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The role of bioarchaeology today? Exploring social and scientific implications through Central and Southern African case studies

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Abstract

This article focuses on the role of bioarchaeology, a hybrid discipline that analyses human remains from various archaeological contexts. It reviews the work of bioarchaeologists in sub-Saharan Africa, to discuss the scientific and growing social implications for contemporary human groups (e.g., population history, restitution of ancestors). The contribution of recent case studies in bioarchaeology is discussed, focusing on Central Africa, a region less well documented due to poor skeletal preservation but, nevertheless, at the centre of academic research. Case studies from southern Africa are also included, given their crucial role in the decolonisation of research. The article is structured around the following three topics: 1) the evolution of bioarchaeology to date; 2) the discipline's ability to reconstruct the history of groups and individuals; and 3) its key role in addressing current ethical issues concerning human remains. To conclude, it is argued that bioarchaeology must question its ethical approach and scientific contributions, which should benefit African descendant communities.

Keywords: archaeological human remains, interdisciplinary research, ethics, Africa, osteobiography

Résumé

Cet article se concentre sur le rôle de la bioarchéologie, une discipline hybride qui analyse les restes humains issus de divers contextes archéologiques. Il passe en revue le travail de bioarchéologues en Afrique sub-saharienne, afin de discuter des implications d'ordre scientifique et social pour les groupes humains actuels (ex. histoire des populations, restitution des ancêtres). La contribution de récentes études de cas en bioarchéologie est discutée, en se focalisant tout particulièrement sur l'Afrique centrale, une région moins bien documentée à cause de la pauvre conservation des squelettes et, néanmoins, au centre de l'attention des chercheurs. Des études de cas d'Afrique australe sont aussi ajoutées à cause de leur rôle crucial pour la décolonisation de la recherche. L'article est structuré selon les trois sujets suivants : 1) l'évolution de la bioarchéologie jusqu'à présent; 2) la capacité de la discipline à reconstruire l'histoire des groupes et des individus; et 3) son rôle clé pour aborder les questions éthiques actuelles concernant les restes humains. En conclusion, il est souligné que la bioarchéologie a le devoir de se questionner sur son approche éthique et ses contributions scientifiques, qui devraient être directement bénéfiques pour les communautés Africaines descendantes.

Mots-clés : *restes humains archéologiques, recherches interdisciplinaires, éthique, Afrique, ostéobiographie*

1. INTRODUCTION

In this introduction, the authors described how the question under focus – the current role of bioarchaeology – has been raised and why it is essential to expand on this subject, particularly for Central Africa and its communities. The term 'bioarchaeology' is however, defined differently globally, often encapsulating the study of all biological data, including faunal and human remains within an archaeological context (Larsen, 1987, 2015; Larsen & Walker, 2010; Arbogast & Tengberg, 2020). Here, its North American definition will be used, which focuses only on human remains. It can be considered equivalent to the term palaeoanthropology (Arbogast & Tengberg, 2020).

As part of their role in the *Human Remains Origin(s) Multidisciplinary Evaluation* (HOME) Belgian project, the authors were asked to reflect on the scientific value of their bioarchaeological research on Central Africa and more generally on the discipline of bioarchaeology (expanded here to Southern Africa). The multidisciplinary HOME project is a first step towards the decolonisation of the Federal Scientific Institutions in Belgium (Verbeke, 2023). It is

part of a worldwide process, encouraging the restitution and repatriation of skeletal human collections to their countries of origin (e.g., Nienaber *et al.*, 2008; Rassool, 2015; Schoeman & Pikirayi, 2011; Wright *et al.*, 2018; Le Gall & Mboro, 2020; Garsha, 2020; Batt, 2021; Rassool & Gibbon, 2023). The HOME recommendations call for an open policy in the Federal Scientific Institutions, encouraging both the legal and respectful protection of human remains, collaborations with descendant communities, and especially the restitution and repatriation of human remains related to Belgium's colonialism (see Author's name, this volume).

As this paper is aimed at a broad readership, the text is not overtly technical. Bioarchaeology is not purely biological and incorporates components from the social sciences, as human remains, and their context, are the reflection of not only biology but also various environmental and cultural aspects (e.g., Larsen & Walker, 2010; Agarwal & Glencross, 2011; Stojanowski & Duncan, 2015; Murphy & Klaus, 2021). As the discipline evolves, there is significant additional literature on both theoretical and ethical considerations (e.g., Walker, 2000; Morris, 2008; Schmidt & Pikirayi, 2016; Porr & Matthews, 2019; Watkins, 2020; Digangi & Bethard, 2021; Pfeiffer, 2021; Martin-Moya *et al.*, 2023). The increasing reflection on ethics has relevance (e.g., Smith *et al.*, 2017; Prendergast & Sawchuk, 2018), for descendant communities, especially in Southern Africa (e.g., Gibbon, 2020; Gibbon *et al.*, 2023). However, whilst there has been a great deal of literature on bioarchaeological studies in Southern Africa, there is not yet a comprehensive synthesis for Central African bioarchaeology. To address this gap, we have compiled a selection of key bioarchaeological studies for this region.

The article is structured around the following three topics:

1. the evolution of the discipline from the 1980's to the present day;
2. the discipline's ability to reconstruct the history of groups and individuals; and
3. its key role in addressing current ethical issues concerning human remains.

The Central African skeletal remains discussed in the article were found in different countries (Cameroon, Gabon, Democratic Republic of Congo (DRC)) and some of those are housed abroad (e.g., Ishango in Belgium and USA; Shum Laka in Belgium) (**Fig. 1**). They mostly relate to Central African archaeology and are largely dated to within the past 10,000 years (Holocene). The sites selected aim to fill in some of the bioarchaeological 'gaps', but also to link our discussion to the HOME project. As part of the HOME project, researchers engaged with Central African communities to ask their views on repatriation. A series of recommendations were produced which encompassed the views of all stakeholders and recommended that the Federal Scientific Institutions should be open to repatriation when requested. It is also therefore essential to share and reflect on research results from the last thirty years and their contribution to present Central African populations. While consolidating the discussion, examples from Southern Africa have also been added, as this region has strong historical and archaeological connections with Central Africa. Southern Africa has produced leading bioarchaeologists (who are notably further ahead in exploring the ethical dimensions of the discipline on the continent).

2. EVOLUTION OF THE DISCIPLINE OF BIOARCHAEOLOGY

Bioarchaeology can be considered as a rebirth of the discipline known as 'physical anthropology' (Armelagos & Van Gerven, 2003). Like physical anthropology, bioarchaeology focuses on the analysis of archaeological human remains, but also emphasizes the integration of contextual data (e.g., paleoenvironment, archaeology, history) into the osteological analysis (Martin *et al.*, 2013; Buikstra & Beck, 2016). This transformation occurred in the late seventies with the New Archaeology movement, while research became interdisciplinary. Bioarchaeological research focuses on the exploration of human adaptation and behaviour and its underlying forces (environment and culture) (Larsen, 1987). Consequently, it uses an array of specialized disciplines (e.g., paleodemography, palaeopathology, paleonutrition, paleochemistry, paleogenetics) to explore various topics (e.g., death rituals, health, diet, mobility, activity, violence, marginalisation) on different scales of analysis (e.g., individual, population, regional, continental; Martin *et al.*, 2012; Stodder & Palkovich, 2012; Larsen, 2015; Mant & Holland, 2019; Sutton, 2020).

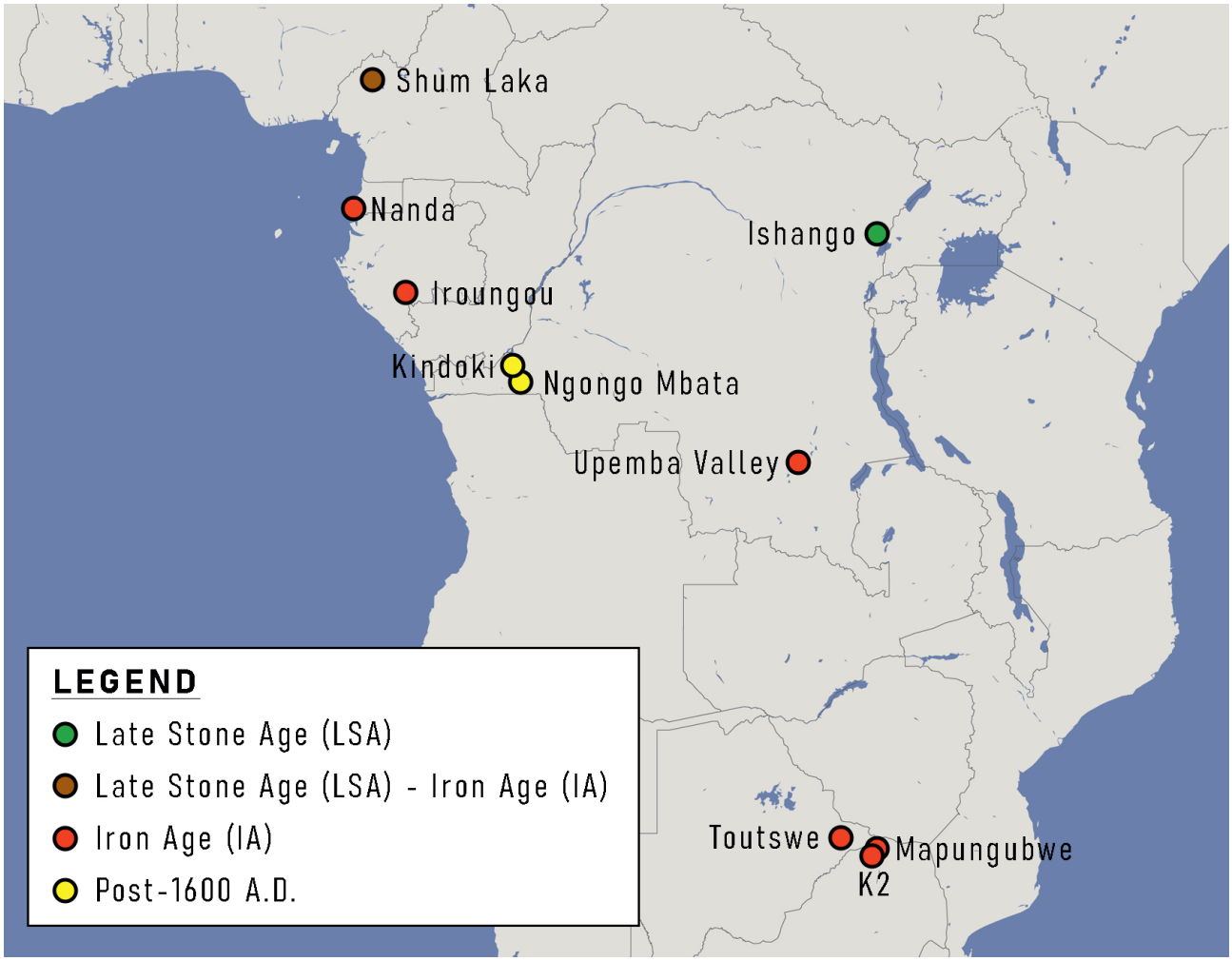

Fig. 1 – Map showing the key sites mentioned in the text using several Central and Southern African bioarchaeological case studies. Source map: snazzymaps.com.

In North America, one of the driving transformations of bioarchaeology was the *American Graves Protection and Repatriation Act* (NAGPRA), which started in 1990, and officially integrated ethics into the conversation with descendant communities (Hitchcock, 2002). In other regions such as South Africa, the integration of ethics into bioarchaeology was initiated mainly after 1994 (post-apartheid), a political and social context that was the driving force (Morris, 2014). Despite the variability of the process of restitution and the length of time restitution can take, the integration of ethics nevertheless contributed to accelerating bioarchaeological transformation around the world (e.g., Blakey, 2008; Lamptey & Apoh, 2020; Black *et al.*, 2022; Houle *et al.*, 2023; Martin-Moya *et al.*, 2023). On the African continent, South Africa has played and continues to play a leading role nationally and internationally in ethical issues. These include the repatriation of human remains within the last twenty years (Nienaber *et al.*, 2008; Morris, 2014; Henderson, 2014; Rassool, 2015; Masiteng, 2019; Gibbon & Morris, 2021; Black *et al.*, 2022; Gibbon *et al.*, 2023).

As social theory was incorporated into the field of bioarchaeology (Knudson & Stojanowski, 2008, 2020), the notion of identity was revisited, emphasizing its complexity and social components (gender, age, socioeconomic and health status, ethnic and religious affiliations) that interact with the social world (Epstein, 1978). Social identities are expressed on both individual and collective levels (collective identities are based on an individual's feelings of

belonging to a group and others' recognition of an individual's group affiliation) (Jenkins, 2008). Although these social components are intangible, they leave traces on a human skeleton through the following indicators: bone and dental lesions due to a vast array of diseases (e.g., infectious, metabolic, immune, degenerative, occupational); intentionally modified skeletal elements due to cultural practices; and chemical composition of both bone and dental tissues which reflect diet, mobility and place of residence (Larsen, 2015). These various skeletal indicators (macroscopical, microscopical and chemical) enable the reconstruction of past lives (e.g., origin, age, sex, health, activities) through 'osteobiographies' (Pfeiffer, 2021). They suggest that a body is not only plastic (or in other words, reacting to stress) but also durable. After death the body can provide information on the life condition of the deceased individual or group (e.g., health status, intensity of activities). Social identity can be also expressed through various other forms such as funerary rituals (e.g., body treatment, structures, and artefacts associated with the burial) as well as the genetical and morphological variation of an individual or group reflecting specific mating patterns (Knudson & Stojanowski, 2020).

The analysis of different bioarchaeological markers has allowed bioarchaeology to explore more deeply the notion of social identity and events of oppression. As Mant & Holland (2019) discussed, events of oppression are often not detailed in historical accounts. Furthermore, the theories regarding the relationship between multiple human social dimensions (especially geographical origin, gender, and class) had been instrumental in bioarchaeological research. These ideas have enabled bioarchaeologists to comment on the histories of marginalised people during colonialism (Blakey, 2001; Van Der Merwe *et al.*, 2010a; Kacki & Romon, 2013; Kootker *et al.*, 2016; Meyer *et al.*, 2013; Murphy & Klaus, 2021; Maass, 2023; Martin-Moya & Ribot, 2024). For example, when Maass (2023) analysed the skeletal remains of African enslaved people on the Peruvian Plantations, she emphasized the underestimated impacts of living conditions on women. Her research showed that bioarchaeology can be instrumental in exploring intersectionality, a concept that critically analyses multiple overlapping identities and social statutes within a context of systemic oppression (Collins, 2019). These 'new' developments have been a step forward for the following reasons:

1. to redefine the discipline and its objectives towards not only purely scientific goals;
2. to decolonise the approach of scholars and institutions; and
3. to move towards a collaborative practice with descendant communities (Supernant, 2020; Buikstra *et al.*, 2022).

New developments in bioarchaeology are also illustrated by recent research from other fields including ancient DNA studies (Alpaslan-Roodenberg *et al.*, 2021). The latter have provided considerable information on both the short and long-term history of our species, especially within Africa (e.g., Lipson *et al.*, 2020; Avila-Arcos *et al.*, 2023; Vicente & Schlebusch, 2020). However, due to a lack of the collaboration between scientific disciplines, ancient DNA studies have not always included the bioarchaeological context of the individual under focus in detail (e.g., age, sex, health, diet; Pfeiffer *et al.*, 2019; Pfeiffer, 2021; Morris, 2023). This can lead to 'incomplete' conclusions, based on the lack of context. Nevertheless, recent ancient DNA studies combined with robust bioarchaeological data have shown that they can potentially re-explore a wide range of themes. Recent studies include the regional diversity of ancient foragers in both South Africa (Morris *et al.*, 2014) and West-Central Africa (Lipson *et al.*, 2020); the expansion of pastoralists and/or farmers in sub-Saharan Africa (e.g., Wang *et al.*, 2020; Fortes-Lima *et al.*, 2024); and the forced African migration in a trans-Atlantic context (e.g., Fleskes *et al.*, 2019).

In conclusion, Klaus (2020: 184), perfectly summarized the definition of the discipline: [….] '*bioarchaeology inhabits unique anthropological, scientific, and even philosophical positions. These qualities emerge from our status as a hybrid discipline that bridges many of the strengths of biological anthropology and archaeology.*' In fact, bioarchaeological traditions are strongly rooted in archaeology in both Southern Africa (e.g., Pfeiffer, 2009; Van der Merwe *et al.*, 2010a, 2010b; Botha & Steyn, 2016) and Central Africa (e.g., Ribot *et al.*, 2001; Dlamini *et al.*, 2016; Smith *et al.*, 2017; Asti *et al.*, 2020). Furthermore, as research themes in bioarchaeology (e.g., population movement, environmental adaptation) uses skeletal and archaeological data, inferences from other fields (e.g., genetics, linguistics) can be included into the bioarchaeological

interpretation(s). The following section will focus on Central Africa and its relationship with bioarchaeology, post-1980.

3. BIOARCHAEOLOGICAL RECONSTRUCTIONS OF PAST POPULATION HISTORY IN CENTRAL AFRICA

Central Africa is extremely diverse and rich in various aspects (biology, environment, culture). It has attracted and still attracts the attention of interdisciplinary researchers: e.g., archaeology (Mercader, 2002; Cornelissen, 2002; Eggert, 2014; Smith *et al.*, 2017; Nlend, 2022); biological anthropology and paleoanthropology (Hiernaux, 1979; Froment 1998; Crevecoeur *et al.*, 2014; BergstrÖm *et al.*, 2021); ethnography and history (Vansina, 1990; Denbow, 2014); linguistics (Bahuchet, 2012; Bostoen *et al.*, 2015); and genetics (Tishkoff & Williams, 2002; Verdu *et al.*, 2009; Fan *et al.*, 2023).

For the last forty years, research themes relating to past cultural and biological human diversity have been raised in bioarchaeology (Buikstra & Beck, 2016). The following three research themes will be tackled below separately:

1. funerary archaeology used to explore past cultural diversity;
2. cranial morphology as a proxy of genetics to understand past population diversity; and
3. health and nutrition to explore past socio-economic organisation.

These three research axes correspond to different methodological approaches derived from bioarchaeology. The first (1) is based on the science of death, named archaeothanatology, combining *in-situ* skeletal observation with knowledge of body decomposition (Duday *et al.*, 2009); the second (2) is based on the morphometrical analysis of both size and shape of bones and teeth in 2D or 3D (Pilloud & Hefner, 2016); and the third (3) axis is based on both palaeopathological and paleochemical methods (Buikstra, 2019; Katzenberg & Waters-Rist, 2018).

3.1. Funerary archaeology used to explore past cultural diversity

Bioarchaeology allows us not only to explore past lives but also the ways deaths are perceived and treated through funerary practices (Tarlow & Nilsson Stutz, 2013). While the dead might not mirror the living, material traces can introduce us to the immaterial or spiritual world. This is however challenging. For example, without written and/or oral evidence, interpretations about funerary sites and how a deceased body was treated remain speculative (Duday *et al.,* 2009). Furthermore, skeletal preservation is variable, and many organic materials related to the burial might not survive and impede a fuller understanding of the funerary ritual. Nevertheless, when funerary archaeological data are combined with skeletal data (e.g., age, sex, health), bioarchaeology can explore a funerary site on both individual (osteobiographies) and group (internal organisation of a funerary site, selection of individuals) levels. In other words, the approach of using several disciplines helps us reconstruct past social organisation. To illustrate these different avenues of interpretation(s), this discussion will focus on Shum Laka, using a few comparative samples from elsewhere (e.g., Upemba Valley, Kindoki, Ngongo Mbata, Iroungou).

Located close to the northern border of the equatorial forest in North-Western Cameroon, Shum Laka, a rock shelter, is one of the unique sites in West-Central Africa, where human remains (18 individuals), were found and dated to the Later Stone Age (LSA) and Earlier Iron Age (EIA) (Lavachery *et al.*, 1996; Ribot *et al.*, 2001). The burials containing deposits were dated between around 9,000 and 3,000 Before Present (BP) with two distinct burial phases (calibrated radiocarbon dates): the Earlier Holocene (7,882-7,635 calBP) and Later Holocene (3,370-3,030 calBP) (Suppl. Inf. *in* Lipson *et al.*, 2020:2-23). From the mid-Holocene, the drier climatic conditions seemed to coincide with observed changes in lithic and ceramic technology. The changes in these technologies might have contributed to the emergence of new economic strategies (arboriculture) despite the long-term continuity of hunting (Giresse *et al.*, 1994; Lavachery *et al.*, 1996).

Detailed excavation of the human remains with *in situ* skeletal observations (e.g., examining the degree of skeletal articulation on the remains being excavated) demonstrated an impressive variety of burial types (Ribot *et al.*, 2001). The two chronological phases provided both primary burials (articulated skeleton(s) corresponding to one main funerary event) and secondary burials (disarticulated and fragmentary skeleton(s) resulting from several funerary

events). The number of burials and different types of burials seemed to increase from the Early to the Late Holocene phase. In the Early Holocene, there was 1 single adult primary burial, 1 double child primary burial and 1 secondary adult burial with long bones only. In the Late Holocene, there were 2 single child primary burials, 1 collective burial for 7 children, 1 double adult primary burial, 1 secondary deposit and 1 adult cremation (Ribot *et al*., 2001: 185-190). New ways of treating the deceased emerged during the Earlier Iron Age (EIA) around 3,000 years ago and were even more complex than in the earlier phase (LSA). For example, a collective burial pit (unit 7) corresponded to several funerary events for at least seven partially disarticulated and burnt juvenile skeletons; and a double adult primary burial (unit 6) was associated with a complex secondary deposit, which included fragmentary human and chimpanzee remains (some were partially burnt and/or covered with ochre) (Ribot *et al*., 2001:48-62; 63-720).

Two main hypotheses were proposed to understand Shum Laka's funerary diversity, (Ribot *et al*., 2001:189-190; Suppl. Inf. in Lipson *et al.*, 2020:6). First, increasing diversity through time may be interpreted as a phenomenon related to the advent of more complex societies in the Early Iron Age (EIA) (e.g., farming, mixed economies, social stratification, state-based system). Shum Laka is not comparable with any other contemporary sites in the region for the Early Iron Age (EIA), although secondary and collective burials do seem to increasingly appear during the (Later) Iron Age (LIA). Examples of secondary and collective burials can be found at the open-air site of Nanda in Equatorial Guinea (González-Ruibal *et al.*, 2012) and the cave site of Iroungou in Gabon (Villotte *et al.*, 2021). In particular, the collective burial of Iroungou has been interpreted by Villotte *et al.* (2021) as the possible consequence of an increased centralized authority (retainer sacrifice, e.g., sacrifice of servants for the afterlife of high-status people).

The second hypothesis is that the LSA-EIA rock shelter of Shum Laka could reflect a special place for unusual deaths. This is because it is unlike other simpler village or church cemeteries that have only primary burials, such as those that have been discovered in the DRC for the Iron Age (Upemba Valley, DRC) (de Maret, 1985, 1992) and Late Iron Age (Kindoki, Ngongo Mbata) (Polet *et al*., 2018; Clist *et al.*, 2018). This hypothesis could be supported not only by the diverse burial typology and complex associated deposits, but also by the individuals buried in the cemetery. For example, a case of severe unhealed pelvic trauma was observed on a 5–7-year-old child skeleton in unit 7 (Ribot *et al.*, 2001:146-148). Although this skeletal evidence is not sufficient to support this hypothesis, it is interesting to note that Shum Laka could be reminiscent of the funerary rituals that are practised today in Africa (Bayard, 1993). When a death occurs accidentally or 'abnormally' (e.g., disease, pregnancy, trauma, suicide), it is considered a 'bad' death. The deceased is therefore buried far away from the village, as is observed for the Bamileke (Grassfields, Cameroon; Buhan, 1975:105) and various other Cameroonian and Nigerian populations (e.g., Lembezat, 1950; Okpoko, 1993).

To sum up, the Shum Laka burials reflect an extremely high variety of funerary practices that relate to two different periods (LSA and EIA), although likely associated with closely genetically related populations, as verified recently by ancient DNA analysis (Lipson *et al.*, 2020). This suggests a continuity of funerary traditions over at least 5,000 years, including both primary and secondary burials in a cemetery used locally. Although a comparison with modern grave styles is interesting, caution is needed not to read too much into archaeologically derived data. Both primary and secondary burials (the first being the most common) are still used today, as is the case for the less common burials (secondary deposits) that are still practised in North-Western Cameroon (Kirdi groups; Lembezat, 1950). Nevertheless, this section has allowed us to reflect on archaeological and ethnographical data about a unique cemetery and to see how burial patterns could help reconstruct past social organisation.

3.2. Cranial morphology as a proxy of genetics to understand past population diversity

In addition to providing contextual data, bioarchaeology also offers the possibility to study directly various biological and cultural aspects of past populations. Skeletal morphology is central in the discipline, as it illuminates the importance of the micro-evolutionary mechanisms of human diversity (e.g., geography, drift, selection) (Howells, 1995; Pietrusewsky, 2000; Roseman & Auerbach, 2015; Agarwal, 2016; Stojanowski & Schillaci, 2006). From the development of population genetics and the rise of New Archaeology, the analysis

of skeletal variation has evolved significantly. Previously it was based on 'racial typology', which unfortunately encouraged population categorisation and discrimination. This is no longer the case. As human variation is continuous and complex in nature, skeletal morphology is analysed by both quantitative genetics and population-based research to understand the underlying causal factors (e.g., genetic and phenotypic inheritance, developmental mechanisms, environmental and cultural influence) (Von Cramon-Taubadel, 2019).

Studying different skeletal parts (skull, postcranial skeleton) enables bioarchaeologists to gather different types of 'data'. The postcranial skeleton is more prone to reflect environmental forces (e.g., temperature, latitude, altitude, available resources) than the skull (especially the cranium rather than the mandible) (Roseman & Auerbach, 2015). In particular, the analysis of the mechanical properties of the postcranial skeleton has been recently useful in exploring past human behaviour in Southern Africa. For example, Stock & Pfeiffer (2004) showed that variations in the robustness of the upper and lower limbs can sometimes reflect habitual activities (e.g., terrestrial mobility versus boat mobility, hunting and farming). Unfortunately, very few studies of this kind have been done so far on Central African collections and interpretations remain limited due to small sample size (e.g., Crevecoeur *et al*., 2016; Klagba, 2022).

In contrast to the postcranial skeleton, the cranium has been used as an alternative approach to genetics for the following two reasons:

1. cranial morphology is relatively more genetically determined than the postcranial skeleton (its variation better reflects geography and genetics); and
2. its morphometrical analysis (e.g., biodistances) is less expensive than ancient DNA (Pietrusewsky, 2000; Stojanowski & Schillaci, 2006).

Using both cranial and dental morphology, bioarchaeologists today can explore the past within- and between population diversity through time and space (e.g., Irish 1998, Stynder *et al*., 2009; Dlamini, 2014; Gross & Edgar, 2021). For this purpose, researchers rely on a large dataset of comparative modern skeletal populations (e.g., Froment, 1992; Relethford, 1994; Howells, 1995; Ribot, 2004; Grine *et al.*, 2007; Franklin *et al.*, 2010). These morphometrical data sets can help to understand morphological changes and reconstruct past events (e.g., isolation, gene flow, long-term distance migration). As researchers also used very recent colonial population data, ethical considerations will also be discussed later in this paper. To illustrate the usefulness of cranial morphology in Central Africa, this section will focus on different chronological periods from the end of the Late Pleistocene to the Holocene period (the last 25,000 years).

Ishango, located in Central Africa, in the DRC (Western Rift) along the Semliki River, is one of the earliest sites dated to the Late Pleistocene. It provided human remains which were radiocarbon dated to between 19,540 and 24,145 BP (Ishango 11 occupation layer; de Heinzelin, 1961, 1962; Brooks *et al*., 1995). The archaeological context is known for its evidence of harpoons, engraved bones and microlithics, suggesting not only the presence of a fishing-hunting-gathering community in the region, but also the appearance of more complex social behaviours for the early LSA. Interestingly, the site dates to a phase during which African populations probably diversified due to regional isolation following a dry and cold climatic phase (Last Glacial Maximum). This precedes large Holocene migration and morphological homogenisation (loss of diversity) within Africa. Morphometric studies were performed to understand why LSA population diversity no longer exists (Orban *et al.*, 2001; Crevecoeur *et al.*, 2016, 2022). In Central Africa, human remains tend to be poorly preserved and scarce. However, Crevecoeur *et al*. (2016) examined the preserved cranial remains (cranium, mandible, inner ear cavity) and found that fossils from Ishango 11 appeared to have closer affinities with other earlier Pleistocene fossils, rather than modern humans. Unique skeletal features (robustness of upper limbs, mechanical bone properties) also confirmed the archaeological hypothesis of high investment in both aquatic context and subsistence practices (Crevecoeur *et al.*, 2016: 51).

In a more recent study by Crevecoeur *et al*. (2022), as the shape of the inner ear cavity of a Shum Laka individual (burial unit 2, SEII) also appeared to be closer to Late Pleistocene human remains (Ishango 11) than recent Africans, it underlined the persistence of an archaic morphology during the Early Holocene. This hypothesis was also supported by other

morphometrical observations (e.g., cranium, mandible, teeth), which were done on various Shum Laka individuals (Ribot *et al*., 2001; Suppl. Inf. *in* Lipson *et al.*, 2020; Ribot *et al*., 2022). However, the archaic morphological features of SEII observed by Crevecoeur *et al.* (2022), were corroborated by ancient DNA results. Lipson *et al.* (2020) showed that this male adolescent appeared to be characterised by a very rare and ancient genetic feature (Y-chromosome haplogroup A00). In this precise case, by comparing different methods (morphology of the bony labyrinth and ancient DNA), phenotypic data confirmed that they have a strong genetic component and, that they can also provide a solid assessment of the phylogenetic relationship between human groups.

More recently, for the mid-Holocene (around 5,000 years ago), it is crucial to mention a key large-scale event (Bantu-speakers Expansion) that shaped the whole present sub-Saharan African population diversity and has inspired and continues to inspire research in many fields (e.g., Bostoen, 2007; De Filippo *et al.,* 2012; de Maret, 2013; Li *et al.*, 2014). According to linguistic studies that analysed various aspects (e.g., lexical and vocabulary variations, glottochronology), the Bantu languages appeared to have spread out between approximately 5,000 and 1,500 years ago, from an ancestral homeland (Grassfields, Nigeria and Cameroon) across most of Central, Eastern and Southern Africa (Bostoen, 2020). Although the Bantu-speakers Expansion was initially observed as a linguistic phenomenon, archaeology has provided evidence that it was also a movement not only of speech, but also of 'people' introducing new lifestyles, material culture and technologies (pottery making, large stone tools, farming, metallurgy) (de Maret, 2013). Furthermore, recently, genetic studies provided additional evidence showing that this population dispersal was a major demographic event with signatures left in the gene pool of modern Bantu-speakers (Li *et al*., 2014; Fan *et al*., 2023). Linguistic and molecular data even favoured the hypothesis that Eastern Bantu languages diversified more recently from the Western Bantu ones south of the rainforest, occurring around 2,000 years ago (De Filippo *et al.,* 2012). This diversification likely coincided with a climatic event that encouraged population dispersal.

Research interest on the Bantu-speakers Expansion also developed earlier in the sixties amongst bioanthropologists, like Hiernaux (1968), who was one of the first to explore living sub-Saharan African variation using a renewed approach based on multivariate analysis and population genetics. Since the 1960's, morphology has been used as a mean to explore population diversity in relation to geography and history. Hiernaux (1968) combined both anthropometric traits (e.g., facial measurements, stature, limb proportions) and hematological hereditary traits (blood groups) to produce a matrix of biodistances. As he showed that modern Bantu-speaking groups had the lowest mean distances, this fact supported the hypothesis of a recent common origin. Later, using a global data set (past and modern), Howells (1995) and Relethford (2002) confirmed that phenetics (craniometrics), can be a good proxy of genetics. Their craniometrical data broadly reflected geographical and genetic distances, although migratory events, gene flow and selective pressures are also a source of variation. However, these authors found no clear morphological evidence of homogenisation (or loss of diversity) within the modern Bantu-speaking populations. This underlies that cranial morphology does not necessarily reflect very well large-scale migration events, as other factors on a more detailed regional level can produce morphological changes (e.g., selective pressures, gene flow).

Hereafter, many researchers retested this hypothesis (effects of Bantu-speakers expansion) using craniometrics on various skeletal collections, but all of them found a marked regional diversification instead of clear homogeneity (Froment, 1998; Ribot, 2003, 2004, 2011; Franklin *et al.*, 2010; Ghalem, 2020; Ribot *et al.* 2022). Froment (1998) was one of the first to focus on African phenotypic diversity by using a large compiled craniometrical dataset and observed marked regional differences, especially between the west and the south of the continent. Ribot (2003, 2004, 2011) re-examined the sub-Saharan African diversity, by expanding the study with various groups based on geography (West, Central, East, South Africa) and mode of subsistence (e.g., hunting and gathering, farming). However, a regional diversification without any clear signature of homogenisation in the population was again substantiated. Finally, using a different craniometrical dataset and geometric morphometrics, an improved approach that could better analyse size and shape separately, Franklin *et al.* (2010) re-analysed various regions in sub-Saharan Africa. Whilst their results (e.g., population

distances and variance) found rather modest mean size and shape differences between the populations, they did not support a loss of diversity, which could suggest genetic bottlenecks because of migrations relating to the Bantu-speakers dispersal. Although genetic data then did not show strong bottlenecks leading to a decreasing diversity with increasing distance from the Grassfields homeland (Manica *et al.*, 2007), Fortes-Lima *et al.* (2024) recently succeeded in providing this evidence with expanded and more detailed African datasets.

Craniometrics failed to clearly support the Bantu-speakers dispersal hypothesis in contrast to genetics. It nevertheless showed that morphology probably diversified according to multiple factors as well (e.g., gene flow, selection). All morphological changes might arise not only from genetic changes, as environmentally induced factors alone can play a role in initiating morphological novelty (e.g., phenotypic plasticity; Levis *et al.,* 2018). Gene flow probably contributed to a regional diversification within sub-Saharan Africa at a morphological level. In fact, it is known from both ethnography and genetics, that Bantu-speaking communities often interacted in a symbiotic manner with local hunter-gatherers (Hiernaux, 1976; Vansina, 1990; Verdu *et al*., 2009; Fortes-Lima *et al.,* 2024).

It is also important to mention that selection could also be one of the underlying causes of diversification, especially within the African continent where a vast array of environments generated the highest levels of human biological diversity (Manica *et al.,* 2007). Central Africa is a region where strong selective pressures can act on the body morphology decreasing its size (and hence the cranium) because of extreme climate (high temperature and high humidity; Hiernaux & Froment, 1976; Froment, 1993) and such effects are also known in other parts of the world (Harvati & Weaver, 2006; Von Cramon-Taubadel & Lycett, 2008). Interestingly, Franklin *et al.* (2010) observed morphological distinctiveness (e.g., shape, size) for some groups (Central and Southern African foragers) like in previous studies (Howells, 1995; Froment, 1998; Ribot, 2003, 2011). As the Central African foragers also appeared rather like the Bateke, a neighbouring Bantu-speaking group, morphological similarities were interpreted as resulting from two possibles factors such as:

1. the similar selective pressures (producing morphological convergence due to phenotypic plasticity); and
2. the interbreeding between Central African hunter-gatherers and farmers (Franklin *et al.*, 2010:31). Using geometric morphometrics, Ghalem (2020:98) also observed similarities amongst Central Africans, reinforcing the hypothesis of a morphological convergence between the foragers and some Bantu-speaking populations in DRC (e.g., the Bassoko).

The above studies on Central Africa have assisted us in understanding past and modern diversity and its underlying causes (geography, history, selection). The creation of large 2D and 3D craniometrical data sets on various African populations has allowed bioarchaeologists both in Africa and worldwide to analyse cranial human remains before the Bantu-speakers expansion up until colonialism with a focus on not only Central Africa, but also various sub-Saharan African regions (e.g., Ribot, 2004; Crevecoeur *et al*., 2016; Ghalem, 2020; Mounier *et al.*, 2023), and especially Southern Africa (Morris & Ribot, 2006; L'Abbé *et al*., 2006; Van Der Merwe *et al.*, 2010b; Ribot *et al.*, 2017; Botha *et al.,* 2017; Ribot *et al.*, 2022).

The 2D craniometrical analysis of Ribot *et al.* (2017) revealed that, during colonialism, the slave trade reshaped the local population composition in both Cuba (Caribbeans) and the Cape region (South Africa) with the arrival of various diasporic groups between the late 17th and early 19th centuries AD. According to various sources (historical accounts, style of dental modifications), Central Africa was previously suggested as one of the geographic origins of Caribbeans and Cape people (as well as southern Africans and Madagascans for the latter). In particular, the population affinities revealed by the morphometrics, using a very large African and non-African comparative dataset (n = 696) also supported these hypotheses (Ribot *et al.,* 2017:345). However, this fact underlines that comparative datasets are key tools in morphometrics and must be geographically well-represented to explore the colonial period, as the latter reflect complex forced migrations (e.g., slave trade) from various regions of the African continent.

To sum up, as we saw with the previous example and contemporary bioarchaeology (Mant & Holland, 2019), research has

increasingly focused on oppressed and marginalised populations. In recent times, the analysis of cranial morphology, *via* not only 2D but also 3D techniques, is considered a proxy of genetics and a valuable tool to provide broad information about ancestral links and population history for both the African continent and elsewhere (e.g., Ghalem, 2020; Jones, 2022; Martin-Moya & Ribot, 2024). Morphological data on past population and individual variation can be then compared to ancient DNA and isotopic analyses on mobility (oxygen and strontium measurements) as well as other aspects related to health and diet (e.g., life conditions; Morris, 2023).

3.3. Health and nutrition to explore past socio-economic organisation

As bioarchaeology is interested in evaluating the influences of cultural and environmental changes on the lives of past populations, the discipline often combines, in addition to archaeology, data on origin, mobility, health and diet (Larsen, 2015; Larsen & Walker, 2010; Katzenberg & Waters-Rist, 2018). Palaeopathological observations and the analysis of their frequencies can lead to many interpretations that, however, must remain cautious because of various limitations (e.g., skeletal representativity, lack of palaeopathological evidence for acute diseases, variations in individual frailty; Wood, 1992; Wright & Yoder, 2003). Nevertheless, many key palaeopathological studies have provided working hypotheses on past population health for different regions and periods in Sub-Saharan Africa, concerning the following topics: health variation amongst Iron Age (Bantu-speaking) farming communities during their southern diffusion and diversification (e.g., Steyn, 1997; Mosothwane & Steyn, 2009; Ribot *et al.*, 2010; Dlamini *et al.*, 2016); health deterioration during the 19th century AD following industrialization (migrant working conditions in South African mining companies; Van der Merwe *et al.*, 2010a; Meyer *et al.*, 2013); and the effects of colonialism in Southern Africa on the health of marginalised hunter-gatherers (San) and pastoralists (KhoeKhoe) (Botha & Steyn, 2016).

Most of these studies have been produced in Southern Africa, as in this region, bioarchaeology is a very dynamic field with a high number of, both researchers and skeletal collections. For example, some of the key recent research focused on the health comparison of various Iron Age agro-pastoralists, whose settlements became increasingly complex between the 8th and 13th centuries AD (Steyn, 1997; Mosothwane & Steyn, 2009). Mosothwane & Steyn (2009) found that, despite similarities characteristic of pre-industrialised and pre-antibiotic eras (e.g., low life expectancy), the Early Iron Age Toutswe's population (n = 84) from East-Central Botswana appeared in better health than neighbouring populations from South Africa (K2 and Mapungubwe) (n = 106). Although skeletal samples still do not represent entirely a living population at that time, the authors could propose that deteriorated health at K2 and Mapungubwe might reflect political and/or climatic instability within some of the Early Iron Age states, as suggested previously by archaeologists (Huffman, 1986).

For Central Africa, palaeopathological studies approaching past health variations on a populational level is rather a challenge, as archaeological human remains discoveries are much scarcer and more fragmentary than in Southern Africa, because of various reasons (e.g., hot and humid climate not ideal for skeletal preservation, lack of local bioarchaeological research). Except for Ribot *et al.* (2001), who provided osteobiographies for 18 individuals dated to the LSA-EIA period (Shum Laka, Cameroon), most studies focused on later periods from the Iron Age up to colonialism, such as those of Dlamini (2013, 2014) and Dlamini *et al.* (2016) (Upemba Valley, DRC, n = 85), Polet *et al.* (2018) (Kindoki, DRC, n = 10) and Asti *et al.* (2020) (Ngongo Mbata, DRC, n = 38).

Although the study of Ribot *et al.* (2001) was very limited by the sample size and the lack of comparative data for the same period, it provided, for the first time, data on the past health and diet of Late Stone Age-Early Iron Age populations. For example, two very rare palaeopathological cases were noted (e.g., cranial congenital abnormality or scaphocephaly, unhealed pelvic trauma due to a projectile, an unretouched flake used as an arrowhead). Dental wear patterns could also suggest a diet rich in coarse food like tuber roots. However, isotopic analysis (carbon measurements) provided additional information on the habitat and resources consumed (C_3 plants and C_3 consumers), as originating mainly from the dense forest and only marginally from the savanna (Suppl. Inf. *in* Lipson *et al.*, 2020:13-15). This confirmed that Shum Laka foragers lived in a mixed habitat in West Central Africa, which

agreed with paleoclimatic data (Giresse *et al.*, 1994). Interestingly, nitrogen measurements succeeded in identifying a shift in food subsistence around 3,000 years BP - from hunting-gathering with higher animal protein intake to proto-agriculture or arboriculture with more plant consumption. Although this concurred with archaeology and past climatic events (Lavachery *et al.*, 1996; Giresse *et al.*, 1994), paleochemical and microbotanical research needs to further explore the following issues: the possible subsistence shift during the LSA-IA period; and the persistence of forest resources exploitation, in parallel to the adoption of different crops, throughout the EIA period (Bleasdale *et al.*, 2020; Cagnato *et al.*, 2022).

Dlamini's work (Dlamini, 2014; Dlamini *et al.*, 2016) is the largest scale paleonutritional analysis for the Central African region so far, as a series of Iron Age groups that practised mixed agriculture in the Upemba Valley (Central Katanga, DRC) between the 8th and 17th centuries AD were analysed not only palaeopathologically but also using isotopes and dental morphology. Subtle intra-regional variations previously noted in the material culture (ceramic assemblages) were revealed in the subsistence economy (choice of cultigens), especially between the Sanga and Katoto sites. In the northern area of the Upemba Valley (Sanga), people consumed a diet richer in C_4-based resources (e.g., millet, sorghum), in contrast to the southern area (Katoto) characterised by C_3-based resources (e.g., cucurbits, yams, legumes) (Dlamini *et al.*, 2016). Intra-site variations for Sanga also showed a difference in both dental health and diet between women and men, suggesting that the latter consumed highly cariogenic C_3 food (e.g., palm wine) (Dlamini *et al.*, 2016:147). Finally, dental morphological variation suggested biological homogeneity through time, contradicting the oral history of the present-day Luba, who did not believe in population continuity in the Upemba Valley (Dlamini, 2014: 215-225).

Finally, moving towards the more recent past with increasing social stratification and urbanisation (17th and 19th centuries AD), Polet *et al.* (2018) and Asti *et al.* (2020) analysed various skeletal remains from two key cemeteries (Kindoki & Ngongo Mbata, DRC) of the Kongo Kingdom. They provided detailed osteobiographies, discovering two possible rare cases of DISH (diffuse idiopathic skeletal hyperostosis), a disease affecting often high-status individuals with a rich diet, obesity and type II diabetes (Asti *et al.*, 2020: 20). Although the frequency of this disease is impossible to evaluate before the appearance of medical archives, it is interesting to note here their presence already in a relatively small skeletal sample. This example might inform us indirectly on how communities in the past cared for individuals, who experienced this kind of disease. It is also a theme of research (bioarchaeology of care) that has been recently developed (Schrenk & Tremblay, 2022).

To sum up, palaeopathology and paleochemistry by accumulating data on various sites and periods can help to better understand the evolution of diseases and diet in parallel to changing economies and societies. The aforementioned examples have contributed and continue to contribute with ongoing research to build up complete bioarchaeological datasets that will be useful for future generations of bioarchaeologists and communities wishing to explore their past.

4. KEY SOCIAL ROLE OF BIOARCHAEOLOGY FOR CURRENT AND FUTURE ETHICS

The two previous sections provide an overview of bioarchaeology evolution and recent approaches to reconstructing past population history (especially in Central and Southern Africa). They highlight that the discipline is in constant flux. Bioarchaeology aims to better understand the biology of an individual or a group in close connection with its cultural and physical environment through an expanding set of constantly improved osteobiographical data (e.g., age, sex, health status, diet, activities, mobility, geographical origin). Although studies on past Central African skeletal human remains are less numerous than for Southern Africa, their increasing number post-2000 illustrates the growing interest in this key region (e.g., Ribot *et al.*, 2001; Ribot, 2003, 2004, 2011; Crevecoeur *et al.*, 2016; Dlamini, 2014; Dlamini *et al.*, 2016; Polet *et al.*, 2018; Asti *et al.*, 2020; Lipson *et al.*, 2020; Crevecoeur *et al.*, 2022; Ribot *et al.*, 2022; Mounier *et al.*, 2023).

Bioarchaeology still raises the following existential question (Prendergast & Sawchuk, 2018): how can scientific contributions be beneficial to African descendant communities? In addition to oral memory and historical sources, recent archaeological and bioarchaeological studies have contributed to this question, by

exploring the effects of colonialism and the slave trade [e.g., marginalisation, discrimination, poverty, and health inequalities] (Ribot *et al.*, 2017; Kootker et *al*., 2016; Botha & Steyn, 2016; Botha *et al.*, 2017; Mant & Holland, 2019; Maass, 2023; Martin-Moya & Ribot, 2024). They have provided a voice to invisible African communities and community stakeholders previously neglected in history books (e.g., migrants, slaves, women, and children).

However, besides scientific interests and changes in research orientations, a key ethical shift occurred worldwide concerning the management of human skeletal collections appropriated during Colonialism (Black *et al.*, 2022; Rassool & Gibbon, 2023). During the late 19*th* and early 20th centuries, museums and universities acquired human remains unethically without the consent of the African descendant communities (Rassool & Gibbon, 2023). Nevertheless, during the late 20th and early 21st centuries, bioarchaeological research continued to use various 'Colonial' collections. This is partly the result of institutions (e.g. museums, universities) having not fully documented the acquisition process and lacking any ethical guidelines in place (e.g., Houle *et al.*, 2023; Martin-Moya *et al*., 2023).

However post-2010, interest in documenting African skeletal collections increased the awareness of unethically acquired human remains and to trace the descendant communities (e.g., Steyn *et al*., 2013). Although individual documentation (e.g., family name) was often lost, the regional origin and/or group affiliation was sometimes recovered archivally. For example, for Southern Africa, Botha & Steyn (2013) explored the origin and historical context of Khoe-San collections housed in two European museums (Musée de l'Homme, Paris, France; and Rudolf Poch, Vienna, Austria). Here they underlined not only the scientific value of the collections (e.g., marginalised population during the 19th and 20th centuries, negative effects on health), but also, the ethical issue related to the data collection without the consent of the descendant communities.

Furthermore, it is only recently through museums, universities and associations, that biological anthropologists have started to propose ethical guidelines about the management of human skeletal collections (e.g. American Association of Physical Anthropologists, 2003; British Association for Biological Anthropology and Osteoarcheology, 2019; *Canadian Association of Biological Anthropology*, 2019; Black *et al.*, 2022; Buikstra *et al.*, 2022) as well as ancient DNA derived from the collections (Alpaslan-Roodenberg *et al.*, 2021). These guidelines will help to avoid any new form of colonialism, where African human remains are analysed and/or exported without considering the permission of the descendants. Before any possible skeletal analysis, researchers in bioarchaeology are now encouraged to develop an ethical framework, especially on a collection of known origin. Descendant communities must be the real decision-makers when a bioarchaeological project starts, as is illustrated by Malek *et al.* (2023). Even before initiating research, these authors obtained the approval of the San communities (The San Council of South Africa, 2017), as their study involved San skeletal collections. Their research appeared beneficial for the communities, as it potentially improved sex estimations and therefore individual identification for forensic and bioarchaeological cases.

Post-2000, bioarchaeology has accelerated not only its engagement with descendant communities but also the return of human remains to the San and Khoe people in South Africa (Gibbon *et al.*, 2023). Gibbon *et al.* (2023) described in detail this ethical process with an exemplary South African case study, which returned the remains of nine San and/or Khoe individuals to their communities in the Northern Cape Province. In the name of science ('racial typology'), colonists and academics, during the 19th and 20th centuries, pillaged cemeteries worldwide to build up museum human skeletal collections and South Africa did not escape this situation (Morris, 2008). As the place of burial of the skeletons was known, the restitution process first started by contacting the descendant families and by prioritising their wishes. Their wishes included the reburial of their ancestors and wanting to learn more about each individual's biological information (e.g., age, sex, health) (Gibbon *et al.*, 2023). This recent example underlines that bioarchaeology can participate respectfully in reconnecting the descendants with their heritage and help toward restorative justice and healing.

Although ethical guidelines have been initiated for the first time for Central Africa with the HOME project (see Author's name, this volume), it is still a huge task that needs to be done elsewhere in Africa. Researchers such as Gibbon (2020) and Black *et al.* (2022) proposed

detailed and concrete guiding principles that could help the restitution of human remains in South Africa. Particularly, they underlined the key role of descendant communities in every step of the bioarchaeological project. However, they also mentioned that their guidelines cannot be entirely transferred outside South Africa, as socio-political and historical factors vary from one region to another. Therefore, despite a common aim (e.g., protection of human skeletal collections, engagement with all stakeholders), ethical guidelines in bioarchaeology must be defined for each country specifically.

5. CONCLUSION

This work demonstrates the important role of bioarchaeology in engaging with descendant communities and stakeholders, emphasizing the importance of collaboration, ethics, and respect for the wishes of those who may be culturally or biologically linked to the remains being studied. It highlights the responsibility of bioarchaeologists to protect both the tangible and intangible heritage associated with skeletal remains while decoding past events through scientific analysis. The emphasis on collaboration with descendant communities reflects a growing recognition within the field for ethical engagement and respect for the rights and wishes of those affected by skeletal research. As bioarchaeologists, we must be sensitive to ethical issues and therefore integrate them deeply into our work (Held, 2006). This was not done in the past, because ethical guidelines did not exist, but our aim now is to change that situation and encourage researchers to do so.

From this literature review, Central Africa is a key region for the continent's history. It continues to attract the attention of researchers worldwide. Scientific goals have changed and can be beneficial to communities as they incorporate environmental adaptation, health, population continuity or discontinuity through time. For some of the unethically acquired African collections that are curated in various Belgian institutions, the HOME project is a major step forward and the recommendations should help to initiate a process of restitution and reconciliation with descendant communities (see Author's name, this volume). Colonisation had many negative effects on colonised people, and many lost their ancestors, their connection to their past and their traditional and cultural heritage. Moving forward it is up to the descendant communities to decide whether they want to explore their past, which for Africa, is one of the most diverse and richest histories on the planet.

Our final message is that we should examine past human adaptations about climatic change, socio-economic transformations and growing inequality. Bioarchaeological research can help to better understand the present, demonstrate ways to be resilient and find solutions for the future. Bioarchaeology, as a discipline, can play a key role in the protection of our past, in the education of our future generations, as well as providing restorative justice for affected African populations.

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