Central African Rainforest Archaeology

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Abstract

Although it remains largely unknown to the general public, archaeological research in Central Africa has uncovered an extraordinarily rich heritage. Lack of awareness is probably due in part to the lack of recent synthesis work, but it is also true that the absence of political support, the lack of media coverage, logistical difficulties, and the dependence of African research units on foreign research funding are all obstacles to the advancement of our knowledge. However, the gradual integration of rescue archaeology into land use planning projects represents an opportunity to update existing local and regional datasets, even if the transformation of a simple consultancy into genuine scientific research issues remains a major challenge.

Central Africa's forests have long been perceived as having no history. This denial, linked to the justification of the slave trade of the sixteenth to nineteenth centuries by the colonization of the nineteenth and twentieth centuries, was undoubtedly reinforced by a lack of written sources. The development of archaeological research as part of multidisciplinary projects integrating oral tradition, art history, and linguistics has helped change mindsets and develop richer, more nuanced historical narratives. In this contribution, we will first present a very

general overview of the evolution of our knowledge and the methods that have enabled us to achieve this; we will then examine the major phases in the history of human societies and their ability to adapt to the tropical environment over the long term.

Keywords

Central Africa · Methods · Stone Ages · Iron Ages · Kingdoms · Emergence of agriculture

Introduction

The Central African forest block is dominated by the Congo and Ubangi river basins, but it is important not to overlook other major basins such as the Sanaga, the Ogooué, and up to the Cross River and the Nyanga.

Research carried out to date shows an extraordinary richness of archaeological heritage in the Congo Basin, but it has to be said that major challenges still have to be overcome before it can take its rightful place in the history of mankind.

No comprehensive work on the archaeology of Central Africa, such as *The Archaeology of Central Africa* (Van Noten 1982), *Paysages Quaternaires* (Schwartz and Lanfranchi 1990), or *Aux Origines de l'Afrique Centrale* (Lanfranchi and Clist 1991), has been published for over 30 years.

The development of archaeology in this part of Africa is hampered by a lack of political support, a lack of media coverage, logistical difficulties, and the dependence of African research units on foreign research funding. Despite these difficulties, it should be noted that international academic research projects and preventive and salvage archaeology initiatives carried out on large-scale projects have nevertheless made a significant contribution to improving our knowledge of Central Africa's past (Oslisly 2014).

The major summaries published in the past on the archaeology of Central Africa, as well as the numerous scientific publications in international journals, have tended to emphasize environmental history to the detriment of social and cultural history; to convey outdated evolutionary concepts, particularly with regard to the relationship between material culture and identity; or to focus on linguistic phenomena such as the Bantu expansion, where numerous problems of circular reasoning between archaeology and linguistics have arisen (Fig. 1).

State of the Art

For a long time, the perception of tropical forests was dominated by the idea of primary, static forests. Today, we suppose that the Central African forest block is subject to a variety of dynamics: Successive expansions and regressions have given

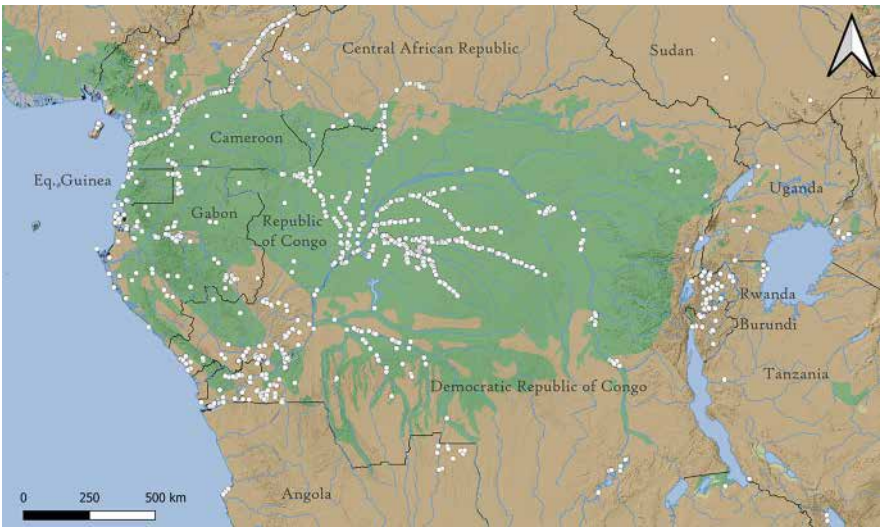

Fig. 1 Map of excavated and dated archaeological sites in the forests of Central Africa and neighboring areas based on Cornelissen and Livingstone-Smith (2015) and Garcin et al. (2018)

way to the development of savannahs with varying degrees of shrub cover over several centuries.

The same applies to the history of human societies. Intertropical Africa has long been perceived as having "no history." This denial is probably linked to the justification of the slave trade of the sixteenth and nineteenth centuries and the colonization of the nineteenth and twentieth centuries, but this simplistic prejudice has undoubtedly been reinforced by the lack of textual documents, long considered to be the fundamental source of history. The development of archaeological research, including within multidisciplinary projects integrating oral history, art history, and linguistics, has greatly enriched our vision of African history (Vansina 1990; Livingstone Smith et al. 2023).

In its early days, the archaeology of the region was essentially centered on prehistory, with little openness to interdisciplinary approaches. However, from the 1960s onwards, a series of methodological advances strengthened the discipline, enabling richer and more nuanced scenarios to be developed. The introduction of absolute dating techniques, such as radiocarbon and thermoluminescence, helped to establish solid chronology. At the same time, the rise of related disciplines such as archaeozoology and archaeobotany has enriched our understanding of past environments and ancient ways of life. More recently, isotope analyses, particularly of oxygen, are providing climate indicators that are independent of the study of vegetation alone. Other advances, such as beryllium/aluminum dating, optically stimulated luminescence, accelerator mass spectrometry, and soil carbon analysis, have opened up new perspectives. Finally, the development of computer tools and genetic studies has considerably expanded the possibilities for analysis and

interpretation (Patin et al. 2014). For the first time, these different methodologies are enabling archaeologists to write the complex history of a region that is critical to the evolution of our species.

In this contribution, we will quickly outline the methods allowing for this endeavor, before examining the most salient points of the very long history of Central Africa. To do so, we will consider in turn the main chronological eras: the Stone Ages (between 650,000 and 10,000 yrs BP); the end of the Late Stone Age (10,000–3000 yrs BP); the Beginnings of Sedentarization (3000–1400 yrs BP); Break-ups, Resilience, and Innovations (1400–800 yrs BP); and Emergence and Development of Large Political Entities (800–120 yrs BP). In each case, we will summarize the main aspects of past societies and consider their impact on past ecosystems.

Methods

In Central Africa, as elsewhere, reconstructing the past requires multidisciplinary work and the use of a variety of analytical methods.

The results of the archaeological excavations consist mainly of remains of material culture, mainly because of the conditions in which they were preserved. These include flakes of chipped stone, pottery, iron, and copper objects. Techniques have also been developed to collect ecofacts, organic remains such as charred seeds or fruit, bones, microscopic and geochemical traces, etc., making it possible to reconstruct lifestyles in the environmental context of the time (Livingstone Smith et al. 2017b).

Lithics

Lithic analysis enables us to reconstruct the lifestyles of ancient populations, their techniques, and their cultural exchanges. Studying stone tools reveals invaluable information about social organization, the economy, and adaptation to the environment. This analysis is essential if we are to fill in the gaps in our knowledge of human evolution in Central Africa. It sheds light on the interactions between human groups and their exploitation of local resources while enriching our understanding of the region's cultural, geographical, and geological heritage.

The study of chipped stone tools reveals the appearance of heavy, archaic, macrolithic stone tools, such as pebble tools, in the Congo Basin at least 650,000 years ago. Over time, these tools became more refined and took on new forms, such as handaxes, leading to armatures, finely carved foliate points, and microlithic stone tools such as blades, scrapers, and trenchers. Hunter-gatherers had a very good knowledge of rocks, preferring siliceous rocks such as quartz, jasper, and flint.

Pottery

Pottery was first introduced into the Congo Basin from the Luani Early Phase around *ca.* 4000 yrs BP (Coutros et al. 2025). Pottery fragments are the predominant remains found in archaeological sites dating back to at least 2500 years or less in the Congo Basin. The analysis of ceramic remains is therefore an important aspect of archaeological research. Reconstructing vessels from shards makes it possible to identify styles of manufacture, finishing, and decoration and to put forward hypotheses about their use. All of this makes it possible to address aspects relating to the identity of ancient populations and their dietary practices. The study and comparison of decorative styles on pots also suggest ancient regional or continental cultural interconnections and, in some cases, allows us to track people's movements in time and space.

Metals

The archaeometry study of iron and copper metallurgy in Africa enables us to understand metal manufacturing techniques, the evolution of skills, and their impact on ancient societies, in terms of daily life, rituals, and trade. These analyses also shed light on regional and transcontinental trade networks, the specialization of craftsmen, and social organization. Iron metallurgy was first introduced into the Congo Basin region around 2600 BP. Iron is extracted from ore in low furnaces that produce iron burls. The burl is purified by hammering by the blacksmith, who then takes fragments that are gradually shaped into an artifact. This produces objects or tools, such as hoes, knives, axes, spear points, and jewelry. In many parts of Central Africa, metal objects were used as currency in certain exchanges.

Copper metallurgy appeared later, around the twelfth and thirteenth centuries, in the southwestern part of the Congo Basin. This rare, yellow, shiny material was considered a prestige metal used mainly to make jewelry (bracelets, necklaces, money clips, bracelets, etc.).

Archaeobotany

Although archaeobotanical analysis is booming in the Congo Basin, published studies are still limited, and even fewer have employed statistical and systematic sampling methods. However, the research that does exist offers an initial insight into the evolution of agriculture and food practices in the region. This evolution reflects a shift from the collection of wild plants to more complex agricultural systems, including the cultivation of plants from the New World and the management of forest plots. It also reflects the adoption of African dryland crops such as millet, cowpea, and sorghum, as well as Asian crops such as taro and banana.

Archaeozoology

Archaeozoology, which studies the faunal remains, provides information about the dietary practices of ancient populations. It complements archaeobotany by providing clues about the types of animals consumed, hunting and rearing methods, and eating habits. In Central Africa, however, archaeozoological studies remain limited due to soil taphonomy and the lack of rigorous methods, such as fine dry or wet sieving in archaeological digs. These techniques, often neglected, limit the collection of relevant data. However, in more favorable preservation conditions, such as in caves, bone remains are better preserved, permitting more comprehensive analyses of ancient fauna communities harvested by people.

Oceanic and Continental Palaeoenvironmental Issues

The study of marine and continental cores makes it possible to reconstruct the climatic and ecological history of the Earth over long periods. By analyzing the sediments, fossils, and pollen in these cores, researchers can trace past climatic variations, such as glacial and interglacial periods, and understand the evolution of landscapes. These cores also provide information about changes in vegetation, fauna, and environments. They are crucial for understanding better the impacts of climate change and for predicting the future.

The results of the analysis of marine and continental cores (Maley and Brennac 1998), as well as the work carried out in Cameroon (Garcin et al. 2018), Gabon (Ngomanda et al. 2007; Ngomanda et al. 2009), including in the marshes of the Lopé National Park (Bremond et al. 2021), provide essential elements for understanding climate change and the evolution of landscapes inhabited by hominids and humans over time. The issues addressed in a continental context also include stone-line and alluvial terraces, stony formations that often amalgamate chipped stone tools.

Dating

The dating of archaeological sites is based on three families of methods: radiocarbon (AMS), measurement of exposure to solar radiation (OSL), and cosmogenic dating (Beryllium). In this way, we can establish a more precise chronology of the history of the sites (Livingstone Smith et al. 2017b).

- Radiocarbon dating: It is based on measuring the quantity of 14 carbon, a radioactive isotope present in all living organisms.
- Optically stimulated luminescence: OSL is used to date minerals, such as quartz or feldspar, present in ceramics, sediments, or heated stones back 400,000 years. This method is particularly useful for dating ceramic objects and sediments, complementing ^{14}C dating.

- Cosmogenic dating: It is based on the accumulation of energy in siliceous artifacts linked to extraterrestrial radiation.

Using these methods, the past of the Central African forest block can be divided into major chronological phases characterized by significant societal changes.

The Stone Ages (650,000–10,000 Yrs BP)

In Africa, the Stone Age began 3.3 million years ago at the Lomekwi 3 site in the north of Kenya (Harmand et al. 2015). In forest-dwelling Central Africa, a few sites have revealed large-sized pebble tools that have recently been dated at over 650,000 years old (Braucher et al. 2022).

Material Culture

Earlier Stone Age (ESA) 650,000–320,000 Yrs BP

Geoarchaeological studies of Early Stone Age sites in the Congo Forest Basin are rare in the vast expanse of forest that stretches from the Atlantic coast to the great lakes of the African Rift. This region combines open environments of the Sudano-Zambezian type with more closed areas of the Guineo-Congolian type. The main challenge for prehistoric research lies in characterizing the chronological and techno-cultural framework of the Pleistocene, which is still poorly defined today. This paucity of knowledge is due to a lack of specific research on this period and to taphonomic conditions, where tropical vegetation and/or climate disturb or conceal traces of ancient human occupation.

Nevertheless, we know that the first lithic industries, represented by choppers and chopping tools, appeared in both open and forested contexts. The Elarmekora site (Gabon, 650,000 yrs) illustrates this technological adaptation to the forest block of Central Africa, often considered hostile to human settlement (Braucher et al. 2022). These technologies are also observed at Dungo 4 (Angola, 650,000 yrs), where the patterns suggest a certain continuity in the production of pebble tools (Lebatard et al. 2019). These pebble tools are undoubtedly evidence of adaptation to a variety of environments.

Middle Stone Age (MSA) 320,000–50,000 Yrs BP

This period saw the development of Middle Stone Age industries, of which the Lupembian, a lithic industry characterized by bifaces (Lanceolate points) and tools on prepared cores, appears to be a local variant.

In recent decades, the Middle Stone Age has received renewed interest as the archaeological context for the appearance of *Homo sapiens*, around 320,000 yrs ago (Hublin et al. 2017). Research has focused on the rare examples of technological diversity and material culture circumscribed in time and space, which are generally found in open regions, particularly shrub savannahs. Examples include Still Bay,

Howiesons Poort (South Africa), and Lupemban (DRC), all of which can be considered as specific variants.

On the other hand, archaeological assemblages apparently devoid of distinctive features have received little attention in their own right. Such assemblages can be grouped together under the informal term of the Middle Stone Age, which is more generic. The apparent continuity and commonality of generic Middle Stone Age elements over large spatial and temporal scales raise many questions about the early evolution of our species. It could be seen as the common technological and material substrate for the behavior and culture of the first *Homo sapiens*. However, it must be stressed that we lack the quantitative studies that would justify grouping nearly 300,000 years of material culture under a single category.

While the Lupemban industry is presented by some as the only representative of the Middle Stone Age in the region, it must be stressed that the details of its chronostratigraphic relationship with previous industries are still unclear. The Lupembian has mainly been conceptualized as part of the Early Stone Age/Middle Stone Age transition and as an early Middle Stone Age entity at the end of the Middle Pleistocene. It was subsequently superseded or passed into an "undifferentiated" MSA or into a "Lupembo-Tshitolian" subregional industry. In contrast, the shorter records from the lowlands of Atlantic Central Africa mean that archaeologists have instead reported the Lupemban as a persistent Late Pleistocene industry that temporally adjoins the Late Stone Age without any "generic MSA" (Will and Scerri 2024).

Among the regional assemblages best contextualized to document the Late Pleistocene period in the Atlantic Congo Basin, we find a good example of the difficulties of classifying Central African industries according to one or other regional techno-cultural facies, during the Late Pleistocene, and even in terms of the broader continental framework of the MSA and LSA. However, we can now state that at Maboué 5 in central Gabon (Mesfin et al. 2021), in an environment marked by the onset of savannah expansion, hunter-gatherer lithic technology is composed of both MSA-type technological features, such as the high variability of production methods and the use of prepared core technology, but also includes LSA-type features, such as a microlithic component and the dominance of quartz raw material.

Considering the chronology of Maboué 5, we cannot say whether the co-occurrence of the MSA and LSA technical models depicts a continuity of MSA-type technical behavior during the Last Glacial Maximum (LGM) or the emergence of LSA-type technical behavior before the LGM.

Later Stone Age (LSA) 50,000–10,000 Yrs BP

The lithic assemblages became more complex and showed an increasingly assertive choice of raw materials (flint, jasper, quartz). Archaeologists point to the existence of various trends. The first, known as Tshitolian, seems to be an extension of earlier practices characterized by symmetrical tools with bifacial core-axe retouching (Fig. 2), particularly in the southwestern Congo Basin. Elsewhere, we find traditions whose cutting practices are more diversified. There is little standardization in

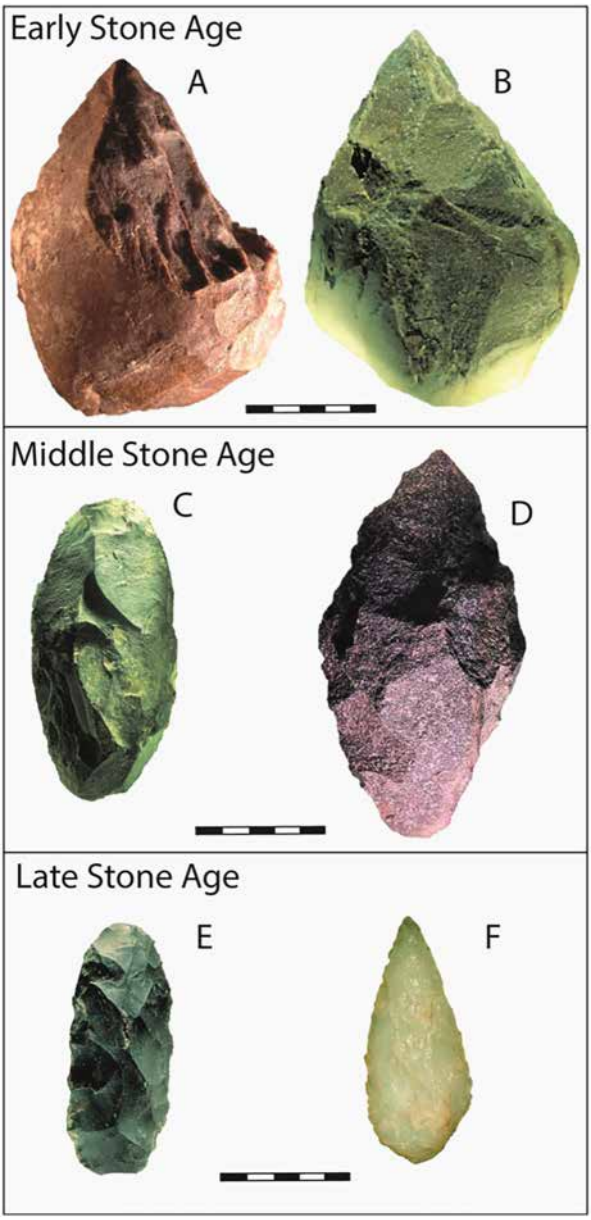

Fig. 2 Stone tool characteristic of the Stone Ages of the Congo Basin forests. (**a** and **b**) Pebble tools, (**c**) handaxe, (**d**) double-pointed peak, (**e**) core-axe, and (**f**) arrowhead. (© Duboze R (B, C, D, E, F), © Oslisly R (A))

production, with a relatively wide range of nuclei and cutting methods, from microliths to medium-sized blades.

At Maboué 5, quartz tools and microliths coexist with production techniques that are also still linked to the MSA, indicating a gradual technological transition. At the

Shum Laka site, a trend toward microlithization, a reduction in the size of armatures to less than 2 cm, suggests tools and weapons dominated by the insertion of flakes and lamellae into bone or wood supports (Cornelissen 2003). It is thought that this type of material made it easier to adapt to different types of hunting in a changing landscape. This approach continued during the reconquest of the forests and the drastic retreat of the savannahs in Central Africa at the end of the LGM, after 10,000 yrs BP.

Food Sources

Most of the information on the food sources of Stone Age peoples comes from indirect evidence or comparisons with better-documented regions. There is no direct evidence of plant use before 10,000 yrs BP. Archaeobotanical studies have mainly been devoted to recent Holocene periods, and virtually nothing is known about plant use in earlier periods. The timing and location of transitions in human-plant interactions, such as the shift from foraging to plant management or cultivation, remain unknown. It is assumed that the populations of the Congo Basin depended on gathering and hunting, with gradual changes toward the management of certain species, such as *Canarium*. We should bear in mind that over such long periods of time, human societies also had to adapt to climatic variations and their consequences for the environment.

Social Organization

Absolutely nothing is known about social organization during this period. Mobility was a key factor in enabling human groups to adapt to varied ecosystems and to respond to changes brought about by climatic variations. The absence of permanent structures in archaeological sites from this period supports this idea. Analyzing the mobility of hunter-gatherers is a field of research.

Changes and Transitions

During the Late Glacial Maximum (LGM, 26,000–19,000 yrs BP), it is assumed that savannahs expanded and forests retreated, influencing subsistence and land use patterns. Marine cores show climatic changes, but continental data are limited, with the oldest dating back 90,000 years (Lézine et al. 2019). However, it is likely that some changes were regional, with drier periods favoring the expansion of savannah and wetter periods leading to an increase in forests. It is assumed that, at LGM, the forests were fragmented, although some areas, particularly in the center of the Congolese basin, may have always been forested due to the density of the hydrographic network. Studies also suggest a decoupling of environmental variations between the coastal region and the basin of the Congo Basin.

Key Sites

Gabon: Elarmékora (ESA). This site is an alluvial terrace 175 m above the Ogooué River containing 650,000-year-old pebble tools (Braucher et al. 2022).

Angola: Dungo 4 (ESA) is a full site with pebble tools dating from 600 to 650,000 years ago (Lebatard et al. 2019).

Gabon: Maboué 5 (MSA/LSA). This open-air site, located on a hilltop, shows seven levels of occupation, including a level of 280 cm dated at 45,000 years, and reveals a microlithic industry on quartz (Mesfin et al. 2021).

Cameroon: Shum Laka (LSA). This rock shelter was occupied as early as 30,000 BP and shows microlithic industries associated with diversified exploitation of forest resources (Lavachery 2001).

Conclusion

The period between 650,000 and 10,000 BP in Central Africa corresponds to a key phase in human evolution. Marked by climatic variations, it saw alternating arid and humid phases that shaped the forest and savannah landscape. The first traces of human settlement appear in the form of early lithic industries, followed by the more sophisticated tools of the Middle Stone Age. However, archaeological data remains fragmentary, particularly for densely forested areas, limiting our understanding of the dynamics of settlement and technical innovation in this vast region. Few well-preserved sites dating back to this period are known, and they are very far apart. It is, in fact, too early to be able to propose a synthesis. Everything remains to be done.

End of the Late Stone Age (10,000–3000 Yrs BP)

This period, which follows the Last Glacial Maximum, corresponds to the deglaciation of the Holocene and is marked in its first half by the African wet period, a humid climate that favored the expansion of forests and the development of new ecological systems. At the same time, the emergence of specialized practices, notably the processing of plant resources, was reflected in the evolution of tools. Lithic assemblages diversified, reflecting adaptation to a variety of environments and more specific uses. Palaeoenvironmental studies, using core samples from lakes Barombi Mbo (Maley and Brennac 1998; Garcin et al. 2018) and Bambili (Lézine et al. 2019) in Cameroon, provide detailed climatic chronosequences dating back more than 25,000 years BP, revealing the impact of climate change on regional ecosystems.

Material Cultures

The small number of well-contextualized sites excavated to date, and the conditions in which they are preserved in a humid tropical environment, limit our understanding of life at this time. The two main types of artifacts are lithic (stone tools and manufacturing waste) and a few ceramic shards from 7000 BP onwards (Lavachery 2001).

Lithic

Lithic assemblages vary from region to region. At Shum Laka, LSA microliths appear to be a continuation of an earlier trend (Cornelissen 2003). These tools, often made of quartz, reflect an adaptation to varied environments and more specific uses. At other sites, not necessarily marked by microlithism or by the predominance of quartz, we note the presence of tools that are not standardized or retouched. The emergence of new specialized practices concerning plants is perhaps indicated by the appearance of macrolithic tools during the Holocene: Tools resembling hoes were discovered around 7000 years BP at Shum Laka, while partially polished stone axes are beginning to appear sporadically in Cameroon (Lavachery 2001) and in sites currently being studied in Cameroon and Gabon. In addition, regional industries such as the Tshitolian show local variations, but their classification remains a source of debate in the absence of well-contextualized sites.

Ceramics

Ceramics appeared in the northwestern part of the forest block, on the border between Nigeria and Cameroon ca. 7000 BP in Shum Laka and Mbi Crater rock shelters (Asombang 1988; Lavachery 2001). Ceramics dating back 4000 years may also have been discovered in the Democratic Republic of the Congo (Coutros et al. 2025), but the data is too sparse to be able to confirm the fact.

Food Sources

The emergence of agroforestry practices at Shum Laka can be traced back to 8250–6200 BP, marking the gradual shift toward management of wild plants. The increasing use of *Canarium schweinfurthii* (Lavachery 2001), probably as a pre-tree crop, is an early example, while dietary diversification is seen with the appearance of species such as *Elaeis guineensis* (oil palm) and *Ensete gilletii* (a plant from the same family as banana). Despite a few interruptions, the stratigraphy of the cave extends into modern times. The period between 4500 and 4000 BP saw a significant expansion in the exploitation of *Canarium*, moving toward formal arboriculture. The appearance of new taxa of plants, such as *Ensete gilletii* and *Canarium*, suggests that forest cover is changing, perhaps because of arboricultural practices. Evidence of *Canarium* arboriculture would persist until at least 2100 yrs BP. The remains of *Elaeis guineensis* also appear currently. However, pastoralism and cereal farming (millet and sorghum) did not reach the region before 1000 BP, or even later.

Preliminary analyses of the Youmbidi cave show similar use of *Canarium* and other tree fruits, but sampling and analysis are ongoing.

In short, the archaeobotanical evidence suggests a transition to arboricultural and agroforestry practices well before the introduction of cereal-based agriculture. The use of *Canarium* at Shum Laka is evidence of selective collection leading gradually to the probable domestication of plant resources, illustrating a key stage in the evolution of food systems and anthropized landscapes.

Social Organization

We have no data on the organization of societies during this period. Some groups developed semisedentary strategies, particularly in favorable environments where resources were abundant. The regular reoccupation of rock shelters such as Shum Laka and Mbi Crater in Cameroon and Youmbidi in Gabon suggests cycles of exploitation and abandonment of sites, but there is nothing to suggest that there was a filiation between the groups of humans that used the site.

Developments and Transitions

This period marks a significant transition: The gradual changes of the forests and the expansion of the savannahs coincided with a shift from opportunistic collection to active management of plant resources. This change, which is reflected in the early emergence of agroforestry practices (notably through the management of *Canarium schweinfurthii*) and the appearance of species such as *Elaeis guineensis* and *Ensete gilletii*, probably led to a diversification of feeding practices.

Impact on Ecosystems

We lack data for a detailed appraisal of human impact on ecosystems during the Early Stone Age. Indeed, there were even doubts that early hominins could have adapted to tropical rainforests. Data available elsewhere indicate that Earlier Stone Age population made use of fire (Hlubik et al. 2019), but there is little evidence about their mastery.

The Middle Stone Age (MSA) is better represented in Central Africa, and we can speculate that the impact of humankind is increasing. MSA-type assemblages have been found from Cameroon and Gabon to Angola and Eastern DRC, suggesting adaptation to a variety of environments. Fire is mastered and used for stone working (Brown et al. 2009), including forest edges. The question of penetration of dense forest by MSA populations remains a matter of debate, but there is increasing evidence of adaptation to forested environments (Roberts et al. 2021), and there are some stone implements designed for woodworking. Fire is also used elsewhere for cooking, thus extending the reach of humans in their environment (Wadley et al. 2020).

In short, while we can attest to the increasing foothold of mankind in the environments of Central Africa, it is difficult to have a clear picture as the data is few and far between.

Key Sites

*Shum Laka and Mbi Crater (Cameroon): This site reveals a major technological transition, with the gradual introduction of macroliths (polished axes, typical hoe shapes suggesting the beginnings of horticultural management) from 7000 yrs BP onwards. This new set of tools seems to have coexisted with microliths from the earlier period. The appearance of pottery is attributed to 7000 yrs BP onwards, but according to Asombang 1988, pottery found at Mbi crater could have appeared earlier, around 9000 yrs BP.

*Caves in the Lastoursville area (Gabon): Youmbidi and Pahon. The Youmbidi site, which is currently being excavated, shows stable lithic industries that are not very standardized or retouched (Angue Zogo et al. 2023). Traces of *Canarium* and *Elaeis* have been found here since at least the Middle Holocene. A fragment of a partially polished axe was discovered in the Pahon cave in a well-dated stratigraphic situation.

Conclusion

This pivotal period, marked by the end of the LGM, is still poorly understood. It was marked by the appearance of polished stone tools, characteristic of new activities, and the first pottery. Increased management of plant resources, with evidence of early manipulation of the landscape, was evident in the specialized use of fruits such as *Canarium* and the emergence of agroforestry practices. The diet, diversified and adapted to local environments, was based on a combination of hunting, specialized gathering, and fishing, making full use of the forest resources.

The Beginnings of Sedentarization (3000–1400 Yrs BP)

This period is clearly distinguished by major sociocultural transformations. Whereas the previous period was marked by subsistence practices based mainly on hunting, gathering, and management of forest resources, this period saw the introduction of domesticated plants from the Sahelian and Sudanese regions. This spread of agriculture and arboriculture, adapted to humid tropical environments, marked a turning point. It was accompanied by significant changes in all aspects of society, including what appears to have been a village lifestyle, the emergence of iron metallurgy, the spread of ceramics throughout Central Africa, and indications of trade. Not only was there a diversification of foodstuffs, but also a radically different social structure, reflecting the emergence of societies in the throes of change.

Material Culture

Stone to Metal Age

Lithic industries are rare, marking a transition toward the use of metals. Iron metallurgy emerged between 2600 and 2500 yrs BP with even earlier evidence in eastern Cameroon, although this is not universally accepted (Zangato 2008).

Ceramics

The early phases (3000–2000 yrs BP) reveal similar ceramic assemblages, forming stylistic horizons of sorts, such as those at the Obobogo, Bwambé, and Bissiang (Cameroon) and Okala and Epona (Gabon) sites. Related styles quickly appeared along the Atlantic coast as far as the mouth of the Congo River, then as far as the interior basin of the Congo River (Wotzka 1993), and as far as Bakebena to the southeast of Kisangani (Nieblas Ramirez et al. 2024). In the beginning, there is striking similitude in the repertoire of shapes and decoration styles evolved

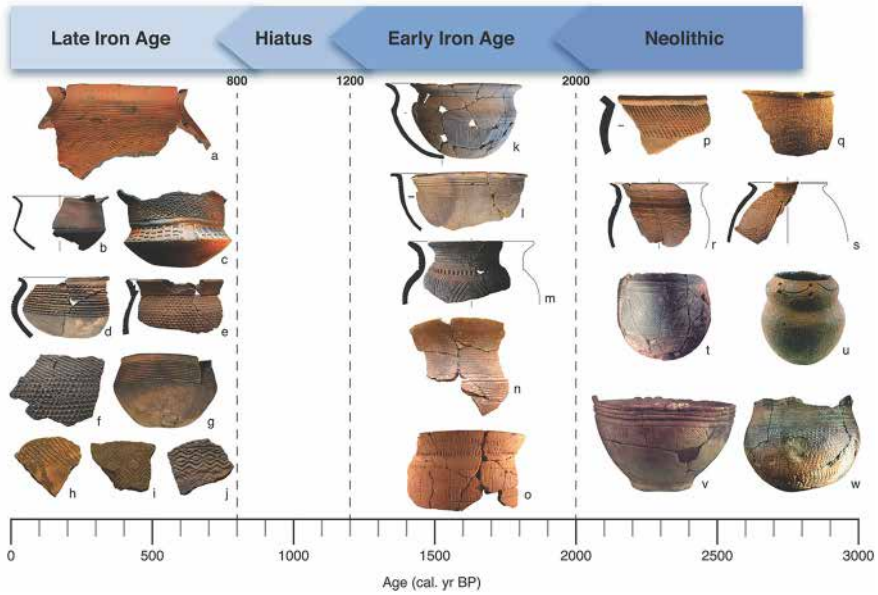

Fig. 3 Chronology of Western Central Africa with pottery traditions over the past 3000 years from de Saulieu et al. (2021). Late Iron Age: (**a** and **b**) Dibamba A—Cameroon; (**c**) Lopé region from eleventh to eighteenth centuries—Gabon; (**d** and **e**) Dibamba B—Cameroon; (**f**) Oku—Cameroon; (**g**) Dibamba C—Cameroon; (**h** and **i**) Lobéké—Cameroon; (**j**) Kovifem—Cameroon. Early Iron Age: (**k** and **l**) Campo—Cameroon; (**m**) Akom—Cameroon; (**n**) Lalara—Gabon; (**o**) Otoumbi—Gabon. Neolithic: (**p**) Dibamba E—Cameroon; (**q**) Mpolongwé—Cameroon; (**r** and **s**) Nya Zanga—Cameroon; (**t** and **u**) Epona—Gabon; (**v**) Imbonga—DRC; (**w**) Madingo-Kayes—Republic of Congo. (© Denbow J (**w**), © Oslisly R (**c, q, o, n, t, u**), © Saulieu G de (**a, b, d–m, p, r, s**), and ©Wotzka HP (**v**))

progressively in the different regions without any major break until around 1500 yrs BP (Fig. 3).

Refuse Pits

Pits are structures dug and used as dumps (Livingstone Smith et al. 2017a), and they are typical of many sites from this period. They were dug in or around village sites and are filled with the refuse of everyday life (charcoal, burnt fruit, shards, ashes, etc.). Some of the pits may have been used for a variety of purposes: septic tanks, pits for rotting clay, traps, etc. Whatever the case, they all bear witness to rigorous domestic organization. In addition, some of the pits undoubtedly had a symbolic and ritual dimension, as suggested by the deposit of a few complete vessels (Wotzka 1993; Nlend Nlend 2013; Livingstone Smith et al. 2017a).

Food Sources

The dietary transition was marked by the domestication and cultivation of plants such as millet (*Pennisetum glaucum*) and oil palm (*Elaeis guineensis*). Archaeobotanical and archaeozoological analyses indicate a combination of food crops, hunting, and fishing. This dietary diversity reflects adaptation to local environments.

Introduction of Domesticated Cereals and Agricultural Diffusion

Millet was introduced from the West African savannahs. Pearl millet appeared in several archaeological sites in Cameroon and DRC around 2400 BP (Eggert et al. 2006). Initial archaeobotanical analyses showed limited quantities of grain, suggesting ritual or occasional use, perhaps in connection with social events or symbolic practices. Thanks to new sampling methods, thousands of grains have recently been detected in field excavations, suggesting that they were an integral part of everyday life, both as food and potentially in the manufacture of beer. The adaptability of millet, now grown in humid climates, testifies to its resilience and makes it a key element for food security in the face of climate change. Cowpeas (*Vigna unguiculata*) were grown alongside millet, reflecting the gradual introduction of legumes, improving dietary diversity and contributing to protein-rich diets (Kahlheber et al. 2014a; Kahlheber et al. 2014b; Neumann et al. 2022) and perhaps soil management.

Other plants also appeared 3000 BP onwards, including sorghum, plantain, and taro. Sorghum (*Sorghum bicolor*) was probably introduced from Sudan around the beginning of our era, although its exact spread remains uncertain. As for plantain, taro, and yams, these tubers and fruits would have been adopted from adjacent forest regions, encouraging mixed farming practices combining cereals and arboriculture.

Transformation of Arboricultural Practices

Despite being a key resource in earlier periods, the *Canarium schweinfurthii* appears to have declined after 3000 BP, to the benefit of *Elaeis guineensis*—whose fruit is used primarily to produce palm oil. The appearance of large quantities of palm nuts in archaeological pits suggests an intensification of their management and their central role in food and socioeconomic exchanges.

Social Organization

Thanks to the discovery of villages and necropolises, we have more information on the organization of societies. Villages, located on hilltops or on the banks of rivers, are identified by a series of refuse pits, testifying to a structured community organization (de Saulieu et al. 2015). The similarity between ceramic styles suggests regional and supra-regional cultural interconnections. The funerary sites of Akonetyé and Campo in Cameroon and on the island of Corisco in Equatorial Guinea reveal the existence of high-ranking individuals, buried with elaborate pottery, weapons, and ornaments, indicating social stratification.

Evolution and Transition

This period is the setting for a series of major transitions, including the almost simultaneous appearance of metallurgy, agricultural practices, and new ceramic styles (~2500 BP). These changes indicate significant cultural transformations on the scale of the entire forest block. Sites showing long-term occupations and reoccupations (Dibamba, Nachtigal in Cameroon, and Otoumbi, Lopé in Gabon) contrast with sites showing shorter occupations, often limited to one or two phases.

These changes are thought to be related to the Bantu language expansion phenomenon (Vansina 1990), marking a key stage in the structuring of forest societies. The origin of the expansion is thought to have started as early as 6000 yrs BP around the Cross River plain in Nigeria. The existence of a population movement was confirmed by genetic studies (Pakendorf and de Filippo 2015), but the processes of the expansion and its correlation with the archaeological record are still debated.

The spread of Sahelian agriculture is probably linked to population movements. The integration of these new resources favored the development of permanent villages, often located on hilltops not far from a permanent watercourse (Oslisly 2001) with typical dumping pits, evidence of stable domestic and agricultural organization. The cultural sequence shows relative continuity up to 1500 yrs BP, followed by a marked transition after 1400 yrs BP, when interruptions appear in the chronologies of many sites.

Impact on Ecosystems

During this period, the impact of human societies in the Congo Basin changed dramatically. The construction of villages means openings in the forests and the development of agriculture induced extensive clearing of forest patches (Morin-Rivat et al. 2014; de Saulieu et al. 2018). While we have no direct evidence for agricultural techniques, the recurrent occupation of sites at different periods of time may indicate a degree of mobility related, among other things, to slash and burn agriculture. One should also keep in mind that once opened, the forest may have been subject to other processes—it seems that animals, like elephants, play a role in the husbanding of forest clearing (Baï). Archaeozoological results also indicate that domesticated ovicaprids were probably herded and that forest hunting and fishing still provide an important part of the diet. While the use of wood for cooking was probably of a marginal impact, new technologies such as iron smelting and iron smithing to produce tools and weapons must have had significant consequences (Eichhorn et al. 2019).

Key Sites

- Cameroon: Obobogo, Nkometou, Oliga, Okolo, Nkang, Ndindan, Nachtigal, (Yaoundé area), Malongo, Bwambé, Bissiang, Mpolongwé (Kribi coastal region), and Dibamba (Douala), which present the first homogeneous cultural sequences showing a transition toward complex ceramic assemblages and early metallurgy as early as 2700–2500 yrs BP (Mbida Mindzie 1996; Nlend Nlend 2013; de Saulieu et al. 2017; de Saulieu et al. 2024).
- Gabon: Epona, Lopé, Okanda, and Okala with long cultural sequences (Oslisly 1998; Clist 2005). These sites show long occupations spanning up to 2700 years, revealing dump pits, metal tools, and ceramic production as village markers.
- Democratic Republic of the Congo: Dimba, Ngovo, Sakuzi, Imbonga (Wotzka 1993), Bomane Yangwa, and Yamontonga (Livingstone Smith et al. 2017a; Nieblas Ramirez et al. 2024; Vutseme Sokoni et al. 2024). Overall, these were early food-producing villages, with pits filled with ash and plant remains (millet, palm nuts). The ceramics are mostly ovoid with flat bottoms and everted necks. Pits containing specific assemblages of vessels bear witness to ritual activities and inter-regional contacts.
- Exceptional sites: Akonetyé and Campo in Cameroon (Eggert and Seidensticker 2016) and Corisco Island in Equatorial Guinea (González-Ruibal et al. 2011) for their burial wealth.

Conclusion

During the period from 3000 to 1400 yrs BP, the archaeology of Central Africa reveals a radical change in material culture and lifestyles. Ceramics, which are

characterized by styles specific to each region, also display common features indicating a kinship of origin or strong social interactions. This period also saw the emergence and spread of iron metallurgy—although the details of this process are still poorly understood.

Funerary deposits of metal attest to one or more forms of social stratification, with some tombs clearly more richly endowed than others. The almost systematic presence of dumping pits is also characteristic. Diversified dietary practices, the emergence of organized villages, and evidence of social stratification all point to a new complexity.

The arrival of Sahelian plants (millet, cowpea) and Sudanese plants (sorghum) marked a decisive stage in the spread of agriculture in forested Central Africa. These agricultural innovations, combined with the spread of iron metallurgy and the diversification of tree resources (*Elaeis g*.), led to an increase in population and the structuring of communities into stable villages (de Saulieu et al. 2021). The successful integration of these cultures highlights the flexibility of ancient societies and offers lessons for adapting to contemporary environmental change. The recent Holocene saw the emergence of societies that would give rise to the great states that would mark the history of Africa during the second millennium AD.

Break-Ups, Resilience, and Innovations (1400–800 Yrs BP)

The period from 1400–800 yrs BP is marked by a notable break in the archaeological sequences in the Atlantic Congo Basin and could be described (Fig. 4), as in Europe, as the "Dark Age." It is important to remain cautious, however, as this break is marked by a lack of data; in fact, virtually no sites have been dated to this period in the forest block of southern Cameroon, central-eastern Gabon, and northern Congo (Oslisly et al. 2013). What is striking is that we see this decrease at the regional level as well as the local level, with sites with a long chronology presenting interruption of occupation (de Saulieu et al. 2017; de Saulieu et al. 2024).

There are many possible explanations for this: a decline in population—perhaps linked to an epidemic crisis—major social upheavals, the relocation of settlements to areas that are still unexplored from an archaeological point of view, or selective soil erosion and loss of fertility during this period. The regions bordering the forest block bear witness to complex social and environmental dynamics, which perhaps explain this situation. In Katanga, there seems to be a relative disconnect with what is described above. Indeed, in the Upemba Depression, this period marks the beginning of a flourishing cultural phase, with a hierarchical society engaged in various forms of trade (De Maret 1999; Nikis and Livingstone Smith 2017). In any case, in the absence of data, it is difficult to propose serious global hypotheses, whether in terms of settlement, material culture, diet, or social organization.

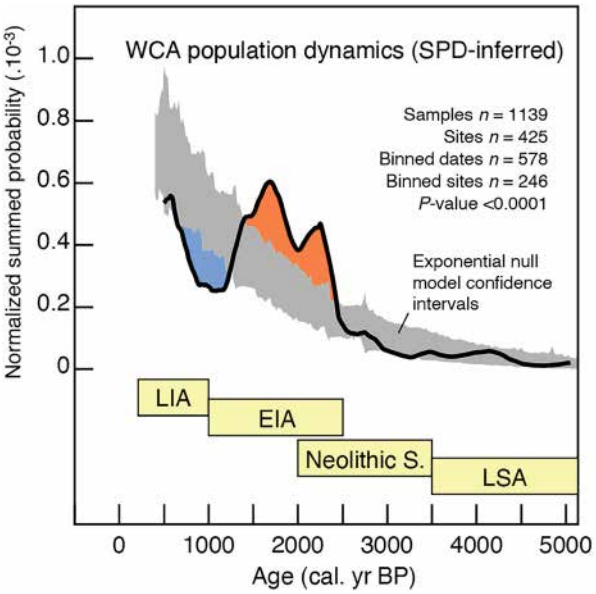

Fig. 4 Archaeological synthesis of Western Central Africa during the past 5000 years. All archaeological data presented rely on the SPDs of calibrated 14C dates. Summed probability density is a statistical method to reduce geographical and chronological bias, allowing for inferring population dynamics of the past: SPD of 14C dates (thick line) was compared against an exponential model used as a conservative null hypothesis. In other words, only the difference with the model is significant. The dark grey area represents the 95% confidence interval for the null model. Red and blue areas represent intervals with significant positive and negative deviations from the exponential model. A positive deviation may be interpreted as a demographic increase and a negative one as a decrease. (Regional cultural timeline shown at the bottom: *LSA* Late Stone Age, *Neolithic S* Neolithic stage, *EIA* Early Iron Age, *LIA* Late Iron Age. (From de Saulieu et al. (2021))

Key Sites

- Cameroon: Bwambé-Beach, Eboundja 3, and Mpolongwé, most of which have low levels of occupation (Nlend Nlend 2013).
- DRC (Katanga): Sanga and Katoto, necropolises rich in ceramics, copper jewelry, and prestigious iron objects (bells, parade axes). The funerary material suggests, among other things, the probable existence of a political and/or ethnolinguistic demarcation, a marked social stratification, and a trade network operating over medium to long distances (De Maret 1999).
- DRC (Tshopo): Yangambi and Basoko. The appearance of ceramic techniques typical of the Sahel attests to new interactions with populations north of the Congo River (Livingstone Smith et al. 2017a).
- No sites dating from this period have been discovered in the forests of Gabon. The period 1400–800 yrs BP in Central Africa marks a major break in demographic and cultural dynamics. The causes of this transformation remain to be elucidated, although we believe that an epidemiological phenomenon may have had an impact on Central African forests (Oslisly et al. 2013).

Emergence and Development of Large Political Entities (800–120 Yrs BP)

This period was a turning point for humanity and particularly for Central Africa. Today, thanks to a variety of sources—archaeological, oral, written, artistic, and genetic—we can better understand its history in terms of politics, trade, and inter-continental exchanges. Analyzing this period requires a multidisciplinary approach.

From an environmental point of view, we know that this period corresponds, for the northern hemisphere, to the medieval optimum (1100–750 yrs BP) followed by the Little Ice Age (750–350 yrs BP) (Ngomanda et al. 2007), but the environmental dynamics and their impact on societies remain little explored for Central Africa. At the time of the arrival of European travelers, there were large political groups, sometimes controlling considerable territories like the Kongo Kingdom, engaged in short-, medium-, and long-distance trade. Certain trade goods had probably existed before, such as iron, copper, and salt, but we also see the arrival of manufactured objects from Europe (as well as local copies) and the start of international trade in goods such as ivory and human beings (Arazi et al. 2024).

Material Culture

Ceramics

The ceramic traditions that emerged at the end of the previous period sometimes showed elements of continuity with earlier traditions, but above all mark an abrupt change in relation to everything that had gone before. In some regions, flat-bottomed ovoid shapes were abandoned in favor of round-bottomed hemispherical shapes; in others, square shapes, previously nonexistent, made their appearance. The previous decorative techniques were still used, but new techniques were emerging, notably *roulette* decorations using woven plant fibers or engraved on a wooden core. There was great stylistic diversity in terms of decorative schemes. These changes probably reflect major societal changes and medium- and long-distance interactions, as well as the emergence of new social spaces within which stylistic norms were established. These social spaces can often be linked to political formations (Livingstone Smith 2016).

Metallurgy

Iron continued to be produced and traded. Tools and weapons were produced with great skill. They were both utilitarian objects and currencies, the shapes and calibers of which varied from region to region.

Copper production began at Boko Songho-Mindouli (Republic of Congo) in the Pool Malebo region. This copper was used to make jewelry and coins for inter-regional trade. This is also the case at the southern edge of the forest block, on the Katanga side, where copper production continues. However, there have been changes in the style of ingots (shapes and sizes), the famous "croisettes." These changes indicate a regionalization of production, which could be linked to the emergence of new political entities (De Maret 1995; Nikis and Livingstone Smith 2017).

European Dishes, Guns, Pearls, and Cowries

Beads appear around 200 yrs BP in the forest block, from the northern coastal region of Cameroon (Douala) in the Upemba Depression west to Katanga (De Maret 1977). Similarly, European earthenware, stoneware, and glass vessels appear scattered in archaeological contexts from 200 yrs BP onwards. Produced outside Central Africa, they quickly became the imported objects of choice, competing with certain local crafts. In addition to their value as ornaments, they were used in a whole series of transactions, some of them of great prestige, as can be seen from the descriptions of bride prices in ethnographic sources from the nineteenth and twentieth centuries.

Food Sources

Colonization introduced plant species of American origin that profoundly altered local agricultural and food practices.

Crops such as maize, cassava, sweet potatoes, and groundnuts, which originated in America, as well as new varieties of yams, bananas, and taro from Asia, have been adopted by local populations. These new species have diversified diets and changed farming practices, contributing to a transformation of production systems and eating habits in the region. In arboriculture, the introduction of exotic fruit species has enriched cultivated biodiversity but has also led to changes in the management of orchards and local ecosystems.

Although the range of new plants and farming practices introduced during this period is more in line with today's food situation, unfortunately, few studies have been carried out on the subject. Everything remains to be done to gain a better understanding of the new agricultural dynamics introduced during this period.

Social Organization

Central Africa presented a mosaic of social and political systems, ranging from powerful centralized states, such as the Kongo Kingdom, the Mwat Yav, and the Luba, to small lineage-based societies, and even acephalous societies, particularly among hunter-gatherers. It is undeniable that, except for the so-called "pygmy" populations, wealth plays an important role everywhere, particularly in terms of marriageability. Chiefs were able to accumulate wives at the expense of their communities, while external slavery (as a result of war) and internal slavery (enslavement of relatives) are well documented in ethnohistorical sources (Vansina 1990), helping to concentrate power along river routes, along the coast, and in strategic areas.

Evolution and Transition

This period was marked by migrations, cultural changes, and outside influences, such as the introduction of Sahelian ceramic traditions into the Congo Basin and of American fruits and plants. The dramatic increase in human trafficking to Muslim markets and to the American colonies had a lasting effect on social structures and demographics.

Key Sites

- Littoral (Cameroon): Dibamba presents five ceramic traditions that succeed one another over 2500 years BP, some of which show an interconnection with those of other regions (de Saulieu et al. 2017).
- Southern Gabon: The Iroungou cave is a necropolis revealing a massive burial and prestige goods, including more than 500 iron and copper objects. Thirty skeletons, including many skulls, show antemortem dental avulsions (Villotte et al. 2021) (Fig. 5).
- West (Kongo Kingdom): Mbanza Kongo and Kindoki are major centers documented by historical and cartographic sources (Balandier 1965).
- Pool Malebo (DRC): Sites such as Gombe and Kingabwa, linked to the Teke Kingdom, show traces of important economic activities, particularly metallurgy (Van Noten 1982).
- Central (Congo-DRC Basin): Lisala and Ubundu have Sahelian influences and cultural dynamics that have been little explored (Livingstone Smith et al. 2017a; Nieblas Ramirez et al. 2024; Vutseme Sokoni et al. 2024).

Fig. 5 Beautifully crafted twisted copper bracelet from the burial cave Iroungou (Gabon, fourteenth to fifteenth century CE). (© Tigoe N)

Fig. 6 Aerial view of the center of the ancient Swahili City of Kasongo-Tongoni (Maniéma, DRC), with the stone foundations of some buildings. (© Arazi and Livingstone Smith MRAC-KMMMA)

- Southeastern DRC (Upemba): The burial sites of Sanga, Kabamba, and Katoto show a complex social organization with well-defined chronological sequences such as the Kisalian and Kabambian (De Maret 1977; De Maret 1999).
- Eastern DRC (Kindu, Kasongo): Little data, but historical sources mention the presence of Zanzibarite merchants in the nineteenth century (Arazi et al. 2020).
- Mbanza Nsundi (DRC): This is a major site for understanding the formation of the Kongo Kingdom (Bostoen and Brinkman 2018).
- Kingabwa (DRC): The remains around Pool Malebo are rich in evidence of commercial and craft practices (Van Noten 1982) (Fig. 6).

Conclusion

The period from 800 to 120 BP reflects a profound transformation of Central Africa, marked by the history of major political entities, major cultural changes, and the development of international trade networks. The material remains, and external influences bear witness to a resilience in the face of upheaval and a capacity for innovation that shaped pre-colonial societies.

Making Archaeological Heritage Part of Our Heritage

Showcasing our archaeological heritage remains a major undertaking. The remains of excavations are rarely exhibited in museums or officially restored. However, there have been some successes. An exhibition on the Iroungou site is still running at the National Museum in Libreville since September 2022. Some institutions in Central Africa, such as the Museum of Civilization in Dschang, Cameroon, the Lopé Ecomuseum in Gabon, the National Museum of the Congo in Kinshasa, and the National Museum of Lubumbashi in the DRC, have archaeological collections.

General Conclusion

The history of Central Africa over the last 650,000 years has been marked by major environmental and sociocultural transformations. The first human societies adapted to climatic cycles using rudimentary lithic tools, as attested by a few archaeological sites. The Last Glacial Maximum and the African Wet Period profoundly altered the environment, encouraging the expansion of forests and influencing lifestyles.

Around 7000 yrs BP, a more specialized management of plant resources appeared, accompanied by the combined use of macrolithic and microlithic tools. This period marked the beginning of a gradual transformation toward agriculture, with the early domestication of certain plants and the manipulation of the landscape.

Between 3000 and 1400 yrs BP, the introduction of Sahelian plants such as millet and cowpea led to the development of an agricultural and arboricultural economy in the rainforests. The growing exploitation of oil palm and other species reflects the ingenuity of local populations in the face of environmental constraints, marking a significant diversification of the food supply.

Between 1400 and 800 yrs BP, a phase of social reorganization led to a reduction in archaeological occupation. However, by 800 BP, new kingdoms were emerging, such as those of Mbanza Kongo and Kingabwa, illustrating a revival of political and economic dynamism (Clist et al. 2018). Inter-regional trade intensified, thanks to the production of copper goods in the southern Congo Basin, soon to be rivaled by the first European objects from the sixteenth century onwards.

With colonization, the introduction of American crops (cassava, maize, tomatoes, chillies, and potatoes) and Asian crops (rice and taro) profoundly transformed diets and agricultural landscapes, redefining production systems and trade. Central African societies have adapted to climatic, cultural, and economic challenges, laying the foundations for modern social and economic structures.

Research carried out to date has revealed the extraordinary wealth of Central Africa's archaeological heritage. However, major challenges remain if this heritage is to find its rightful place in the history of humanity. Nevertheless, international research projects and archaeological safeguarding initiatives have made a significant contribution to enriching our knowledge of Central Africa's past. We need to continue in this direction by encouraging preventive archaeology programs during major works (dams, roads, pipelines, mines…).

For a long time, the perception of tropical forests was dominated by the idea of a primary, static forest hostile to human development. Today, it is recognized that the Central African forest is subject to a variety of dynamics: Successive expansions and regressions have given way to the development of more or less shrubby savannahs over several centuries.

The protection of archaeological heritage is essential to preserve and enhance these remains, but it requires a collaborative approach. Involving local political players and civil society, particularly at the local level, is crucial to ensuring that this heritage is managed sustainably and with respect. Archaeology, in dialogue with local populations, can offer insights into the adaptability of past societies to environmental and social change, providing valuable lessons for tackling contemporary challenges. By promoting an interdisciplinary and participatory approach, archaeology in the Congo Basin contributes not only to understanding the past but also to building a sustainable future for local communities.

Competing Interest Declaration The author(s) has no competing interests to declare that are relevant to the content of this manuscript.

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