa’s over-reliance on international publishing outlets with editorial boards dominated by “thought leaders” and “reviewers” from the Global North can be frustrating for upcoming archaeological scientists. Due to the existing disparities in the knowledge production matrix, African scholars often require their research findings to be legitimized by the West (Thondhlana & Garwe, 2021). Western (2003, p. 15) claims that barriers that inhibit access to research findings further hold back resident African researchers. Many African research institutions do not have the funds to acquire or subscribe to literature from overseas publishers (Bryant, 2014; Connah, 2004, 178; Posnansky, 2009; Western, 2003). Scholars in the Global South often cannot afford to attend international conferences due to visa restrictions and the high costs of travelling and accommodation. The current popularity of virtual conferences and seminars, triggered by the COVID-19 pandemic, has allowed some African scholars to attend professional meetings that were largely a preserve of scholars from wealthier nations. Unfortunately, access to uninterrupted internet remains a challenge, and where the internet is available, the prices are so steep for most African scholars.

Sustaining research interest in African archaeometallurgy has been a very big challenge. Most pioneering African archaeometallurgists could not sustain their research interest upon returning to their home countries. Herman Kiriama, one of the first East African scholars to employ archaeometric approaches to understand ancient African pyro-technology (Kiriama, 1986, 1987), has since moved to heritage management and cultural heritage studies. Edwin Okafor was also among the pioneering archaeometallurgists to conduct analytical work on iron production debris around Nsukka in eastern Nigeria (Okafor, 1992). Killick (2004, p. 102) reports that “Okafor has not since his return to Nigeria had access to either the funding or to the scientific facilities that would have enabled him to apply his training to new research.” The experiences of the authors of this article after training in archaeometallurgy seem to follow the same route. In the absence of research facilities, some of us have returned to default settings, including the typological analyses of metal artifacts and ceramics. Iles and Lyaya (2015, p. 490) persuasively argue that in Africa, “archaeometallurgy has often been sidelined in favour of more accessible forms of material culture that do not require expensive analytical techniques.” Most Africa-based archaeometallurgists are losing momentum, and their once-promising careers face a bleak future. The other reason for this state of affairs is that the majority of African institutions of higher learning are teaching universities rather than research-intensive universities (Sooryamoorthy, 2015, p. 18). The burden of heavy teaching loads and administrative duties have also contributed to the erosion of research capacity among resident African archaeometallurgists.

**What Needs to be Done Going Forward?**

The preceding sections of this paper present inherent struggles that resident African archaeometallurgists face. Highlighting challenges without providing solutions is an exercise in futility. The first solution is strengthening research collaborations between North-to-South and South-to-South that do not perpetuate asymmetrical power relations. Researchers with access to laboratories should continue to facilitate access to resident African scholars through programs such as visiting fellowships and scholarships. On the other hand, Global North academics should also consider to take academic leave and sabbaticals in the Global South to fully appreciate the barriers that scholars in the Global South face (Fongwa, 2018). Funding for African scholars should go beyond just human capacity development to include the establishment of basic research infrastructure in Africa. Ramoutar-Prieschl and Hachigonta (2020) recommended that funding agencies should make provisions for equipment grants for African institutions.

The underfunding of African archaeology is likely to continue for a very long period because
the continent has serious human needs that require very urgent attention. Top priorities for most African governments include alleviating unemployment, addressing the socioeconomic and political consequences of climate change, poverty alleviation and redressing social inequalities, and providing access to good education and health (Murimbika & Moyo, 2008). The sociopolitical circumstances in most African countries include civil strife, economic decline, and famine. African archaeological research priorities should therefore be aligned to national, continental, and global priorities, challenges, and realities (Chirikure, 2021). Unfortunately, African archaeologists have hitherto avoided pressing issues in African societies (Shepherd, 2003). Researchers on or in Africa have been criticized for preoccupying themselves with issues that are merely an “intellectual impulse” (Tilley, 2011). The discipline of archaeology remains far removed from the everyday struggles of the African people. The recent outbreak of the COVID-19 pandemic and poor access to vaccination is another health challenge facing African countries and this will further marginalize archaeological research on the continent. As clearly intimated by Murimbika and Moyo (2008, p. 101), academics have to do more than demand respect for their intellectual authority in elite conferences and publications. Mining and metallurgy remain economic pillars of most African countries and surely African archaeometallurgists should exploit this to their advantage. Industry usually plays a crucial role in the development of expertise, infrastructure, and disciplines within institutions of higher learning. Mining companies have traditionally sponsored academic programs in geology, mining, and metallurgy in Africa (Ndlovu, 2017). With some creativity, African archaeometallurgy has the potential to mobilize the support of local and foreign players in the mining sector. International or multinational corporations that continue to exploit Africa’s mineral wealth should be encouraged to fund the establishment of research chairs and facilities in Africa. Currently, linkages between industry and African archaeometallurgists remain weak. Often, our research does not directly respond to contemporary industrial development needs. African archaeometallurgists should engage more with modern industrial giants so that they can contribute meaningfully to ongoing conversations on artisanal mining ventures and their implications for community development, environment, and safety (Chipangura, 2017, 2019).

Solutions to some of the challenges highlighted in this paper also lie in the hands of African scholars residing on the continent and in the diaspora. Building research capacities locally should be given top priority. African archaeometallurgy can go to the next level if the key players come together to establish a vibrant research group. There is a need to build an intra-African network of archaeometallurgists that can fundraise for the development of basic research infrastructure in Africa. African scholars, resident and the diaspora, can do more to mobilize resources to further build research capacity (see Thondhlana, et al., 2021). Africans in the diaspora can contribute to sourcing and establishing basic research infrastructure. For example, the Department of Archaeology and Tourism at the University of Nigeria (Nsukka) recently received microscopes from the African Diaspora networks. Africanist should come together to identify topics that will have global appeal and garner the much-needed international sensation. Hitherto, African metallurgists have been working on isolated projects that do not feed into each other. Africans should further strengthen local capacity through transnational knowledge production initiatives. African archaeologists have been encouraged to establish transnational and transcontinental research groups (Ogundiran, 2016). Efforts by Shadreck Chirikure to establish a transnational research consortium of African archaeometallurgists should be acknowledged. Kusimba (2016) encourages African archaeologists to support each other and build bridges in the quest for funding, collaboration, laboratories, and data sharing. African scholars should also engage in mutual citation practices which will allow them to become visible in the international arena. International and regional archaeology associations can also assist in the establishment of transnational research laboratories on the African continent. Ogundiran (2016) advocates that archaeological associations should explore possibilities of establishing regional laboratories and facilities to advance archaeological research on the African continent.

Resident African archaeometallurgists need to think outside the box when it comes to accessing laboratories. One of the solutions to the perennial challenges of access to laboratories is to collaborate with

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colleagues in the natural sciences faculties. For Ogun- diran (2016), building bridges across the frontiers of archaeological knowledge as well as scientific and humanistic disciplines is very crucial. Faculties (Col- leges) of Science often have material science equip- ment in their physical, biological, and earth science departments. African archaeometallurgists should establish ad hoc collaborations with colleagues in other disciplines such as geology and material engineering. Nonetheless, there should be strategic efforts to establish archaeology science labs in many African countries. There must be a concerted effort to secure basic equipment which allows researchers to at least carry out preliminary work like sample preparation and basic optical microscopes at their institutions. Then for subsequent analytical work, access may be negotiated with other well-resourced institutions on the continent and abroad.

Conclusion

This article is meant to generate conversations about the future of African archaeometallurgy. It argues that joining the professional ranks of archaeological scientist is not easy for most resident African researchers. Due to diverse geopolitical circumstances, most African countries cannot afford to invest in robust knowledge creation infrastructure. Singh and Allen (2006) noted that scientists prefer to locate in areas that have sound research infrastructure. It is not surprising that there is always a flight of African archaeometallurgists to countries with better research facilities. Countries like South Africa continue to attract skilled archaeological scientists. Singh and Allen (2006, p. 666) submit that countries that make a substantial investment in research and development are also likely to lead others in knowledge production and technical know- how. Luminaries of African archaeology like Merrick Posnansky (2009, p.150) who left Africa for a position at the University of California Los Angeles (UCLA) noted that “opportunities for research in Africa seemed greater from the United States than in Africa.” Most African intellectuals have very limited access, if any, to international research funds and grants. To this end, Africa remains a “breeding ground” or a “living laboratory” for researchers from Europe and North America (Tilley, 2011). It is therefore not surprising that the most promising African archaeometallurgists end up relocating to overseas research institutions. The analysis of samples and materials in overseas laborato- ries is not always feasible due to the exorbitant costs of travelling and visa restrictions. Until many African countries develop their own laboratories, asymmetrical relationships with colleagues in the Global North will likely continue. African-based researchers must be encouraged to be creative enough in upscaling and building scientific capacity locally. African archaeo- metallurgy is slowly developing into a “big boys club” without any internationally recognized African women practitioners. Some intentionality efforts must be made to rectify this issue.

International support to build Africa’s capacity in archaeological science is a necessity. South-to-South research coalitions should be promoted to establish state-of-the-art archaeological science laboratories in Africa. Without the requisite research infrastruc- ture in the form of laboratories, Africa-based scholars will not be at the forefront of developing cutting-edge techniques and research outputs in archaeological sciences in the foreseeable future. Chirikure (2021) warns us that retreating to scientific rigor alone will not be the ultimate answer. Archaeological scientists and archaeometallurgists should set research agendas that address broader African challenges. There is a lot of untapped potential among African-based archaeo- metallurgists. We hope that this contribution will provoke serious discussions and action on capacity development in African archaeological science.

Comments

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Thondhlana et al. offer substance for scholastic and pragmatic thought about archaeology in Africa. Their article, which is based on the woes and lived experiences of some foreign-trained African archaeo- metallurgists, resonates with my experiences as a US-trained African archaeological anthropologist currently residing in Africa. The only exception is that I am practicing archaeology without the neces- sity of complex laboratory facilities: my focus on classical field excavations is not burdened by the
need for sophisticated gadgets. Nevertheless, the encumbrances of inadequate funding for sustained multi-season research and lack of resources to enable resident African archaeologists to date excavated materials and to conduct further scientific/elemental analysis on recovered samples have been a bane to scientific archaeological productivity in Africa. The lamentations of Thondhlana et al. elucidate important issues that will require strategic interventions by archaeology professionals and organizations around the globe.

Advanced training in the archaeometry of past metallurgical and pyrotechnological practices is a specialization that does not come cheap. Thus, after achieving such skills, African professionals are often expected to return to their home countries to practice archaeology and share their knowledge. However, the fact remains that the lack of laboratories equipped with advanced, or even basic, analytical equipment often renders these specialists redundant, even though so many resources were expended on their training at well-endowed institutions outside Africa. No wonder then that some African archaeometallurgists wander off to pursue other, non-scientific careers. Does this phenomenon not represent a wasted effort to build African capacity in specialized scientific fields?

Questions of power and participation in African archaeology drum home issues of inequality in how research is carried out. First, a lack of specialist training and equipment leads many African archaeologists to partner with non-archaeologists in the fields of material science, engineering, earth science, and nuclear science at well-endowed foreign and African universities, such as the University of Ghana and the University of Cape Town, to process and conduct analyses on some of their finds (see Asare et al., 2020; Nyankson et al., 2020).

Second, it’s worth expatiating on the issues raised by Thondhlana et al. about power dynamics in local-foreign collegiality and access to funding and training in archaeological science in African archaeology. As they rightly argued, unequal power relations between local and foreign archaeologists, often manifesting along racial or gender lines, usually lead to unsustainable knowledge production. I can say emphatically that every African archaeologist has experienced at least one instance of collegial inequality and power play in the quest for and implementation of funded joint projects. In most cases, European and American funds come from their taxpayers, so this seems to justify their access to the funds for fieldwork and equipment. Recently, many grant agencies require the participation of at least one Africa-based archaeologist in the grant application. Foreign partners have had success in shopping around for one to include. The African scholar may not be privy to the full scope of the proposed project, especially the financial arrangements, or not be informed about the outcome of the application until a note of inquiry is sent to them. When funded, some African scholars are left out of the implementation. Symmetrical relationships between African archaeologists and foreign partners require an equal share in the research funding and deliverables.

Furthermore, there is merit to the authors’ argument that African scholars or laypeople are conduits for foreign colleagues to access African sites (Fleisher & Wynne-Jones, 2010). The African partner tends to exercise power at the beginning of the project in terms of providing or not providing an invitation letter and smoothing (or not) access to project sites and local community leaders. Once the community becomes familiar with the foreign partner, the African scholar can lose this initial power because they are not the ones doling out money to the local leaders and workers; this is especially the case where collegial respect and ethical expectations are not strongly emphasized and adhered to.

The novel recommendations proffered by Thondhlana et al. to ensure sustainability in the training and practice of archaeological science in Africa are spot on. To add to these, I believe Africans must also look within for useful indigenous knowledge to invent our approach to scientific research. Let’s take a cue from the many descendants of enslaved Africans who used, and still use, the indigenous African knowledge systems to patent many industrial and lifesaving gadgets used in all facets of life today. One can recall Garrett Morgan, an African American who invented the sewing machine and gas mask, and improved traffic light in the 1920s. Similarly, George Edward Alcorn, Jr. invented the fabricating knowledge of the X-ray spectrometer in 1984. And in my own backyard in Ghana, Thomas Mensah is a Ghanaian-American chemical engineer with fourteen patents who is popularly known for the development of fiber optics and nanotechnology used in all communication appliances today (Mensah, 2017). When the skills of
foreign-trained African experts are endangered, I conclude that African scholars need to develop homegrown and long-term research capacities and strategies by first exhausting internal possibilities of cross-disciplinary use of scientific colleagues and research laboratories.

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“Whatever training you received, from now on you are a lawyer”: Versatility as a lifeline for African archaeological scientists

The opening quote came from a Chicago-based private collector who requested me to facilitate the repatriation of some African objects acquired through unconventional means. Clearly, the ability to converse with a diverse audience is becoming priceless throughout the world. Thondhlana and colleagues argue that resident African archaeometallurgists are forced to diversify their research portfolio due to frustration and lack of facilities and resources to do what they were trained for—archaeometry. They suggest novel strategies for promoting sustainable archaeometallurgical programs in Africa. As someone, who until recently, was also a resident African metallurgist, I share the frustration, but not their reasons for diversification. In the context of dwindling and unstable global economies, diversification may be the lifeline for African scientists. Thondhlana et al. proposed solutions are on point, and the authors should be congratulated for their bravery.

Archaeologists in Africa are usually called upon to justify their relevance in a continent bedeviled by many pressing existential issues (Chirikure, 2014; Ndlovu, 2017). Thondhlana and colleagues argue succinctly for the necessity of specialist subdisciplines of archaeology to address certain key questions and expose the field to new ideas, questions, and interpretive frameworks. Archaeometallurgy does this with minimal effort because it is naturally a multidisciplinary and collaborative specialization (Rehren & Pernicka, 2008). Early on, metallurgical reports were a constant appendage of most archaeological research in Africa, but recent calls have rightly called for trained archaeometallurgists to be represented from the project conception phase (Bachmann, 1982; Chirikure et al., 2013).

I see the methodological overlaps and multidisciplinary nature of archaeometallurgy as two major reasons for African archaeometallurgists to broaden their pursuits. One obvious case comes from Professor Shadreck Chirikure, who has led the only archaeometallurgical laboratory in Africa for nearly two decades at the University of Cape Town (UCT). His credentials put him on the elite level of a select few, having done reputable work on iron, copper, tin, bronze, brass, and gold metallurgy, including studies of production debris, reaction infrastructure, and finished objects. As a laboratory director with access to various national and international funding sources, Chirikure did not have to diversify due to a lack of resources. Indeed, nearly a third of his more than one hundred and fifty published works would qualify as archaeometallurgical (Google Scholar, 2022). However, his other publications draw on methodological overlaps and collaborations beyond the archaeometallurgical sphere to cover a vast array of topics, including general archaeology, physical anthropology, heritage, geography, biology, epidemiology, and pharmacology. As a former archaeometallurgy student of Chirikure, I continue (although at a modest pace) to expand my interests in African archaeology. After starting my postgraduate studies on the Stone Age of eastern Zimbabwe, I switched to archaeometallurgy due to the perceived lack of resources in Zimbabwean Stone Age research at the time. I retained an interest in Stone Age research but thought I could make a bigger impact with archaeometallurgy when arguing for Africa’s place in global discourse. Like Thondhlana et al., I expanded into less familiar territory, including work on glass beads, statistics, ceramics, shells, stonewalling, and general archaeological theory and methods. While I lament the lack of archaeometallurgical facilities that forced me into a five-year-long postdoctoral fellowship at UCT, I have always viewed myself as an archaeologist, first and foremost. I have always resisted archaeology’s obsession with “ages” (Hall & Silliman, 2006) and was never content with just the archaeometallurgical hat.
The archaeological record is also rarely made of clean categories of material.

Thondhlana and colleagues correctly note that the trajectory of each African archaeometallurgist is case-specific, but I would note that so is external financial support for archaeometallurgical research in Africa. Historically, multidisciplinary projects are more likely to be funded than pure archaeometallurgical pursuits—a deplorable situation that is unlikely to change in the foreseeable future. Global economies have become volatile, and archaeology is under assault for its relevance; several institutions in the Global North are shrinking or closing shop altogether (Harris, 2021). Museums, universities, and Cultural Resource Management (CRM) firms remain the main employers of archaeology graduates, but they rarely employ specialist archaeologists. The efforts of “unfortunate” African archaeometallurgists at diversification are, therefore, a good omen because global archaeology is headed in that direction.

Thondhlana and colleagues are spot-on with their suggestions for collaboration and partnership. This has already been advocated for and applied on a small scale (Ndlovu, 2017). Partnerships with existing hard science departments remain key to the survival of many African archaeometallurgists because of the high cost of purchasing and maintaining research facilities. The ultimate dream is to pull together resources to create a grand archaeometallurgical research group; but for now, it remains just that: a dream.

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It is a truism that archaeological science has been neglected in Africa. Thondhlana et al. argue that this results from two major issues. First, archaeology is not considered as science in most African countries; therefore, the need to avail the necessary resources for conducting archaeological research projects does not occur to political leaders and, surprisingly, to academic leaders. I remember as an Honors undergraduate student the difficulties I faced with the Dean of the Science Faculty of my university when I sought permission from him to use the Geology laboratory equipment to analyze my data. He could not

understand why and how a “history” student could want to undertake a “scientific” study. It took the intervention of the Vice-Chancellor to instruct the Dean to allow me to use the facilities because they belonged to the university, and I was a student at that university! A second issue raised by Thondhlana et al. is the lack of adequate budgetary allocation, not only to the humanities but also for research in general. This leads some university administrators to jealously guard their equipment because if they break down, it may take a long time to have them repaired or replaced.

Therefore, the lack of local resources leads African archaeological scientists to be at the mercy of institutions and scholars from the Global North for their research programs. The problem with this dependency is that these foreign scholars may want African scholars to reach conclusions that are in line with scholarship in the Global North. For instance, in 1986, after my Master’s degree, I tried to publish a paper based on my thesis, which was at odds with the opinions of the “leading” scholars of the time. When the manuscript was sent to some of these scholars for review, they dismissed its findings and even questioned the methods that I had used. On that basis, several journals refused to publish the paper. Fortunately, some scholars agreed with my conclusions, and the article was eventually published (Kiriama, 1987). This protectionism/gatekeeping means that it can take a long time for an African scientist to publish their work. And maybe by the time they publish, somebody else from the Global North has already broken the new ground, making it appear as if the African scholar has plagiarized that work. This is why some of us moved to “softer” research in archaeology/heritage studies, where the challenges are not as insurmountable as those in archaeological science.

The other issue raised by the authors, which I totally agree with, is that most African scholars do not reference one another. There is this tendency that I would rather reference the work of a non-African scholar who has done work in the same area. The result is that most African scholars continue to lack visibility, which further contributes to the challenge of raising funds for research.

The blame game, however, cannot continue. African archaeological scientists need to come together as a group and chart a way forward, starting with making the resources at our disposal and in our
universities available to young scholars. Established scholars also need to use their networks to create training and research opportunities for students willing to venture into this subdiscipline. We need to move from our ivory towers and communicate the results of archaeology to the public, including the role our research can play in national development and in uplifting the livelihoods of local communities. Showing how earlier communities utilized the mineral resources in their areas may galvanize political leadership to develop programs that can sustainably utilize the same mineral resources for the benefit of the populace. This, in turn, will enable us to get the necessary budgetary allocation for continued research. Finally, we need to establish publishing channels for communicating our research findings; there is an over-reliance on journals and publishing houses based in the Global North which in most instances do not give room to African scholars to publish their work.

This discussion forum has come at the right time when many African archaeological scientists are moving out of the subdiscipline.

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African archaeologists can help to challenge stereotypes of Africa as a monolithic entity where nothing is happening when compared to the Global North. Some of the many questions that confront archaeometallurgists, archaeobotanists, and other archaeological scientists more specifically include: What does the future hold for archaeological science in Africa? Is there a way to mobilize archaeological science to solve key issues and challenges in the continent? Archaeologists combine theoretical and methodological frameworks to answer these questions through fieldwork, data recovery, and various scientific techniques.

The history of archaeological science research in Nigeria is relatively recent. During the 1960s to 1980s, most of the archaeology in Nigeria was not scientifically inclined but was focused on artifact categorization, relative chronology, and stratigraphy, among other topics. Presently in Nigeria, we have over 150 universities, but only ten of these offer archaeology as a course of study. Seven of these programs do not have a well-equipped archaeological science laboratory for research. As a result, the research capacity in archaeological science is very low.

Furthermore, the limited infrastructure and lack of access to necessary equipment mean that technical staff and students do not receive adequate training. Most archaeological scientists from universities in Nigeria have accessed most or part of their training in Europe to get the knowledge and expertise needed for a successful career. It is important to note that just a fraction of archaeologists from Nigeria had earned their PhDs in the UK, Canada, or the USA when compared to colleagues from East or Southern Africa. For those Nigerian scholars who studied archaeological science abroad, it is quite challenging for them to be productive when they return home because of the absence of well-equipped laboratories. Hence, it is very difficult to practice the skills and expertise they have learned abroad. Most times, those with archaeological science training are encouraged to go to other departments, such as Botany, Zoology, and Material Science, to conduct their analyses—whether or not these departments have the needed equipment. In other words, we are confronted daily with training, equipment, and capacity-building challenges.

Archaeology as a discipline has so much to offer for understanding the deep-time human experience. Unfortunately, it is given a low priority compared to the other fields. From my experience, most archaeologists in Nigeria have good fieldwork skills, but they do not have access to laboratories to analyze their findings. Presently, there are no radiocarbon dating labs in Nigeria. There may be only two such labs in Sub-Saharan Africa as a whole—the iThemba Laboratory for Accelerator Based Science in Gauteng, South Africa and the IFAN Laboratoire de Carbone 14 in Senegal. This makes it difficult for most archaeometallurgists, archaeobotanists, and geoarchaeologists, among others, in the continent to have a productive research program. The solution to this problem is to develop home-grown and long-term research capacities and strategies on the continent that will sponsor Ph.D. students and academic staff to learn key skills through travel to the Global North for short-term courses on issues pertaining to archaeological science and resource management. However, international workshops, seminars, and hands-on training should be designed around the needs of the people requesting them. Building on the commendable ways
that African archaeologists collaborate with individuals and organizations beyond the continent, there is a further need to organize diverse alliances and networks between individuals, institutions, and organizations like SAfA and WAC. Their statutes encourage diversity and collaboration between themselves and African countries (Mizoguchi, 2015). Laboratories should be established in archaeological departments that do not have the facilities. At the same time, African archaeologists should think outside the box and work together using local resources to obtain some of the basic equipment for research, including place beakers, funnels, pipette, lab stands, conical flasks, lab coats, and protective gloves. If archaeological scientists mobilize the results from their laboratories, they will yield sustainable outputs and solutions through time. The way African archaeologists are collaborating with individuals and different organization in Europe and other parts of the world is quite commendable although more collaboration is needed. Collaborations with other scientific disciplines are also highly recommended to enhance the value of archaeological science now and in the years to come.

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