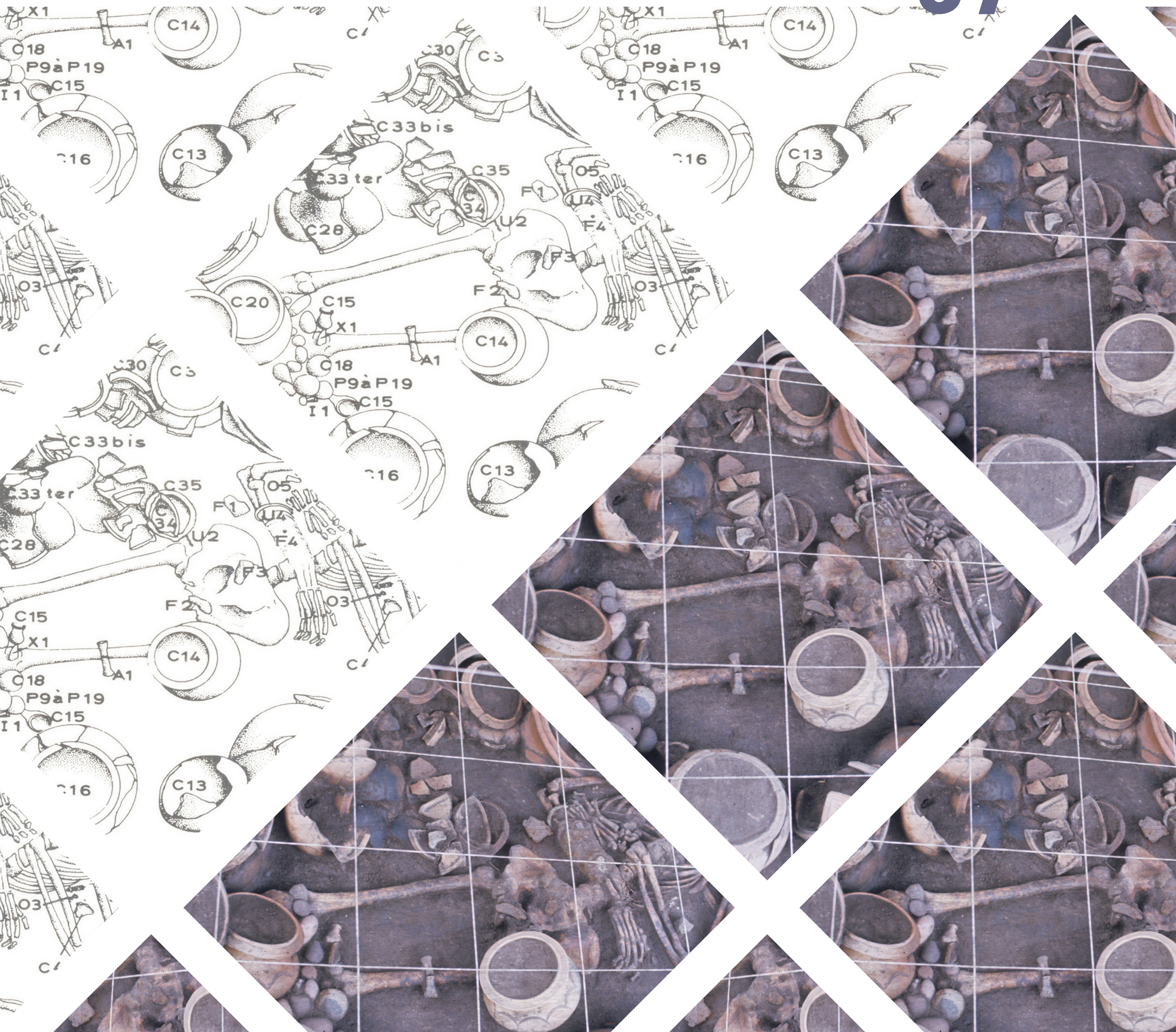
Field Manual for African Archaeology



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Foreword

Alexandre Livingstone Smith, Els Cornelissen, Olivier P. Gosselain & Scott MacEachern

Pierre de Maret retired from the university in October 2015. A prominent scholar with a worldwide reputation, his scientific contributions to the field of African archaeology could have been celebrated through a *Festschrift* bringing together an international panel of friends and colleagues. Yet Pierre also dedicated an important part of his academic career to the training and funding of students in African archaeology, many of whom became professional archaeologists and currently occupy academic positions.

A large number of these students had spent time at the Royal Museum for Central Africa, a Belgian federal institution with which Pierre has been associated since the early 1970s. Besides consulting documents and analysing collections, they often sought practical advice for conducting fieldwork in Africa. They asked basic – but critical – questions, to which Pierre's colleagues and friends tried to provide effective, no-nonsense answers. Through this process, we gradually realised that despite the wealth of books dedicated to African archaeology and to field archaeology, there was no publication specifically devoted to field practice in African archaeology. Keeping that in mind and wanting to celebrate Pierre's commitment to the tutoring and supervising of young researchers, we decided to edit a *Field Manual for African Archaeology*, drawing on the expertise of the international community to which Pierre belongs.

This manual is about how to find, excavate and study archaeological sites in sub-Saharan Africa. Obviously, archaeological methods in Africa do not differ from excavations in any other part of the world and any student with an Internet connection will easily find references on how to do things in the field. But knowing about the tool is not the same thing as using it. This is where the experienced professionals contributing to this manual make a difference. Sharing tips, describing possible pitfalls, contextualising field methods and research orientations, they help prospective Africanist archaeologists becoming more knowledgeable and autonomous out in the field.

Readability and ease of access were a crucial issue. First, we wanted the text to be as clear and concise as possible. Hence authors were asked to submit short contributions, avoiding jargon and focussing on essential and straightforward concepts and methods. References were kept to a strict minimum, focussing on key and accessible sources. Second, in order to reach as large an audience as possible, especially in Africa, we chose to publish in French and English and opted for an online open-access format. We also decided to offer each chapter as a separate download, which might prove useful where Internet access is expensive and irregular.

This manual is certainly not perfect. Not all topics could be covered and there are overlaps between chapters, which sometimes correspond to slightly different perspectives or field conditions. Also, the sheer number and diversity of contributors may lead to some stylistic heterogeneity. At the same time, it definitely opens a wider perspective on doing archaeological fieldwork in Africa. The manual might thus best be viewed as a work in progress, liable to evolve in parallel with the field of African archaeology.

On a final note, we would like to thank all the authors involved in this unusual project, as well as the people who helped them directly or indirectly. Special thanks are due to Isabelle Gérard and her team at the Publications Service of the RMCA and to the Belgian Development Cooperation for funding the translations.

To Pierre, with respect and admiration for all he has achieved.

Introduction

Thinking and writing on the past in Africa

INTRODUCTION

Alexandre Livingstone Smith[1] & Scott MacEachern[2]

Is there anything to find in Africa? While the continent is generally acknowledged as the cradle of mankind, the general public is rarely aware of events following this almost mythical beginning. The African continent clearly has a past, but knowledge of this past is partial, filtered and sometimes biased. The reason for this denial of history is related to the international slave trade and the politics of colonial expansion, which certainly did not leave much room for mutual respect and enlightened exchange, but also to the fact that scientific research in colonial nations was dominated by evolutionist thought. The simplistic idea of opposing stereotypes, 'industrial/dynamic' and 'traditional/unchanging', is still strong today. Researchers most of the time find what they are looking for. History has long been a discipline devoted to only written sources, hence neglecting civilisations that are better known through other records such as archaeology. Needless to say, archaeology, like any historical discipline, is immersed within the social context in which it is practiced. Interpretation of archaeological data may therefore be affected by the interests of a researcher or of the community (s)he belongs to.

Archaeology has played an important role in political struggles across the African continent for more than a century, in very different contexts. In many countries, it has been used to build up nationalist feelings, or more generally to inculcate pride in the African past. In other cases, as at Great Zimbabwe, archaeological evidence was denied or distorted to support Eurocentric and colonialist assumptions about ancient societies. Researchers need to pay continuing attention to the social and political circumstances in which their research is undertaken and its results interpreted. The following papers should help in this respect, as they outline the history of the discipline and the state of the art from various points of view.

To start with, **John Sutton** outlines the role and the main characteristics of African archaeology. Our discipline is just one line of investigation, along with history, linguistics or anthropology, to name but a few. Looking at research designs and objectives, he distinguishes two schools: Universalists, for whom Africa is just a case study serving larger research objectives, and Africanists, whose aim is primarily the reconstruction of the African past. The needs of the latter explain how African History came to be 'written' or recorded by combining archaeology, anthropology, linguistics and local memories.

Focusing on the present situation, **Susan K. McIntosh** reviews the state of practice in archaeology, considering funding and priorities, theoretical and research agendas, project designs and stakeholder values. In doing so, she outlines the various key elements a researcher needs to take into account when conducting research on the African continent - or elsewhere. She makes it clear that a dialogue between all the

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parties involved in the outcome of an archaeological investigation is crucial. This means that, to comply with the tight schedule involved in grant proposals, a researcher needs to build a network with local and international parties that can be activated when a grant needs to be submitted.

Moustapha Sall elaborates on these questions from a West African point of view. Using Senegal as a case study, he considers the origin of archaeological research in the region and its transformation in the new independent states from the 1960s onward. He examines a series of key issues such as the cultural attribution of archaeological sites, the role of historical archaeology, heritage protection and the training of future generations of archaeologists. He emphasises the growing role of Heritage Management Studies and rescue excavations, yielding unbiased data since they are not problem oriented other than saving material traces of ancient human or hominin presence.

Christophe Mbida Mindzie: examines this topic from a Central African perspective. Using the example of Cameroon, he explains how archaeology, considered an auxiliary to History, was developed by a combination of political decisions which promoted Cameroonian research institutions, national research programs, and collaborations with international teams. Considering the 21st century, he examines the benefits and drawbacks of preventive and rescue archaeology development.

RECOVERING THE AFRICAN PAST: LOOKING BACK FROM THE PRESENT

John Sutton[1]

Archaeology, as the study of the landscape, and of every feature visible on its surface or revealed by excavation, is essential for understanding the past wherever people live or have lived. But it is not the sole method of historical enquiry. For in probing backwards from the present, the archaeological record can be correlated with anthropological insights, especially ethnographic studies and linguistics, as well as oral testimonies and written accounts, wherever available (see also Chapter 6 this volume). This methodology of historical reconstruction from multiple approaches has been pioneered in Africa where documentary sources – the traditional mainstay of historical research in Europe – exist for few regions only before the 20th century.

I. ARCHAEOLOGY OF AND IN AFRICA

Individual archaeologists involved themselves in parts of sub-Saharan Africa before 1900 (and earlier still in Egypt). But in most countries structured and sustained research had to await the final years of colonial rule (1950s/60s) or the first decades of independence. The political upheavals of that period were accompanied by a radical demand, popular and intellectual at the same time, for explaining the background to Africa's peoples and cultures in a positive way – in contrast to the diffident view of African history typical of colonial administrations and their education departments. The establishment of universities, as well as national and regional museums and antiquities services in the mid-twentieth century, opened institutional bases for a scattering of archaeologists across the continent. These pioneers, mostly expatriate at first, had each their own specialisation by region, period and theme. There were contrasts in purpose and outlook too, which have persisted as research has expanded. Putting it simply, archaeologists active in Africa belong to two schools or 'clubs' – what might be labelled the 'universalist' and the 'Africanist' traditions. The distinctions are not clear-cut; these two broad traditions are not overtly opposed. Where they differ is in their visions and agendas.

A. Universalists

The universalist school is concerned for archaeology as a worldwide academic discipline (one usually seen in North America as a division of anthropology). Accordingly it selects regions for fieldwork and promising sites for excavation, in Africa as elsewhere, for testing general hypotheses and for understanding human lifeways and adaptations from the earliest times to the recent past. These researchers do, of course, take proper note of local factors and signs of changes in the environment through time, these being central to their purpose of recognising the range of human cultures between the continents and within them. But at its purest – if one may characterise – this 'club' is focussed less on Africa and its history as such than on addressing universal questions of archaeological and anthropological theory, practice and interpretation. Its emphasis is on ideas worth testing *in* Africa, rather than the archaeology – and history – *of* Africa and its parts.

Such an approach applies especially to Stone Age archaeology and palaeoanthropology, that is, the study of humans from their emergence as upright tool-making animals in Africa some two million years ago (not to overlook yet older pre- and proto-humans). As is well known, much of the field research responsible for current knowledge of human evolution, not simply physical (through discoveries of fossil bones) but also behavioural (through study of their environments, living places and tool-kits), has since the mid-twentieth century concentrated on the eastern side of Africa. Olduvai in Tanzania, with its exceptional succession of fossil-bearing deposits and Early-Stone-Age tools, is but one of many important sites (**fig. 1**). As a result, the evidence that the evolution of humanity occurred in Africa is now beyond dispute. But that conclusion is only a starting point for increasingly sophisticated questions, in which the African finds, and their detailed laboratory examinations by anatomists and other scientists, assume worldwide significance. For no one 'owns' the past; human history, from its beginning to the present, belongs to everyone.

The complex issue of expansion of humanity from Africa into Eurasia (and eventually around the globe) is

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Fig. 1. Two million years of evolving human history revealed at Olduvai Gorge (northern Tanzania), a massive erosion gully cutting through 100 meters of successive Pleistocene layers, including volcanic ash and tuffs. Most of these deposits had formed in shallow alkaline lakes, a situation ideal for bone fossilisation. The site achieved international fame in the late 1950s through the discoveries in the lowest strata (by Louis and Mary Leakey) of fossil remains of *Australopithecines* and *Homo habilis*. (Photo © J. Sutton.)

Fig. 2. Rubbish dumps, a key to the history of town settlements, as at Ntusi (western Uganda), a centre of sorghum cultivation surrounded by a specialised cattle grazing zone, c1000-1400 AD. Two 5-metre dumps – known as 'Ntusi male' and 'female' – testify to an organised system of disposal of domestic refuse, notably cattle bones, charred sorghum seeds and broken pots, and illustrate the balanced agricultural and herding economy. The pasturing of the finest cattle in these rich undulating grasslands is recalled in the regional traditions of gods and heroes. (Photo © J. Sutton.)

of obvious interest to people everywhere. Moreover, it has now become clear that such 'Out of Africa' movements happened more than once. The first occurred hundreds of thousands of years ago, involving pre-*sapiens* humans with Early-Stone-Age traditions of manufacturing and using tools for everyday living dependent on gathering and hunting. Eventually their descendants were superseded by modern humans (*Homo sapiens*), an advanced species which also evolved within Africa and developed more versatile cultures and behaviour (including, so recent research suggests, artistic sense and skills). Offshoots of *Homo sapiens* spread into Asia less than a hundred thousand years ago – only 'yesterday' in overall human history – and reached more distant continents much later still.

This broad picture emerges partly from fossil found in Africa as well as in Eurasia at the same time, and their dating in laboratories (equipped for the latest isotopic measuring processes of carefully collected samples), but also from recent advances in comparative genetics (especially DNA). The details, naturally, are in flux as research continues. That involves not only teams of archaeologist and geologist fieldworkers, but equally palaeontologists and anatomists for studying the fossils and conferring with geneticists (based in museums and medical faculties around the world) as well as the dating laboratories. Thus the search for archaeological remains of early *Homo sapiens* in Africa, that is for fossilised skeletal materials and, equally important, associated Stone Age finds and their contexts (environmental, climatic etc), is – like that for the evolution of the genus *Homo* over the preceding one, two and more million years – an international concern, relevant to public thirst for knowledge worldwide. Research in a single continent, whether in archaeology or any other science, cannot be isolated from the world at large.

B. Africanists

The second tradition of archaeologists active in Africa – the more avowedly Africanist school – is not a formally separate 'club'; in fact, some might deny a real distinction. Nevertheless, there is a contrast in outlook and emphasis. Whereas the first school consists of specialists at work on all types of sites (and of all ages too) which happen to be *in Africa*, the other's concern is for the archaeology *of Africa*, with a commitment to 'rediscover', region by region, bit by bit, the *history* of the continent and its *existing* peoples and cultures within their environments. And these environments, it should be emphasised, are those which the same populations have helped create over time, particularly by clearing land for cultivation of various crops and grazing by their cattle and other livestock. That means concentrating on a relatively short time-scale, stretching back centuries or the last few millennia, usually with marginal concern for the Stone Age.

This impetus for researching the background to the present African populations emerged, effectively, in the 1950s/60s as the clamour for independence from colonial rule reverberated around the continent. In that situation it was only natural that popular demands extended beyond mere politics to the spheres of culture and education. In short, a new vision of Africa and its people was being called for, with priority for the writing of histories – continental, national and regional, including those of particular ethnicities and ancient kingdoms. This was the start of an intellectual revolution, seeing that before independence the notion of *pre-colonial* African history had been generally dismissed as impossible owing to the lack of 'sources' (meaning written documents in the established tradition of European thinking). For what had been labelled 'History of Africa' in colonial-era schools concentrated on foreign explorers, traders, Christian missionaries, soldiers and eventually administrators, in which African people figured secondarily, almost as an afterthought. By the same colonial mentality, instances of enlightenment, development, technical initiative, political sophistication or what was vaguely called 'civilization' were explained as having reached Africa by some process of diffusion from outside. That image of Africa had to change!

The reason for the former entrenched 'Eurocentric' bias was not a lack of research on African societies but, rather, one of vision and direction. For, from the beginning of the twentieth century many parts of the continent had proved fertile ground for anthropological recording – by colonial administrators, missionaries and, in time, trained academics. The quality of their formidable published output was variable, but the finest studies contain informative and perceptive accounts of individual African societies at that time, as well as detailed grammars of their languages. Thus these pioneering field anthropologists ensured that a vast amount of invaluable documentation has been saved for posterity. However, their perspective was generally not so much historical as ethnographic, that is, focussed on describing the 'traditional' culture and institutions of each so-called 'tribe', as if these existed in an essentially changeless present-past. Not surprisingly, for the spirit of the 'African awakening' of the 1950s/60s, such a static and patronising image of pre-colonial Africa and its peoples looked seriously inadequate. The need now was for a dynamic vision, one charting historical development and duly recognising indigenous African initiatives and achievements – an endeavour which would engage an emerging generation of African scholars. As for research method, the old excuse of the sparsity of written materials could no longer be acceptable. New sources and techniques of historical enquiry needed to be identified and explored. An obvious way forward was to examine the landscape, searching for signs of former settlement and activity on the ground, in other words to turn to archaeology – especially of what came to be called the African Iron Age (see **figs**. **2** and **3a & b**).

II. AFRICAN HISTORY: COMBINING EVIDENCE FROM ARCHAEOLOGY, ANTHROPOLOGY, LANGUAGES AND LOCAL MEMORIES

This archaeological commitment, from its patchy first efforts of the mid-twentieth century in western, central and eastern Africa, thus focussed on the existing populations of Africa and how they had come into being. It endeavoured, with the help of local informants as well as available ethnographic knowledge, to probe backwards through the preceding generations, to 'open a window' as it were into the past and especially to grasp any available chronological clues. The perspective, therefore, was on discovering the background to the present over recent centuries or, in some cases, the last thousand years or more. If that sounds vague, it is because in the 1950s and 60s so little was documented or dated – the radiocarbon method being new and barely tested then – that the horizons of research initiatives were hazy. In fact, enthusiasm and speculation were apt to race ahead of solid research results, with the agenda being driven by general historians (their fashionable catchphrases and all) and by popular and educational demand, as much as by the few archaeologists on the ground. Sites were selected for excavation by their prominent features (for example mounds of different types or unclear purposes, walls interpreted rightly or wrongly as fortifications, and village settlements identified by broken pottery eroding out), or again places reputed to have been royal capitals, according to traditional authorities. Thus, despite rather haphazard beginnings, what was labelled 'Iron Age' or sometimes 'historical archaeology' developed across Africa; and, as a sub-discipline, it soon distinguished itself from so-called 'prehistory', the domain of Stone Age specialists. The emphasis on the working and use of iron – some two thousand years old in parts of sub-Saharan Africa,

Fig. 3. Town walls and their gates: rules of entry and exclusion, symbols of power and the pride of history.
(a) Surame (north-western Nigeria), a capital of the Kebbi kingdom of 16th-17th centuries surrounded by double concentric stone walls. A century after Surame's desertion, the site was rediscovered by the Fulani jihadists – 'These ruins are like nothing we have seen before' – and inspired them in building their new capital at nearby Sokoto.
(b) Zaria, the capital of the former Hausa kingdom of Zazzau, conquered by the Fulani jihadists in the early 19th century and reduced to an emirate within the Sokoto empire. Like other old Hausa cities, it boasts stretches of prominent walls (typically built of sundried brick) with guarded gateways. But the heavy gates reinforced with iron strips have long gone, and the case for protection and conservation of what remains is obvious. (Photos © J. Sutton.)

as became clear with improved handling of radiocarbon testing – and equally on the development of regional agricultural (and also pastoral) economies, set the scene for more systematically designed research across the continent in the following decades.

Certain of the practitioners concentrated essentially on the archaeological sites and finds and in reporting them in specialist monographs and journals (including those published by learned societies in several African countries). Others, committed to 'outreach', tried interpreting the results more broadly and maintaining close rapport with the History schools in the new African universities, as well as in European institutions (where valuable library, archival and museum collections were attracting increased attention, spurred by the growing popularity of African Studies, especially in North America). Moreover, dialogue was encouraged with scholars in other disciplines relevant to the pre-colonial past. These comprised, in summary, oral traditions (and 'folklore') and surviving written references (in Arabic and European languages); and anthropology generally defined, but particularly ethnography (with details of social organization, economy and material culture, recorded 'tribe' by 'tribe'), and especially comparative linguistics. This last discipline has proved enormously important not only in charting historical relationships between communities over time, but equally valuably, through attention to sound- and meaning-shifts, for documenting cultural and economic innovations (from crops and agricultural methods to technology and trade), and the order in which such developments and their expansions occurred.

While truly multi-disciplinary field projects were few at first, what mattered was the emerging principle of combining these varied approaches for reconstructing pre-colonial African history. In retrospect, some early cross-disciplinary exercises were conceived too narrowly and simplistically. For instance, excavations undertaken at shrines or claimed capitals (notably in the interlacustrine region of East Africa), in the hope of verifying legendary names and confirming the dating of specific events through recitations of oral traditions and lists of kings, would now appear rather naive. But in time Africanist archaeologists – and historians generally – have learned from social anthropologists to be less concerned about the literal accuracy of oral testimonies (and equally of written ones too), or regarding them sim-

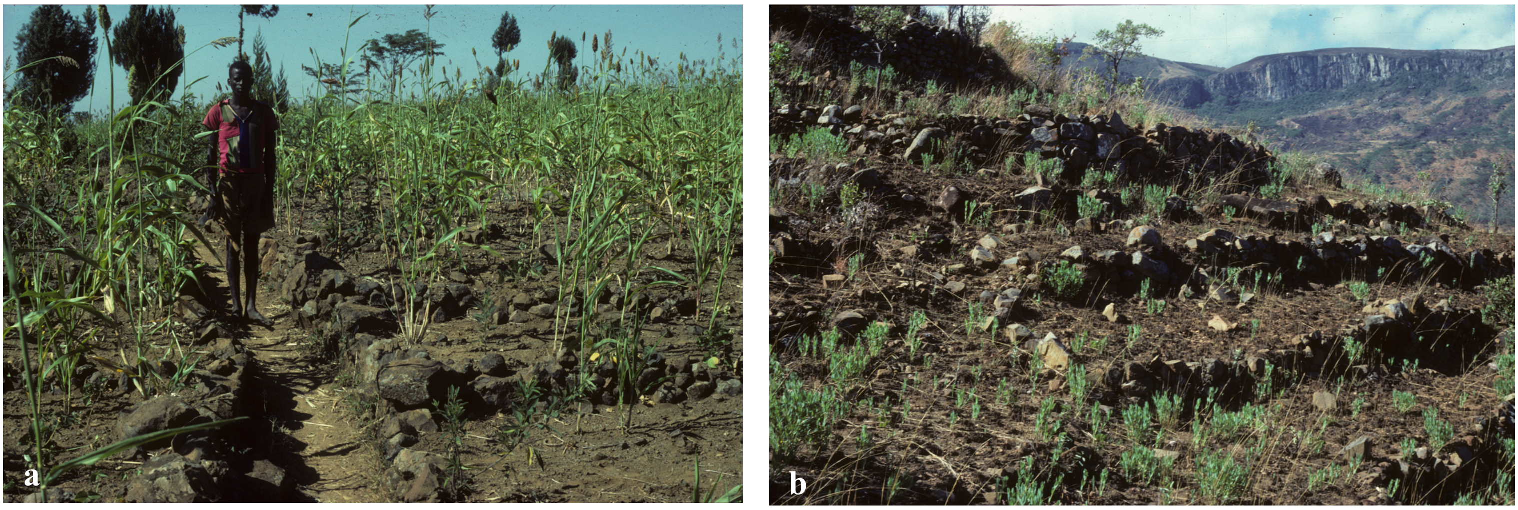

Fig 4. Ethnography and Archaeology: terraced and manured sorghum fields. **(a)** existing (crossed by path for villagers and small cattle), Konso (Ethiopia); **(b)** abandoned 200-300 years ago, Nyanga (Zimbabwe). (Photos © J. Sutton.)

plistically as sources of dated 'facts'. Instead, they have come to appreciate the deeper significance of traditional lore and the realm of so-called 'myth' for understanding both the present and the past of societies and their cultures. Indeed, although the human sciences in Africa are no longer monopolised by anthropologists, the latter – and their cumulative work – play an essential role in modern historians' thinking. Archaeologists take note!

This particularly holds when drawing on ethnography, especially aspects of material culture, for interpreting archaeological findings. Some earlier attempts to compare specific settlement features and household items, as recovered by excavation, with existing 'traditional' examples (of house types, pottery styles, ironworking etc.) may, in retrospect, look facile and crude, being too selective while overlooking essential context. This is where a perceptive anthropologist's eye and ear could have offered a corrective. But recognition of previous inadequacies does not mean that ethnographic analogy should be eschewed as a way towards understanding the findings from excavations (**fig. 4**).

For, implicitly at least, all archaeological interpretations, whether of whole sites or landscapes or of individual objects recovered, rely on reasoning from the present. More explicitly, tentative conclusions can often be tested by suitably designed experiments, especially if undertaken with the cooperation – intellectual as well as manual – of the local community. Essential here, for comparative purposes and regional historical reconstruction, is the indigenous terminology for each material item, process or even concept, which means that the exercise needs a linguist with local experience or at least a sensitive translator. Some of the most fruitful of such ethno-archaeological projects have extended into detailed studies of rural villages, their compounds and building methods in action, as well as their land use, year-round agricultural strategy and crops, and the associated technology. Thus, with proper handling and without undue sentimentality – which means rejecting the nostalgic vision of a 'traditional', unchanging Africa before foreign intervention – one may begin to discern both 'the past in the present' and 'the present in the past', and, by broadening the perspective, the place of Africa in world history.

ARCHAEOLOGY IN AFRICA: WHO OR WHAT SETS THE AGENDA?

Susan Keech McIntosh[1]

For anyone wishing to undertake archaeological research in Africa, there are opportunities galore to provide pioneering insights in unstudied areas, to establish basic chronological frameworks and create reference databases, or to revisit sites excavated in prior decades and expand existing information. The ratio of practicing archaeologists to habitable land mass in Africa is staggeringly low. In some countries (e.g., Guinea Conakry, Guinea Bissau), there are no professional archaeologists in universities or government offices; at the other pole, uniquely, is South Africa, with numerous and diverse archaeological expertise and well-funded research carried out in numerous institutional contexts. Countries such as Senegal, Morocco, Egypt, Kenya, Botswana, Nigeria, and Ghana occupy positions more or less midway between these two poles.

The development of archaeology within Africa has been highly uneven, varying from country to country as a function of local colonial and post-independence experiences with professional training, institution-building, and funding. This is also the case for our knowledge of Africa's past. Certain time periods and geographical areas have been favored for study, while vast sectors of Africa remain uninvestigated. This uneven, profoundly partial landscape of knowledge can be attributed to three dominant factors (Stahl 2004):

1. The questions archaeologists choose to investigate, which are underlain by all manner of assumptions about the nature of African societies past and present;
2. How sites are valued or identified as 'significant' – a factor clearly related to the first factor;
3. Access to funding for fieldwork, analysis and publication, archaeological training, and institutional frameworks providing facilities, support, and the rationale for archaeological research.

Archaeological agendas in Africa have been, and continue to be, fashioned on the basis of implicit or explicit applications of theory and theory-laden concepts, almost all of which originated outside the continent. During the colonial period, the Enlightenment historical narrative of social and technological progress was deeply embedded in the Three-Age system that was transposed with only partial success to Africa. The colonial, imperial enterprise was well-served by the belief that Africa was an unprogressive continent, timeless and unchanging. 'As we see them today, thus have they ever been', Hegel proposed. The primary theoretical framework deployed by the small number of archaeologists in the colonial service from the 1930s onward was culture history, a descriptive approach to identifying normative material culture groupings. Thought by some to be a value-neutral approach to the past, culture history in fact had little in its conceptual toolkit to explain culture change. Rather, it often relied on diffusion and migration to account for change, and exogenous influences were regularly invoked to account for technological innovation or monumentality – from Great Zimbabwe to the megaliths and tumuli of the western Sudan.

After independence, the focus of archaeology shifted in most countries away from universal histories/prehistories, into which Africa had figured marginally, to local and national histories. Profoundly aware of the loss of traditional histories and oral traditions that had occurred during the colonial period, Africans in many countries turned to archaeology as a primary mechanism to regain and re-establish their pasts. In these countries, a nationalistic archaeology focussed on recent periods – from the origins of food production through to the trans-Atlantic era – emerged. Part of the new agenda for archaeology was refuting the view of Africa as an unprogressive backwater. The processual paradigm of the 'New Archaeology' that developed in England and America in the late 1960s and 1970s, with its emphasis on explaining endogenous culture change, was well-suited to this new agenda, despite the shortcomings that would be critiqued by the post-processualists beginning in the 1980s. British and American researchers in several countries worked within the processual paradigm and began to train students. Throughout most of Africa, however, culture history continued as the dominant framework for both local archaeologists and foreign researchers from different countries throughout western Europe. Robertshaw (1990) provides details on the differential development of theory, practice and archaeological research agendas in different regions of Africa during the colonial and post independence pe-

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riods. A number of African countries sent students for archaeological training in the then USSR and Soviet bloc countries including Poland, but Soviet archaeology never significantly shaped archaeological agendas, as it funded very few archaeological projects in Africa.

I. FUNDING AND ARCHAEOLOGICAL PRIORITIES

The African archaeologists I interviewed for this chapter were clear that money drives agendas in African archaeology. Externally-funded projects account for the majority of archaeological research in many countries, and the agendas are set by European and North American researchers as they write their grant proposals.

Within individual African countries, internal agendas and priorities for archaeological research, conservation of archaeological sites, and rescue work depend on institutional contexts, professional capacity and infrastructure, all of which reflect current and historical funding levels. Heritage management, linked to tourism, is often the best developed sector, but decisions about archaeological heritage may be in the hands of government employees with management background rather than archaeological training. National legislation regarding development and cultural resource management opens another research avenue in certain countries, where CRM occupies a tiny but growing aspect of archaeology. In most countries, trained archaeologists located in universities and government entities such as Institutes of Human Sciences or Directorates of Monuments and Museums provide the primary personnel for archaeological fieldwork. Depending on the country, these archaeologists may be stymied by weak antiquities legislation or lack of enforcement, not to mention low to non-existent levels of funding for their own research and for field training for students. It is not uncommon for research and training funds for entire archaeology departments in Africa to range from several hundred to less than $5000 per year. Under such circumstances, foreign projects may provide a very welcome opportunity for both research partnerships with local archaeologists and field training for local university students. One difficulty that can arise is the disconnect that often exists between the government directorate that issues permits for archaeological research and the relevant university archaeology faculty. Although assigned a government 'homologue' who earns a *per diem* for participating in the project, a foreign researcher often needs to reach out personally to colleagues in university archaeology departments in order to locate faculty collaborators and students interested in gaining fieldwork experience. Ideally (and circumstances are often less than ideal), these contacts and conversations will be initiated as the project is being formulated rather than after the project has been funded. The chance for students to work on some of the project materials for master's theses or student papers may also be appropriate and greatly appreciated.

II. THEORETICAL AGENDAS

Theory is fundamental to archaeological agendas and influences the kinds of questions we ask about the past, the observations and data that we consider relevant, and the interpretations we offer. Whether or not we acknowledge and make explicit our theoretical orientation, it undergirds all of our archaeological activities. Concerns with theory making and its articulation with the formulation of research questions, research design, data collection and analysis, and the evaluation of interpretations or hypotheses were foregrounded in the New Archaeology in the 1960s and 1970s. Subsequent decades have seen an explosion of archaeological theories, accompanied by shifts (styled as 'turns') in orientation and preoccupation: the 1980s brought the 'critical turn' (variously described as the literary, reflexive, post-modern, post-structural, or interpretive turn); linguistic, somatic, and material turns, and (most recently) the ontological turn have followed. Most of these shifts originated in disciplines other than archaeology. Indeed, some have accused archaeology of having no theory of its own, relying instead on mining other fields for new ideas and constructing bridging arguments to operationalize them for archaeological data (Yoffee & Sherratt 1993). A diversity of interpretive frameworks, each presenting a different 'window of observation' on the archaeological past, appeared in rapid succession from the 1970s onward: economic, ecological, behavioral, spatial, symbolic, structuralist, post-structuralist, evolutionary, Annaliste, cognitive, feminist, social, and landscape archaeologies, among others. The primary producers of this shifting theoretical landscape were and are academic archaeologists in Britain and North America, where the political economy of knowledge production favors the theoretical innovator who can build a following. The prize is status, conferred by citation counts and job offers from influential, well-funded departments where particular theories gain adherents among networks of colleagues and graduate students. The objective of these theoretical engagements is of course an expanded, preferably transformed understanding of various pasts. Whether particular theories achieve this, or whether they are merely transitory shifts in fashion may not become apparent for some time (Trigger 1990).

The African archaeologists I interviewed are keenly aware that archaeological theory is externally derived and that foreign researchers generally set their own agendas. Their assessment is that, in general, local archaeologists in their universities don't concern themselves much with theory. In some cases, the 'Eurocentric' nature of theory is cited as a rationale for ignoring it, resulting, ironically, in minimal engagement with the development of theories more appropriate for African data. Outside of South Africa, it is primarily archaeologists with recent North American or European Ph.D.s who incorporate theoretical considerations actively and self-consciously in their teaching and research. Their concern is to encourage more explicit framing of research questions by students and more critical thinking about the kinds of data collection and analysis needed to address those questions.

III. RESEARCH AGENDAS, PROJECT DESIGN, AND STAKEHOLDER VALUES

Whatever the theoretical orientation or research agenda of a foreign-funded project, a key element must be a research design, crafted in advance, that takes into consideration the range of stakeholders in the project and the social interests involved. For an approach to research design that integrally incorporates stakeholder interests along with the demands of an academically rigorous field archaeology, there are few guides better than Martin Carver's *Archaeological Investigation* (2009). He reminds us that 'archaeological investigation is powered by design, linking what is done with its purpose, reconciling the diverse agendas that fieldwork must satisfy, balancing its objectives, its ability to read the ground, its social context…[W]ithout a…project design, a field archaeology project must be judged at best inept, at worst unethical.'

A useful concept here is Carver's (2009) 'value-led archaeology', which evaluates the different values placed on a particular site or landscape that is the proposed target of research. Potential stakeholders range from local and descendant communities to national and even global interests, all of which need to consulted and acknowledged alongside academic interests, ideally as part of the research design. Meaningful dialogue that is respectful of stakeholder concerns and viewpoints can open up new ways of thinking about the research and suggest valuable collaborations. It cannot eliminate conflict where various interests collide, but it can and should be an arena to demonstrate openness, sensitivity, and good faith. Wherever possible, research design and implementation should strive to create additional value for local stakeholders, including archaeologists, students, and community members, through active engagement, collaboration, and sharing of information. A project design should be a consultation document, containing 'proposed programmes designed to serve research, conservation, and other interests. Its importance lies in its acknowledgement that historic resources are about to be expended and that we seek broad consent. Its utility lies in the exercise of deciding exactly what to do and costing it. Its social purpose is to take field research out of its academic enclave and to place it at the heart of the modern community.' (Carver 2009).

REFERENCES

Carver, M.O.H. 2009. *Archaeological Investigation*. London: Routledge.

Robertshaw, P. (ed.). 1990. *A History of African Archaeology*. Portsmouth: Heinemann.

Stahl, A.B. (ed.). 2004. *African Archaeology: A Critical Introduction*. Hoboken: Wiley-Blackwell.

Trigger, B. 1990. *A History of Archaeological Thought*. Cambridge: Cambridge University Press.

Yoffee, N. & Sherratt, A. (eds). 1993. *Archaeological Theory: Who Sets the Agenda?* Cambridge: Cambridge University Press.

I am grateful to the archaeologists who agreed to be interviewed about archaeological funding, theory, and agendas in their home universities and countries: Drs Ibrahima Thiaw (Senegal), Zacharys Anger Gundu (Nigeria), Benjamin Kankyapeng and Wazi Apoh (Ghana), Morongwa Mongosthwane (Botswana).

ACADEMIC RESEARCH IN WEST AFRICA: THE CASE OF SENEGAL

Moustapha Sall[1]

INTRODUCTION

In West Africa, as in other countries on the continent, archaeology was introduced by European colonial administrators and doctors. The founding of the Institut français d'Afrique noire (IFAN) in August 1936 reflects this influence. Established in Dakar, this federal institute covered all of French West Africa and became a genuine focal point for research (mandatory depositing of all discovered materials). These ambitions gave rise to research campaigns, but also to academic bulletins (*Bulletins de l'IFAN* and *Notes africaines*) that publicised all such discoveries in West Africa and above all enhanced the value of sites. Enthusiasts in Senegal thus became interested in remains for a variety of reasons. Some wanted to reconstruct part of the history of the Senegal River's middle valley, others to solve the mystery of megaliths, still others to establish the origin of hundreds of shell middens on the coast.

Since this (colonial) period, research campaigns have focused on the precolonial past and fall under three chronological benchmarks. The first campaigns, by amateurs such as de Mézière, Jouenne and Joire, contributed to the discovery of sites and the identification of cultural and technological behaviours. In the 1970s and 1980s, the first professional research teams were formed by the same foreigners and joined by nationals in the context of their individual academic studies, with marked interest in Palaeolithic, Neolithic and protohistoric sites.

Even though this research contributed to the discovery of sites, the academic approach of archaeology paid little attention to societal issues. Taught to very few students, the discipline was characterised by its isolation and silence on the debates of the time (Egyptian origins and identities of Senegambian populations). This interest in links between archaeological remains and populations generated its first data in the 1970s. Ethnologists, during a long, wide-ranging campaign to survey village traditions, became pioneers of inventorying the archaeological landscape, producing the current map of protohistoric sites (Martin & Becker 1974; **fig. 1**). However, during the second half of the 1980s, advances were made both in methodology and interpretation. In addition to a traditional approach, progressive recourse to other methods (ethnography, history) in the study of Iron Age sites helped show that these stones, waste piles of waste materials, mystical places and haunted (in popular perception) cemeteries are veritable libraries quite capable of telling the history of each site and transcending current ideological representations.

I. PAST AND ARCHAEOLOGY: THE EXAMPLE OF SENEGAL

The settlement history of Senegal is marked by the presence of several archaeological (prehistoric, Neolithic and protohistoric) sites.

Of these cultures, we will approach those related to the Iron Age (protohistory) and that have attracted the most research. Indeed, in addition to the work of pioneers such as Bonnel, de Mézières and Monod, non-archaeologists (ethnologists) identified four categories of cultural behaviour of ancient populations. The first, covering many sites in the country's north, particularly in the Senegal River valley, is the 'ancient Sereer village zone'. The second, 'shell midden zone', is related to eating habits (gathering and cooking molluscs and disposing of their shells) and is characterised by an accumulation of disposed shells and its reuse for funerals. The third, 'tumulus zone', encompasses many sand mounds in the central-west. The fourth includes significant megalithic circles and scree circles.

Although this inventory helped prove the extent of archaeological remains, it sparked debate over the definition of an archaeological culture. An interesting reading of this archaeological landscape shows one area reserved exclusively for housing (ancient villages of the Senegal River valley), another area for eating (shell middens), and two areas for burial (tumuli and megaliths) albeit with different burial styles. Even if the approach of these non-archaeologists was subject to criticism, there is no question that professional archaeologists, though driven by differ-

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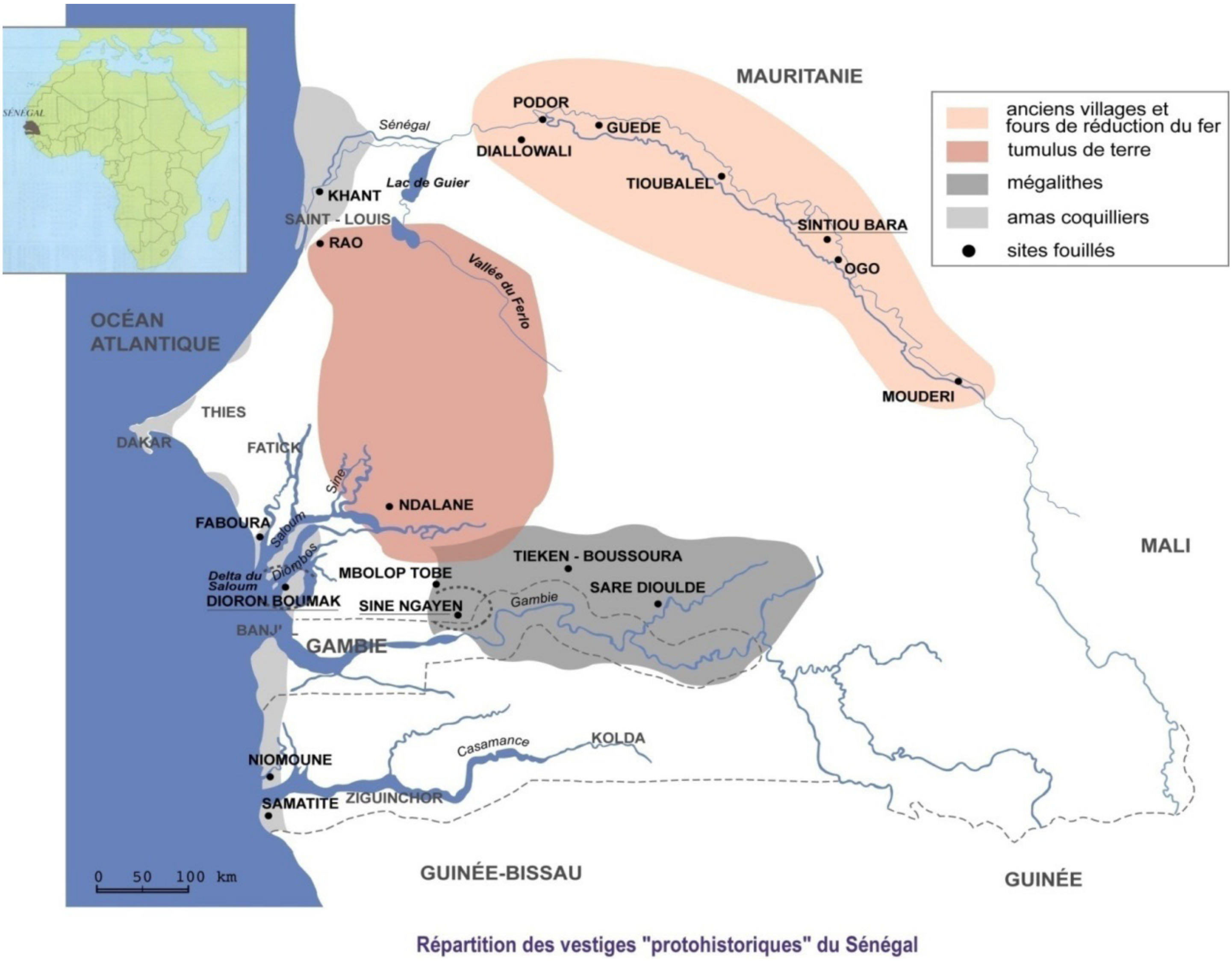

Fig. 1. Archaeological zones inventoried by ethnologists. (© M. Sall)
Legend below: distribution of ‘protohistoric’ remains in Senegal. Legend top right, from top to bottom: ancient villages and iron smelting furnaces, earthen tumuli, megaliths, shell middens and excavated sites.

ent interests and having profound differences of opinion, subsequently strove to conduct their research within these divisions. The characterisation of the Senegal River valley sites (McIntosh & Bocoum 2000) is a perfect example. The same is true for the megaliths and tumuli, with a separation between housing and funerary sites.

Dating this archaeological landscape helped place each site chronologically. The occupation of the middle valley of the Senegal River dates from the first millennium A.D. to modern times; the megaliths from the 4th century BC to the 16th century; the tumuli to no later than the 13th century. The central-west shell middens accumulated between the 7th and 13th centuries AD, whereas those in the south accumulated over a longer duration, from 200 BC to the present day (de Sapir 1971).

A. Cultural attribution

As for identifying the people who created these sites, a brief overview shows that several methods were used. Ethnologists resorted to the local traditions of certain populations and to analogies between the cultural behaviours, morphology and functions of certain sites in order to attribute most of them (ancient villages of the Senegal River valley, tumuli, and shell middens of the central-west) to Sereer populations. The archaeologists mention no link between the megaliths and any cultural group (Sall 2005).

Other archaeologists took advantage of the variability of discovered materials (especially ceramics) to place certain sites in political, historical and social contexts (Thilmans & Ravisé 1980). Applying the generic

Fig. 2. Featured archaeological sites in the heart of Dakar (capital of Senegal). (Photos © M. Sall.)

identity 'Sudan' to all black populations who lived or passed through the Senegal River valley was not supported by archaeologists who attributed certain sites to the Sereer (Sall 2005).

Regarding the shell middens of the south (Casamance), the first archaeological research helped identify four phases of occupation stretching across 19 centuries. The author interpreted these phases based on analogies between past and present ceramics and hypothesised the presence of two groups. The Diola was such a group beginning in the 7th century (de Sapir 1971). However, the interpretation of the pre-eminence of the Diola presence was put into perspective by other ethnoarchaeological research, local traditions and written sources (Sall 2005).

This brief overview of the cultural study of archaeological sites, and above all of methods of interpretation, shows an evolution in the use of some tools. The duration of occupation of some sites until the modern (historical) period and the reference to cultural groups inspired new thinking.

B. Historical archaeology

Unlike the approach of archaeological pioneers in Senegal, the new generation of archaeologists (five out of ten active in the country) began a vast study of historical sites in the late 1990s.

In this context the first surveys targeted 'deserted villages', with particular attention to the causes of their abandonment (Diop 1985). Others targeted the slave trade, with major excavations carried out on Gorée Island (Thiaw 2010).

The same perspective is noted in the south (Casamance). Indeed, a critical review of the studies addressing the populations of Senegal shows that the long history of this region, which occupies a very important place relative to the sub-region's anthropological issues, remained obscure. Like the Senegal River valley, this region was a melting pot of civilisations where several peoples (Baynounk, Manding, Diola, Sereer, Wolof, Balantes, Peul, Manjaques, Mancagnes, Aramé and Pépels) came to settle in order to benefit from its specific ecological conditions. Analysing this cultural dynamic was subject to archaeological, historical, anthropological, linguistic, geographical, etc., approaches whose conclusions are far from exhaustive or convergent (Sall 2005).

To better understand this dynamic, in addition to my ethnoarchaeological studies, I began archaeological research (surveys and excavations) on ancient Baynounk villages in the area between the Gambia (Brefet & Bintang) and Guinea-Bissau. Our recent archaeological excavations (2011-12) in ancient Baynounk areas (Djibonker & Butimul) reflect a Baynounk presence in the west, between 1539 and 683 B.C. (dates not yet calibrated). These excavations are being complemented by others at the sites of Gonoum and Koubone (which the Baynounk consider their oldest sites). Surveys in 2014 mobilised 150 Department of History students, attracted by the new emphasis on the archaeology of living societies.

II. ARCHAEOLOGY, ARCHAEOLOGICAL MONUMENTS AND THE PUBLIC

The colonial period's archaeological dynamics did not survive the successful independence movements of the 1960s. Indeed, in Senegal, even if IFAN remained a major research institute, the country's cultural policy neglected this method (archaeology) of documenting the country's cultural history. Such negligence was reflected in the lack of financial backing and above all at the legislative level in Law no. 71-12 of 25 January 1971, which established rules for historical monuments, excavations and discoveries. These rules provided inadequate protection, which had harmful consequences for archaeological sites. Many of them (to which the local populations recognise no connection whatsoever) were literally razed by public authorities and entrepreneurs. Sites in the capital (Dakar) that had been so proudly shown to visitors during the colonial period were not spared (**fig. 2**).

On the other hand, colonial historical monuments (on Gorée, in Dakar and Saint-Louis), the object of the first national and world heritage classification proposals, were well-protected. These were accorded the most importance in schools, and students often mix them in with all archaeology and/or cultural heritage.

However, in addition to the state, people are a serious threat to archaeological monuments and pose the problem of cultural attribution. Indeed, archaeologists often tend to attribute archaeological sites to ancient populations whose descendants live right nearby; but what about the latter's perception? In the Senegal River valley, Halpulaar consider the monuments in question non-Islamic, which motivates a certain indifference on their part. This lack of cultural feeling is also found in the local populations (Wolof, Peul) in the megalith zone. On the other hand, in the shell midden zone, two behaviours are noted.

Fig. 3. Mixed cemetery (Christian/Muslim) on a shell midden at Fadiouth. (Photo © M. Sall)

Some archaeological middens became sacred places where Sereer populations conduct libations and that they even use as cemeteries. This is the case with the Fadiouth middens where the village's current residents (whether Muslim or Christian) hold a common belief, symbolised by this monument that functions as a mixed cemetery (**fig. 3**). On the other hand, other middens, which do not have this connection, are literally plundered and the shells sold (**fig. 4**).

This attitude of the people is an exception for sacred historical sites (places of worship, memorials and others), where desecration is inconceivable and conducting any research is difficult – archaeologists are not welcome. These problems are exacerbated by Senegal's lack of qualified human resources.

III. ARCHAEOLOGY AND TRAINING

In Senegal, perceptions of archaeologists and of archaeology are mixed. Indeed, the occupation 'archaeologist' remains peculiar. For some, archaeologists are 'desecrators of tombs', and they are often bewildered at how they can come from the university (thus the city) yet pass their time gathering insignificant objects or digging like a mason. The few (ten) Senegalese archaeologists talk often about their misadventures (being seen as insane or academically incompetent). As in many African countries, archaeological research does not benefit from financial support from public authorities because priority is given to vital sectors (health, nutrition, etc.). This lack of


Fig. 4. Local people plundering shell middens, and loss of a skull (right). (Photos © M. Sall.)

financing, linked to the high cost of research, still burdens the discipline. However, while early methodological orientation (prehistoric site studies with no reference to societal issues) interested few students (fewer than 15 per year), the inclusion of the connections between archaeology-heritage and development since the 2000s has attracted many more. Thus this science, originally deemed too complicated and expensive, became appealing because of its engagement with questions of development (heritage management) issues. This shift in approach attracted generations of Senegalese and African students captivated by a field innovative in its scientism (close to the natural sciences and cutting across geology, chemistry, geography, anthropology, etc.) and offering a new methodology (field work and excursions, contact with objects). Thus admissions are now in the hundreds (from 100 in 2010, the enrolment of students specialising in archaeology surpassed 300 in 2014) (**fig. 5**).

CONCLUSION

This short presentation shows that archaeology in Senegal, despite the post-colonial initiatives of enthusiasts and ethnologists, still has a long way to go. Indeed, even though research has contributed to a better understanding and dating of certain parts of history, it has not yet gained visibility in the debate over Egyptian and Arab origins attributed to or claimed by populations who, most often, are thoroughly Islamised. Studies have shown that the current map of protohistoric sites, despite its importance as a source for archaeologists, must be reviewed in order to fix methodological problems: Are the sand mounds observed in the Senegal River valley only islets that remain unflooded? Did others, categorised as tumuli and sometimes found next to basins, have the same function as those in the valley? All this goes to show the need to account for the existence of probable links between cultural provinces, beyond their geographical space, in order to better understand connections between cultural behaviours (eating, burial, etc.) and settlement strategies (housing). Answering these questions requires extensive archaeological research campaigns that unfortunately are hindered by the triple problem of poor existing legislation, the difficulty of mobilising resources and scarce human resources. For the last aspect (training), extending archaeological research to historical or memorial sites and to their relationship to questions of development will help train new actors in cultural development.

Fig. 5. Training students on historical sites. (Photos © M. Sall.)

REFERENCES

Linares de Sapir, O. 1971. 'Shell middens of Lower Casamance and problems of Diola Protohistory'. *West African Journal of Archaeology* 1: 23-54.

Martin, V. & Becker, C. 1974. 'Vestiges protohistoriques et occupation humaine au Sénégal'. *Annales de Démographie historique.* Paris: Mouton, pp. 403-429.

McIntosh, S.K. & Bocoum, H. 2000. 'New perspectives on Sincu Bara, a first millenium site in the Senegal Valley'. *African Archaeological Review* 17: 1-43.

Sall, M. 2005. *Traditions céramiques, identités et peuplement en Sénégambie. Ethnographie comparée et essai de reconstitution historique*. Oxford: Archaeopress (coll. 'B.A.R. International Series', no. 1407; coll. 'Cambridge Monographs in African Archaeology', no. 63).

Thiaw, I. 2010. 'L'espace entre les mots et les choses : mémoire historique et culture matérielle à Gorée (Sénégal)'. In I. Thiaw (dir.), *Espace, culture matérielle et identités en Sénégambie.* Dakar: CODESRIA, pp. 39-66.

Thilmans, G. & Ravisé, A. 1980. *Protohistoire du Sénégal. Sinthiou Bara et les sites du fleuve*. Dakar: Institut français d'Afrique noire (coll. 'Mémoires de l'IFAN', no. 91 (2)).

AFRICAN PERSPECTIVES ON ACADEMIC RESEARCH: THE CASE OF CAMEROON

Christophe Mbida Mindzie[1]

INTRODUCTION

Archaeology as an academic discipline has only recently been introduced to Cameroonian universities. It evolved originally as an auxiliary to history, and it was first taught as an elective in the History Department of the University of Yaoundé – at that time the country's only university. A Department of Art and Archaeology was created as part of the university reform of 1993. In the twenty years since, teaching and research in archaeology at Cameroonian universities have generally progressed quite happily. This text will offer a brief history of archaeological research in the country from the end of the 20th century through the beginning of the 21st, and will sketch the challenges and perspectives facing teaching and research in this discipline.

I. ARCHAEOLOGICAL RESEARCH IN CAMEROON AT THE END OF THE 20th CENTURY

Archaeology was first practiced in Cameroon by enthusiasts and amateurs who, for the most part, were employed by the colonial administration during the 1930s. Among them were several colonial administrators (E.M. Buisson, J. Fourneau, J. Guillou, J.B. Jauze), a physician (M.D.W. Jeffreys), and a church official (Georges Schwab). From 1936 on, however, the man considered the 'father' of Cameroonian and Chadian archaeology, Jean-Paul Lebeuf, a researcher at the French National Centre for Scientific Research (CNRS), conducted intensive ethno-archaeological research in northern Cameroon. With his wife, Annie Masson Detourbet Lebeuf, also a CNRS researcher, he inaugurated the first phase of professional archaeology in Cameroon. Their research programmes dedicated to discovering the lost Sao civilisation continued until the 1980s (Essomba 1986).

In the years following Cameroon's independence in 1960, an institutional innovation gave rise to a Cameroonian research structure, the Office national de la Recherche scientifique et technique (ONAREST, national office for scientific and technical research), which later became the Délégation générale à la Recherche scientifique et technique (DGRST, general delegation for scientific and technical research). This was then integrated into the Ministry for Higher Education and Scientific Research (MESRES). These bodies, given the responsibility for overseeing research, developed and launched the first Cameroonian archaeological research programmes, specifically through the Centre d'Études et de Recherches anthropologiques (CREA, centre for anthropological study and research), a part of the Institut des Sciences humaines (ISH, institute of human sciences). It is for this reason that the first meeting of archaeologists from Cameroon, held in Garoua from 26 to 28 February 1979, took place under the auspices of ONAREST, and the first international conference on archaeology in Cameroon, held January 1986, was chaired by MESRES.

Cameroonian research institutions established cooperation and collaboration agreements with those of other countries or with foreign universities, which even provided financial and logistical support to some of its programmes. This allowed the CNRS team led by J.-P. Lebeuf to pursue their research in the northern part of the country, soon joined by researchers from the Office de Recherche scientifique et technique outremer (ORSTOM, office of scientific and technical research overseas), including Marliac and Gauthier. Nicolas David began carrying out digs in the Bénoué region with the support of the University of Pennsylvania in 1967 and later the 'Mandara archaeological project' with the University of Calgary in Canada. In the early 1980s, under the direction of Professor Pierre de Maret, the Mission belge de Recherches anthropologiques began working in southern Cameroon in partnership with the ISH, but later the Université libre de Bruxelles (ULB) and the University of Yaoundé signed a cooperation agreement (Essomba 1992; Delneuf *et al.* 1998).

We should note that a large number of ISH research programmes were run by university faculty members. It was in this way that archaeology became a part of the academic universe in Cameroon. In the beginning, the

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discipline was considered an auxiliary to history. The Reverend Father Mveng played a pioneering role in that regard. He is the first Cameroonian historian to have turned to archaeology, with some publications of interest. But it was his disciple, Professor J.-M. Essomba, who first taught archaeology in the University of Yaoundé Department of History in 1975. These elective courses remained very theoretical, as the institution had no archaeological research programme. Research programs run by ISH and foreign institutions such as ULB, ORSTOM, CNRS, and the University of Calgary offered opportunities for fieldwork.

In January 1993 Cameroon took another step forward with its university reform. Six new state universities were created. Academic institutions set goals to improve educational offerings both quantitatively and qualitatively. The guiding principles behind these changes included, among others, broad academic and management autonomy, professionalisation and increased educational opportunities, and expanding inter-university and international cooperation. Academically, a Faculty of Arts, Letters, and Humanities was established at the University of Yaoundé I, and with it a new Department of Art and Archaeology. It also provided teaching in the field of heritage management. The reform assigned specific tasks to university faculty, namely teaching, research, scientific advancement, and development support (Fouda Ndjodo *et al.* 2012).

II. ARCHAEOLOGY IN CAMEROON AT THE BEGINNING OF THE 21st CENTURY: ISSUES, CHALLENGES, PERSECTIVES

The third millennium opened on a new context in Cameroon. The ISH closed in 1991 following the political turmoil of the period; a Department of Arts and Archaeology, lacking equipment and adequate funding, opened at the University of Yaoundé I; the country was engaged in major infrastructure works which would affect cultural heritage. Archaeologists took advantage of this opportunity to get funding for fieldwork and basic facilities. It was at this time that first archaeological monitoring programmes for large projects – preventive archaeology programmes – were introduced.

The Bertoua-Garoua Boulaï (BGB), Lolodorf-Kribi-Campo, and Ngaoundéré-Touboro-Bogdibo roads, the Chad-Cameroon pipeline, the Dibamba and Mpolongwé power plants, and the Mbalam mining concession were among the first cases of applied preventive archaeology. These projects involved faculty from the University of Yaoundé I, and offered a suitable framework for carrying out their missions. Students were exposed to practical training in the field, research was made possible by the discovery of new sites and the acquisition of new materials, scientific promotion by publications, and development support by the expertise brought to these projects. We think that these are positive contributions which allow us to be optimistic about the future of archaeological research in Cameroon and Central Africa.

What today are the challenges and perspectives that face archaeological teaching and research in Cameroon? The first challenge is to consolidate structures in order to train enough personnel and ensure minimum equipment and funding for programmes. Academic training in the fields of art and archaeology originally benefited from the competition between the various programmes run by the institutions named above, which is to say the CNRS, ORSTOM – which became the IRD (Institut de Recherche pour le Développement, or Institute of Development Research), the ULB, and the 'Mandara Archaeological Project', Tübingen University. They gave a certain number of students the opportunity to obtain scholarships for doctoral studies. Theses in archaeology were defended by students originally educated at the University of Yaoundé – which, following the reform of 1993, became Yaoundé I – at Paris-Sorbonne University, ULB, and Laval University in Canada. We should highlight the role played by the Prehistory Section of the Royal Museum for Central Africa, which hosted all the doctoral students trained in Belgium.

The manner in which our administrations function is another obstacle to overcome. They must break down their barriers and build synergies through joint programmes and projects and their managers must be animated by a sense of the public interest. The lacklustre results a few years ago of the cultural component of the 'Environmental and Social Capacity Building for the Energy Sector Project' (PReCESSE) intended for preventive archaeology and financed by the World Bank, are a good example and a lost opportunity (Mbida Mindzie, forthcoming). Our training institutions will never achieve the professionalisation goals they have been set if they do not work with the sectors requiring the skills they teach and if they are not aware of the needs of the labour market. It is possible to federate research programmes and projects between the Ministries of Higher Education, Research, Culture, Environment, Public Works, and others, based on the convergence of interests. The opening up of our public administrations is a necessary step for their performance and efficiency.

Ultimately, the future of archaeological teaching and research in Cameroon and other Central African countries should be placed in a more general heritage perspective. A chain of values must be forged, one which trains not only archaeologists and excavators, but also other professionals related to archaeology: conservators, restorers, curators, designers, museum specialists, managers, communication specialists, etc. All of these skills are still lacking but needed for enhancement of the archaeological and ethnographic heritage. Preventive archaeology schould be systematised based on the various development projects planned or underway, and in accordance with national legislation. But, essentially limited to areas of major development work, this does not allow for coherent, basic research, made possible by programmed archaeology, somewhat abandoned by our institutions but still deserving of support. The state is crucial in terms of financing such programmed archaeology.

The Department of Art and Archaeology has gradually been enriched with highly trained personnel. Like every department at the University of Yaoundé I, it is part of the Bachelor-Master-Doctorate system (LMD). Students from Chad and the Central African Republic are regularly trained there. It brings its expertise, in conjunction with the University of Coimbra in Portugal, to the National Institute of Cultural Heritage (INPC), an arm of the Ministry of Culture of Angola with which a cooperation agreement was signed as part of the project to register the ancient city of Mbanza Kongo on the World Heritage List. One of the latest challenges facing this department is to consolidate its teachings through adequate facilities (laboratories, reserves, logistics, etc.), sufficient staff of sufficient quality, a multidisciplinary research team with established programmes, a reliable network of collaboration with local and foreign institutions. Steps in this direction have been taken with programmes and universities in the United States, Europe, and Asia, all of which will allow the department to consolidate the regional and international influence to which it aspires.

REFERENCES

Delneuf, M., Essomba, J.-M. & Froment, A. (ed.). 1998. *Paléo-anthropologie en Afrique centrale. Un bilan de l'archéologie au Cameroun*. Paris: L'Harmattan (series 'Études africaines'), 368 p.

Essomba, J.-M. 1986. *Bibliographie critique de l'archéologie camerounaise*. Yaoundé: Librairie universitaire de Yaoundé, 132 p.

Essomba, J.-M. (ed.). 1992. *L'Archéologie au Cameroun*. Paris: Karthala, 384 p.

Fouda Ndjodo, M. & Awono Onana, C. 2012. 'Les réformes de gouvernance dans l'enseignement supérieur camerounais. Pré-conférence de l'International Institute for Educational Planning (IIEP) à Dakar le 14 novembre 2012 "Réformes de gouvernance dans l'enseignement supérieur : quelle politique avec quels effets"'. Unpublished document available at www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Dakar/pdf/REFORMEGOUVERNANCECAMEROUNnov2012.pdf.

Mbida Mindzie, C. (forthcoming). 'Archéologie préventive au Cameroun: le contexte institutionnel et légal, les enjeux, les défis'. In C. Mbida Mindzie & R.N. Asombang (eds), *Archéologie préventive et patrimoines en Afrique centrale: actes de la Conférence internationale sur l'archéologie préventive le long du pipeline Tchad-Cameroun (24-26 May 2011, Yaoundé, Cameroun).*

Ministère de l'Enseignement supérieur, République du Cameroun. 2009. 'Stratégie opérationnelle de la nouvelle gouvernance universitaire. Une vision pour l'université camerounaise – Horizon 2020'. Unpublished report, available at www.camerounenmarche.com.

Chapter 1

How do archaeologists plan projects in Africa?

INTRODUCTION

Alexandre Livingstone Smith[1]

In Africa, like elsewhere, academic problem-oriented projects have long been the spearhead of archaeological research, but archaeological rescue operations, also known as Cultural Resources Management (or CRM), are growing in strength and numbers. While the first are generally designed to answer specific research questions in an academic environment, the latter have the broader objective to preserve a maximum of information regardless of any specific period or problem and are usually set in a business environment. There are a lot of common points to any archaeological project, but planning and managing academic of CRM projects can be very different.

In the field they differ drastically, as the agenda of construction works sets the pace of archaeological investigations in CRM. Hard choices and scientific shortcuts have to be made on the go, always keeping pace with the calendar of earthworks. To do this properly, one needs a lot of experience. Finally, whatever the project, at every turn, from inception to closure, the local communities need to be taken into account. Indeed, people living in the target area of an archaeological project play an important role. They may also, in some cases, benefit from the touristic development of archaeological heritage when local security and infrastructure allow it.

Also, at this stage, few African states have set standards of quality and good practice in CRM so the list of practical experience offered by the various contributors in this chapter may serve as a point of departure.

The organisation of academic international projects is summarised by **Anne C. Haour & Didier N'Dah**. Considering the building of networks and cooperation, they explain how students can (and must) take advantage of such projects to learn, but also to promote their own research agendas. They also consider the practical side of things such as planning fieldwork, including the budget and equipment. Important here is to highlight the ways in which a student may benefit from and use the considerable resources of international projects. Finally, everything comes with a price, the authors also underline the serious administrative requirements involved in the process.

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Peter Mitchell, acknowledging the growing importance of Cultural Heritage Management projects in Africa, reviews the threats and opportunities offered by such endeavours. He considers the challenges of development, the assessment of archaeological impact as well as their agenda and their outcome in terms of capacity building, publication, and return to the community.

CRM is also at the core of **Noemie Arazi**'s contribution, but she focuses on the practical aspects of executing CRM on the ground. Case studies from Central Africa serve to explain the negotiation phase, the definition of the impact area, problems of manpower and the need to collaborate with local agencies, the problem of copyrights, as well as crucial questions concerning budget and equipment, security and preparations for fieldwork, and, finally, implementing fieldwork itself.

Richard Oslisly's contribution on CRM handles the case of rescue and preventive archaeology on roads, thermal power stations and quarries. He considers the assessment phase, fieldwork methodology and the prioritisation of sites with practical examples drawn from his experience in Cameroon.

Ibrahima Thiaw offers a west African perspective on CRM. Using Senegal as a case in point he identifies a series of problems related to the discrepancy between the fast growing body of data and material coming out of CRM work and the funding and coordination of national agencies that are assumed to process the results of CRM into research projects and public oriented activities.

Finally, **Nicolas David** considers the question of relations with the communities to whom the land belongs on which the excavations or field work takes place. He examines the question of contacts prior to, during and after field work based on his personal experience. Any student is likely to learn from this first-hand, practical and long experience to apply to his/her own interaction.

ORGANISING AN INTERNATIONAL ARCHEOLOGICAL RESEARCH PROJECT IN AFRICA

Anne C. Haour[1] & Didier N'Dah[2]

INTRODUCTION

Designing and implementing an international archaeological research project in Africa requires a certain amount of experience. In this chapter we examine the central workings of such a project. To this end, we will discuss challenges, preparation, timing, financing methods, and potential problems.

First, it should be noted that major funding is not generally offered to students, but rather to researchers who have already completed their PhDs and generally have some degree of experience. For example, for 'beginner'-level funding (the Independent Starter Grant) from the European Research Council (ERC), a candidate should have between two and seven years of post-doctoral experience.[3] Many countries have their own researchfunding bodies, for example, the Arts and Humanities Research Council in Britain or the Agence nationale de la Recherche in France. Such bodies rarely fund fieldwork alone; most require long-term scientific projects focusing on research questions. These projects may include, but are certainly not limited to, field visits. Such projects call for administrative and financial resources beyond the capacity of the average student; budgets can quickly escalate, especially if funders cover the researcher's salary while he/she is devoted to project-related research, or overhead costs such as administration or premises.[4] The funding application alone, which can be 30 pages or longer, represents a significant investment in time and energy. Finally, another point that is important to note is that, regardless of the funder, the chances of success are always slim: usually, fewer than 10% of applications are successful.

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3 http://erc.europa.eu/starting-grants/french

4 The Arts and Humanities Research Council and the European Research Council are among those covering complete budget costs.

I. NETWORKS AND COOPERATION

A student of an African institution has an indirect means of access to this type of financing: the student may join a research project in which his or her professors are involved as partners or co-investigators. The student can thereby take advantage of the field opportunities this offers to build an independent research project (for a thesis, for example) around related themes. This is the most common approach and it applies to all students – African or otherwise – regardless of nationality. Most funders are pleased to participate in students' field training. Success depends on two conditions: the student should be among the best in his/her class, and have professors who are recognised internationally for their scientific profile and therefore offer the international partnerships necessary for setting up a project.

The first condition is something students can control – the second less so. Students may nevertheless conduct critical research before enrolling in a particular university: if there are options, they should look for institutions with an explicit strategy for integrating training opportunities into their scientific research, and where such research serves as a bridge to other regional and international scientific research institutions.[5] Students should also look for professors who share this vision, who are open, and who have an international scientific profile. Very often this second condition can lead students to reorient their research to partner with an instructor who seems supportive.

Once enrolled, students should improve the odds as much as possible by participating in conferences and other scientific colloquia. These offer an opportunity to learn about research underway or being set up – bearing in mind that all major projects are prepared at least 18 months, and often years, in advance. Symposia and conferences are occasions not only to learn about current and future opportunities, but also to learn about and to make known one's own research, and to learn directly about the manner in which to present it and how to in-

5 http://www.uac.bj/public/index.php/fr/universite/missions-et-visions

teract with researchers and other students. Face-to-face contact is unquestionably the best way to build personal connections, which can then be maintained at a distance, for example through email, the universal availability of which neatly overcomes geographical barriers. A word of advice, however: when emailing, remember that your correspondent is probably very busy and receives a large volume of mail. It is therefore best not to send general messages of the 'Hi, just saying hello' variety, but to write specific and concrete texts ('Hello, I wrote an article related to my research project on the manufacture of clay beads that I would like to submit to journal X. I have attached it. If you have a moment to look it over, I would be very grateful to know your thoughts').

Lastly, doctoral students, including those enrolled in African universities, can apply for scholarships or internships that allow them to undertake their own field research. Institutions such as the Académie de Recherche et d'Enseignement supérieur (ARES)[6] in Belgium, the Agence universitaire de la Francophonie (AUF)[7], the German Academic Exchange Service (DAAD),[8] and the Association of African Universities (AAU)[9] offer funding and mentoring that can help doctoral students pursue their dissertations. In most cases, such work is co-directed by the home university and the host university giving the students the opportunity to carry out their fieldwork. We also note that the Council for the Development of Social Science Research in Africa (CODESRIA)[10] offers small grants to help masters and doctoral students complete their work.

II. PRACTIC ALITIES: SCHEDULE, BUDGET, AND EQUIPMENT

In each region of Africa, archaeological fieldwork takes place according to a fixed timetable. In the Sahel and Sudan zone, for example, the months from December to February are the most appropriate. The vegetation cover is reduced, there is no rain, and the heat is not excessive. The rainy season reduces access to certain regions (e.g., north-eastern Ghana is called 'overseas' by the people of the south, due to the poor road conditions during the wet season) and there is a risk of trenches flooding. On the other hand, reading stratigraphic sections may be easier if the soil is moist.[11]

An archaeological research project requires significant financial resources. For example, five weeks in the field with a staff of 15 researchers/instructors, 15 students/research assistants, and 40 workers will cost about 60,000 euros, with the majority spent on equipment, international flights, workers' wages, and stipends for students[12]. A student undertaking a field project should expect to spend far less. By running fieldwork at the same time as the main project or soon after it, a student may be offered the use of excavation equipment for free or for a nominal fee. Students may also benefit from the network of administrative alliances that coordinators of the main project will have established with local institutions, and from workers already trained for the task. Maintaining and fuelling a vehicle remains a significant budget item; for research that doesn't require transporting too much equipment, a motorcycle might suffice. It is worth approaching the main project coordinators to see if the price of some radiocarbon dating can be covered. A student who happens to get one of the stipends discussed above can readily complete fieldwork after the main project is concluded.

The basic equipment required for archaeological fieldwork is:

- stakes (15 cm long, to mark the trench);
- plastic containers, 20 l, to conserve water – buy empty vegetable oil containers instead of those used for gasoline;
- trowels;
- camera;
- GPS;
- first aid kit (disinfectant, gauze, bandages, etc.);
- 3 funnels;
- thick gloves (the type used for gardening);

6 http://www.cud.be/index.php?option=com_content&task=view&id=416&Itemid=143

7 https://www.auf.org

8 http://paris.daad.de/daad.html

9 http://www.iau-hesd.net

10 http://www.codesria.sn

11 Laporte, L. 2010. "Mégalithismes sénégambiens – dualités exacerbées sur le site de Wanar", delivered at the 13th Congress of the Panafrican Archaeological Association for Prehistory and Related Studies (PAA), 20th meeting of the Society of Africanist Archaeologists (SAfA), Dakar, 1-7 November 2010.

12 While a project can be completed with much more limited resources if it involves fewer students in training or has no international collaborators, this would not adhere to the ideals of a major European project with a pluridisciplinary and collaborative slant.

Fig. 1. Students recording a stratigraphic profile, site Alibori 2, Northern Benin. The sequence includes an early occupation at about 2,500 B.P. (Photo © D. N'Dah.)

Fig 2. Sieving of sediments at a site under excavation, site Alibori 2, Northern Benin. (Photo © D. N'Dah.)

- 100 large nails;
- hurricane lamp;
- canteen to store equipment;
- 2 sieves (one 5 mm mesh, the other 2 mm mesh); bring material for repairs;
- 5 brushes;
- foil for packing charcoal samples;
- 2 rulers;
- 3 buckets (preferably rubber);
- 3 notebooks;
- graph paper;
- plastic bags for artefacts – 3 sizes, 200 in total. The plastic must be strong. It is also possible to hire a tailor to make canvas bags;
- 200 labels;
- 4 tape measures: two of a length of 5 m, two of a length of 30 m;
- 10 pens;
- box of chalk;
- slate;
- scissors;
- 2 document cases;
- piece of fabric to make shade for photos;
- compass;
- 2 marker stakes (1 m long);
- bedding, kitchen, and miscellaneous materials (mats, plates, buckets, etc.);
- pickaxe;
- 3 machetes;
- 2 shovels.

In addition, the student must design forms for recording information on sites located during survey and on artefacts collected during excavations, and for laboratory analysis of data. Students should also have excavation notebooks in which to record comments and impressions, which will help interpretation during the ground analysis of results.

III. ADMINISTRATIVE REQUIREMENTS

Funders will require scientific and financial reports at specified intervals and often require independent audits. If research funding comes from public funds – taxpayers' money – the obligation is to report adequately; the requirement is often the same for private funds. The situation varies according to the funder, but to take the example of 'beginner' and 'advanced' financing from the ERC, two scientific reports are required – one mid-term and another at the end of the project. These keep the ERC informed of the research progress and accomplishments, as well as publications and other activities, such as participation in seminars. At the same time, financial reports are required, typically at 18-month intervals, in order to justify spending. When funding reaches certain sums, an independent audit is required. In the case of the ERC, reporting dates are generally known, which prevents last-minute panic, but the situation is not as simple as one might think. The submission of reports is

Fig. 3. Excavation of a pottery concentration by a student of Université Abomey-Calavi, site Alibori 1, Northern Benin. (Photo © D. N'Dah.)

Fig. 4. Surface collection at site Alibori 2 (Northern Benin) by workmen and students. (Photo © D. N'Dah.)

done through a web portal,[13] in language specific to the organisation, and signed paper copies are often also required. This can cause problems if a team member is in the field without a good Internet connection, or if there is no team member familiar with the official terminology. Donors are nevertheless aware of the need to maintain a balance between the obligation to justify the use of public funds and the need not to crush researchers under the weight of administrative requirements[14].

Doctoral students who receive scholarships are also accountable to their supervisory institutions and the organisation granting the scholarship through annual reports on the progress of their work. They must adhere strictly to the timetable proposed in the award of the grant; any failure to do so amounts to breach of contract, and could lead to a loss of funding.

CONCLUSION

In conclusion, planning an archaeological project in Africa entails a good deal of lengthy preparation, including the submission of funding applications that require a significant investment of energy, relatively advanced scientific knowledge, and institutional support. This is why it is extremely rare that projects be allocated to students. Students may nonetheless benefit indirectly from others' financial, logistical, and training resources, provided they can, with the help of their instructors, plug themselves into international research networks. They can also apply independently for scholarships allowing them to complete the fieldwork for their dissertations.

13 http://ec.europa.eu/research/participants/portal/desktop/en/home.html

14 'ERC Grants aim to provide grant holders with simple procedures and reporting structure, in order to maintain the focus on excellence, encourage creativity and combine flexibility with accountability whilst being in complete accordance with the EU Financial Regulation and the Implementing Rules' (European Research Council, 2012, Guide for ERC Grant Holders, p. 15). http://ec.europa.eu/research/participants/data/ref/fp7/89557/guide_erc_grant_holders_en.pdf

CULTURAL HERITAGE MANAGEMENT IN AFRICA

Peter Mitchell[1]

Africa's archaeological record is imperilled not just by natural processes of decay and disintegration, but also by human action. Across the continent, rapidly accelerating economic development and population growth threatens both the integrity and the persistence of archaeological sites. This chapter briefly identifies some of these threats and considers how the archaeological profession responds to them. As with other forms of archaeological fieldwork, several ethical issues (regarding capacity-building, training, community involvement, and timely publication) arise, not least because development-dictated projects may be more tightly constrained by external, non-archaeological considerations than is the case with purely research-oriented fieldwork.

I. RESPONDING TO THE CHALLENGE OF DEVELOPMENT

The political and economic imperatives to raise the living standards of Africa's population are compelling. Major development projects form part of the response to this challenge. As well as large-scale mining (Chirikure 2014) and the construction of pipelines for exporting oil and gas (Lavachery *et al.* 2010), they include the building of dams to provide water for agriculture, industry, human consumption, and hydroelectric power (Brandt and Hassan 2000). Dams pose a particular threat to archaeological resources because they often flood large areas that may have been especially attractive to past populations. However, the archaeological record is also affected by the cumulative impact of other, less immediately obtrusive processes, such as urban growth (Lane 2011), farming, and unregulated tourism, which is endangering the survival of many rock art sites (Liverani *et al.* 2000).

Laws to protect national archaeological heritages exist in all African countries, but scarce resources for monitoring potential threats or taking action to mitigate their impact often limit their effectiveness. Large projects that include funding from international donors, notably the World Bank, may constitute an exception since access to such funds may partly depend upon measures being taken to identify and mitigate a project's likely impact on the archaeological record. Only rarely, however, must developers cover such costs themselves through the principle of the 'polluter pays', i.e. those who profit from destroying archaeological resources must pay the costs of minimizing that destruction. Moreover, few countries require a development's likely impact on the archaeological record to be evaluated before consent for it is given (Arazi 2011). In South Africa and – on a smaller scale – Botswana and Namibia most such assessments are undertaken by archaeologists working in the private, commercial sector, but although this increases the numbers of archaeologists available for heritage management projects, many ethical dilemmas remain (Ndlovu 2014).

II. ASSESSING ARCHAEOLOGICAL IMPACTS

Assessing the archaeological (and broader environmental) impact of a development project involves at least three stages. First comes an initial assessment based on existing knowledge of the area in question, including that obtained from previous fieldwork. This 'desk-top' study must then be followed up by fieldwork designed to investigate the affected area, identify archaeological sites at risk, and assess their importance. Limited test excavations may form part of this phase, along with survey work to locate archaeological materials visible on the surface, rock art sites, upstanding buildings or monuments, and other traces of past human activity. Having completed this first phase of fieldwork, its results must be evaluated: how large, unusual, or well preserved are the sites encountered? To what extent may they provide new or different information about past human activity, not just in the area to be directly affected, but also within the broader regional, national or even international context? Do any of them already benefit from specific legislative protection? Which archaeological sites or other localities, including cemeteries and graves, but also natural features of the landscape, hold special significance for local residents? The text here by Noemie Arazi looks at how such questions can be addressed in one specific archaeological context from Central Africa.

However imperfect, some kind of formal or informal evaluation along these lines is necessary in order to establish a set of priorities for the second, mitigative

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phase of fieldwork. In some cases, the archaeological or broader cultural value of certain sites or monuments may be such that developers have to amend their plans to avoid destroying them. But while it may be possible to reroute small sections of a road or pipeline at relatively little cost, this is generally not feasible for many projects, most conspicuously dams, not just because of their intrinsic size, but also because of the political and economic commitments already made to construct them. Mitigation, therefore, most frequently involves an element of triage, deciding what fraction of the archaeological sites present can be investigated or documented further and to what extent. The goal therefore unavoidably becomes one of minimizing the potential loss of evidence while securing as comprehensive an overview as possible of the area's total archaeology. Compounding the problem is the fact that archaeological investigations are often only carried out *after* decisions have been made to undertake a particular project and their results cannot therefore influence initial discussions about its practical feasibility or environmental desirability. Nevertheless, development projects may, if carefully planned, deliver scarce and difficult-to-repeat resources for investigating a region's archaeology beyond the strict confines of the sites that will be directly impacted by them (MacEachern 2010: 358).

III. WHO SETS THE AGENDA?

The agendas of cultural heritage management projects are therefore often ultimately set by developers, with archaeologists playing a game of 'catch-up' after the event. In this situation it is thus vitally important to explain clearly why the archaeological record matters and how – to be blunt – its successful mitigation may work to the credit of the corporation, donor or government agency involved. Moreover, in the absence of the 'polluter pays' principle or of a robust national system for ensuring compliance with heritage legislation, archaeologists may find themselves in a weak negotiating position when seeking funds to cover the costs of mitigation, not least because the mere removal of artefacts and other finds from the ground is, of course, just part of the story: as with any other archaeological project, long-term, secure, but accessible storage and curation of excavated finds, photographs, drawings and other project records does not come cost-free (see Kleinitz & Näser 2011 for a recent high-profile instance where this was not adequately covered). Where resources for these tasks are limited, or where national legislation does not already dictate where the 'outputs' of a project should be conserved, appropriate provision must be identified and funding for it allocated. Likewise, it may not always be apparent to developers, including international donors, that significant post-fieldwork funding will almost inevitably be needed to analyse the finds made and bring them to publication (see below). To achieve these goals, and to make sure of having sufficient infrastructural assistance from developers where this is needed, archaeologists must be comfortable in advocating and arguing for what are essentially political, rather than narrowly academic, objectives. Lobbying for archaeological impacts to be assessed by archaeologically literate individuals in order to avoid situations in which projects may be approved without thorough investigation of the number and quality of heritage resources at risk of destruction is also essential (cf. Arazi 2011).

IV. BUILDING CAPACITY

Given the limited resources available for archaeological research in much of Africa and the current scale of infrastructural expansion across the continent, cultural heritage management projects hold enormous potential for boosting the growth of archaeology through processes of capacity-building. Recent initiatives drawing together participants from a range of African countries have been empowering in this regard (Arazi 2009). However, on large, donor-funded projects and smaller scale, commercially funded projects alike, significantly more needs doing to break out of the trap in which a few archaeologists (often foreign or, in southern Africa, white) employ many relatively unskilled workers as and when necessary, without providing those individuals with much by way of responsibility and even less by way of opportunities to learn how archaeological fieldwork should be conducted. Less hierarchical systems in which the burden of recording and interpretation are more widely shared and skills are transferred through on-the-job training can work, at least up to a point, in helping to build capacity for the longer term (e.g. Arthur *et al.* 2011), even if the costs in time and money of attempting this may deter many commercially oriented archaeologists from following suit. Happily, at least in principle, one major international donor – the World Bank – recently recommitted itself to strengthening institutions and encouraging training through the heritage-related projects that it funds in Africa and elsewhere (Arazi 2011).

V. THE CHALLENGES OF PUBLICATION

A major concern of much developer-initiated and developer-funded fieldwork is how, if at all, its results are made available to the broader archaeological community. There are several reasons for this: developers and donors may not feel/be obliged to fund publication on top of fieldwork or the analysis of field results; they may insist upon 'gagging' clauses in contracts that impose delays on publication or require papers to be vetted prior to their appearance; commercial archaeologists may lack the time or inclination to publish because this does not directly contribute to their profit margins; and, perhaps most important of all, the sheer quantity of information generated, especially where archaeological impact assessments are legally mandated prior to any development being permitted, exceeds the capacity of traditional journal or monograph outlets. One solution is to exploit new electronic media and place impact assessment reports on the Web, a policy followed by South Africa's Heritage Resources Agency (SAHRA). Greater liaison with university teaching departments may also make material found in the course of cultural heritage management projects available for further research and study, even where specific funding for this was not included in a project's original funding. In many countries more detailed regulation and effective oversight is desirable to ensure that archaeological impact assessments always provide a consistent minimum set of observations and catalogue of finds (see Lane , this volume, pp. 79-85).

VI. CULTURAL HERITAGE MANAGEMENT AND THE COMMUNITY

Recognising that the results of archaeological fieldwork need to be transmitted back to those among whom that work was undertaken is now widely understood. However, since developer- and donor-funded projects often impact on local communities (including destruction of culturally sensitive sites, loss of economically important resources, or even physical relocation) it is particularly important in the field of cultural heritage management. Good practice dictates that those communities should be consulted and kept informed at all stages, that such involvement should feed back into how fieldwork is undertaken (including creating employment and training opportunities), and that aspects of cultural heritage relevant to them, including living heritage, be included in what is investigated and recorded. Where archaeologists are unable, or unwilling, to engage in this way, or are perceived as mere agents of development projects that ride roughshod over community interests, it is not surprising that local residents resist their presence (Kleinitz & Näser 2011). Though difficult, preserving a degree of independence from those ultimately funding archaeological research or undertaking the development project in question may thus be essential to ensuring that research is conducted in a community-engaged and ethically responsible way (cf. MacEachern 2010).

REFERENCES

Arazi, N. 2009. 'Cultural research management in Africa: challenges, dangers and opportunities'. *Azania: Archaeological Research in Africa* 44: 95-106.

Arazi, N. 2011. 'Safeguarding archaeological cultural resources in Africa – policies, methods and issues of (non) compliance'. *African Archaeological Review* 28: 27-38.

Arthur, C., Mohapi, M., & Mitchell, P.J. 2011. 'Archaeology and dam projects in Lesotho'. *Conservation and Management of Archaeological Sites* 13: 231-252.

Brandt, S.A. and Hassan, F.A. (eds) 2000. *Dams and cultural heritage management*. Working paper submitted to the World Commission on Dams.

Chirikure, S. '"Where angels fear to tread": ethics, commercial archaeology, and extractive industries in southern Africa'. *Azania: Archaeological Research in Africa* 49: 218-231.

Kleinitz, C. & Näser, C. 2011. 'The loss of innocence: political and ethical dimensions of the Merowe Dam archaeological salvage project at the Fourth Nile Cataract (Sudan)'. *Conservation and Management of Archaeological Sites* 13: 253-280.

Lane, P.J. 2011. 'Future urban growth and archaeological heritage management: some implications for research activity in Africa'. *Conservation and Management of Archaeological Sites* 13: 134-159.

Lavachery, P., MacEachern, S., Bouimon, T. & Mbida Mindzie, C. 2010. *Komé – Kribi: Rescue Archaeology Along the Chad-Cameroon Oil Pipeline, 1999-2004*. Frankfurt: Afrika Magna Verlag.

Liverani, M., Cremaschi, M. & di Lernia, S. 2000. 'The "archaeological park" of the Tadrart Acacus and Messak Settafet (south-western Fezzan, Libya)'. *Sahara* 12: 121-140.

MacEachern, S. 2010. 'Seeing like an oil company's CHM programme: Exxon and archaeology on the Chad Export Project'. *Journal of Social Archaeology* 10: 347-366.

Ndlovu, N. 2014. 'Contract archaeology in South Africa: some ethical concerns'. *Azania: Archaeological Research in Africa* 49: 203-217.

CASE STUDY: HERITAGE MANAGEMENT IN CENTRAL AFRICA

Noemie Arazi[1]

INTRODUCTION

Heritage management in the context of infrastructural development is a major concern for professionals involved in the safeguard of Africa's archaeological resources. Even sites inscribed on the World Heritage List need to face up to Africa's infrastructure boom (for recent examples see the Mapungubwe Cultural Landscape in South Africa and the Ecosystem and Relict Cultural Landscape of Lopé-Okanda in Gabon).

National legislation for the protection of cultural heritage exists in all African countries. However many countries still lack regulatory mechanisms such as open calls for tenders for independently led cultural heritage assessments and salvage excavations. Hence much of cultural resource management (CRM) work, especially in its initial phases, is carried out under the framework of Environmental Impact Assessments (EIA) whereby heritage professionals usually work as subcontractors to larger environmental firms that are appointed to lead the compilation of a project's EIA. What now follows is a practical account on heritage assessment in the context of EIA, drawn from experience in Central Africa.

I. NEGOTIATION

An important element to bear in mind for any expert involved in a cultural heritage assessment is to evaluate the project and its client. Does the project stem from the public or the private sector? From personal experience, public sector projects tend to be more challenging especially with regard to delays, ranging from project launch dates, to the approval of specialist reports and payment. Public sector projects, however, might be better suited for implementing the actual salvage of archaeological sites identified during an EIA as state institutions adhere more closely to regulations concerning the safeguarding of its cultural resources. Private sector projects tend to be managed more efficiently, especially if the client is sensitive to environmental, social and cultural safeguard policies. However, they might be less inclined to implement salvage excavations, as the archaeological resources present within a project imprint constitute state resources. Having said that, there are no general rules to any of those projects as much depends on the contracting authority's experience in handling large-scale infrastructure projects, the project's financial management and the client's commitment to operate by the rules and regulations.

II. IMPACT AREA

Environmental firms in need of cultural heritage subcontractors have a tendency to remain vague about the extent of a project's impact area in order to limit the period of fieldwork to a minimum, which naturally bears directly on a heritage assessment's budget. It is therefore advisable to obtain as much information as possible on the extent of a project's impact area and its characteristics regarding vegetation and topography in order to make a realistic offer on the duration of fieldwork, team composition, subsequent sampling strategies and budgeting. Information on the scope and topography of the study area are also important tools for planning a methodology. If previous studies have already been done in the region, the methodology needs to include a literature review of the study area, the assessment's aims and objectives, the scope of the proposed work, details about prospection techniques and the project team.

III. MANPOWER

When planning the team as a subcontractor to an environmental firm, a point should be made about the necessity for at least two experts as two trained individuals can cover more ground and more importantly, identify more sites, than just one person. Whenever possible a national counterpart should also be part of the team. Not only do they know the local context far better than expatriates but experts from national institutions tend to bring the necessary weight on sensitizing the client and funding agencies on follow-up programs if needed, which might range from construction monitoring to sal-

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vage excavations, training, and publication. University students should also be involved, as training in cultural heritage assessment is a major necessity in many African countries.

IV. COPYRIGHTS

An important element is the issue on copyright, as most consultants need to sign a confidentiality and copyright agreement, hence ownership of all the resulting data goes to the client. In that case, heritage professionals should define the length of the copyright agreement to make sure that publication of the data will be possible after an agreed-upon period. This is an issue of great importance, especially in Africa, as many EIAs are done in so-called 'virgin territory', areas that have never undergone any systematic investigation by heritage professionals.

V. BUDGET & EQUIPMENT

In regard to expert salaries, one should take into account years of experience, past assignments in similar projects, the security situation of a project's impact area, and the client's background. For instance, a multinational company might offer better wages than a public sector project financed by a governmental institution. It is also necessary to obtain information on available resources in the impact area. Mining projects tend to have basic installations already in place, including accommodation, canteens, four wheel drives, etc. In that case the budget might be limited to the team's travel costs, visas and medication. If the EIA takes place in a location with no logistical resources yet in place, the heritage expert will have to organize and budget for a vehicle, possibly a chauffeur, petrol and the team's per diem. Provisions should also be made to pay for a local guide or informant who can accompany the team during prospection and assist with interviewing local authorities and communities.

Basic fieldwork equipment such as a GPS, plastic bags, photographic scales, etc., can also be included in a heritage assessment's budget while photographic equipment and/or laptops are more difficult to budget during the initial phase of an EIA.

The project duration also bears direct consequences on a budget. Generally, cultural heritage assessments include a desktop study, fieldwork, and reporting. The desktop study can be done by one individual, whereas fieldwork is done by an entire team. Reporting involves the principal experts.

VI. SECURITY

Many infrastructural development projects occur in conflict or post-conflict areas, which are often far removed from major population areas and healthcare centres. The archaeological salvage project for the Lom Pangar Dam, currently taking place in the East Region of Cameroon with a team of ten archaeologists, is a case in point. The country is currently under intense pressure from regular Boko Haram incursions in the north, ongoing political instability in the neighbouring Central African Republic (CAR), and a considerable influx of refugees from Nigeria, Tchad and the CAR (Simms 2014). Even though the Lom Pangar team is so far only indirectly affected by these developments, they need to keep constant watch on security issues, especially once they start prospecting the zone earmarked for the reservoir, a remote area with little to no mobile phone coverage.

VII. PREPARATION

Once a contract for a cultural heritage assessment has been signed and the dates for fieldwork have been set, topographic maps of the study area are needed before the start of fieldwork in order to plan survey strategies.

For the desktop study two kinds of data are generally analysed: published data, such as articles and books and unpublished data and collections stored in museums and museum archives. Fort the first type of data, bibliographic references for most countries are available from university libraries and/or Internet databases. In the absence of any previous investigations on what constitutes an infrastructure project's immediate impact area, published data should be consulted on neighbouring regions. Desktop assessments should also integrate the anthropological and art historical literature, as spaces and objects that are of cultural or spiritual/religious importance to local communities constitute significant elements of heritage assessments in the context of an EIA. Archives and museum collections can contribute with additional data on unpublished material.

VIII. FIELDWORK

Once in the field, situations can vary drastically depending on the presence or absence of a base camp in a project's impact area. If a base camp should be present, which – as already mentioned – is usually the case for mining projects, the cultural heritage team might be met by a health and safety officer, who usually holds

Fig. 1. Field walking along lines on ploughed ground at Tenke Fungurume in the Katanga Province of the DRC. (Photo © N. Arazi.)

an induction briefing on the mining concessions' rules and regulations concerning security, driving, and other safety issues. When working in Tenke Fungurume in the Katanga Province of the Democratic Republic of the Congo (DRC), which boasts the country's biggest copper and cobalt mining operation, our team was assigned to the mining company's environmental unit. We reported to the unit's executive manager on a daily basis in order to keep him up-to-date on our progress while they assisted us with all sorts of logistical issues. We were also in contact with the mining company's social unit as they advised us on the mining concession's local authorities and helped us in setting up meetings with them and the communities. In the absence of a base camp or any other logistical assistance by the contracting authority, the team is faced with issues of car rental, petrol, accommodation and food, which we experienced for the EIA study of the Lom Pangar hydroelectric project in Cameroon.

Turning to the technical aspects of fieldwork, the general goal of any heritage assessment is to identify the potential archaeological and cultural significance of an area earmarked for development. This is usually connected to construction work and road building. The assessment determines whether the area of development impact is likely to contain significant archaeological resources and makes recommendations as to whether the archaeological remains can be avoided or if an excavation is necessary before development work can commence. Considering the vast terrain of areas to be impacted by development, the major goal is to cover as much ground as possible. At Tenke Fungurume, for instance, three survey procedures were tested: transects, area surveys and thematic surveys.

Transects, which involves field walking in grids or along lines, worked best on either ploughed ground or surfaces with little vegetation (**fig. 1**). Area surveys, which consist of the systematic coverage of a specific portion within a study zone, usually larger than a transect, did not turn out to be the most effective method in Tenke Fungurume due to the sheer enormousness of the impact area and the fact that no significant finds were made. Thematic surveys, which involves the search for archaeological material in particular locations to test hypotheses about past uses of those spaces, turned out to be an efficient method in addition to the transects. In the former case we concentrated on areas close to water sources and termite heaps in order to identify possible metallurgical sites.

Interviews constitute another important element in heritage assessments as they provide highly useful information concerning the location of sites that are of cultural or spiritual/religious significance to local communities. In the case of the Tenke Fungurume study, most interviews were held with the village chiefs, known in the area as '*chef de terre*' and *'chef de localité*'. Other points that can be discussed during those interviews include local history and settlement in the impact area.

Each site or find spot needs to be recorded with a handheld GPS, so that identified sites can later be mapped on geo-referenced maps. It should be underscored, however, that in the case of an archaeological field survey, the results constitute only a sample of the archaeological potential of a given landscape. In other words, one could come back to the same area at different times of the year for several years in a row and find new sites, owing to vegetation cover that changes at different seasons of the year or human-induced change (**figs. 2 and 3**).

In landscapes with compromised visibility such as forested areas, subsurface testing methodologies such as coring and shovel test pits can be effective tools for archaeological surveys. However, the limited time and personnel allocated to heritage assessments render the systematic application of those methods often too time consuming. Hence, survey activities in forested environments, as was the case for the Lom Pangar hydroelectric project, tend to concentrate on road cuts and cultivated fields as well as on the presence of anthropogenic tree species for the discovery of sites or at least clues of ancient human activities.

Fig. 2. First field survey at Tenke Fungurume (DRC) during the month of December, showing extensive vegetation cover (and copper deposits in the background). (Photo © N. Arazi.)

Fig. 3. Second field survey at Tenke Fungurume (DRC) during the month of September after human-induced fire for slash-and-burn agriculture. Even though overall visibility was better than during the first field season, the blackened ground tended to conceal archaeological remains. (Photo © N. Arazi.)

IX. REPORTING

Once the fieldwork has been accomplished, all collected data need to be assembled, analysed, and presented in a report. In structure, a heritage assessment report contains standard sections such as the methodology and approach of the study, the description of sites and presentation of results, geo-referenced maps of the identified sites and their location within the impact area, and photos of the sites and surface material. But there are also distinctive sections that are specific to a heritage assessment report in the context of an EIA. These include the policy and legal frameworks on heritage preservation and the institutional regulations the client adheres to in relation to cultural heritage management; an assessment of site significance, which usually refers to sites of aesthetic, historic, scientific, social or spiritual value for past, present or future generations (see The Burra Charter, The Australia ICOMOS Charter for Places of Cultural Significance, International Council on Monuments and Sites. 1999; for a specific example see Heritage Council of New South Wales 2009); and an assessment of the project's potential negative impacts on the area's cultural resources and the mitigation measures for limiting the project's adverse impacts. The former should include an assessment of both the direct impacts associated with destruction or physical disturbance and the indirect impacts caused by changes in topography, water table levels, land use practices, and induced development (see Cultural Heritage in Environmental Assessment 1994). Appropriate approaches for mitigation activities may range from avoidance of sites to archaeological monitoring of sub-surface clearing and trenching activities, salvage excavations, soil and rock stabilization, the application of chance find procedures as well as capacity building of institutions involved in heritage management. The latter usually applies to countries that lack institutional capacity in cultural heritage management.

CONCLUSION

It has been shown that heritage assessments in the framework of EIA follow generic processes as defined by the EIA process (see Abaza *et al*. 2004). EIA reports strive to be, in the words of the International Association of Impact Assessment, 'purposive, rigorous, practical, relevant, cost-effective, efficient, etc.' (International Association for Impact Assessment 1999); hence, heritage professionals need to apply a great deal of pragmatism in order to achieve the required objectives and results. Indeed, it should be borne in mind that private and public sector projects alike do not seek to finance costly and time-consuming archaeological research projects but the most efficient and cost-effective measures to comply with national and international standards in regard to heritage preservation. Coming back to this chapter's case studies, it is interesting to note the following: the Lom Pangar hydroelectric project, which stems from the public sector, now has a considerable salvage excavation program underway, in spite of long delays. In contrast, Tenke Fungurume, a private sector project, has not launched any mitigation processes to this day despite the identification of more than a hundred archaeological find spots.

REFERENCES

Abaza, H., Bisset, R. & Sadler, B. 2004. *Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach*. Geneva: United Nations Environment Program (http://www.unep.ch/etu/publications/textONUbr.pdf, consulted on 10.09.2014).

Cultural Heritage in Environmental Assessment. 1994. *Environmental Assessment Sourcebook Update.* Environment Department, The World Bank. http://siteresources.worldbank.org/INTSAFEPOL/1142947-1116497775013/20507410/Update8CulturalHeritageInEASeptember1994.pdf, consulted on 05.09.2014.Heritage Council of New South Wales. 2009. *Assessing Significance for Historical Archaeological Sites and Relics*. Heritage Branch, Department of Planning (http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/ArchSignificance.pdf, consulted on 10.09.2014).

International Association for Impact Assessment. 1999. *Principles of Environmental Impact Assessment Best Practice* (http://www.iaia.org/Members/Publications/Guidelines_Principles/Principles%20of%20IA.PDF, consulted on 27.09.2014).

International Council on Monuments and Sites. 1999. *The Australia ICOMOS Charter for Places of Cultural Significance* (http://australia.icomos.org/wp-content/uploads/BURRA-CHARTER-1999_charter-only.pdf, consulted on 26.09.2014).

Ndoro, W., Mumma, A. & Abungu, G. (eds). 2008. *Cultural Heritage and the Law. Protecting Immovable Heritage in English-Speaking Countries of Sub-Saharan Africa*. Rome: ICCROM, series 'Conservation Studies', vol. 8 (http://www.iccrom.org/ifrcdn/pdf/ICCROM_ICS08_CulturalHeritageandLaw_en.pdf, consulted on 01.09.2014).

Pope, J., Bond, A., Morrison-Saunders, A. & Retief, F. 2013. '*Advancing the theory and practice of impact assessment: Setting the research agenda*', Environmental Impact Assessment Review 41 : 1-9 (http://disciplinas.stoa.usp.br/pluginfile.php/127572/mod_resource/content/1/Pope%20et%20al.%20-%202013%20-%20Advancing%20the%20theory%20and%20practice%20of%20impact%20assessment%20Setting%20the%20research%20agenda.pdf, consulted on 30.09.2014).

Rakotomamonjy, B.(ed.). 2009. '*Protection juridique du patrimoine culturel immobilier : Orientations pour le pays francophones de l'Afrique sub-Saharienne*'. Rome: ICCROM, series 'Conservation Studies' 9 (http://www.iccrom.org/ifrcdn/pdf/ICCROM_ICS09_ProtectionJuridique_fr.pdf, consulted on 01.09.2014).

Simms, M. 2014. 'Boko Haram threat grows as Cameroon comes under pressure'. *Human Security Centre, Defence and Security* 3 (9) (http://www.hscentre.org/sub-saharan-africa/boko-haram-threat-grows-cameroon-comes-pressure/, consulted on 21.09.2014).

RESCUE AND PREVENTIVE ARCHEOLOGY: ROADS, THERMAL POWER STATIONS AND QUARRIES

Richard Oslisly[1]

INTRODUCTION

For almost 15 years, with the assistance of international cooperation, consortia and funding parties, preventive and rescue archaeology has developed considerably in Africa. Cameroon and Gabon, for example, have developed major infrastructure projects: pipelines, roads, thermal power stations, dams, quarries, etc. These major projects are carried out in accordance with the public interest objective of safeguarding the national heritage, through the development of rescue archaeology in certain cases (discoveries after or during construction) and, recently, of a genuine preventive archaeology component. It is through respect for cultural heritage protection laws during major public works and through the systematic establishment of a preventive archaeology component in the environmental and social impact assessment (ESIA) and in the environmental and social management programme (ESMP) corresponding to the compensation measures that diagnostic operations, surveys and archaeological excavations are funded. The fundamental question, during these ESIAs, will be to know the (diagnostic) procedures and (landscape reading) methods that will lead us to discover and prioritize archaeological sites. We will see through three examples of rescue archaeology and preventive archaeology how we applied the research methodology in the context of the Central African forest.

I. PREVENTIVE ARCHAEOLOGY ASSESSMENT DIAGNOSIS

Before going to the site, one needs to prepare by examining:

- the specific bibliography (reports, articles…) on the Internet and comparing references;
- the geographic area, using topographical maps of various scales in order to obtain toponyms and discern types of relief;
- a recent satellite image of the region (via free Internet sites), because in Central Africa topographical maps are very often old;
- the mapping of vegetation formations, to sharpen interpretation of the landscape and to learn about the habits and customs of the people in relation to their environment;
- a pedological map that shows the quality of the soil (rich soil could have supported past cultivation) and any clay-bearing hydromorphic flats (pottery);
- a geological map that will help determine the materials used by prehistoric humans and the location of minerals (iron metallurgy).

II. FIELD METHODOLOGY: HOW TO FIND AND WHERE TO LOOK?

After analysing map data on the future project, zones with archaeological potential must be identified. In the Central African forest, 90% of identified archaeological sites (Oslisly & White 2003) were discovered on the summits of hemispherical hills relatively close to a watercourse and on top of ridges. When prospecting, one should examine roadsides by paying special attention to hill peaks and laterite deposits.

Moreover, botanical knowledge is necessary, because certain trees indicate the past human presence; for example, if on a hill summit you find *Elaeis guineensis* palm trees combined with *Mangifera indica* mango trees and *Dacryodes edulis* butter fruit trees, you are in the presence of an old abandoned village. Also on hill summits, if you find pure stands of *Aukoumea Klaieneana* gaboon mahogany or *Lophira Alata* red iron wood, you are in all likelihood in an area once home to slash-and-burn agriculture or a village; these species are heliophilous and easily take root in areas deforested by humans. Depending on the Central African ecoregion, there are of course other tree species on these hills indicative of a past human presence, such as *Baillonella toxisperma* (moabi), *Canarium schweinfurthii* (African elemi), *Triplochiton scleroxylon* (obeche in Nigeria, wawa in Ghana, ayous in Cameroon, samba in Côte d'Ivoire), *Ceiba pentendra* (kapok) and/or *Dracaena arborea* (dragon) (Oslisly & White 2003).

This method of discovery, which draws on several disciplines, is called 'landscape reading'. To check its validity, use an auger to drill holes, whether by transect or grid, that will almost certainly reveal the presence of charcoal and sometimes pottery shards.

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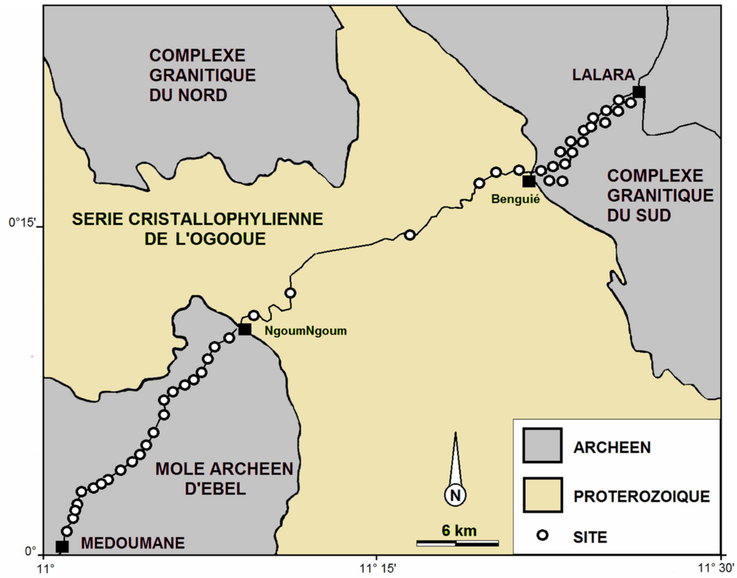

Fig. 1. Archaeological sites along the road between Medoumane and Lalara. Geological formations of the Archaean (in grey: Northern and Southern Granitic Complex, Archaean Complex of Ebel), and of the Proterozoic (in yellow: Metamorphic series of the Ogooue). (© R. Oslisly.)

Fig. 2. Mpolongwé: discovery of a pit (dark area) in the trench. (Photo © R. Oslisly.)

III. CLASSIFYING SITES

During the archaeological diagnostic phase and depending on the number of artefacts and their features, such as the diversity of decoration and shapes of pottery or the quantity and quality of flaked pieces, as well as their spatial distribution and stratigraphy, sites are classified by 'priority', which is a fundamental notion for decision-makers and builders.

Low priority: the site has a small area with some artefacts and does not require excavation.

Medium priority: sites of average size that will be excavated later; most often they are sites whose majority of remains lie outside the construction zone.

High priority: sites with abundant remains that will be excavated immediately because they are often located in the construction zone.

Each site that is discovered will be named after the closest place name on the topographical map, positioned using GPS coordinates and recorded.

We will examine results obtained using this research method from three specific cases: a road in Gabon that involved rescue archaeology, and a thermal power plant construction site in Cameroon and a quarry in Gabon, both of which involved preventive archaeology.

A. Médoumane-Lalara road in Gabon (from 9,000 BC onwards)

The landscape reading method led to the discovery of 52 sites along 84 km of this road in the centre of the country. The roadsides were meticulously examined to obtain the most thorough archaeological diagnosis. Sites fell into three zones, from east to west: zone 1, from Médoumane to Ngoumgoum, contained 29 sites; zone 2, from Ngoumgoum to Benguié, contained only 6 sites; zone 3, from Benguié to Lalara, contained 23 sites. Locating the sites on a geological map revealed that zones 1 and 3 were on Archean formations and thus ancient (**fig. 1**), with many hemispherical hills separated by a very developed hydrographic network conducive to the establishment of villages. Zone 2 contained the more recent (Proterozoic) geological formations that display sharp, sloping relief more favourable to human passage (Oslisly & Assoko 2006). In total along these 84 km, 56 sites and 2 iron ore mines were discovered, or one site every 1,500 m.

B. Thermal power plant at Mpolongwé in Cameroon (10,000 BC to 400 AD)

At the request of AES Sonel electricity company, in 2010 we began a survey of the future location of the Mpolongwé thermal power plant, where a permanent watercourse meandered around two hemispherical hills. Pits and a layer of flaked stone were discovered. After 22 hectares of forest were cleared, we began working in close collaboration with the construction company, which progressively levelled the main hill in strips 2 m wide by 40 m long, in order to level the site. From the first shovelful, pits appeared (**fig. 2**) and were immediately marked, protected and, soon after,

Fig. 3. Mpolongwé: grid excavation phase. (Photo © R. Oslisly.)

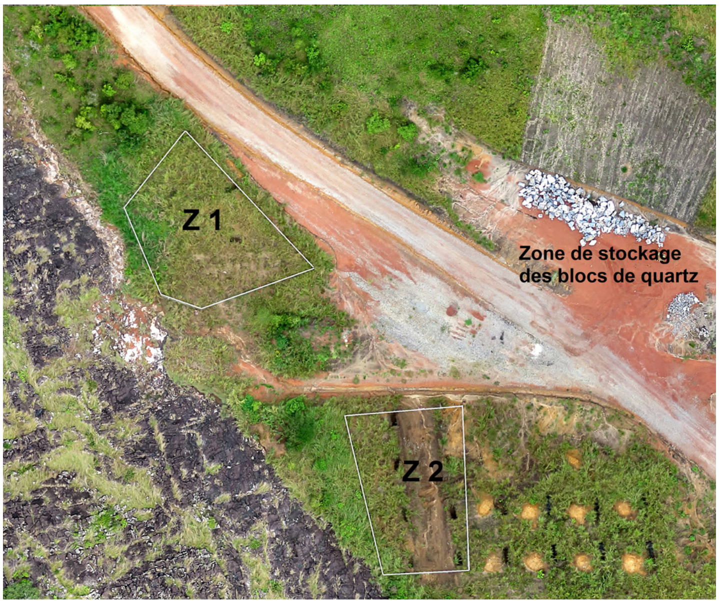

Fig. 4. Mikaka: aerial view of protected zones Z1 and Z2; the rectangles correspond to boreholes made during the diagnostic phase (adapted from COMILOG by R. Oslisly.)

excavated (**fig. 3**). During this work, 50 archaeological structures were discovered: 37 pits, 12 archaeological levels and a forge. Material remains (392 kg) included flaked stone, pottery fragments, earthenware, remnants of metallurgical activity (iron tools), beads, and glass.

C. Quarry at Mikaka in Gabon (11,000 to 6,000 BC)

During a 2013 environmental impact assessment of a future quartz quarry by the Ogooué mining company (COMILOG), numerous stone flakes of jasper were discovered, lying on the rocky slabs of the land within the purview of the quarrying permit. In the context of the environmental and social management programme (ESMP), COMILOG funded a preventive archaeology project.

Preliminary diagnostics helped define a first zone (Z1) in the form of a butte where four boreholes were made (**fig. 4**), revealing several levels of which the oldest dated to 9,500 BC. This zone was fenced off for protection. For the second zone (Z2), corresponding to the site of the future service station, a more advanced examination was carried out with the support of a backhoe that dug 41 pits totalling 246 m^3 over an area of 3,000 m^2 and yielding almost 1,000 flaked stones. This second zone was also fenced off with a view to future excavation. Mikaka is the first open air site comprising levels of occupation of hunter-gatherer-stone-knappers ranging from 3,000 to 9,500 BC.

These three examples illustrate perfectly the importance of a research methodology based on a multidisciplinary approach in a forest environment.

Moreover, preventive archaeology facilitates access to data that would have been difficult to access via conventional archaeology. Earth-moving equipment has opened otherwise inaccessible forest areas to prospecting and excavations. During each project, preventive archaeology proved to deliver a very positive experience and demonstrated that it is possible, without adverse economic impact, to have fruitful collaboration between scientists and developers. It furthermore contributes to the practical training of students through frequent fieldwork missions, and also to their earning academic degrees.

REFERENCES

Oslisly, R. 2010. ‘Une décennie d’archéologie de sauvetage et préventive au Cameroun (2000-2010)’. *Les Nouvelles de l’archéologie* 120-121: 75-80.

Oslisly, R. 2014. ‘L’archéologie préventive en Afrique centrale (Cameroun et Gabon) : un outil de développement’. In J.-C. Galipaud & D. Guillaud (eds), *Une Archéologie pour le développement.* Marseille: Éditions La Discussion (Coll. ‘Patrimoines’), pp. 143-154.

Oslisly, R. & Assoko Ndong, A. 2006. *Archéologie de sauvetage sur la route Médoumane-Lalara*, *vallée de l’Okano, Gabon.* Libreville: WCS Éditions.

Oslisly, R. & White, L. 2003. ‘Étude des traces de l’impact de l’homme sur l’environnement au cours de l’Holocène dans deux régions d’Afrique centrale forestière : la réserve de la Lopé (Gabon) et le sanctuaire du Banyang Mbo (Cameroun)’. In A. Froment & J. Guffroy (eds), *Peuplements anciens et actuels des forêts tropicales*, Marseille: IRD Éditions, pp. 77-87.

MANAGING CULTURAL HERITAGE IN AFRICA: A STUDY OF IFAN IN SENEGAL

Ibrahima Thiaw[1]

INTRODUCTION

Founded in 1936, IFAN (originally Institut français d'Afrique noire; renamed Institut fondamental d'Afrique noire – African Institute of Basic Research – in 1966) is staffed by professionals and amateurs dedicated to the inventory, acquisition, and preservation of cultural resources. This staff, consisting mostly of expatriates, were the first to fight for the defence and preservation of Senegal's archaeological heritage in a context in which the discipline had little historical presence. Local populations were only involved in archaeology as labourers or, at best, as sources of information.

Even today, only professionals are really involved in the preservation of archaeological resources in Senegal. IFAN's activities are still limited to small-scale acquisitions and inventories, and managing collections of previously acquired materials. Participation in international programmes, often initiated by universities or research institutes in North America or Europe, remains the main source for new acquisitions and archaeological knowledge (Thiaw 2012).

Over the past five years, however, a preventive archaeology programme has been established to serve developers whose activities threaten cultural resources. Simultaneously, IFAN has been trying to create closer ties with the state services that are its primary source of funding. Unlike the colonial government, however, the postcolonial government has given it no specific mandate.

This article examines the role of the IFAN archaeological laboratory in the management of Senegal's cultural heritage. Their mandate changes according to the needs of government administrations, colonial or postcolonial, as they seek to establish policies concerning the use and development of the territories in their jurisdiction. After becoming a part of the University of Dakar in 1959, IFAN was gradually forgotten. This raises questions about the social role of the university, one of the central missions of which is to serve surrounding communities. Here we will analyse, on the one hand, the tensions between the normative and operational frameworks and, on the other, the issues, opportunities, and practices related to preventive archaeology in Senegal, where community engagement is low, with small margins for manoeuvre. The experience acquired over the past five years by the IFAN archaeology laboratory will serve as a basis for exploring the future of preventive archaeology in Senegal.

I. LACK OF SYNERGY BETWEEN ADMINISTRATIVE AND OPERATIONAL BODIES

The first regulatory framework for the management of cultural assets with which the principle actors were bound to comply was established during the colonial period. Following independence in 1960, one of the major obstacles to the development of preventive archaeology was the lack of clarity concerning the jurisdictions of the administrative apparatus managed by the Ministry of Culture through the Direction du Patrimoine ('heritage office') and the operational branch of archaeological research, namely the IFAN archaeological laboratory based at Cheikh Anta Diop University in Dakar.

Postcolonial legislation has remained unchanged since law 1971-12, which regulates excavations and discoveries (Naffé *et al.* 2008). Operationally, it is based on no territorial administration, and cultural heritage management remains centralised. There is no synergy between the administrative (Direction du Patrimoine culturel) and operational (IFAN) bodies, even though these two structures have been under the direction of the same person for the last four years. The result is that a great deal of pillaging and destruction goes unnoticed.

Beginning in the middle of the 20th century, the various inventories of heritage resources drew a map that offered territorial administrations the tools needed to establish resource management policies. At the end of the 1950s, most topographical maps included ruins and historical sites, as well as places of worship, such as sacred woods, mosques, churches, cemeteries, etc.

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Fig. 1. Visit to the burial mounds at Ndayane, Diourbel, Senegal. (Photo © I. Thiaw.)

We note however that more attention was paid to the intangible heritage than to archaeological sites (Arazi & Thiaw 2013).

National or regional inventories have increased since the 1970s. These have strengthened the archaeological map of Senegal, even if the archaeological laboratory was not associated with the most recent inventory, commissioned by the Direction du Patrimoine in 2003. These efforts have not led, however, to a national database that might serve as a tool for heritage management. The Direction du Patrimoine is happy to grant research permits without having to worry about follow-up or database management. The archaeology laboratory, on the other hand, expands its collections, but barely manages to organise them due to limited space and resources. On an operational level, IFAN's cultural preservation activities are still limited to acquisition and salvage.

II. PREVENTIVE ARCHAEOLOGY IN SENEGAL: PRACTICES, OPPORTUNITIES, AND CHALLENGES

The first attempts at preventive archaeology in Senegal took place in the mid-1990s in the context of the Cayor Canal project with the Consortium SNC-Lavallin/BCEOM. The works, which consisted essentially of surveying, were directed by Massamba Lame. It would be another ten years before another attempt was made, this time with the Oromin Joint Venture Group (OJVG). In 2009, an international team made up of SRI Inc., Nexus Heritage, and the IFAN Cheikh Anta Diop archaeology laboratory undertook the evaluation of heritage resources in the OJVG mining perimeter, located in Sabodala, in eastern Senegal. The partnership with SRI Inc. and Nexus Heritage was strained by the developer's reluctance to make use of more expensive international experts. This pioneering experiment contributed to professional development, with the training of a dozen students. This continued outside of Senegal and allowed capacities to be strengthened, laying a foundation for preventive archaeology.

Since then, the IFAN archaeology laboratory has progressively developed programmes in collaboration with other local or international firms to ensure that the cultural component is included in major projects' environmental or social impact studies. It continues to focus on training students in order to build an operational team capable of responding in Senegal and elsewhere (**fig. 1**). Students are offered the opportunity to take part in fieldwork, which is often missing from training programmes at Cheikh Anta Diop University.

Today, despite some reluctance, many mining companies have progressively integrated archaeology into their environmental and social impact studies. This progress has yet to incite the Ministry for Culture and the Direction du Patrimoine to become actively involved in the process, notably in assessing reports and following up on recommendations.

As a result, the economic and cultural impact of these studies remains negligible. Preventive archaeology is still limited to small-scale surveys undertaken to meet donor requirements and obtain licences. Lack of government involvement in the process means that the recommendations made during the pre-feasibility stage are rarely followed.

On the other hand, some decisions require cooperation between various stakeholders, the relevant government services, funders, and developers. Classification criteria, site importance assessment, the decision to acquire or avoid, as well as the management and improvement of collections, are important aspects of preventive archaeology that suffer from a lack of coordination and cooperation between these actors.

The interests of the authorities responsible for culture are limited to maintaining a handful of colonial buildings in urban zones and to sites included on the World Heritage list, which are used to fuel political propaganda. Just like the sites classified on the national list, these sites are exposed to all kinds of attacks (Thiaw 2014). Certain na-

Fig. 2. Well-maintained and protected sacred site in the village of Andiel, Bedik country (Kédougou Region). (Photo © I. Thiaw.)

tional companies continue to destroy multiple archaeological sites situated within or near their projects.

In the middle valley of the Senegal River, several sites that had been inventoried were destroyed as part of land-management activities. Like the dams at Diama and Manantali, which were built without any consideration of the archaeological component, the exploration underway as part of the phosphates project in Matam is taking place without any attention paid to the rich archaeological resources present in the vicinity. The Diallowali site inscribed on the national list has been assigned to a private developer. Not far from there, Nder, an historic village and the 19th century capital of the Waalo kingdom – where women self-immolated in a final act of resistance to slavery – is on the verge of being wiped from the map without any reaction from the authorities at the Ministry of Culture, who had listed it as a national heritage site.

In the Saloum Delta, a World Heritage Site, several shell middens (such as those at Faboura) have been completely destroyed during the construction of the Joal-Ndangane road. Those at Niodior and Dionewaar are on the verge of disappearing (Naffé *et al.* 2008). More recently, the construction of the Dakar-Diamniadio toll-road led to the destruction of several archaeological and historical sites, including parts of the famous Thiaroye camp, which is an important site of remembrance linked to the Tirailleurs sénégalais mutiny during the Second World War. In Keur Momar Sarr, the SDE was built at the Tata of Yamar Mbodj – a classified national heritage site – without any impact study performed or any form of mitigation undertaken. The Ndayane site, located in the city of Diourbel and on the national heritage list, has become an enormous garbage dump coveted by developers, and already largely occupied by the city hospital. In light of the current situation, preventive archaeology in Senegal remains a huge project. It is therefore surprising to hear politicians speak about the centrality of culture to their development policies.

III. THE FUTURE OF PREVENTIVE ARCHAEOLOGY IN SENEGAL

The future of preventive archaeology in Senegal is therefore bleak. Without the involvement of public authorities, professionals and stakeholders at the community level have nowhere to turn. It is difficult to apply the 'polluter pays' principle when government services show neither the necessary vigilance nor political will. The absence from the field of state authorities or funders leads to all kinds of abuses. Links to the state are even the pretext on which national companies refuse to comply with procedure. They consider archaeological-resources management and related costs to be obstacles to development.

The development of preventive archaeology requires a more sustained engagement with community stakeholders. Collaboration is necessary and must lead to the joint definition of research agendas by professionals and local communities and the identification of relevant issues.

If it is to play its role fully, preventive archaeology must extend its reach beyond its field *stricto sensu*. It must look at both the tangible and intangible cultural heritage, ancient and contemporary, and to its future. This approach, which makes it possible to link the past, present, and future, could be particularly productive for surveying in the context of development programmes. Such an approach, which takes charge of the intangible heritage as well as sacred and ancestral sites, could persuade local populations, whose interest in this type of heritage is evident (**fig. 2**). The term 'preventive archaeology' is too narrow to include these equally important aspects. We also recommend closer collaboration with populations in order to move towards cultural engineering capable of proposing credible and durable development solutions for the management of cultural heritage and historic landscapes.

CONCLUSION

In Senegal, the preservation and enhancement of the cultural heritage has long been considered an indispensible part of development. As of today, however, this has not yet been translated into action. The normative and administrative structures and the operational structures, largely inherited from the colonial system, have barely evolved since 1970. Cultural heritage resources are being lost beneath the weight of a modernity and a modernisation that places little importance on archaeological heritage. The question of 'the future of tradition' is more relevant than ever (Diagne 1992).

Heritage management policies conflict with the demands of development policies. Rather than guaranteeing prevention by eradicating or limiting the negative effects of various projects, archaeological resources management consists of inventories and acquisitions in zones where the process of destruction is already underway. These interventions, which take the form of salvage, may have allowed IFAN to amass rich collections, but make it a prisoner of its time and of an out-dated paradigm.

Some timid progress has been made since 2008. There has been a great increase in prevention missions, with important implications not only in terms of heritage management in the broad sense, but also in the training of students.

Faced with rapid urbanization and the creation of new agricultural and residential zones as well as hotel and road infrastructure, faced with mineral exploration and exploitation, etc., these preventive missions remain negligible. The Ministry of Culture must urgently and in partnership with professionals set out legislation that conforms to international norms and standards, and establish a national database of archaeological sites.

REFERENCES

Arazi, N. & Thiaw, I. 2013. 'Managing Africa's Archaeological Heritage'. In P. Mitchell & P. Lane (eds). *Oxford Handbook of African Archaeology*. Oxford: Oxford University Press, pp. 213-225.

Diagne, S.B. 1992. 'L'avenir de la tradition'. In M.C. Diop. *Sénégal. Trajectoire d'un État*. Dakar: CODESRIA, pp. 279-298.

Naffé, B.O.M., Lanfranchi, R. & Schlanger, N. (eds). 2008. *L'Archéologie préventive en Afrique.* Saint-Maur-des-Fossés: Éditions Sépia, 256 p.

Thiaw, I. 2014. 'The management of cultural World Heritage Sites in Africa and their contribution to sustainable development in the continent'. In S. Makuvaza (ed.). *The Management of Cultural World Heritage Sites and Development in Africa: History, Nomination Processes and Representation on the World Heritage List.* New York: Springer, pp. 69-82.

Thiaw, I. 2012 'Colonization and the development of archaeology in Senegal'. In S.J. Van der Linde, *European Archaeology Abroad: Global Settings, Comparative Perspectives*. Leiden: Sidestones Press, pp. 349-374.

RELATIONS WITH LOCAL COMMUNITIES

Nicolas David[1]

In the early 1960s, I was Hallam Movius's foreman at the Upper Palaeolithic site of Abri Pataud in France's Dordogne department and on the weekends used to play midfielder for Les Bisons, the Les Eyzies soccer team. Although not a model of archaeological relations with a community, the situation displays some of the elements. While I did not become an 'Eyzien', I made lasting friends and had fun besides gaining status as someone involved and wishing to contribute. Movius's enthusiastic presence at matches confirmed the engagement of the whole dig.

My field research in Africa has been more ethnoarchaeological than archaeological, but I have made several, mainly test, excavations with small teams in Cameroon (e.g. David 2008), the CAR, Nigeria and South Sudan. My archaeological experience is thus not unlike that of African and Africanist researchers running their own programs for the first time. I should add that my teams have never engaged in what is now known as 'community archaeology', in which the host community is a full partner in the archaeological enterprise. An article by Peter Schmidt (2014) and its rich set of references provides an excellent introduction to that topic. Community archaeology is a highly desirable but not always achievable form of practice, for example when archaeologists carry out research with and among groups that, for lack of education, extreme poverty or other impediments, are incapable of acting as partners. In such cases it is nonetheless very much to the benefit of the research to conform to the ideals of community archaeology, involving and benefiting community members in all possible ways, including training, and leaving a material and documentary legacy that will one day be appreciated by community descendants.

I. FIRST CONTACT

I have organized this piece in terms of the progression of research, starting with the choice of a particular place to undertake fieldwork. A local community is always going to be involved, and all the ministerial, provincial and other permits in your pocket will be useless unless the host community is willing to cooperate and support your work by providing − besides labor − knowledge and many-sided human interaction. So first contact is critical as the start of a relationship of reciprocity that must be perceived as balanced by all parties. Luckily you are interested in something that interests them: their past and their present. For even if the chosen community is one of recent conquerors, as at Bé in northern Cameroon, its inhabitants knew a great deal about making a living in that environment, and were intrigued by the mounds produced by their predecessors (David 1971). In 1967, accompanied by Eldridge Mohammadou, ethnohistorian, guide and friend, we toured much of Cameroon looking for sites that might inform on the Bantu expansion. I wanted to work at Bé as soon as I saw it. After visiting the chief, Alhaji Hamman Sali, explaining my interest, and getting his permission, Eldridge and I hiked to the highest of its settlement mounds − well over a thousand years of stratigraphy. By the time we got back to the chief's residence I had the outlines of a project. The chief and councilors listened graciously to my off-the-cuff presentation, then approved in principle. And so we left.

Leaving is helpful; it gives time for the community to become accustomed to the possibility of your living amongst them, to discuss its potential advantages and disadvantages and relations with the researcher. Over the next months I kept the chief informed of developments by letter. When I returned the following fall with a team and two vehicles, I was no stranger, having morphed from casual visitor with odd ideas to someone of substance who had kept his word. We were up and digging in days.

II. IN THE FIELD

Though this was by no means my only reason, I demonstrated respect in my dealings with Hamman Sali by learning Fulfulde, the language of the Fulbe (or Fulani, Peul, etc.). This I did in Philadelphia by using a dictionary and grammar and listening to Eldridge's record-

1 Emeritus Professor of Archaeology, University of Calgary, Canada.

ings of the exercises in the latter − and then spending every weekday breakfast for a semester teaching the language to Frank Bartell, my future chief assistant. In the event, French was the language of the dig, but after four months excavating I was able to conduct ethnoarchaeological research in Fulfulde thanks to a local assistant, Souaibou Barkindo, who spoke no French but communicated with me at a level of difficulty precisely adjusted to my increasing competence.

'Field assistants are born, not made … but sometimes they are thrust upon one and require a great deal of training.' I wrote on this important topic in *Ethnoarchaeology in Action* (David and Kramer 2001: 73) and will not repeat it here, except to say that I had an assistant thrust upon me in the first year of the 1984-2008 Mandara Archaeological Project (MAP). He was bright and energetic but, a proud descendant of the slave-taking Wandala state, regarded Mandara Mountains montagnards, whose ancestors were the slavers' prey, as inferior beings. During that season we were engaged in survey and test excavations and were able take advantage of his good qualities. But he was not rehired when we returned in 1986 to do ethnoarchaeology. One's field assistant (interpreter, guide, and if all goes well eventually confidant and friend) should then be a member of the host community, intelligent and curious (though not necessarily highly educated), discreet, tolerant and sympathetic, and from neither too high nor too low a position in society. If such a person works with you a good length of time, he or she will learn a great deal about the research (and much more), which they relay to other community members. An assistant, well-trained and informed on his or her society and its past, is not the least legacy that an archaeologist can leave to the host community. I should add that assistants must also cope with the suspicion that they are failing to redistribute the large sums of money they are believed to be earning. This brings me to the subject of wages.

Fig. 1. Paying the workmen their wages at DGB-2, a monumental site in Cameroon. Nic David calculates, Frank Kense counts banknotes. Edward Matenga, the conservator of Great Zimbabwe, and Gerhard Müller-Kosack observe. (Photo © Judy Sterner.)

Hiring is a political act that the outsider is required to perform when least qualified to do so. The political aspects include whom and whom not to hire (and risk offending) and how much to pay them. I have found it best to hire a majority of the workers from among those resident in the immediate vicinity of the site (**fig. 1**). This can be justified to the larger community in terms of their availability. Laborers' wages are typically derisorily low for workers, some of whom can be more quickly trained than most Westerners to grasp the principles of stratigraphy, discriminate between minor strata and recognize faint architectural features. (This proved useful when I happened on the remains of a massacre in southern Sudan and had to prove to my Dinka employees that the remains were not those of their ancestors.) On the other hand, the outsider is unwise to upset the local labor market by offering substantially higher wages. It has been my practice to start workers at a wage marginally above the local standard − and to increase it rapidly for the better excavators. You avoid antagonizing local employers and at the same time gain goodwill and respect.

It's not just a matter of money. In Africa, far more than in the West, personal and business relationships go hand in hand. In 1975 I brought a small team from the

Fig. 2. Judy Sterner shares photos of Canada with Gobway, a Sirak potter, and her family. Cameroon, 1990. (Photo © Nicholas David.)

Fig. 3. The going away party organized by Sukur and Damay for Nic David (in front of the great baobab) and Judy Sterner (on the dance floor) in March 1993. (Photo © James H. Wade.)

University of Ibadan, Nigeria, to the Central African Republic to work on monumental Tazunu sites (David 1983). In this impoverished country, almost empty of people, the villages were strung out along the roads waiting endlessly for the schools and clinics that had been promised them by their President-for-life and later Emperor Jean-Bédel Bokassa. We hired workers at going rates but found they were incapable of handling the massive granite slabs and uprights of the Tazunu without extra protein in their manioc-based diet. So each day we bought them meat.

Entering a new culture is learning to swim in a sea of expectations that one negotiates through reciprocities of various kinds, from simple greetings to substantial and ongoing exchanges (**fig. 2**). The outsider is often in a position to offer transport, for example, and when Judy Sterner and I got settled at Sukur in Nigeria (www.sukur.info), she offered first aid to our neighbors while at the same time training one of our assistants, to whom we eventually passed on our copy of *Where there is no doctor* (Werner *et al*. 1993).[2] Crucially important amongst these reciprocities is the exchange of information with interested members of the community and particularly its leaders. It is essential that what you are doing is done in the open; people are suspicious, and if an occasional spectator-damaged section wall is the price of transparency, it is well worth paying.

The previous paragraphs offer sufficient clues as to the types of behaviors that are likely to lead to good relations between archaeologist and the community – and hopefully between the community and the other outsiders in the archaeologist's team.[3] If the team is resident away from the community, it may be able to live in its own bubble and have little contact outside of work. This, I was told by an amused Tale teacher in 1991, was why the Canadian International Development Agency compound in Bolgatanga, Ghana, was known to locals as 'Johannesburg'. But, although it may take a little courage to make the initial move, every archaeologist needs to get involved and to learn as much about local life and culture as is possible – without bringing him or herself into conflict or disrepute with the host community, thereby endangering the project. (As team leader, you must be prepared to send an offender home if necessary.) Good behavior requires good manners and achieving a balance between willingness to enter into others' lives and maintenance of your own identity (**fig. 3**). You will make mistakes, as I did in 2001 when first venturing up Mount Oupay in Cameroon searching for monumental sites on a Mafa festival day. I was handed a bowl of beer and, before drinking and without thinking, spilled a few drops on the ground. My host, greatly affronted, took this as a claim to his land. I apologized, explaining that my libation was intended, as elsewhere in the mountains, for Zhigile, the creator

2 Judy was qualified to provide first aid. All members of the MAP 1986 team took a St Johns Ambulance course, an investment that paid off, for example when Kodzo Gavua resuscitated a Mafa baby who had 'died' twice.

3 The chapter on fieldwork and ethics in David and Kramer (2001: 63-90) offers much more on this and related topics.

Fig. 4. Leaving Mokolo in 1990 at the end of the first Cameroonian phase of the Mandara Archaeological Project. (Photo © Nicholas David.)

god. We parted on reasonably good terms. Learning another's culture requires both sensitivity and a willingness to take risks.

I am very conscious that, were I digging in an urban environment such as Soweto rather than a village in Central Africa, opportunities and problems in the area of community relations and community archaeology would be very different. But principles remain the same.

III. THE TIES OF DEPARTURE

Leaving a community in which you have spent months and invested much of yourself is hard. Besides the personal, there are a thousand professional things to do. It is emotionally draining (**fig. 4**). A extraordinary phase, one in which you never felt more alive and which is critical to your career, is coming to a end. It is an opportunity for generosity; there are goodbyes to be said; you are torn between reluctance to leave and wanting to get out of there as quickly as possible.

But in one sense you never leave. The network of reciprocities extends from the village back to your base. You make sure that photographs and later publications, CDs and DVDs are sent back to the community. Perhaps you author a website with room in it for community contributions and the intention of ultimately handing it over to your hosts.[4] Interactions gradually become less frequent, but years later you may find yourself writing a reference or receiving requests for assistance in, say, completing a school or building a road. And that is even if you never return: a relationship that continues with multiple visits over decades is in every way richer, more academically productive and more likely to benefit the community that has contributed so much to your career (see Heckenberger 2009). Judy Sterner and I have just completed a paper that evaluates the benefits and costs to Sukur of its citation as a World Heritage Cultural Landscape.[5] You can take the archaeologist out of the site but not the community out of the archaeologist. It's with you for life and, in my case, never more so than as I write. The Islamist Boko Haram insurrection (see https://www.mandaras.info/InformationToShare.html) has murderously disrupted the lives of Mandara montagnards in both Nigeria and Cameroon, and there is so very little I can do to help (but see www.bokoharamvictimsrelief.org).

REFERENCES

David, N. 1971 'The Fulani compound and the archaeologist'. *World Archaeology* 3

David, N. 1983 'Tazunu: megalithic monuments of Central Africa'. *Azania* 17: 43-78.

David, N. 2008 *Performance and agency: the DGB sites of Northern Cameroon*. 'BAR International Series', 1830. Oxford: Archaeopress.

David, N. & Kramer, C. 2001. *Ethnoarchaeology in action*. Cambridge: Cambridge University Press.

Heckenberger, M.J. 2009 'Mapping indigenous histories: collaboration, cultural heritage, and conservation in the *Amazon*'. *Collaborative Anthropologies* 2: 9-32.

Schmidt, P.R. 2014. 'Rediscovering community archaeology in Africa and reframing its practice'. *Journal of Community Archaeology and Heritage* 1: 38-57.

Werner, D., Thuman,C. & Maxwell, J. 1993 *Where there is no doctor: a village health care handbook for Africa*. London: Macmillan Education. (Many versions and editions, also in French and Spanish.)

4 See www.sukur.info. While few rural communities in Africa have access to the internet, computers that can read CDs and DVDs are becoming ever more common. Whole websites distributed on CDs and DVDs and locally copied can this achieve wide distribution on many parts of Africa.

5 This is to appear in a volume edited by Peter Schmidt and Innocent Pikirayi that constitutes the outcome of a 'Workshop on Community Archaeology and Heritage Work in Africa' held at the University of Florida, Gainesville, in March 2014.

Chapter 2

Finding and describing archaeological sites

INTRODUCTION

Alexandre Livingstone-Smith[1]

Finding and describing archaeological sites is the first step of any archaeological enterprise. It generally consists of two phases: desktop assessment and fieldwork.

During a desktop assessment, one may assess the archaeological potential of an area using published research, archaeological databases, museum archives, but also literary sources or old maps. The exact extent of the survey needs to be plotted on a map as accurately as possible, with all the data collected during the desktop assessment (topography, hydrography, vegetation, archaeological finds, resources, settlements and tracks, etc.). One may then develop a survey strategy and survey grid, or in other words, the type of survey and the degree of detail that one needs to achieve. Evidently, these two aspects are linked.

It may be possible to target specifically a single site previously reported, but one may want to survey a small area intensively (i.e. a plateau, a hill, the banks of a lake, a village or a city) or to cover a whole region extensively. This choice (which will probably depend on the overall goals of the operation), will affect the logistics and the survey grids in the field. If the target is a single site, a hill that is supposed to have been an important political centre for example, the need for vehicles will be limited and one can imagine an extensive survey of the area. When surveying a whole region, however, transport will be needed and some sort of sampling will have to be chosen. One can decide for example to make a linear survey every 5 km or 10 km. Clearly, in this way many sites may escape notice, but in the end the archaeological team will have an idea of the archaeology of the area without having to examine every square meter of an area.

Except in a few cases (if one uses a boat or a jeep), field surveying generally involves a lot of walking. Surveyors walk along lines (often called transects), looking for vegetation anomalies (some plants are associated with human activities), topographic anomalies (old structures), artefacts (often associated with charcoal) lying on erosion surfaces, or ploughed field, etc. In the latter case, sites can be found on a track, on the surface of a village, on the banks of a river, anything that will make the substrate visible. The people living in the surveyed area may have crucial information, particularly when the have been made aware of the aims of the survey.

The important thing is to be able to report the finds, describe them and possibly collect samples. In these matters much will depend on the means of the team, but it is possible to undertake extraordinary surveys with little equipment!

This chapter explains the principles of site identification, evaluation and location. It discusses how to define an archaeological site and how to evaluate its priority within overall project planning, as well as emphasising the importance of survey strategies and site localisation. Depending on the context, the research questions the archaeologist has in mind, or the type of site he is investigating, these general principles are applied in varied ways.

For instance, **Alfred Jean-Paul Ndanga** offers an exemplary case showing how African urban areas provide good grounds for low tech and low budget surveys. He brilliantly uses Bangui, the capital of CAR, as a case study and underlines the advantages of this kind of survey. Reviewing the preparation, site identification procedure and description, as well as the methodological advantages and challenges he encountered, he shows how archaeological surveys can be organised, in difficult circumstances and with limited means.

Manfred K. H. Eggert examines rainforest archaeology, reviewing the research strategies, results and evaluation. He explains why and how he developed river-born surveys in the Inner Congo Basin of Central Africa. While he had, in the end, rather significant means to achieve his goals, his contribution explains how heavily forested environments can be efficiently surveyed from an archaeological point of view. It is also apparent how, at a modest scale, one may easily find archaeological sites inside forest villages.

Kevin MacDonald looks at a completely different type of environment: the semi-arid Sahel. It goes without saying that conditions of visibility are very different and field surveys may be prepared, to a degree, analysing aerial photographs or satellite imagery. He then examines the advantages and disadvantages of pedestrian and vehicular surveys, before addressing the crucial question: What is a site? What should one record and what should be collected?

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1 Heritage Service, Royal Museum for Central Africa, Tervuren, Belgium.

Akinwumi Ogundiran and Babatunde Agbaje examine the question of archaeological surveys with a view to exploring ancient polities, using as an example the survey of a metropolis, Oyo-Ile, and one of its outlying colonies, Ede-Ile, both located in modern Nigeria. In doing so, they show how research questions frame archaeological surveys and how one can prepare the excavation of complex sites.

One step further, **Jeffrey Fleisher** explores the surveying of towns, explaining how to go from non-invasive and less-destructive techniques to geophysical survey, then to ground-truthing and sub-surface testing, and the interpretation of results. As in the previous case, one can see how the accumulation of small scale observations can help the archaeologist understand the layout of large scale archaeological phenomena.

Paul J. Lane gives a thorough overview of the questions of site recording and cataloguing. To do so, he reviews the necessary preparations and equipment, the crucial cataloguing and archiving. As with other authors, he provides essential guidelines, lists of equipment and examples of site recording forms that can easily be used or adapted in various parts of Africa.

James Denbow examines the case study of surveys he undertook in the Loango region on the western coast of Central Africa. This case study offers an interesting view on a project that initially started as an academic undertaking and turned into a preventive and rescue archaeology project facilitated by the private sector. This case study also illustrates one of the earliest examples of this kind of collaboration in Central Africa.

Pascal Nlend is charged with the difficult task of considering the question of student participation in impact assessments. This contribution is designed to offer students taking part in large scale operations some insights on what will be expected of them – a rarely considered aspect of fieldwork. He uses his experience in Cameroon, but the situation can certainly enlighten students from other countries.

Isabelle Ribot's contribution deals with the specific aspect of funerary sites in field surveys. She reviews aspects pertaining to desktop assessments (archives and oral history), surface and sub-surveys, as well as the planning of the excavations. Here the relationship with local communities is particularly important, as ethical issues may hinder the process of cemetery excavations.

Benjamin Smith examines the essential aspects of rock-art surveys, beginning with what type of artefact qualifies as rock art. He reviews issues concerning the importance of research questions, preliminary investigations, desktop survey and survey proper, with some cautionary advice to keep one's eye open for the unexpected.

ARCHEOLOGICAL EXPLORATION IN AN URBAN AFRICAN CONTEXT: THE CASE OF BANGUI IN THE CENTRAL AFRICAN REPUBLIC

Alfred Jean-Paul Ndanga[1]

Surveys conducted on foot in and around the city of Bangui beginning in 2002 identified approximately 40 archaeological sites ranging in typology from the late Stone Age to the period of iron production. The approach combines a cartographic division of the city into archaeological zones with on-foot surveys. Visits involve the whole team and require swift action in the areas to be surveyed.

The survey of archaeological sites in an urban area resulted from a lack of material or financial resources, but above all from the country's recurring military crises, which have restricted archaeological activity.

In general, however, the opportunity for urban archaeology in the Central African Republic, a poor country, arises from the fact that Bangui is under construction. The use of the space and the evolution of the infrastructure offer fantastic opportunities for archaeological investigation and, subsequently, development.

I. THE ARCHAEOLOGICAL CONTEXT IN BANGUI

The bare spaces of a city allow archaeologists to read the ground directly.

Established during colonisation, Bangui has only slowly 'modernised' (**fig. 1**). Ground cleared by human occupation is exposed to the elements and/or anthropogenic actions that regularly allow the identification of archaeological sites.

Archaeological research in Bangui began in 1966, but was limited to the acquisition of a few flaked stone objects by first R. Bayle des Hermens and, later, P. Vidal. The next few decades were lost in the archaeological doldrums.

This inactivity was both caused and aggravated by political instability. The resulting politico-military crises limited all scientific initiatives. There was also a shortage of financial resources, materials, and qualified personnel.

As a response to these problems, the Centre universitaire de Recherche et de Documentation en Histoire et Archéologie centrafricaines[2] initiated a survey programme in Bangui and surrounding areas in 2002. CURDHACA's response to the issues facing the development of archaeology opened a broad field of investigation.

II. PREPARATION, TECHNIQUES, AND SITE IDENTIFICATION

Surveying begins in the laboratory. Neighbourhoods in the metropolitan area are divided into archaeological sectors. This is done first to delimit the city so that spaces to be surveyed can be visualised along with the results obtained. The maps used for Bangui were scaled at 1/200,000 and 1/80,000. Their analysis allows the identification of localities – such as riverbanks, the confluences of rivers, the edges of plateaux, and toponyms linked to metallurgical activities – likely to have accommodated ancient human activities.

The surveyor teams are made up of six to ten people. They are joined by archaeology students, who take part as of their first year of training. While walking from habitation to habitation, the surveyors spread out in a line and walk in the same direction, crossing one another's paths. This allows inspection of areas examined by one's nearest neighbour.

In the field, open spaces around habitations, earthen roads and embankments, lateritic crust, ditches near houses, the walls of trenches that served as dumping grounds or as clay quarries, areas and slopes furrowed by rainwater, and trees testifying to vegetation since vanished or uprooted by wind are examined.

Everything on the surface is closely observed. Flaked stone, potsherds, and scraps from ancient metal production are easily spotted. The surfaces of the lateritic crust or large rocks – which could be the sites of rock art – and surviving forest trees may signal the existence of an archaeological site.

III. DISCOVERY AND DESCRIPTION OF SITES

A survey file is filled out following the discovery of a single artefact or a visible cluster of pieces. This document collects information including the name of the site, the GPS coordinates, digital photographs, measurements (in the case of structures), the designation of artefacts, and an initial typological classification. The area of the site is estimated following a more intense survey of the area of

1 CURDHACA, Bangui, Central African Republic.

2 University Centre for Central African Historical and Archaeological Research and Documentation.

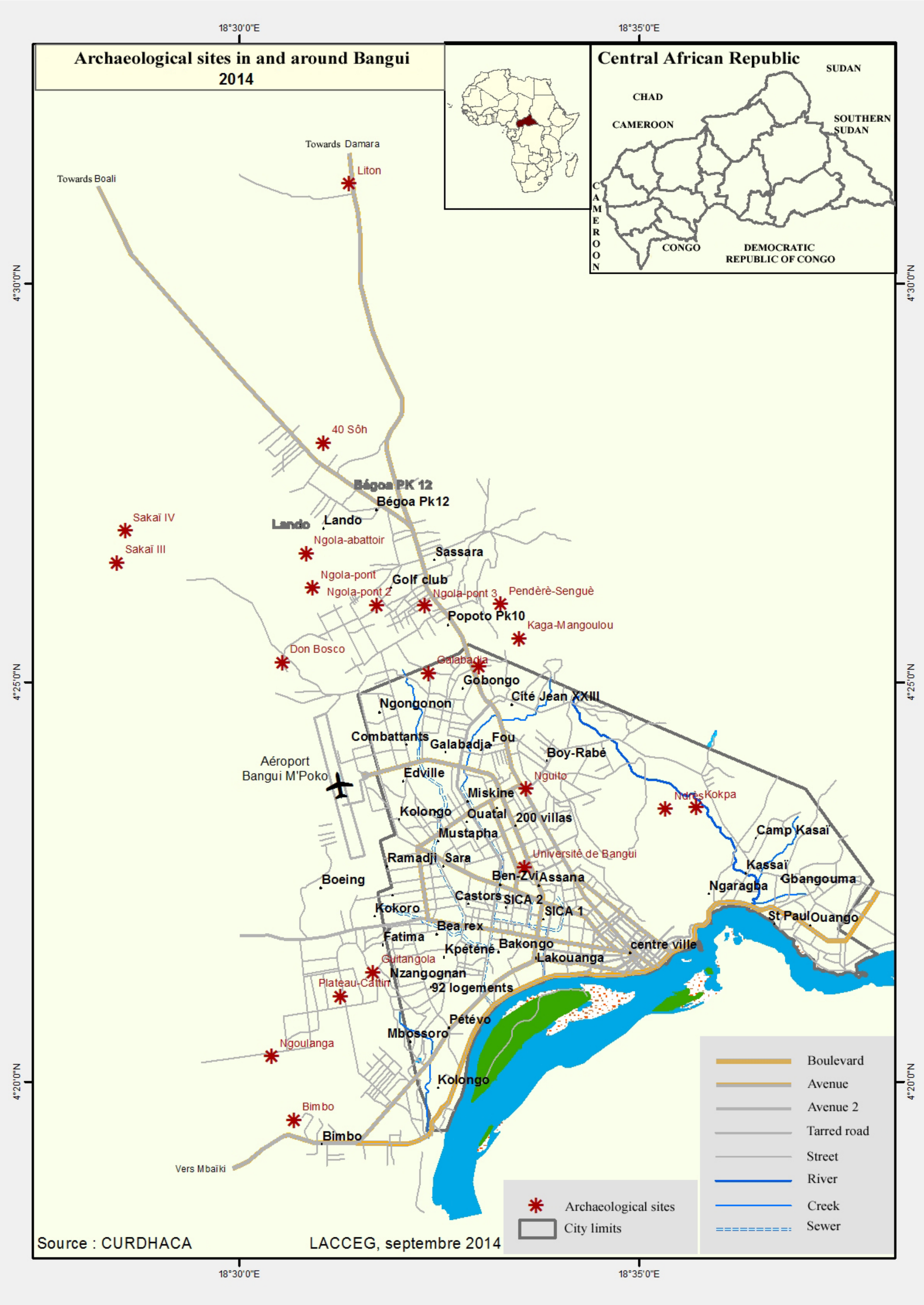

Fig. 1. Archaeological sites in Bangui and surrounding areas.

Fig. 2. (**a**) Bimbo, one week after discovery; (**b**) Bimbo today. (Photos © J.-P. Ndanga.)

discovery and a close reading of the ground. The extent of the site is assessed by the distribution of pieces on the surface or embedded in the talus of roads, as is the case on the sites of Sôh, Bimbo, and Ngola.

A. A lithic quartz industry in Sôh

The Sôh site was found in 2005. Easily accessed, it sits in a new development in the city's northern suburbs. It is located three kilometres from the PK 12 district on the Bangui-Boali road. The discovery occurred following the use of bulldozers to score the ground, sometimes deeply. The lithic pieces uncovered were on and around a residual mound along the eponymous River Sôh.

Three major clusters of quartz flakes were discovered at the site, two above and one to the east of the mound. The eastern cluster consisted for the most part of debitage, ceramic, and a polished shale-rock axe. All were embedded in the wall of the talus.

In addition to the lithic pieces, two small laterite slabs with holes were also found on and at the foot of the mound. The first, located 100 metres from the deposit of the lithic materials described, has a dozen randomly distributed holes. The widest of these are about 15 cm deep and 33 cm in diameter, and the sides are carefully polished. The second slab has 11 holes, of which five are arranged in a cross, and six in a line. These are physically similar to the others, but noticeably smaller.

B. Bimbo: archaeological remains in the roots of a fallen tree

This site sits at the southern exit from Bangui, about 300 metres north of the police checkpoint known as PK 9 Bimbo. The site occupies the left bank of the Mpoko, near housing for Catholic nuns. Trees such as *Terminalia superba, Cola gigantea, Triplochiton scleroxylon, Musanga cecropioïdes, Ceiba pentandra* and so on have survived here, relics of a cleared forest. The discovery of the site was serendipitous in more than one respect.

In fact, an uprooted *Ceiba pentandra* (a kapok) made it possible to identify artefacts (ceramics, iron slag, river shells, and animal bones) that were present in the roots of the fallen tree. A close inspection of the zone led to the discovery nearby of large pottery fragments and bones uncovered by hoeing. This open-air site is spread over an area measuring 1.5 kilometres long and 800 metres wide, at least according to what is visible on the surface. A week after it was discovered, the tree which led to the discovery burned. If the surveyors hadn't been there at the right time, it would have been difficult to detect the site, which is located in a rural area. In fact, rescue excavations are automatically scheduled, for two main reasons:

- the site is threatened by ploughing (which disturbs the site's surface layer); and
- cultivation of the fields might limit future activities.

At present, the excavated area and the rest of the site are completely occupied by new construction (**fig. 2**).

C. The iron furnaces of Ngola

Surveying the banks of the Ngola, which crosses several neighbourhoods in the western part of the city, led to the discovery of four iron production sites. Only the first will be described. Called Ngola-Pont, it is located 200 metres south of the bridge leading to the PK 12 district. The discovery of a single smelted iron slag led to a more intense

Fig. 3. Ngola-Pont: slag heap on a low mound; the black arrow indicates the furnace. (Photo © J.-P. Ndanga.)

survey of the area based on this initial discovery (**fig. 3**).

An iron working area is generally found within one hundred metres of the first slags encountered, and indeed, the uppermost ring of the furnace was found near a house and within fifty metres of the first iron slag found. It rises eight centimetres from the ground and is partially deteriorated; the clay wall is six centimetres thick, and the diameter of the circle is 70 centimetres. There is a slag mound adjacent to the furnace.

Construction of a house has damaged two structures, causing partial deterioration of the slag heap. No other elements of the metallurgic workshop are visible because housing in the area is extremely dense.

IV. METHODOLOGICAL ADVANTAGES AND LIMITS

The advantage of this method is the ease of access to the survey areas and later to the discovered archaeological sites. Mobility is facilitated by urban transport and the general cost of operations represents a small fraction of the Institution de recherches archéologiques centrafricaines's[3] finances. This proximity also allows rapid intervention, such as rescue excavations, if needed. Archaeology students have a field school at their disposal and training is less costly.

These archaeological sites are nevertheless under immediate threat from human occupation and its associated activities affecting the space. The presence of a site on private property is often the subject of endless discussions with the location's owners, who may refuse the team permission even to take photographs of visible artefacts. Worse still, the digging of a test pit must sometimes be interrupted, which is extremely frustrating for the archaeologists. Further activities, such as excavations, often depend on the perspicacity of archaeologists and the relations they are able to establish with the landowner. It should be noted that there are often no laws governing the subject, and those that do exist tend to be unfamiliar to the average citizen.

CONCLUSION

As the example of Bangui proves, the African urban environment is conducive to archaeological development and in particular to the practice of on-foot surveys. It is essential to be familiar with the place and to persevere. It is highly desirable that investigators have a good grasp of the physical appearance of artefacts commonly encountered in these places (lithic material, ceramic shards, metal slag, etc.), especially when these are scattered across a complex landscape. Open areas between the houses of urban areas are places with a good deal of potential for archaeological discovery.

REFERENCE

Ndanga, A.J.-P. 2008. *Nouvelle campagne de prospections et de sondages archéologiques dans la zone de la boucle de l'Oubangui*. Bangui: CURDHACA, Département d'Archéologie et de Paléontologie.

3 Institution of Central African archaeological research.

CASE STUDY: RAINFOREST

Manfred K. H. Eggert

INTRODUCTION

It is a truism that the equatorial rainforest is characterised by intense vegetation. And it is another truism that dense vegetation constitutes a major obstacle for archaeological research. The 'visibility' of material remains and structures from the past or, rather, their potential of being visible, is of crucial importance wherever archaeological fieldwork is intended. In contrast to densely settled areas in more or less open landscapes, be it in Central Africa or in Central Europe, rainforest habitat all over the world is almost by definition inimical to archaeological research.

Given this, it is not surprising that the Central African rainforest constituted, until the late 1970s, the last immense inner-African territory which was virtually unexplored archaeologically. In geomorphological terms, the equatorial rainforest of Central Africa is largely equivalent to the inner Congo Basin, the better part of which belongs to the Democratic Republic of the Congo ('Congo-Kinshasa') and the Republic of the Congo ('Congo-Brazzaville'). The present distribution of the evergreen tropical rainforest extends over about 2,500 km west-east and 1,600 km north-south and thus amounts to approximately 8% of Africa's surface. In 1990, its coverage was estimated at c. 2.04 million square kilometres which means that it has decreased to about 51% of its maximal extent of about 3.95 million square kilometres between 8000 to 5000 BP (Wilcox 1995). Since a rather detailed paper on the current state of Central African rainforest archaeology has been published recently (Eggert 2014), the following will concentrate on some basic aspects which are determinant for archaeological fieldwork in the forest.

There might have been other reasons than the low archaeological visibility that led to the fact that the Central African rainforest remained an archaeological *terra incognita* for so long. First of all, the internal political situation in both Congos after independence in 1960 very often was not favourable for systematic and prolonged research. Furthermore, until the late 1970s there were hardly professional Central African archaeologists and the very few who, after obtaining an academic degree in Europe or North America, returned home were not provided with any funds for archaeological field projects if they had a paid job in the administration or universities at all. As to European or North American archaeologists, some may have refrained from an archaeological engagement because of general equatorial climatic conditions or specific Western perceptions of forests as 'the shadow of civilization' (Harrison 1992; specifically for the Central African rainforest see Eggert 2011).

Be this as it may, it is idle, in our context, to give further thought to this, not least since the last two points, though they may have played a certain role, will not stand

Fig. 1. The drainage system of the Congo River (adapted from G. Laclavère (dir.). 1978. *Atlas de la République du Zaïre*, series 'Les Atlas Jeune Afrique'. Paris: Éditions Jeune Afrique, p. 11).

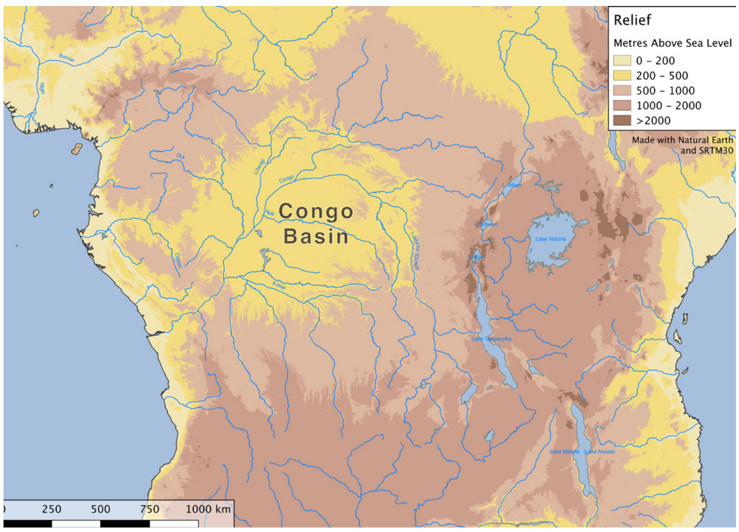

Fig. 2. The Congo Basin (adapted from R. Van Chi-Bonnardel (dir.). 1973. *Grand Atlas du continent africain*. Paris: Éditions Jeune Afrique, p. 27).

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Fig. 3. Fisher camp on the Ruki River near the village of Ikenge (Democratic Republic of the Congo). Former high water levels are marked by different colouring of the tree trunks. (Photo © M. Eggert.)

Fig. 4. Two archaeological features at the village of Munda on the Likwala-aux-Herbes River (Republic of the Congo). (Photo © M. Eggert)

the test. Rather, the following will be devoted to some strategic and tactical considerations concerning archaeological fieldwork in the Central African rainforest.

I. MAKING USE OF THE RAINFOREST'S CHARACTERISTICS

So far, I have stressed the difficulties with which any archaeologist striving for fieldwork is confronted in the evergreen equatorial rainforest. There are, however, some fundamental positive circumstances as well. As a glimpse at a hydrographic map will show, lowland rainforests are characterised by a multitude of watercourses and sometimes even lakes, both of varying dimensions (**fig. 1**). As for the Congo Basin, it shows a gentle relief of roughly 20 to 40 m (**fig. 2**). It is linked to the many rivers, lakes and creeks as well as swamps and seasonally induced inundation zones in such a way that the topography alternates between zones of low-lying land and more elevated surfaces. Due to the annual fluctuation of the intensity of rainfall, the water levels rise and fall in keeping with the season. Accordingly, the difference between the highest and the lowest water level often amounts to about 3 m, if not more (**fig. 3**).

Year-round settlement along rivers and lakes necessitates sufficiently high banks to protect the villages against rising water levels during the rainy season. Therefore, low-lying territory, that is, land subjected to seasonal inundation, harbors only a very limited archaeological potential, if any. Some activities, particularly intense fishing and the smoking of the fish takes place during the great dry season in provisional fisher camps sometimes erected on poles within the inundation zones of rivers (**fig. 3**). At such places, relics of some ancient occupants may be found by the archaeologist, but the chance for it is necessarily very low.

In view of the predominant non-visibility of vestiges of archaeological interest in the forest, successful fieldwork is dependent on open spaces. These are available wherever permanent settlements are present. In Central African villages, be they on rivers and lakes or in the hinterland, most of the surface between and around wattle and daub huts and mudbrick houses are kept devoid of vegetation, mainly for fear of snakes. Moreover, these surfaces are exposed to often torrential rains in the wet season which leads to constant erosion. This in turn provides an excellent opportunity for the archaeologist to detect not only material relics like ceramics or stone tools, but also structures resulting from excavations in ancient as well as more recent times. These excavations may have served, for example, for the fixing of house poles, as burials, that is for the deposition of human corpses, as well as for pits of all kinds (e.g. rubbish pits vs. pits as cultic depositories of objects, particularly ceramics). Whatever the function of such structures may have been, they clearly stand out from the surrounding soil by their different colour and, very often, fragmented ceramics and burnt clay (**fig. 4**).

As far as rivers are concerned, archaeological potential is linked to more or less steep banks. Here again, the specific climatic conditions of the tropical forest result in constant erosion of river banks. Wherever villages were once installed on these banks, but have long been

Fig. 5. Pit with ceramic vessel in the bank of the Likwala-aux-Herbes River (Republic of the Congo). (Photo © M. Eggert.)

Fig. 6. The Baleinière on the Likwala-aux-Herbes River (Republic of the Congo). (Photo © M. Eggert.)

abandoned since, their traces are potentially visible in the banks's profile (**fig. 5**). Evidently, the same is true for villages that are still existent.

II. RESEARCH STRATEGIES

Generally, we may differentiate between an intensive and an extensive research strategy. Any decision between the two is contingent on the archaeological questions to be resolved. As far as the inner Congo Basin in the 1970s was concerned, the most pressing question of all resided in the fact that this vast territory constituted an archaeological *terra incognita.* There, not even a very rough relative chronology was established, let alone regional sequences, their interrelationships and their position according to an absolute timescale. Under these preconditions it would obviously have been rather futile to opt for an intensive strategy.

However, when I started fieldwork in 1977, I had no logistics let alone any firmly established research base to rely on. Consequently, field equipment had to be limited to the absolutely necessary in order to conduct some reconnaissance work and test excavations. The sphere of activities was limited to an area of about 60 kilometres on the Ruki River, which is one of the main left tributaries of the Congo River. Mobility was assured by a *pirogue* (dugout canoe). Necessarily, the results of this first six-month field campaign of 1977-1978 were quite interesting on the mini-regional level, but virtually non-existent on the broader scale. It became evident that a reliable logistic infrastructure was imperative to surmount the extremely regional or even local bias. The basis for this was realized within the next six-month campaign of 1981-1982 and 1983. On the one hand, the missionary order M.S.C (Missionaires du Sacre-Cœur or Missionaries of the Holy Heart), especially Father Honoré Vinck, was of great help in furthering our plans. On the other hand the Société industrielle et forestière zaïro-allemande (SIFORZAL, then of the Karl Danzer Group at Reutlingen in Germany) was vital in terms of technical and logistic support (e.g. in supplying large quantities of gasoline for outboard motors).

With the end of the 1983 field season the basic outline of what became to be called the 'River Reconnaissance Project' was established and its practical utility tested. Our team had a wooden boat with an overall length of about 18 m and a maximum width of 2.5 m encompassing a gross tonnage of roughly 20 metric tons. This boat, locally called *baleinière*, was spacious enough to house a team of seven people over an extended time period as well as to accommodate not only the necessary equipment but also a maximum of 3,600 litres of gasoline (**fig. 6**).

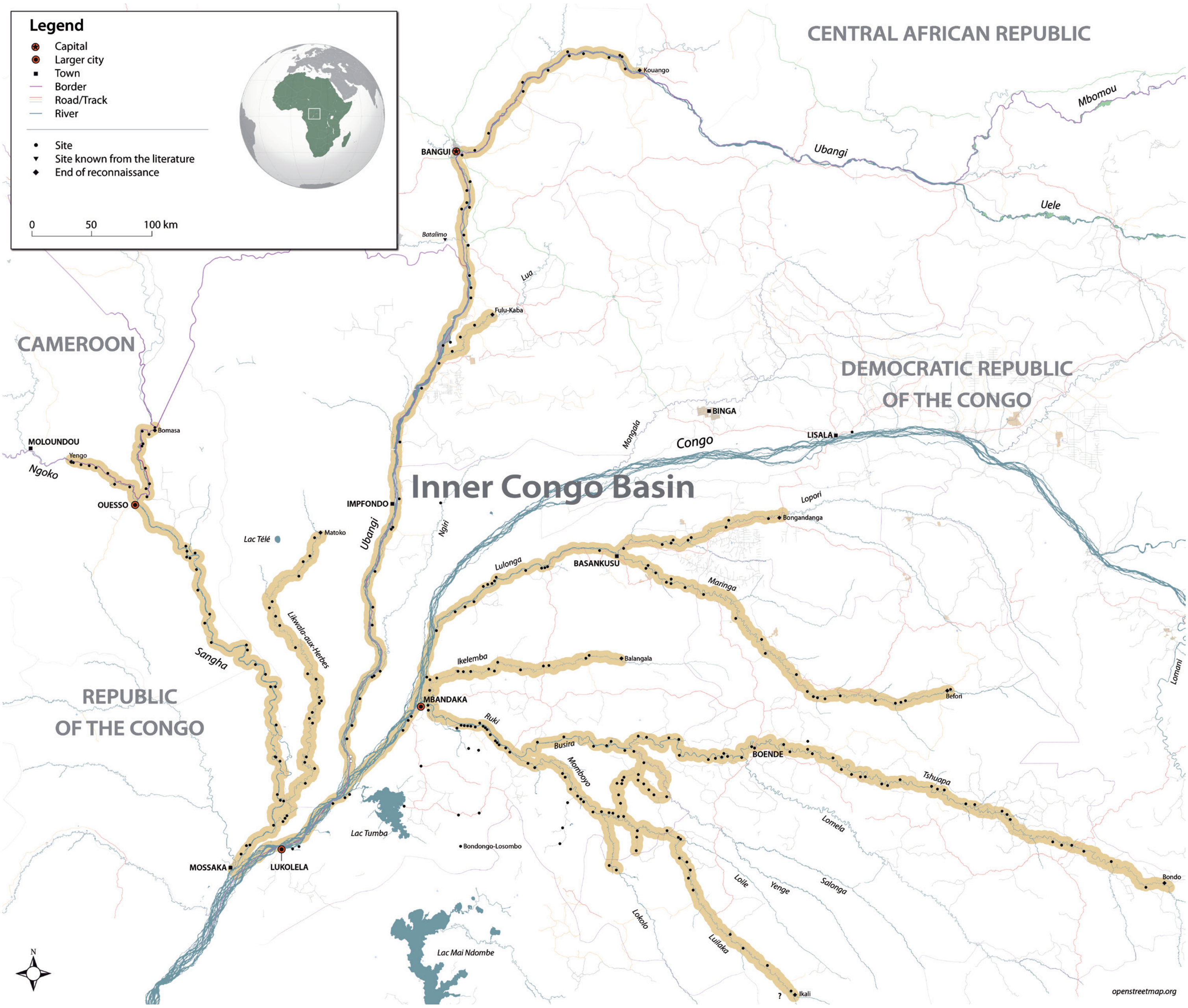

Fig. 7. Rivers in the Congo Basin explored by the 'River Reconnaissance' Project. (© M. Eggert.)

It was propelled by a 25 HP outboard motor which allowed a maximal speed of approximately 8.5 km/h upstream and 16 km/h downstream. Another motor of the same power was mounted on a dugout which served for inspection of village surfaces and river banks whenever the opportunity arose. In the meantime, the *baleinière* was steadily moving on. Finally, in 1985 and 1987, we even had radio contact between the two units.

With the tactical base of the River Reconnaissance Project firmly established in 1983, the procedure to follow offered itself. While going upstream in the archaeologic exploration of some of the major tributaries of the Congo River, a reconnaissance of as many prospective places as possible was effected. On this basis, those offering the greatest archaeological potential were chosen for surveys and small-scale excavations on the way downstream (see Eggert 1983 on this).

III. RESEARCH RESULTS AND EVALUATION

Within ten years of fieldwork and five six-month campaigns in the inner Congo Basin (1977 through 1987), a number of major tributaries of the Congo R. were prospected and a basic and regionally differentiated sequence of ceramics groups as well as their relative and absolute position in time was established (see Eggert 1993, 2014; Wotzka 1995). Looking back, it is obvious that implementing an archaeological survey over so vast a territory in so short a time was only possible in using the waterways in much the same way as the early European explorers did. The overall distance covered by our project amounted to some 5,000 river kilometers (**fig. 7**).

In summary, it can be stated that our expectations of the River Reconnaissance Project were met. Nevertheless, it is important to realize that the archaeological insights thus gained are necessarily river-centred. Our very few surveys into the hinterland by means of bicycles and motorbikes did in no way balance this bias. However, we started out from the conviction that in a vast region which hitherto represented a blank on the archaeological map one ought to try to establish age-area schemes, that is, regional cultural sequences on the basis of the archaeological material at hand (in our case ceramics). These sequences will eventually serve as a backbone for more comprehensive as well as more detailed studies of a local as well as regional focus.

In a ‘survey of surveys’ in sub-Saharan Africa, John Bower devoted some space to our survey strategy (Bower 1986: 34-36). His very thoughtful and well-reasoned critical remarks on our sampling procedure and other aspects deserve attention, although they are not always relevant to the conditions of fieldwork in the equatorial forest and the aims pursued. In apparently realizing this himself, Bower is somewhat vacillating between the pure doctrine of site definition and sampling procedures on the one hand and the insight into the problem of locating archaeological sites in the forest at all. Nevertheless, his contribution stands out in that it is, at least to my knowledge, the only critical commentary on our project at all.

As I stated about 20 years ago in the context of Bower’s remarks, our waterborne river reconnaissance, for all its methodological simplicity, has allowed us to explore a very important part of the major rivers in the inner Congo Basin (Eggert 1993: 296). Much more fieldwork in the Congo Basin was intended. However, for political as well as for professional reasons, our archaeological commitment to fieldwork in the Congo Basin of then-Zaïre (now DR Congo) came to an end. It was only from 1997 through 2008 under much more comfortable circumstances and with a totally different strategy that our rainforest research was resumed, but now in southern Cameroon. In getting this started, my old friend Pierre de Maret with his project Avenir des Peuples des Forêts (APFT) was of vital importance in that he provided me with the necessary research facilities in Yaoundé from 1997 through 1999. But that’s another story.

REFERENCES

Bower, J. 1986. ‘A survey of surveys: Aspects of surface archaeology in sub-Saharan Africa’. *The African Archaeological Review* 4: 21-40.

Eggert, M. K. H. 2014. ‘The archaeology of the Central African rainforest: Its current state’. In C. Renfrew & P. Bahn (eds). *The Cambridge World Prehistory*. Vol. 1. New York: Cambridge University Press, pp. 183-203.

Eggert, M. K. H. 2011. ‘Der “Urwald” als Lebens- und Projektionsraum: Das innere Zentralafrika’. *Saeculum* 61 (1): 161-187.

Eggert, M. K. H. 1993. ‘Central Africa and the archaeology of the equatorial rainforest: reflections on some major topics’. In T. Shaw, P. Sinclair, B. Andah & A. Okpoko (eds). *The archaeology of Africa: Food, metals and towns,* series ‘One World Archaeology’. London: Routledge, pp. 289-329.

Eggert, M. K. H. 1983. ‘Remarks on exploring archaeologically unknown rain forest territory: The case of Central Africa’. *Beiträge zur Allgemeinen und Vergleichenden Archäologie* 5: 283-322.

Harrison, R. P. 1992. *Forests: The shadow of civilization*. Chicago and London: University of Chicago Press.

Wilcox, B. A. 1995. ‘Tropical forest resources and biodiversity: The risks of forest loss and degradation’. *Unasylva* 46 (181). htpp://www.fao.org/docrep/v5200e/00.htm

Wotzka, H.-P. 1995. *Studien zur Archäologie des zentralafrikanischen Regenwaldes: Die Keramik des inneren Zaïre-Beckens und ihre Stellung im Kontext der Bantu-Expansion*. *Africa Praehistorica* 6. Köln: Heinrich-Barth-Institut.

FIELD SURVEY IN THE SAHEL: AN INFORMAL GUIDE

Kevin MacDonald[1]

I. BEFORE YOU GO INTO THE FIELD: REMOTE SENSING

Fieldworkers in the African Sahel will be undertaking their survey in situations of relatively good surface visibility. This means that it is possible to employ 'remote sensing' prior to embarking for the field by analyzing aerial photos and satellite images.

Aerial photos can be examined at, or purchased from, a national Geographic Institute, the IGN in Paris or the UK National Collection of Aerial Photography. These were usually made around 1960, are in black and white, square in shape and cover relatively limited areas of ground, with each image representing roughly 8 by 8 km. They normally come in pairs (with consecutive code numbers). These pairs are slightly offset so that they can be placed beneath a stereoscope and seen in three dimensions. This feature, although antiquated today, can be a very good way for seeing the rise and fall of topography – making it easier to spot settlement mounds. For all the advantages of satellite imagery, this is something which they do not provide. Once you locate mounds and other surface features you can trace them onto calque (tracing paper) and make composite plans of the landscape, including geographic features like watercourses, villages, areas of acacia scrub, etc. A mixed blessing of old aerial photos is their very age: they show you what the landscape looked like in 1960. On the negative side villages could have moved or expanded and road networks changed; on the positive side you may see sites which are now obscured or partially destroyed by development (**fig. 1**).

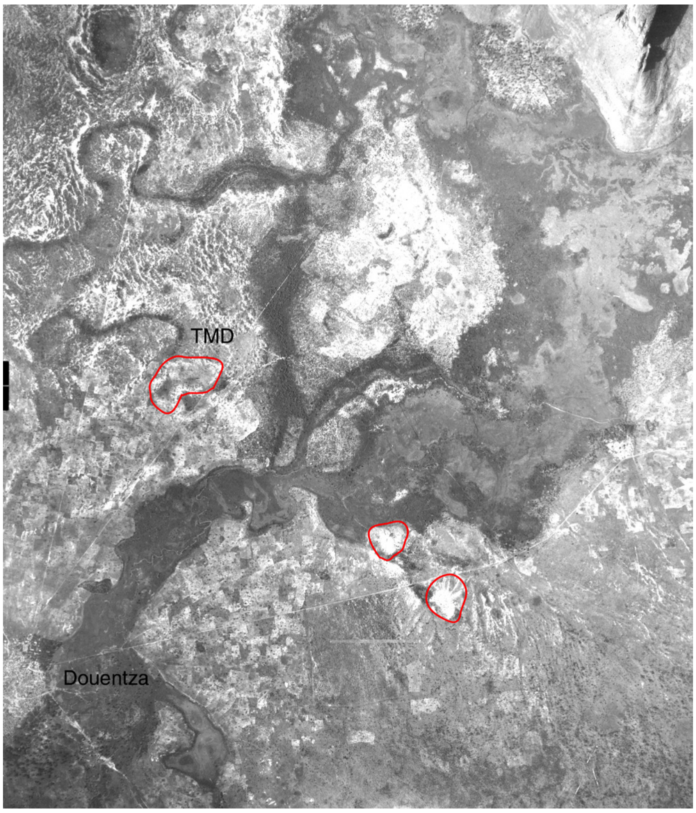

Fig. 1. Example of IGN aerial photo of 1960 showing Douentza, Mali and a fossil drainage system to the north of it. Tell sites, including Tongo Maaré Diabel (TMD), are outlined in red. Note that TMD is rather difficult to distinguish; only revealed by the light bands of sand built up at its flanks. The other tells, with less vegetative cover are easier to see. Viewed as stereo pairs all three of the tells 'pop up' quite nicely. (1960 IGN aerial photo adapted by K. Macdonald.)

Modern satellite imagery is provided through free online services like Flash Earth or Google Earth. Custom-produced satellite imagery can be purchased from various agencies (such as QuickBird) which may have higher resolution and availability in a range of bandwidths (including infrared). Satellite imagery has the advantage of being in colour, which makes some landforms (like wood cover) easier to identify. On sites such as Google Earth they are usually up-to-date and images may exist for different times of the year, offering useful contrasts in vegetation and hydrology. Also key towns are usually marked as points of reference and wherever your cursor is can supply you with coordinates (longitude and latitude) which you can record

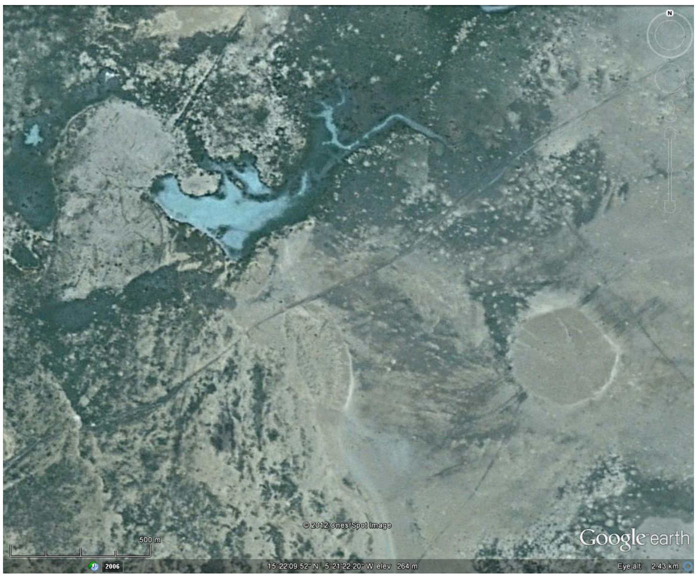

Fig. 2. The tell sites of Kolima, Mema region, Mali. As there is very little vegetation in this region the mounds are relatively clear – this is not often the case. Image via Google Earth.

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Fig. 3. The 18th century capital of Segou Ton Masala as viewed via Google Earth.

Fig. 4. Vehicular Survey in the Mema (1989), Crossing a Palaeolake, observer atop the vehicle. (Photo © MacDonald.)

and match up on the ground with a handheld GPS. Satellite images are, however, rather one dimensional and the settlement mounds you are looking for may blend into the landscape and become difficult to pick out. Larger mound complexes are sometimes visible by the drainage patterns which work their way down the sides of the mounds (though this is also the case for hills!). Alternatively, artefact density may inhibit vegetation growth (leaving distinctive visual patterns) and decaying mud architecture (once tempered with laterite) may appear on the photos as dark red brown patches (**fig. 2**). More recent sites – especially the walled sites of the 18th and 19th century – are often incredibly clear (**fig. 3**).

Whichever remote sensing option you choose, it is wise to spend some days or weeks before your survey carefully going over imagery and selecting sites to visit. If using satellite imagery, you can record the coordinates of each suspected site and also print out views of your survey area, marking potential sites, for consultation in the field. If using aerial photos, make the traced overlays, being careful also to include key landmarks and points of reference which will allow you to situate yourself by taking compass bearings or odometer readings from point to point with your survey vehicle.

If it is at first difficult for you to discern sites in your chosen survey area, an initial field visit and the identification of a few sites on the ground may help afterwards to recognize these on the imagery.

II. PRACTICALITIES: SURVEY OPTIONS

The practicalities of your survey will be dictated by a number of factors: the openness of the terrain, and the dimensions of the area that you wish to survey and the availability of a 4x4 survey vehicle. If the landscape is relatively open you can cover an incredible amount of ground using a vehicle. If the terrain is hilly or covered with high grass or trees then foot survey will probably be your only option. Foot surveys do well in limited zones (e.g. 5 by 5 km in size). If you wish to traverse a vast area, e.g. transects of 25 km or more in length (see Togola 2008), and your region is safely traversable with a 4x4, then vehicular survey becomes a viable option (**fig. 4**).

A. Foot survey

This type of survey is best undertaken in groups, for maximum coverage and safety. Generally, such surveys begin at a fixed point, with each surveyor spaced out within maximal visual distance of one another (50 m or 100 m). One person at the end of the row of surveyors is the guide holding a handheld GPS, or at least a good pocket compass, to make sure that they stay in a straight line. If the other surveyors keep a consistent distance from this person then it is possible for a team of four trained individuals to cover an area of 500 m wide by 5 km of distance in a morning. The size and type of sites being sought, as well as ground cover, will dictate whether or not a 100 m spacing is excessive or not – this gap may need to be modified accordingly. A vehicle can either pick up the group at a pre-arranged point at the end of the transect, or the surveyors can move single-file to their left or right to ‘paint’ another 500 m wide transect on the way back to their start area. An alternative form of survey is the ‘radius’ or ‘dog leash’ survey – in which surveyors walk in a widening or narrowing arc around an easily visible central point (a town with high buildings, an inselberg or a large settlement mound for example).

B. Vehicular survey

This type of survey requires a good driver, a navigator and a spotter. The navigator rides beside the driver with a GPS (or in a worst case scenario with a vehicular or boat compass – never a pocket compass which will be hopelessly skewed by the magnetic field of the vehicle!). It is the role of the navigator to keep the driver on course as you move along very slowly at 10-20 kph. The spotter rides atop the 4x4 and calls for the driver to stop if a point for investigation is sighted. This may seem a health and safety nightmare, but in the more open areas of the northern Sahel this works very well, and sites (whether lithic scatters reflecting in the sunlight) or settlement mounds are routinely visible from 200 m or more from atop the vehicle. It helps to have way-points to steer for and to verify that you are 'on course' (villages, elevations, etc.) but in the desert one must really trust the GPS!

When using a vehicle in more heavily vegetated areas – you can tailor your transects to move along cart-trails. This is not entirely satisfactory, as you are then constrained by how people move around the modern landscape – but it does allow you to cover long pathways quickly, provided there is enough surface visibility for you to still see sites from the top of the vehicle.

The type of survey that you undertake is guided by a variety of factors. You may wish to randomly and systematically survey landscapes. In this case you will conduct a 'stratified sampling', selecting comparable segments of different geographic zones (e.g. floodplain, hilly areas, different distances from watercourses, etc.). The specific survey blocks might be randomly chosen, or focused on areas where your remote sensing turned up the largest number of prospective sites.

Alternatively you may do a 100% remote sensing reconnaissance of your survey region and then verify out in the field the putative sites of which you recorded the coordinates on your GPS. There is however a risk that you will utterly miss site types not visible remotely unless you also build in some forms of systematic transect survey to your plans.

Finally, there are some regions where high ground cover and local sentiments may prevent you from working systematically on the landscape at all. Villagers may not like to have you wandering across their fields or traipsing over sacred sites without their permission. In more traditional and densely farmed landscapes one may have to work from village to village, doing what is sometimes called a locally-led survey as explained in the chapters by Nic David and by Hans-Peter Wotzka.

III. WHAT IS A 'SITE'? WHAT TO RECORD AND COLLECT

The definition of what constitutes an archaeological 'site' as opposed to isolated surface finds is often contentious. Generally speaking, a site is a place where focussed human activity took place over an extended period of time – at the very least a campsite or tomb – and not just a place where a pot was broken or a tool dropped. One minimum definition which I have used is that it contains at least 10 different artefacts (not all fragments of the same object) in a 10 by 10 m area. If such a grouping is not associated with physical features or clear stratification (mounding or erosion from a cut) it is recorded as a **scatter**. Other site categories would include **unstratified habitations** (flat sites with surface features indicative of settlement – hearth stones, granary bases, stone architecture), **settlement mounds and/ or middens** (some relief caused by deposit build-up, with eroding artefacts and surface features), **metal working or smelting sites** (with traces of slag mounds or furnace bases), and **burial monuments** (eroding cemeteries, stone or earthern tumuli). These comprise the bulk of site types encountered, though more idiosyncratic localities (e.g. ritual/cult localities and rock art) do occur and any site typology must remain flexible.

When you arrive at a site, make certain baseline observations:

- a GPS coordinate reading at the approximate centre of the site;
- dimensions across two axes of the site (usually N-S and E-W). This can either be determined with your GPS or by metre pacing (adjust the length of your step to this long stride by practice using a metre tape laid on the ground). This can be used to make an estimate of the site's size in hectares later;
- a brief description of the site: what kind of locality it is, the amount of vegetation cover, its approximate height and any visible surface features;
- a brief description of the surface artefacts encountered, including the full range of different types of material (ground/ chipped stone, pottery, metal slag, metal objects, animal or human bone, etc.);
- a summary of local traditions about the site;
- photo numbers taken of the site on your camera.

It helps if you have a registry sheet for each site to prompt you to record the basic information (see Lane, this volume, pp. 84-85).

If you have more time, for more important localities, you should also make a sketch plan of the site and record a representative sample of artefacts. The sketch plan may be aided by any aerial/satellite images you have brought along with you, or by walking the boundaries of the site with your GPS 'track' mode switched on. If you set your GPS to give grid coordinates rather than latitude and longitude, you can more easily transfer your plan to graph paper and add in the locations taken of any features that occur within the site.

When collecting diagnostic artefacts for quantification and comparison with other sites, there are at least two ways to make your collection. The first is a systematic collection of all pottery rim forms. A sample of 50 to 100 is a minimum for comparative work. The second approach is to lay out a collecting square on the ground using metre tapes: 5 by 5 m or 10 by 10 m are good sizes depending on artefact density. Then, gather all sherds and worked stone artefacts within such collecting squares, with some size cut off for pottery (say, no sherds smaller than 2 cm).

Finally, it is worth considering just how much material you wish to remove from the site for future analysis. Such material has to be both carried and curated. Thus, you may choose to record sherds from your collecting square while on site. This consumes more time, but you have to do it eventually anyway and it saves transport and curation.

Of course the analytical use that you make of all this information and material is another matter, and beyond the scope of this particular entry.

REFERENCES

Bedaux, R, Polet, J., Sanogo, K. & Schmidt, A. (eds). 2005. *Recherches archéologiques à Dia dans le delta intérieur du Niger (Mali) : bilan des saisons de souilles 1998-2003.* Leiden: CNWS Publications.

Ebert, J. 1992. *Distributional Archaeology*. Albuquerque: University of New Mexico Press.

McIntosh, S.K. & McIntosh, R.J. (1980). *Prehistoric Investigations in the Region of Jenné, Mali* (2 vol.). Oxford: British Archaeological Reports.

Raimbault, M. & Sanogo, K. (eds). 1991. *Recherches Archéologiques au Mali: Les Sites Protohistoriques de la Zone Lacustre*. Paris: ACCT/Karthala.

Togola, T. 2008. *Archaeological Investigations of Iron Age Sites in the Méma Region, Mali (West Africa).* Oxford: British Archaeological Reports.

ANCIENT POLITIES: ARCHAEOLOGICAL SURVEY IN A METROPOLIS AND ITS COLONY

Akinwumi Ogundiran[1] & Babatunde Agbaje-Williams[2]

INTRODUCTION

Africanist archaeologists have developed several methods of archaeological survey to answer a myriad of questions dealing with issues of social complexity and ancient polities – city-states, kingdoms, and empires. Such survey strategies have sought to account for the origins and evolution of polities, settlement and social hierarchies in a political landscape (e.g. Norman 2012), materialization of power (Monroe 2014), urban-rural networks (e.g. Fleisher 2010), structure of sociopolitical organization (e.g. McIntosh 1999), and political ecology of state formation (e.g. Sinclair 1987), to mention but a few. The physical attributes of the landscape often affect the survey techniques employed. In general, regional surveys have been implemented more in the savanna and Sahel landscapes with good to excellent ground visibility than in the rainforest belt. The latter has poor ground visibility. More than a coincidence, it is also the savanna-Sahel area that has enjoyed more funds to implement large-scale archaeological survey programs.

Many questions beg for attention in the study of ancient polities. It is therefore important to develop and deploy appropriate survey strategies that are amenable to the type of polity being investigated, the environmental context of its location, and the resources at hand. This chapter is about two complementary survey projects that sought to study the Oyo Empire in West Africa from two spatial perspectives: the metropolis and the colony. These projects shed light on the role of metropolis-hinterland interactions in the creation of the Oyo Empire.

The savanna-based city-state of Oyo launched its political expansionist program into the rainforest belt of Yorubaland between the last quarter of the sixteenth and the first quarter of the seventeenth century. By 1730, Oyo had become the largest political formation in West Africa south of the River Niger, stretching its arms across both the savanna and the rainforest belts, with a vast network of towns, villages, colonies, and kingdoms under its control (**fig. 1**). Until recently, archaeological investigations had concentrated on the imperial capital itself – Oyo-Ile – focusing on the questions of urbanization and demography (Agbaje-Williams 1983). Recent archaeological efforts have extended attention to the role of the outlying regions and provinces in shaping the rise of the Oyo Empire; the strategies of the imperial expansionist process; and the ways of consolidation that legitimized the power of Oyo in the conquered territories (Ogundiran 2012; Usman 2000). The archaeological survey strategies that have been used to address both topics are the subject of this chapter. The first to be discussed is the survey strategy for mapping the city of Oyo-Ile, the capital of Oyo Empire located in the savanna landscape. The second survey focuses on the Oyo colony that was established in the upper reaches of the rainforest belt (Upper Osun region) to advance the project of Oyo political expansion.

I. OYO-ILE: SURVEY

On the basis of the wall system identified from aerial photographs in the 1960, it was known that Oyo-Ile covered an area of more than 5,000 hectares at its peak in the mid-eighteenth century. However, the inventory and spatial distribution of archaeological surface materials, and their relationship to the natural environment, was not known. In 1978, the second author launched a survey strategy that would provide this information (Agbaje-Williams 1983). He sought to survey 10% of the urban landscape (the area within the Oyo-Ile wall system) using a systematic interval transect survey strategy. This meant dividing the archaeological landscape into surveyed tracts (transects) in west to east direction (**fig. 2**). Fourteen transects, with 500 m intervals, were established in order to achieve the targeted 10% coverage. The width of each transect line was kept constant at 50 m, and the surveyed team walked south to north at the mid-point of the transect line, using prismatic compass and metric tapes for recording. The length of each transect line was determined by the outermost walls. As a result, the lengths of the surveyed tracts varied between one and a half to ten kilometres.

Visibility and mobility were easy because of the grassland vegetation and the fact that the survey was conducted in the dry season. The surveyed area covered 525.25 hectares (of the total area of the capital within the walls: 5,252.5 hectares). Out of this, the compound-courtyard

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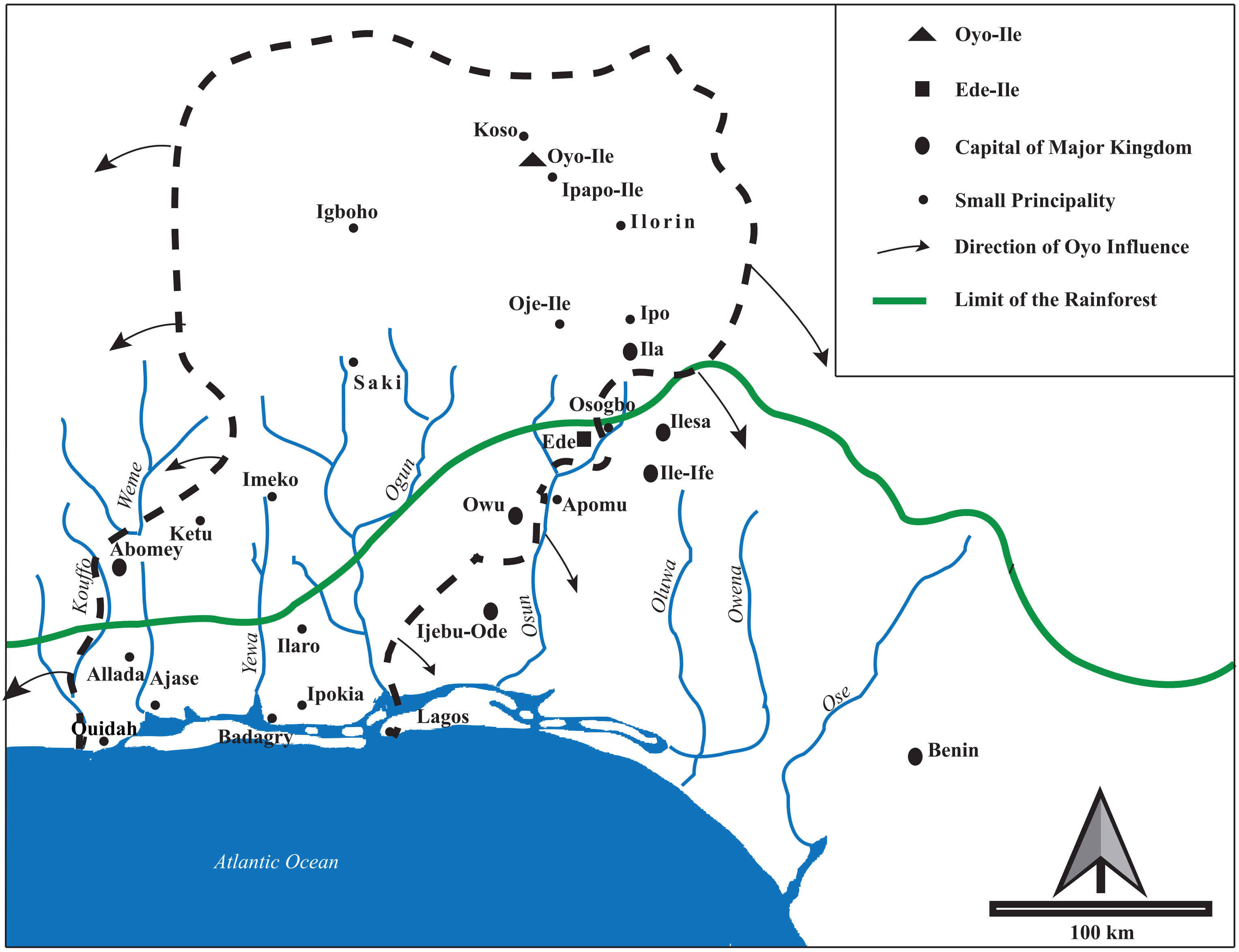

Fig. 1. Oyo Empire at its peak, ca. 1730. (© Ogundiran.)

structures were found to cover an area of 884 hectares (8,840,000 sq.m.), about 17% of the area within the walls. This was the main built-up area of the city. On the other hand, the surface distribution of potsherds extends beyond the residential area covering 1870 hectares, about 35.6% of the total area. As in other parts of West Africa's Sahel and savanna, baobab trees (*Adansonia digitata*) are ubiquitous at Oyo-Ile. The multiple wall system at Oyo-Ile – the palace (innermost) wall, main outer (defence, with deep ditch) wall, outer wall 2 (with shallow ditch), and the northeast and northwest walls – demonstrates a complex history of urban formation (**fig. 2**). At its peak, the ancient capital had a north-south dimension of 10 km while its east-west spanned 6 km.

The survey achieved three goals: (1) It led to the identification of the residential area, comprising mostly compound-courtyard structures (impluvium architecture), granary stone structures, a vast palace complex, a dug-out water reservoir, refuse mounds, as well as grinding stones and grinding hollows on rock outcrops. (2) It provided the spatial and density distribution of artifacts, mostly pottery. (3) It made purposive problem-oriented selective excavations possible because the provenance of many of the features is known.

II. EDE-ILE: SURVEY AND EXCAVATIONS

Although Oyo's metropolis was in the savanna belt, it was in the rainforest that Oyo-Ile scored its first major

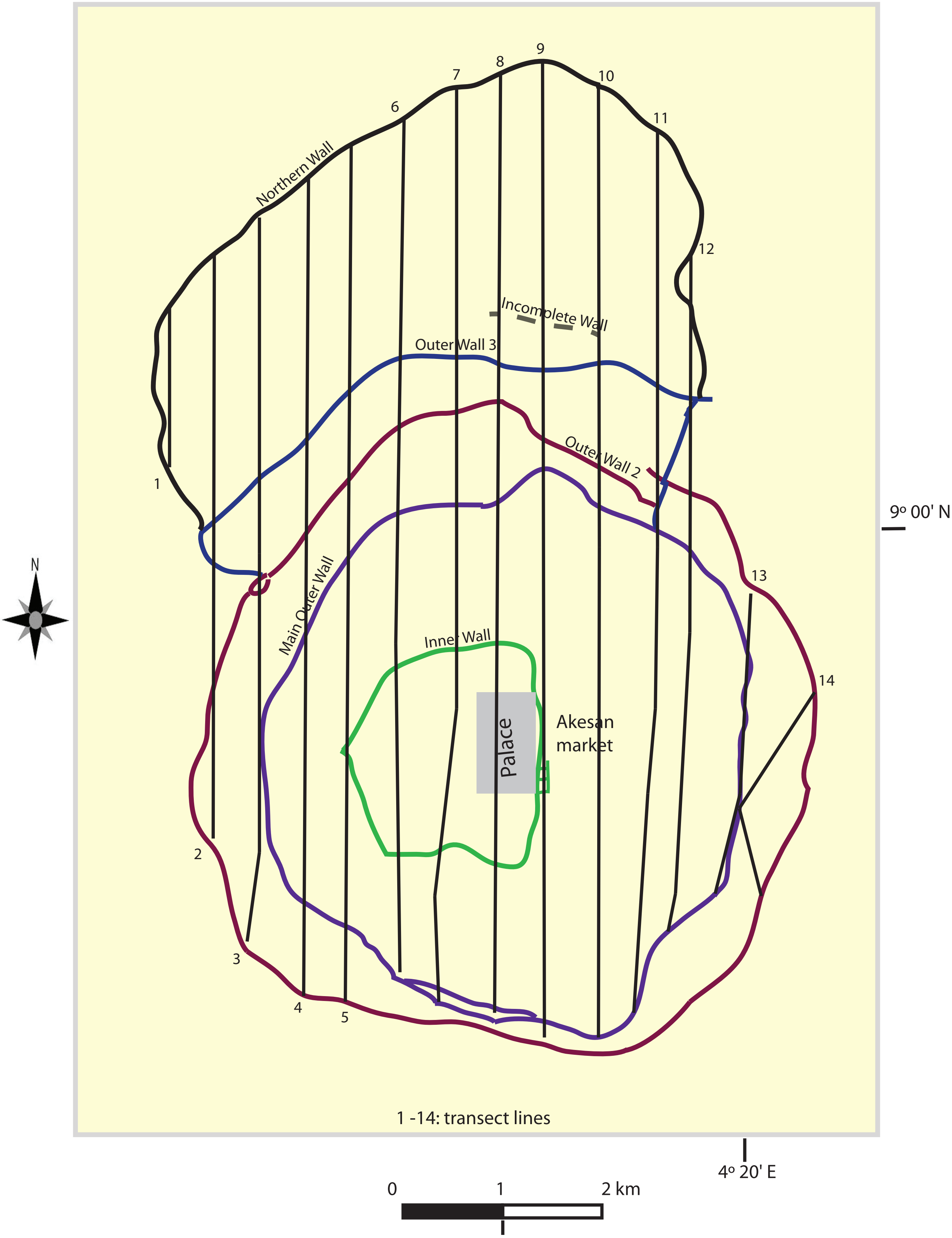

Fig. 2. Oyo-Ile wall system and survey transects, adapted from Agbaje-Williams 2005. (© Ogundiran.)

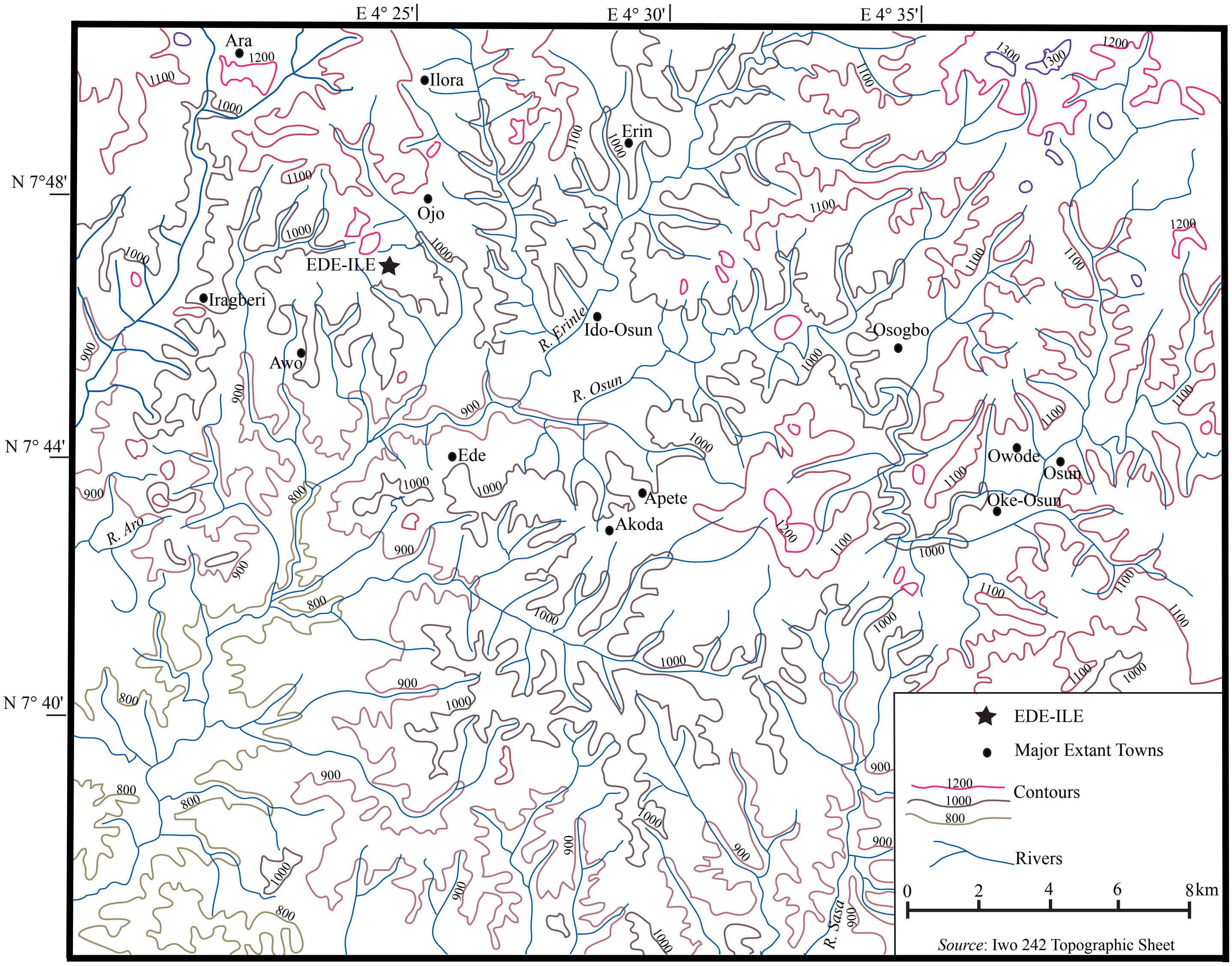

Fig. 3. Topography of a cross-section of Upper Osun. (© Ogundiran.)

success towards becoming an empire. It achieved this by establishing colonies on trade routes that linked the savanna hinterlands to the coast. The official oral traditions of the Oyo palace bards, popular imagination about the empire's history of origins, as well as folkloric representations of the empire's history point to one of these colonies – Ede-Ile – as the place where the march of the city state of Oyo-Ile towards imperial status began. However, this frontier town was abandoned ca. 1840 in the aftermath of the collapse of the metropolis and the empire in the 1830s. Finding this abandoned colony became important to the quest to understand the political, economic, and cultural processes that shaped the trajectories of the Oyo Empire during the late sixteenth through the early nineteenth centuries.

Most informants point to the area between the present-day Awo and Ojo towns as the location of the site (**fig. 3**). This is roughly a 24 sq.km. area with a mosaic of rainforest and derived savanna vegetation characterized by thick undergrowth that makes surface visibility and pedestrian survey difficult. However, a dedicated informant who was familiar with the area led the research team to Ede-Ile where we counted twenty-one standing baobab trees, and we noticed the massive number of ceramics on the surface that are very much the same as the ceramics (both in decorations and forms) at Oyo-Ile (Ogundiran 2012). On these two lines of evidence alone, we recognized that we were dealing with an Oyo-related settlement. Hence, we embarked on mapping the extent and archaeological features of the site in order to understand the settlement size, layout and activity areas at the time of its abandonment, as well as to guide the choice of sites for excavations. The archaeology survey strategy used a direct historical approach in the sense that two representatives

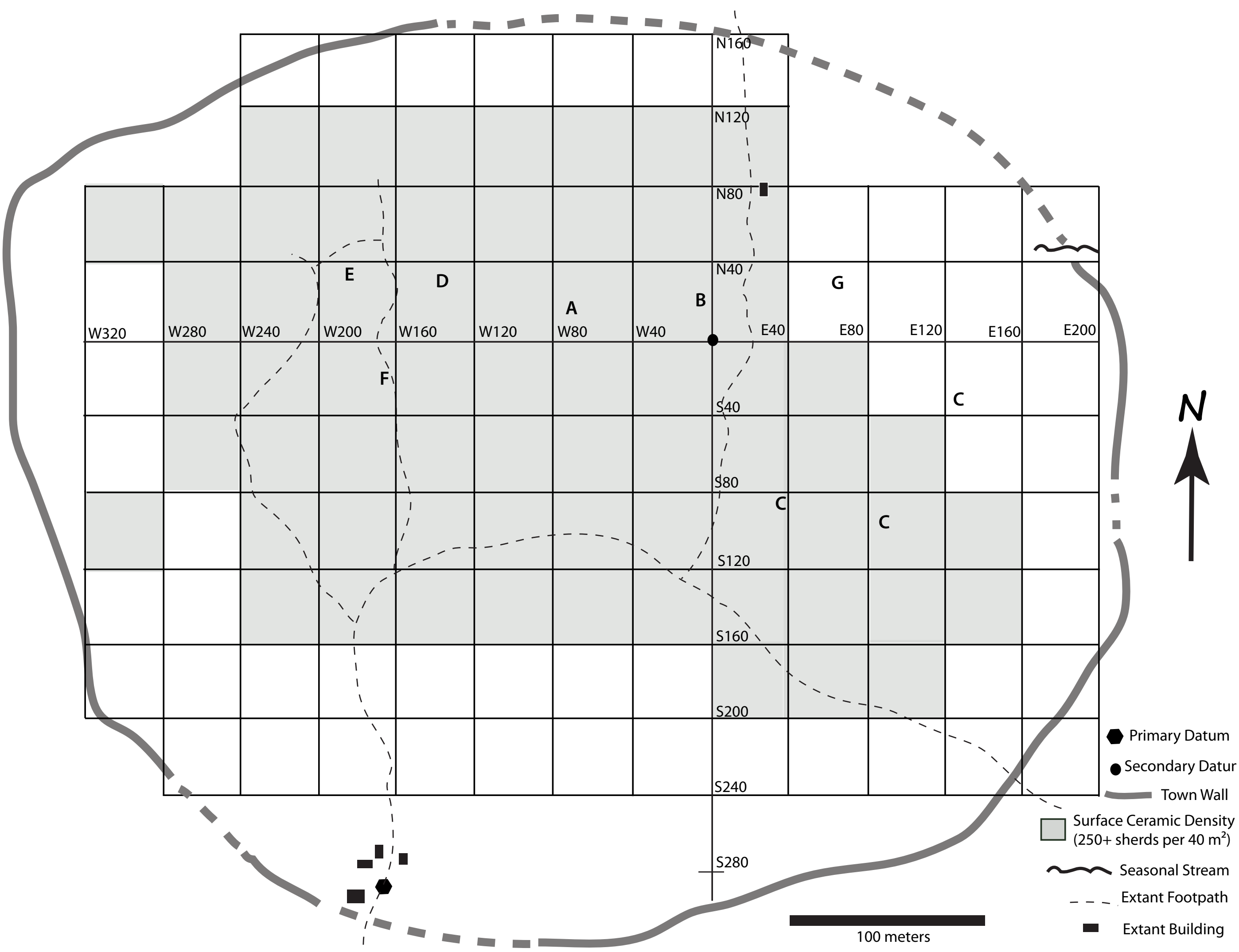

Fig. 4. Ede-Ile: site map. (© Ogundiran.)

of the descendant population living in the nearby hamlet were invited to join the survey team. These representatives belong to a family lineage whose ancestors not only lived in Ede-Ile before 1840 but which has also been farming at the site since the late nineteenth century. They were asked questions about how they had been using the landscape, the activity areas of the old settlement, and any observation they may have had about the archaeological landscape.

Using the *Ficus thonningii* tree at the center of the extant hamlet on the southern corner of the archaeological site as the primary datum point (**fig. 4**), the seven-member survey team mapped the location of each of the standing baobab trees and the other archaeological features at the site with a combination of GPS and compass as well as measuring tapes. Apart from the standing baobab trees, no structural remains such as building walls survive at the site. However, we were able to identify and map the rump of the perimeter walls that enclosed the settlement. Likewise, five refuse mounds were identified in the core area of the settlement.

In order to systematically map the density of ceramic distribution and other features on the surface, the area within the perimeter walls was first divided into east-west and north-south base lines using the summit of the site's largest refuse mound as the reference point. These base lines were divided into 20 m units. Then the entire archaeological site (within the perimeter walls) was divided into 40 sq.m. grids as shown in fig. 4. Each square was individually investigated for archaeological features, special artifacts (e.g., tobacco pipes, cowrie shells, beads, and lamps) and ceramic density. The shaded area refers to the concentrated residential and activity zones in Ede-Ile. This is where more than 200 ceramic shards occur per

40 sq.m. grid. There was a sharp drop in the number of potsherds in the units outside the shaded area. With one exception, all the baobab trees coincide with the area of concentrated surface ceramic distribution.

During the survey, local informants identified a number of important activity areas. They identified Locus B as the area where the imperial governor, his family and his attendants lived, with the stable of horses located in Locus G. The pottery-making workshop and a market site were reportedly present in Locus C, while iron-manufacture took place in Locus F. Another market site was reportedly located in Locus E. Test excavations were carried out in each of these loci and other areas in order to better understand the settlement pattern and the material life of Ede-Ile. Here are the results:

(1) Locus B: This locus has the largest refuse and residential mounds in Ede-Ile. A total of four test units, totaling 28 sq.m. and ranging from 2x1 m (three) to 7x3 m (one), show that this was an important political elite center in the colony. Horse remains were almost exclusively found in Locus B and the highest density and finest finishing of certain artifacts – tobacco pipes as well as bone, wood, and ivory jewelries – were found in this locus, confirming that indeed this was the residential area of the governor of Ede, the most important person in the settlement. Cavalry was the backbone of Oyo army and imperial expansion. It is insightful, therefore, that horse remains were present in Ede-Ile and these are spatially concentrated in Locus B. We know from historical sources that the purchase and breeding of horses were centrally managed by the king of Oyo and the most important political elite in the metropolis (Law 1977).

(2) Locus C: An extensive ash deposit and a dug-out water reservoir are located in Locus C. Between these two features is an open area that our informants refer to as edge-of-the-town market site. The ash deposit area is described as an *ebu* – a dedicated industrial site for pottery (and possibly dyestuff) manufacture. A 21 sq.m.area comprising seven test units (mostly 2x1 m) was excavated in the locus.

(3) Locus D: Seven test units (20 sq.m.) demonstrate the residential nature of Locus D.

(4) Locus E: A total area of 12 sq.m. was excavated to probe the nature of the archaeological deposits in the area that local informants referred to as a market site. Among the finds are a pit (bowl-shaped) blacksmithing furnace, a human burial, a terracotta animal head and other terracotta fragments, in addition to domestic artifacts such as pottery and fauna remains. All of these indicate the presence of a residential-iron workshop-religious complex in Locus E. The blacksmithing forge would have been a hub of commercial and social activities, which may explain why local informants called Locus E a market site.

(5) Locus F: Eight test units totaling 32 sq.m. were used to probe the archaeological deposits of Locus D. The contexts comprised of one residential deposit (5x4 m), a refuse mound, and an iron-smelting waste (slag) deposit.

(6) Locus A is a long corridor between Locus B and Locus D. The archaeological deposits in this area are shallow (not more than 30-36 m deep) and the artifacts here are sparse. The five 2x1 m test units reveal pottery, lamps, cowries, and few animal bones. We suspect that this area might have served as the central market site following the general plan of Yoruba settlement pattern whereby a market is located in front of the residence of the highest political authority. Such an area usually served as the piazza of the settlement. One would not expect any residential or permanent structure in such an area as our survey and test excavations demonstrated in Locus A.

CONCLUSION

The size and vegetation of each site affected the surveyed strategy employed. In Oyo-Ile, the goal was to survey a 10% sample of the vast metropolis (over 5,000 hectares) using transect lines. On the other hand, the goal was to carry out a total survey of Ede-Ile, a settlement of ca. 80 hectares in size. The survey at Oyo-Ile allows us to understand the spatial density of the imperial capital's occupation, urban configuration, and maximum population, estimated at ca. 100,000 in the second half of the 18th century. On the other hand, the survey of the imperial colony of Ede-Ile shows a much smaller settlement constructed in the image of the metropolis. The findings at Ede-Ile reveal something about the use of colonization as a strategy of the Oyo imperial project, a process that involved the movement of populations from the Oyo metropolitan core in the savanna into the frontier rainforest belt. At the time of its abandonment in 1836 or 1837, Ede-Ile was a compact town of about eighty hectares in size but it was a highly diversified and specialized landscape. In baobab trees, Oyo ceramic wares, and horse remains, Ede-Ile manifests the material signs consistent with its origins and purpose as part of the political landscape of the Oyo Empire. It was a colony that was vital to the military, political, and economic interests of the empire.

REFERENCES

Agbaje-Williams, A. 1983. ‘A Contribution to the Archaeology of Old Oyo’. Ph.D. dissertation, University of Ibadan, Nigeria.

Fleisher, J. 2010. ‘Swahili Synoecism: Rural Settlements and Town Formation on the central East African Coast’. *Journal of Field Archaeology* 35: 265-82.

Law, R. 1977. *The Oyo Empire c. 1600-c. 1836: A West African Imperialism in the Era of the Atlantic Slave Trade.* Oxford: Oxford University Press.

MacDonald, K. 2012. ‘Segou, slavery, and Sifinso’. In C. Monroe & A. Ogundiran (eds). *Power and Landscape in Atlantic West Africa*. Cambridge: Cambridge University Press, pp. 169-90.

McIntosh, S. K. 1999. ‘Modeling political organization in large-scale settlement clusters: a case study from the inland Niger Delta’. In S. K. McIntosh (ed.). *Beyond Chiefdoms: Pathways to Complexity in Africa.* Cambridge: Cambridge University Press.

Monroe, J. C. 2014. *The Precolonial State in West Africa Building Power in Dahomey*. Cambridge: Cambridge University Press.

Norman, N. 2012. ‘From the Shadows of an African Citadel: An Archaeology of the Huedan Countryside’. In J.C. Monroe & A. Ogundiran (eds). *Power and Landscape in Atlantic West Africa*. Cambridge: Cambridge University Press, pp. 142-70.

Ogundiran, A. 2012. ‘The Formation of an Oyo imperial Colony during the Atlantic Age’. In J.C. Monroe and A. Ogundiran (eds). *Power and Landscape in Atlantic West Africa.* Cambridge: Cambridge University Press, pp. 222-252.

Sinclair, P.J.J. 1987. *Space, Time, and Social Organization: A Territorial Approach to the Archaeology and Anthropology of Zimbabwe and Mozambique c. 0-1700 AD.* Uppsala: Societas Archaeologica Upsaliensis.

Usman, A. 2000. ‘A view from the periphery: northern Yoruba villages during the old Oyo Empire, Nigeria’. *Journal of Field Archaeology* 27: 43-61.

SURVEYING TOWNS

Jeffrey Fleisher[1]

I. NON-INVASIVE AND LESS-DESTRUCTIVE TECHNIQUES

There are currently a variety of non-invasive techniques that allow archaeologists to examine the extent of urban contexts without disturbing archaeological deposits. These include examinations of the surface deposits and mapping their distribution, as well as more sophisticated techniques that can be grouped under 'geophysical surveys', including ground-penetrating radar and electromagnetic techniques.

A. Surface examination

Surface surveys of urban contexts are the most cost-effective way to understand the extent of the settlement, and to record information on the final occupation of the settlement, as well as alterations that have occurred since the site was occupied. Such post-occupation alterations must be considered at the outset, since an understanding of the nature and extent of modern cultural and natural disturbances should shape the overall approach to the archaeology of any urban site (**fig. 1**).

Mapping surface finds can proceed by walking systematic transects over the surface of a site, preferably at a small enough interval (10-25 m) in order to observe and record the density of different classes of archaeological materials present on the surface. Each survey team should have a sketch map of the site with relevant and obtrusive features so that artifact scatters may be plotted precisely. If Global Positioning System (GPS) equipment is available, points may be taken marking the boundaries of artifact scatters or of newly-discovered features, such as architectural remains. If this is the first stage of a long-term project, surface collections should be kept to a minimum, and photographs of diagnostic materials in the field should be substituted to record potentially significant finds. The goal of this stage of work is to enable the creation of a map of the extent of the site, discover unknown obtrusive features, and to map the distribution of surface finds that might provide clues to the variable uses of the urban settlement. At this stage, it is important to note where the site appears disturbed (if at all), as this will provide an important guide for future research. Disturbances can include the imposition of modern settlements, looting, erosion, vegetative changes and alterations from animals (termites, burrowing animals, etc.).

B. Geophysical survey

If funds allow, a next step should include geophysical surveys, which provide an important means of looking below the ground surface. A number of techniques have been applied to archaeological contexts; the most common include ground penetrating radar (GPR), magnetometry and electro-magnetic techniques. The consideration of what type of technique to use must be made based on the types of soils found at the urban context, the expected materials that were used to construct the urban contexts, and the depth of the deposits. In general, geophysical surveys are useful in locating anomalies related to past disturbances to soils – including pits, ditches, and other features where earth was disturbed – as well as material that has magnetic conductivity, including particular types of soils, but also materials related to metals and metal production, and episodes were burning occurs. This means that geophysical surveys can be useful in locating archaeological features like hearths, graves, and pits, but also help in determining areas related to the production of metals and other materials. Although geophysical surveys can be very productive, they have many limitations. First, there must be clear and relatively even ground surfaces to run the instrumentation for most survey techniques. Second, most geophysical techniques do not penetrate below 50-60 cm below the ground surface; GPR, however, does

Fig. 1. Modern occupation at the site of Kilwa Kisiwani, Tanzania. (Photo © J. Fleisher.)

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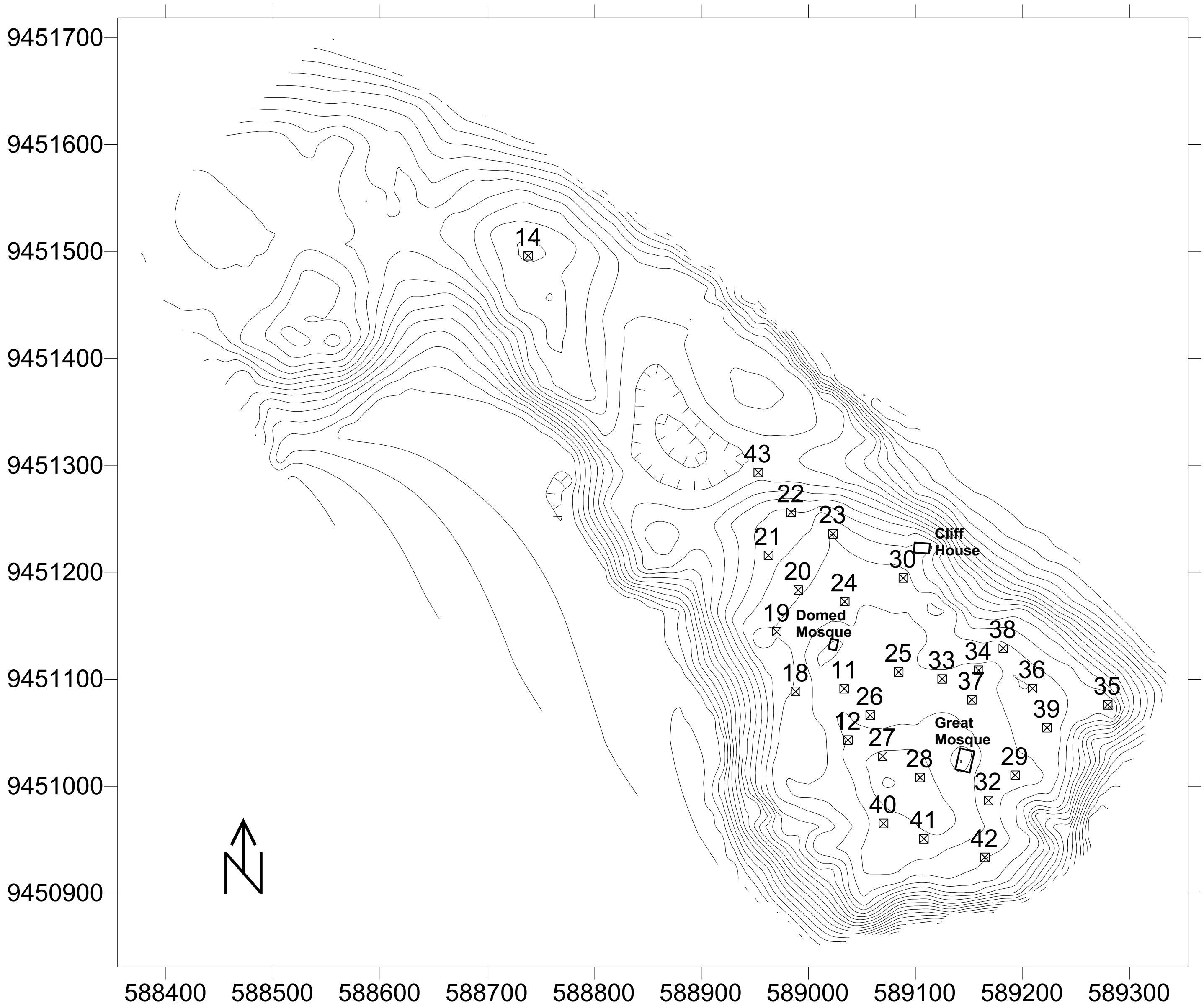

Fig. 2. Test pit program at the site of Chwaka, Pemba Island, Tanzania.

allow for deeper examinations. Third, these techniques do not distinguish between natural or cultural anomalies, and so any geophysical survey must be followed up with ground-truthing excavations to understand the nature of these anomalies. Finally, geophysical surveys require specialized training to operate, process, and interpret the data, and so often involve hiring specialists and their equipment.

II. GROUND TRUTHING AND SUBSURFACE TESTING

The next step in a multi-stage approach to urban contexts includes the ground truthing of anomalies discovered during the geophysical surveys. Without geophysical surveys, this stage will include the testing of areas within the site that offer the promise of revealing data related to particular types of features or activities. To ground truth geophysical surveys, small-scale excavations should be located in such a way as to straddle the anomaly rather than placed squarely within it; this will allow an assessment of the materials that caused the anomaly, as well as those that cause no readings on the instrumentation used.

Other possible approaches at this stage might include a systematic program of test pit excavations. These can be small, 1 x 1 m trenches, located strategically throughout the urban context. Mark Horton's research at Shanga provides a good example (1996); before opening larger trenches, he excavated 29 test pits situated across the site and the data from these carefully excavated and recorded pits provided an important step toward understanding the settlement. The data from these pits offered a glimpse at the overall stratigraphy of the site and provided an initial understanding of the depth and integrity of deposits in different locations within the urban context. Such test pits also provide small windows into the types of deposits that can be found across a site, and can help guide the researcher to the next stage of large-scale excavations (**fig. 2**).

Another approach to understanding large areas of urban contexts is through the excavation of hand-dug, shovel test pits (STPs) or through coring (**fig. 3**). When carried out systematically, and recorded thoroughly, this approach can provide a very detailed overview of large expanses of urban space. These differ from the test pits previously discussed in that they are dug more quickly. When carrying out these approaches, the precise locations of each STP or core hole must be recorded, as well as the soils encountered, and artifacts retrieved. These approaches can also be coupled with soil chemistry and phytolith studies. The pairing of these different techniques and datasets – stratigraphy, artifact distributions, soil descriptions, soil chemistry, and phytoliths – can provide more than just an overview of the settlement; they can offer primary data in areas that do not contain architecture or archaeological features, offering a way to explore spaces that stood 'open' and outside of structures, while offering an appraisal of different areas of the site.

III. ANALYSING SURVEY RESULTS

All of these testing programs – whether accomplished through test units, coring or STPs – are all amenable to spatial analysis in a Geographic Information System. Therefore, these data should be prepared in such a way as to create coverages for each data set. For procedures such as a STP program, this will require plotting each STP with either a Total Station, or with a DGPS unit which allows for high accuracy mapping. By importing data into a GIS, spatial patterns across the settlement can be examined.

Fig. 3. Students digging shovel-test pits (STPs) on Pemba Island, Tanzania. (Photo © J. Fleisher.)

Within GIS programs, such as ESRI ArcGIS (or Quantum GIS, which can be downloaded free at http://www2.qgis.org/fr/site/), data that has been systematically collected, such as in test units or STPs, can be interpolated into kriged density maps, and show the variable distribution of different materials and how they correlate.

All of the procedures discussed thus far allow for a detailed assessment of the extent, depth, and complexity of deposits at an urban site. In some cases, this program of work might offer sufficient evidence to answer basic questions about urban chronology, site size, and the variable use of urban areas. However, these types of approaches do not often provide sufficient data to answer questions on the variability of intra-site deposits (comparisons between different types of housing or neighborhoods), or on specific activity areas within an urban settlement (workshops or production areas). Larger scale excavations are required to address these issues, a topic to which we now turn (Fleisher, this volume, pp. 121-124).

REFERENCE

Horton, M.C., 1996. *Shanga: The archaeology of a Muslim trading community on the coast of East Africa.* Nairobi: British Institute in Eastern Africa.

ARCHAEOLOGICAL FIELD SURVEY AND THE RECORDING AND CATALOGUING OF ARCHAEOLOGICAL MATERIALS

Paul J. Lane[1]

INTRODUCTION

Site recording is a fundamental aspect of surveying, and provides one of the most basic building blocks for further fieldwork, analyses and interpretation. Archaeological field survey without any form of recording of the materials encountered is a waste of time and resources. Hence, the issue is *not* whether or not to record – that is a given. Instead, the key issues are what to record, how to record, and what to do with the records after they have been made. Everybody working on an archaeological field survey should be trained in record keeping and in how to log the fundamental details. Key to all these elements is being consistent and systematic. If some simple rules are followed before, during and immediately after fieldwork, then many future problems can be averted. It is thus essential, and well worth the time taken, to document your observations while still at the 'site' or other archaeological trace (such as an isolated artefact) rather than relying on memory and waiting until back in camp or after having left the field altogether before logging these details.

Time can be a scarce resource on surveys, and there are often pressures to cover as much ground as possible during the course of a survey. As a result, the temptation to rely simply on a few notes, with the plan to 'add details later' is often great. There are ways to minimise this problem, however, by being well-prepared before going into the field; having a clear idea about how much detail needs to be recorded (which is often determined by the aims of the survey and the research questions being addressed); by using pre-prepared (or pro forma) recording forms; and making more effective use of digital recording methods.

Cross-checking records before leaving the field site is also critical, as this can help identify gaps or mistakes in the records. These are much easier to fill or correct while still in the field before the team has dispersed and it is still relatively easy to return to the 'site' in question. Ultimately, all the effort expended on recording and cataloguing in the field will be wasted effort if these records are not eventually deposited in some form of archive where other researchers can access them, both now and in the future. It is therefore important to be familiar with national and regional requirements, prepare records in formats that meet international archiving standards, and consider creating security copies in both a digital and hard copy form which are stored in different locations so as to minimise subsequent damage or destruction as a result of some future unforeseen event.

I. PREPARATION AND EQUIPMENT

Being prepared is often a key to success! In the case of site recording, time spent on preparation ahead of going into the field often saves time and reduces mistakes.

A. Degree of detail

A key issue to determine in advance is the level of detail about site types, their locations, physical extent and constituents, current condition and topographic location, ownership and similar matters that the survey is expected to generate. These are to a great extent determined by the aims, objectives and research questions of the survey. A rapid assessment of the research potential of an area, for example, is likely to call for less comprehensive recording and greater areal coverage than a survey aimed at determining the influence of environmental factors on archaeological distributions.

B. Site categorisation

Decisions also have to be made in advance as to how to categorise discoveries, for instance: whether or not to document isolated finds; what constitutes an 'archaeological site'; and how this is distinguished from an 'artefact scatter' (i.e. a low-density spread of archaeological materials indicative of past activities but unlikely to represent prolonged occupation). Familiarisation with the range of site types, historic buildings and other kinds of archaeological traces known from the general survey region will help with planning recording strategies that are sufficiently flexible to cope with encounters with any and all of these. When making such decisions, however, it is important to provide scope for the documentation of completely unexpected and even unknown forms and types.

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C. Standardisation and archiving

In many countries the national or regional authority with responsibility for the management of archaeological and historical sites and monuments, and/or who monitor archaeological research, maintain national site registers. Consequently, they have sometimes developed standardised recording forms for cataloguing archaeological discoveries (see below). If these exist, then they should be used. This will avoid time-consuming transcription of field notes when records and finds are being deposited with the relevant curatorial authority (such as a national museum). The standardisation of recorded information also benefits the creation of site databases for use in subsequent research and site management activities. In particular, it allows informed comparison, especially in terms of site significance, which is critical for effective archaeological heritage management. It is also critical to know the archiving requirements of the intended archive repository so as to ensure records are prepared in a manner that meets their conditions. The archive process *begins* with planning the creation of the first record and *not* at the end of fieldwork (Brown 2007).

D. Equipment

In terms of basic equipment, the following are essential:

- maps (at as large a scale as is available) of the survey area
- notebook – ideally with a combination of lined (for notes) and gridded (for sketches and measured drawings) alternating pages
- clip-boards
- pro-forma survey forms (either use the national/regional standard, or if not available prepare your own based on some of the examples in Appendix 1). These should be printed, as photocopies tend to fade and are not ideal for archiving
- pens, permanent marker pens, pencils, erasers, sharpeners, permanent labels
- tapes – 1 x 30m tape and at least one hand tape
- prismatic compass
- a graduated photographic scale – at least one metre in length
- resealable plastic bags in a selection of sizes (use bags with a panel for writing on)

While not essential, the use of a handheld Global Positioning System (GPS) receiver to log the latitude and longitude coordinates of each archaeological trace encountered is also highly recommended, and can be especially useful where detailed maps are lacking and in relatively featureless or heavily vegetated terrain – all of which are commonplace in many parts of Africa. If available, the GPS should also be used to log the survey track followed each day. A camera, ideally digital, is also desirable as it can help speed up the recording process provided each shot is carefully framed and meta-data concerning this is logged at the time the photograph is taken (see below). Another useful piece of equipment is a small handheld tape recorder or Dictaphone, which can be used to record observations and impressions that supplement the information logged in notebooks and on pro-forma survey forms.

II. WHAT AND HOW TO CATALOGUE

As mentioned above, different surveys have different requirements and it is important that recording systems are sufficiently flexible and evaluative so as to allow documentation of the unexpected. However, there are some basic standards about the nature of the records and their content that all site catalogues should meet. In order to meet basic project archive standards (Brown 2007), it is important that:

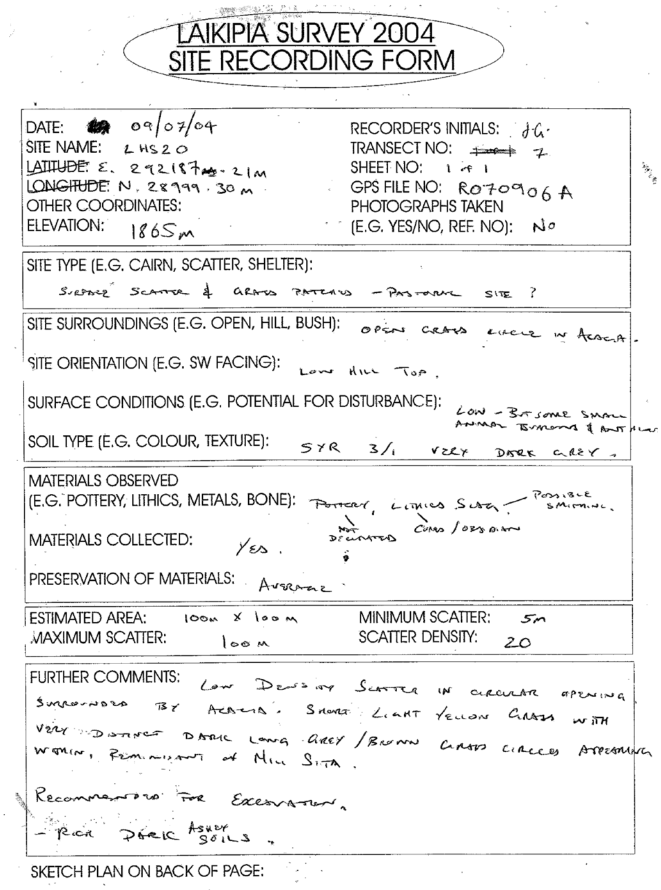
- project records are produced to a consistent format
- pro-forma sheets are used for recording primary data
- records are written legibly using clear language
- consistent terminology is used throughout.

On encountering archaeological remains in the field, unless this is clearly an isolated artefact, it is important to first explore the extent of the site/scatter before starting to record, so as to observe its main characteristics with an aim to identify the site type, its contents, boundaries, condition, likely date and similar information. It can be helpful, and often more efficient, if different team members are assigned different recording tasks – one to complete the pro forma record forms (**fig. 1 and Appendix 1 to 3**), another to take photographs, another to take detailed measurements and so forth. They need tcorrelate their records however, to ensure that their individual records can be identified correctly with the same site.

In terms of content, the minimum level of information that all surveys need to capture is as follows:

A. A unique site or isolated find identifier

Often referred to as a Site Number – this can be an alphanumeric code unique to the project (e.g. Ranaka 92-12 – which identifies the records as being associated with the twelfth site located during the 1992 survey of the Ranaka



LAIKIPIA SURVEY 2004
SITE RECORDING FORM

DATE: 09/07/04
SITE NAME: LHS20
~~LATITUDE~~: E. 292187 21M
~~LONGITUDE~~: N. 28999.30 m
OTHER COORDINATES:
ELEVATION: 1865m
RECORDER'S INITIALS: J.G.
TRANSECT NO: 7
SHEET NO: 1 of 1
GPS FILE NO: RO70906A
PHOTOGRAPHS TAKEN
(E.G. YES/NO, REF. NO): No

SITE TYPE (E.G. CAIRN, SCATTER, SHELTER):
Surface scatter & grass patterns – Pastoral site ?

SITE SURROUNDINGS (E.G. OPEN, HILL, BUSH): Open grass circle in Acacia.
SITE ORIENTATION (E.G. SW FACING): Low hill top.
SURFACE CONDITIONS (E.G. POTENTIAL FOR DISTURBANCE): Low – but some small animal burrows & ant hills
SOIL TYPE (E.G. COLOUR, TEXTURE): 5YR 3/1 very dark grey.

MATERIALS OBSERVED
(E.G. POTTERY, LITHICS, METALS, BONE): Pottery, lithics slag – possible smithing.
(not decorated) (cores / obsidian)
MATERIALS COLLECTED: Yes.
PRESERVATION OF MATERIALS: Average

ESTIMATED AREA: 100m x 100m
MAXIMUM SCATTER: 100m
MINIMUM SCATTER: 5m
SCATTER DENSITY: 20

FURTHER COMMENTS: Low density scatter in circular opening surrounded by Acacia. Short light yellow grass with very distinct dark long grey/brown grass circles appearing within, reminiscent of hill site.
Recommended for excavation.
– Rich dark ashy soils.

SKETCH PLAN ON BACK OF PAGE:

Fig. 1. Example of completed, project specific pro forma from a 2004 survey in the Lolldaiga Hills, Kenya.

area, southern Botswana). Alternatively, and preferably, the national or regional site coding system can be used, in which case a sequence of numbers uniquely assigned to the survey project should be requested from the relevant authority in advance of fieldwork. This is so as to avoid duplicate use of the same site numbers by different survey teams with the result that two or more distinct sites are allocated the same identifying number. In many parts of Africa, the SASES system proposed by Charles Nelson (1993) is in use. This is an alpha-numeric system based on the Universal Transverse Mercator (UTM) coordinate system.[2]

B. Geographical location

The location can be recorded using either a GPS receiver or by using a map and compass bearings. Ideally, locations should be recorded in terms of latitude and longitude *and* as a two-dimensional Cartesian map coordinate recorded with reference to the relevant national grid. Most 1:50000 scale map grids for sub-Saharan Africa are based on the UTM coordinate system. The latter is an ellipsoidal model of the Earth, which divides the earth between 80°S and 84°N latitude into 60 zones with a six-degree band of longitude, to which a unique alpha-numeric code is assigned. Modelling of the Earth's ellipsoid has changed over the years. The current global standard known as WGS84 should be followed unless using maps prepared from an older model, such as ARC 1960. It is important that GPS receivers used to record UTM coordinates should be set to the agreed system, and this information entered onto the record forms so as to allow possible conversion in the future.

C. Site type, characteristics and date

It is important to note the basic characteristics of the 'site'. Is it an open air site or a cave or rock-shelter? Are there any visible earthworks, such as banks and ditches, or building remains visible on the surface? How large an area does it cover? Are archaeological materials present, and if so what types of finds can be seen? What is the approximate extent of the site? Where is it situated within the landscape (at the foot of a hill, along a river bank and so forth)? Can an approximate age of the site be estimated from the finds on the site, or from other sources, such as oral information, collected in the field?

D. Current condition and archaeological investigation

Topics include the condition of the 'site' when encountered, in terms of vegetation cover, surface visibility of finds (ranging from easy to see to very hard to detect), land use, land owner if known, names and details of local informants knowledgeable about the site, possible and actual threats to the site (both human and non-human), and the level of archaeological investigation undertaken (e.g. no surface collection/surface collection, test-pitting, detailed mapping with GPS, etc.). If surface collections were made, then document the guiding principles involved – e.g. unsystematic collection, selected collection of diagnostic/representative artefact types, gridded surface collection.

E. Additional records

It is important to note and cross-reference all other types of record made in the field. These might include photographs, and it is important to make an immediate note of the relevant frame number/s (and film number if the pho-

2 See for instance: http://commons.wikimedia.org/wiki/File:LA2-Africa-UTM-zones.png

Fig. 2. Annotated survey map of Lower Democratic Republic of Congo. Sites are carefully located by observing the landscape and positioning the site on maps (courtesy of Pierre de Maret).

tographs are not digital) while in the field; any sketches or measured plans; recorded interviews with informants, and so forth. It can be helpful to have separate pro-forma forms for each of these types of records to ensure relevant information is captured in a timely and efficient manner. Field notebooks should be used for recording additional information, details concerning the composition of the team, the weather and light conditions at the time of the survey, key landscape features that might help with the relocation of the 'site', and as a general field diary.

F. Date of completion of the record

If follow-up visits are made to the site, the dates of these visits should also be added.

G. Recorder's name & contact details.

In case clarifications are needed.

III. PROJECT ARCHIVES

- Archaeological projects should always aim to produce, stable, orderly and accessible archives (Brown 2007). Project archives are important for at least the following reasons:
- to provide a permanent record of the work undertaken and the information collected
- to add to national and regional inventories of archaeological resources for the purposes of management, research and public education
- to avoid duplication of effort during future research
- To allow reinterpretation and restudy of the original findings
- to contribute to assessments of significance at local, regional and national levels

Project archives should be prepared so they can be assimilated easily into the collections of recognised repositories (Brown 2007). On return from the field, it is helpful to organise records into different categories. Typically these will comprise written forms and field notes, photographs, drawings and sketches, and digital data of different types. Once these are systematically organised – by map sheet and then sequentially according to site number is the most standard approach – then a master catalogue of these records should be compiled (see Ozainne, this volume, pp. 157-162). It is also helpful at this stage to plot the location of all located finds on a clean map (or maps) of the survey area, with their unique identifying number against each point on the map. It is important to bear in mind that digital data often get detached from other records. It is therefore recommended that hard copies of these data be produced and included with the media (CD-ROMs, flash drives etc.) on which the digital data are recorded. Information about the format in which the data are stored and the software used to open the relevant files must be stated. The latter information is especially helpful when it comes to ensuring data migration as data formats and software change. Finally, it is important to prepare project archives promptly and to deposit them with the recognised authorities responsible for their curation in a timely manner.

REFERENCES

Brown, D.H. 2007. *Archaeological Archives. A Guide to Best Practice in Creation, Compilation, Transfer and Curation*. Archaeological Archives Forum.

Nelson, C.M. 1993. 'A standardized site enumeration system for the continent of Africa'. *Nyame Akuma* 40: 62-67.

FURTHER READING

Carver, M. 2009. *Archaeological Investigation*. London: Routledge.

Letellier R. (ed.). 2011. *Recording, Documentation, Information Management for the Conservation of Heritage Places. Guiding Principles* (revised edition). Los Angeles: Getty Conservation Institute.

Richards, J. (ed.). 2000. *Digital Archives from Excavation and Fieldwork: a Guide to Good Practice* (Archaeology Data Service, Arts and Humanities Data Service, York). Oxford: Oxbow Books.

SEGOU Fiche de Village Abandonné (Survey Form) 2005

Form No. /Fiche	Date	Recorder/Chercheur:
Site Name/Nom de Site		

Croquis / Sketch of Site and Collection Zones:

GPS Coordinates (Centre):
Carte IGN:

Closest Village(s)/ Villages le plus proche:	Nearby Sites/ Sites du Voisinage

Longest Axis/ Axe le plus longue: m	Shortest Axis/ l'Axe le Plus Court: m	Stratified?::
Type of Site/ Nature du Site:	Time Period/ Age (basis of estimate):	Features/ Structures?

No. du Sacs / Sacks

Potterie-	Broyage /Gr. Stone-	Small Finds-	Faune-	Scories/ Slag-
How Collected?				

Notes on Artifacts: (Assemblage Archéologique)	Photos:
	Plans:

Observations/ Traditions:

SEGOU Fiche de Village Habité (Survey Form) 2006

Form No. / Fiche	Date	Recorder/Chercheur
Village Name/Nom de Site		

Croquis / Sketch of Village Zones, Points of Interest:

GPS Coordinates (Centre):
Carte IGN:

Dependent Villages/Hamlets:	Nearby Abandoned Sites/ Tomos du Voisinage

$18^{th}/19^{th}$ c. Longest Axis/ Axe le plus longue: m	$18^{th}/19^{th}$ c. Shortest Axis/ l'Axe le Plus Court: m	Stratified?:
Functions of Site: Agricultural- Military- Political- Religious- Other-	Occupation Periods (basis of estimate):	**Pre-1890 Features/Structures?** Tata? Market- Mosque- Other-

Notes on Artifacts (if any): (Assemblage Archéologique)	Photos:
	Plans:

Other Observations/ Traditions (summary only):

Appendix 1a & b. Pro forma recording forms used in Mali (courtesy of Kevin MacDonald).

FICHE D'ENREGISTREMENT DES VESTIGES

SITE	FRT	Surface	
SIGLE	FVD	Sondage	Chercheurs
X	FRS	Carré	Chrono
Y	FKT	Niveau	Phase
Z	Village	Couche	Datation
LAT		Lever	14 C
LONG			TL

	VESTIGES	BORD	PANSE	ANSE	BASE	PIED	COUV	AUTRES	TOTAL	OBSERVATIONS
POTERIE LOCALE	Sans décor – Sans enduit									
	Avec décor – Sans enduit									
	Sans décor –Avec enduit									
	Avec décor – Avec enduit									
Chlorito	Avec motif									
	Sans motif									
	Brut									
Pot. importée	Sassanide									
	Sgraffiato									
	Black on Yellow									
	Pot. Islamique									
	Céladon									
	Bleu & Blanc chinois									
	Pot europ.									
Autres	Métaux	Fer	Cuivre	Bronze	Argent	Or	Aluminium	Autres	Total	
	Divers	Os	Perles	Verre	Pierre	Bois	Plastique	Autres	Total	

SITE CGN Lat./Long./Alt. Travaux Secteur Carré Niveau Profondeur Observations Date	SITE CGN Lat./Long./Alt. Travaux Secteur Carré Niveau Profondeur Observations Date
SITE CGN Lat./Long./Alt. Travaux Secteur Carré Niveau Profondeur Observations Date	SITE CGN Lat./Long./Alt. Travaux Secteur Carré Niveau Profondeur Observations Date
SITE CGN Lat./Long./Alt. Travaux Secteur Carré Niveau Profondeur Observations Date	SITE CGN Lat./Long./Alt. Travaux Secteur Carré Niveau Profondeur Observations Date

Appendix 2a & b. Pro forma recording forms used in Madagascar (courtesy of Chantal Radimilahy).

Archaeological Survey Record Sheet

National Museum Monuments and Art Gallery, Botswana

Site No:

Cultural Components:

Recorders No:

Site Name:

Local Area:

Land owner and address:

Map Location: Map No: Grid reference:

Latitude S Longitude E

Site type: (shelter/open)

Site activity: (eg settlement, smelting, etc)

Site topography: (eg hill top, hill base, dune, river bed, terrace, pan edge)

Site area: (measured/estimated) Site aspect:

Geology: (eg granite, alluvium,nearby ores etc)

Vegetation: (eg mopane scrub, coppiced thorn)

Nearest water: (eg stream, pan, spring) Distance

Artefacts seen or collected: Total collected: (approx/estimate)

a. flaked stone
b. ground stone
c. pot sherds
d. iron/copper
e. bone/ivory
f. shell
g. glass (eg beads)
h. slag/tuyeres
i. clay
j. wood
k. others

Materials, features:

a. bone, shell
b. charcoal, fruits, seeds
c. graves
d. paintings
e. engravings
f. ash middens
g. dung(vitrefied)
h. stone walls/platforms
i. clay structures
j. pits/mines
k. others

Legends etc: (informants names)

Dating evidence:

Published references:

Photographs: (where kept)

Location of collections:

Comments: (sketch plan, map of how to get there – attach separate sheet if necessary)

Site importance: (eg density of material) Proclamation:

Nature and degree of disturbance: (eg vandalism, tree roots, rodents, erosion, exfoliation)

Possible future disturbance: (eg dam, road, urban expansion)

Development potential:

Site first reported by: (name/address) Date:

Site excavated by: Date:

Sheet recorded by: Date:

Site confirmed by: Date:

Office:

National Museum, Monuments asnd Art Gallery, Private Bag 00114, Gaborone, Botswana. Telephone 374616

Appendix 3a & b. Pro forma recording forms used in Botswana (courtesy of NMMAG – National Museum, Monuments & Art Gallery).

LARGE SCALE RECONNAISSANCE AND EXCAVATION STRATEGY ON THE LOANGO COAST OF THE CONGO: A CASE STUDY

James Denbow[1]

INTRODUCTION

This chapter describes an archaeological project conducted on the Loango coast of the Republic of Congo between 1987 and 1993. A full description of the work can be found elsewhere (Denbow 2014, see references therein). The project was begun in 1987 as an academic undertaking designed to investigate an archaeological occurrence discovered by geologists working for Conoco Oil Company. Conoco's objective was to use the archaeological investigation as a means to enhance their competitive position in a bidding competition for oil leases in the Congo. From my side, the project was initially envisioned as a small-scale test excavation to date the ceramics and lithics that Conoco geologists had found eroding from a borrow pit at a place called Tchissanga.

As luck would have it, the initial test excavations were completed early, leaving a few days for additional exploration before returning to the United States. A short trip was therefore organized to investigate a similar physiographic zone to Tchissanga on the opposite bank of the Kouilou River 15 km to the north. Here more ceramics were discovered eroding from a darkly-stained midden 40 cm below surface in another borrow pit. I had been expecting to find materials similar to those from Tchissanga, but these were completely different. Given their depth below surface they were undoubtedly of some antiquity, but I had no way of knowing whether they were earlier, later, or coeval with those from Tchissanga. The possibility that they were later was suggested by the fact that no lithics were observed, as they had been at Tchissanga. The site was named Madingo-Kayes after a small village on a nearby hilltop. Charcoal samples were recovered from a quick test excavation and I returned to Texas excited by the thought that I had the beginnings of an archaeological sequence that could be broadened into a more compete cultural chronology of a hitherto archaeologically unknown part of equatorial Africa.

I. THE FIRST SEASONS: OPTIMISTIC PROSPECTS

Before the first exploratory excavations in the fall of 1987, I had asked Conoco if they would arrange for local Congolese archaeologists to be active participants in the project from its inception. Mr. Aimé Manima-Moubouha, an archaeologist at Marien Ngouabi University in Brazzaville, and Ms. Nicole Sanviti, a visiting scholar from France, met me in Pointe Noire for the first test excavations. The dates for the samples from Tchissanga were among the earliest for Ceramic Later Stone Age materials from the Atlantic coastal region south of the tropical forest. Financial prospects for expanding the work were also good because, as I learned later, the archaeological project fit in with the longer-term interests of Conoco in the Congo.

The following summer more extensive excavations were carried out with the support of Conoco and a small grant from the National Geographic Society in the United States. In Brazzaville, Conoco had organized a signing ceremony for their new oil lease and I was asked to design a small display for the office of the Minister of Energy and Mines. Much to my surprise, and that of the Conoco officials who had come from the United States for the signing, the Minister was so impressed with the display that he arranged for it to be immediately moved to the presidential palace where I presented it to Denis Sassou-Nguesso, President of the People's Republic of the Congo. After a brief televised interview, I returned to Tchissanga with high hopes.

The work went well and, bolstered by the success and publicity of the first field season, I felt we would be able to work together for several field seasons. Unfortunately, Mr. Manima-Moubouha and his students could not participate the following year because the university had gone on strike earlier in the year and the time had to be made up in June and July. It was only in 1992 that Manima-Moubouha and his students could again fully participate. They carried out additional excavations at the Early Iron Age site of BP 113, which had been discovered and preliminarily investigated by my team from the University of Texas in 1990. Thus, in spite of the best of intentions, the local participation that I had wished for did not happen. Such uncertainty is a fact of life in Africa and is something each researcher will have to negotiate. In addition, every African country has a different infrastructure to oversee archaeological research and heritage

1 University of Texas, Austin.

management. In the case of the Congo and many other countries in Africa this infrastructure is still, in practical terms, meagre to non-existent.

II. DISASTER STRIKES

While the Brazzaville students could not take part in 1988 excavations, we were able to expand the small test excavations at Tchissanga to several promising locales at Tchissanga West, Tchissanga East, and Tchissanga Base (Denbow 1990). Good contacts were made with the local authorities in Madingo-Kayes and, with the televised publicity of the meeting the President, prospects looked good for the following year. But I never expected what happened next.

One cannot imagine my astonishment when I crested the hill at Tchissanga in 1989 to find the entire terrace, including the site, planted in eucalyptus. Indeed, eucalyptus plantations now seemed to cover nearly every savannah between the city of Pointe Noire in the south and the Kouilou River 60 km to the north! Since there was no coordinating body to oversee heritage management or archaeological research in the Congo, Congolaise de Développement Forestier (CDF), a subsidiary of Shell Oil, London, and l'Unité d'Afforestation Industrielle du Congo (UAIC), a local eucalyptus company that had operated in the Congo for many years, were granted carte blanche to plough under what they viewed as 'non-productive' savannah for eucalyptus. The process of land acquisition followed a long tradition of colonial land expropriation in the region in which 'land "not effectively used," a definition which was especially unfavourable for the population in areas using BaKongo's extensive production methods [...] was granted to large companies: the mining company UMHK, for example, had an area half the size of Belgium' (Ekholm 1972: 72-75).

Such neglect of archaeological resources is compounded by prejudiced views of an empty or circular African past (Denbow 2012). These biases, when coupled with the scarcity of archaeological research on the continent, combine to reinforce a pattern of neglect and the on-going destruction of cultural resources by multi-national ventures – as well as local development schemes. In the Congo case, it was assumed there were no archaeological sites of significance because there were no records of them in the existing literature. Because there had never been any sustained archaeological investigation of the coast, nothing stood in the way of covering tens of thousands of hectares of supposedly 'unused' savannah with eucalyptus plantations. There was no serious consideration of the need for predevelopment archaeological surveys on the part of the overseas corporate offices that financed the project. An absence of local oversight or national infrastructure for heritage management in the Congo contributed to the problem, with the result that despite the national publicity of the project on one level, no connection was made between that and the excavation units at Tchissanga that were simply ploughed over as an inconvenient nuisance by UAIC tractors! The end result was that the resources of the archaeological project had to be quickly shifted from an academic investigation designed to construct a cultural chronology to a 'salvage' project focused on a rapid large-scale site discovery and preservation operation in advance of on-going planting. Test excavations continued at some important sites, but the scientific excavations now had to come second to developing a methodology to discover and then protect important sites across a very large region that encompassed almost a quarter of the coastal littoral of the Congo. This was complicated by the fact that much of the area was either covered in tropical forest or blanketed by tall grass savannah, making the detection of sites by surface survey almost impossible. In addition, there were no earthworks, stone walls, or other monuments in this region that could be used to locate sites.

III. DESIGNING A RECONNAISSANCE

Three considerations had to be taken into account in designing the reconnaissance strategy. The first consideration was the need for speed. At its peak, the eucalyptus campaign was planting roughly 10,000 hectares of new savannah each year. The second consideration was how to locate buried sites in areas where there had been little cultivation or erosion to bring buried materials to the surface. While sites could be located by walking along the eroding edges of roads, ditches, and the shoulders of gullies and stream terraces, these were few in number and provided little coverage of the vast expanse of rolling plains in between where there was usually nothing to be seen on the surface. Subsurface testing using shovel pits, or remote sensing using devices such as ground penetrating radar, were not practical on such a large scale. The third consideration was how to mark sites once they were found. There were no detailed maps available for the region, and GPS systems were not then in wide use. We made our own maps by tracing proprietary side-scan radar images provided by Conoco. Fortunately, these were

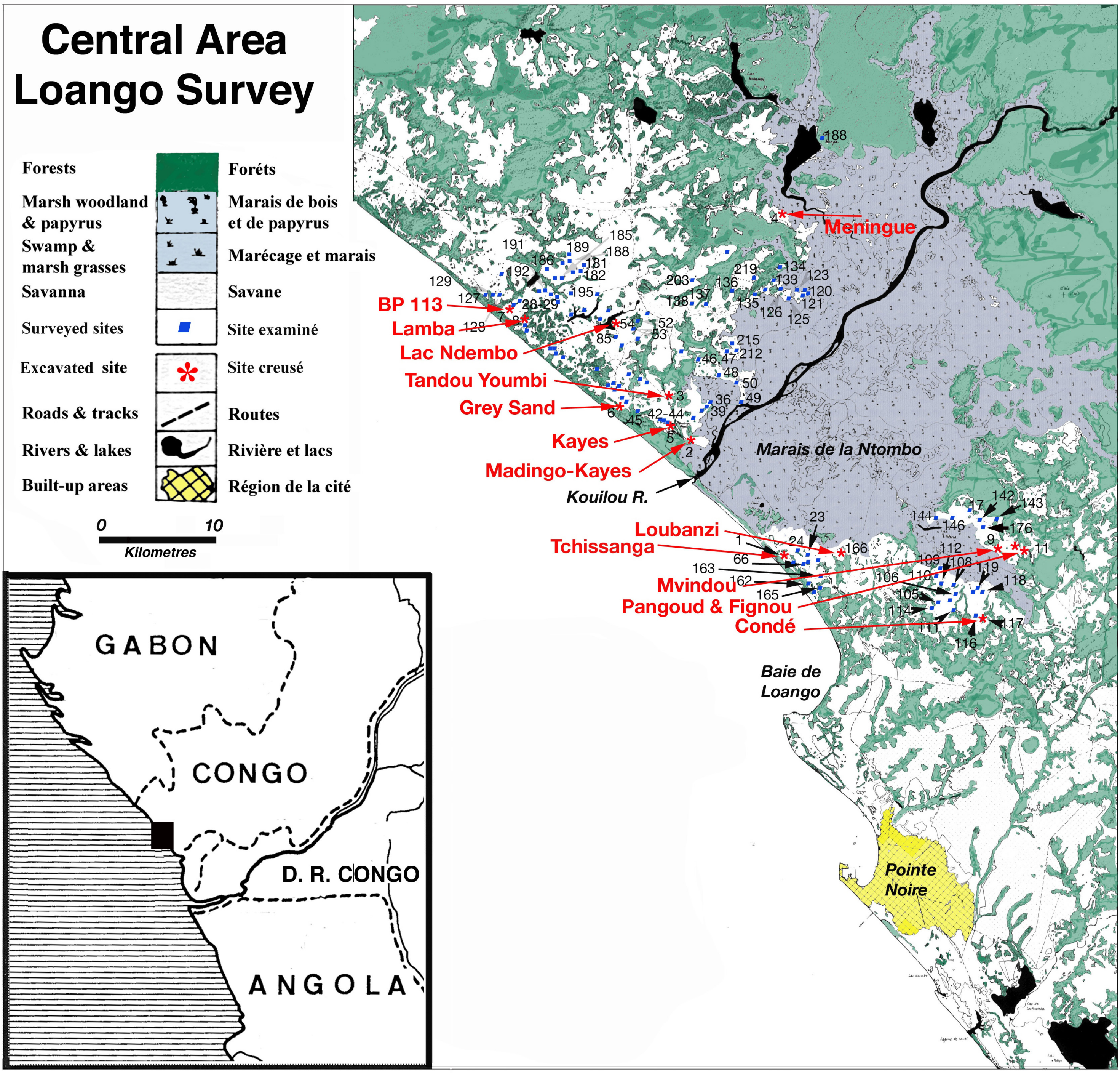


Fig. 1. Map showing the locations of the 204 archaeological sites located during the reconnaissance. Sites labeled in red were test excavated and radiocarbon dated. The savanna grasslands during the time of the reconnaissance is indicated in white. Most of the area south of the sites of BP 113 and Meningue is now planted in eucalyptus. Tropical forest are shown in green; Ntombo marsh is colored gray. (© J. Denbow.)

detailed enough to accurately plot site locations (**fig. 1**). A final problem was how to convey location information to the local tractor drivers doing the actual ploughing. These men, often illiterate, were not experienced in reading large-scale maps.

With the cooperation of CDF and UAIC, a strategy was developed that made the best of available resources. In order to locate buried sites, UAIC/CDF agreed to provide tractors, drivers, petrol, and vehicles to carry out an intensive archaeological reconnaissance in advance of new planting. The sites we had already located were small and averaged between 100 and 150 meters in diameter, with cultural deposits between 30 and 70 cm below the present ground surface. In order to locate buried sites, archaeological cut lines were ploughed at 100 m intervals across each new savannah in advance of planting; each line was 2 m wide and 50 cm deep. This enabled us to locate buried sites that would be directly impacted by eucalyptus planting. If materials existed at greater depths, they would not be directly disturbed by the eucalyptus planting, which was confined to the upper 40-50 cm of the soil.

Cut line ploughing (**fig. 2**) took place during the rainy season so that the rains had time to wash away the dust and more clearly reveal artefacts and other features. CDF hired one of my Congolese assistants, Romain Mougani, to work full time on the project. While academically untrained, he had gained experience in archaeological survey and excavation while working with me in 1989 and 1990. Over the course of several field seasons, he walked approximately 450 km of cut lines, collecting samples of decorated pottery, lithics, and other materials and making note of each site location. When I returned to the Congo at the beginning of each dry season, we revisited the sites Romain had located and marked their locations on the detailed map made from the aerial photography. The variety of the cultural materials recovered, along with assessments of site stratigraphy and the possible existence of sub-surface features, were factors used in determining which sites should be afforded protection. The conserved sites were then marked with 4x8 foot plywood placards. Tractor drivers were told to leave a 100 m in diameter circle unploughed around them. Over the course of the project over 200 archaeological sites were plotted on the master map, with copies left with CDF in Pointe Noire and the district authorities in Madingo-Kayes. Because the reconnaissance found a very high density of sites on the 100 m terrace immediately overlooking the Atlantic Ocean, CDF agreed to leave this zone unploughed.

Fig. 2. Plowing an archaeological cut line. A second cut line is just visible near the top left of the savanna near the forest edge. Each cut line was 2 m wide, 50 cm deep, and plowed at intervals of 100 metres across each savanna to be planted in eucalyptus north of the Kouilou River. This cut-line depth and spacing was selected based on estimates of average site size and depth of cultural deposits from our test excavations. Plowing was done several months in advance of eucalyptus planting so that the rains could wash the cut-lines and enhance artifact visibility. Sites thought to contain significant cultural deposits were marked by signboards. An area 100 m in diameter was left unplowed around each sign to preserve the buried cultural deposits. (Photo © J. Denbow.)

CONCLUSIONS

In the end, the Loango project located over 200 sites, conducting excavations at 13 of them in order to develop a preliminary cultural chronology. Forty radiocarbon dates were obtained which ranged from Later Stone Age horizons dating to the late 2nd millennium BC through three phases of the Early Iron Age dating between 150 BC and 800 AD. Many Later Iron Age and historic period settlements dating from 1100 to 1900 AD were also located.

Because of the systematic nature of the cutline ploughing campaign, one can have some confidence in the settlement patterning uncovered. This is often not the case with less systematic reconnaissance methodologies. On the Loango coast, Neolithic settlements were found to be dispersed around the edges of Ntombo and smaller marshes in both coastal and inland locations. In contrast, Phase I Early Iron Age settlements were highly concentrated on the high coastal terrace overlooking the Atlantic Ocean; far fewer settlements were located further inland. Phase II and III sites were more widely dispersed in both coastal and inland areas. Only two sites were located that contained ceramics dating to the first half of the second millennium AD. Both are situated in more inland locations, but because of the small sample size, settlement preferences for this period remain uncertain. After 1500 AD, historic sites are numerous, reflecting population expansion. These settlements occur in both coastal and inland locations, suggesting more diversification in the ecological, economic and political parameters that impacted settlement choice over the four centuries of interaction with European powers.

The systematic reconnaissance found that even though iron tools and ornaments were recovered from most of the excavations at Early Iron Age sites dating from 100 BC onward, no iron smelting furnaces or slag heaps were found. This suggests that iron-working took place in more inland locations and not on the littoral where iron ores were absent. In addition, neither the survey nor the excavations found evidence for the exploitation of copper before the arrival of Europeans on the coast. This suggests there was little to no access by coastal peoples to the extensive copper deposits east of the Mayombe mountains before the middle of the second millennium.

While financial and logistical constraints mean that extensive regional sub-surface sampling methodologies have so far only been practical in unusual circumstances such as those surrounding the large-scale eucalyptus planting in Loango, or the oil pipeline survey carried out in Cameroon and Chad (Lavachery *et al*. 2010), they can provide useful regional summaries of settlement patterns. Systematic aerial reconnaissance on a regional basis has also been fruitful. particularly in more arid regions such as the margins of the Kalahari and the highveld of South Africa where tree cover is less extensive than in Central Africa (Denbow 1979; Maggs 1976).

REFERENCES

Denbow, J. 1979. '*Cenchrus ciliaris*: an ecological indicator of Iron Age middens using aerial photography in Eastern Botswana'. *South African Journal of Science* 75: 405-408.

Denbow, J. 2014. *The Archaeology and Ethnography of Central Africa*. New York: Cambridge University Press.

Ekholm, K. 1972. *Power and Prestige: the rise and fall of the Kongo Kingdom*. Uppsala: Skriv Service.

Lavachery, P., MacEachern, S., Bouimon, T., & Mindzie, C. 2010. *Komé-Kribi: archéologie préventive le long de l'oléoducc Tchad-Cameroun, 1999-2004*. Journal of African Archaeology Monograph Series 5. Frankfurt: Africa Magna.

Maggs, T. M. 1976. *Iron Age communities of the southern Highveld*. Series 'Occasional publications of the Natal Museum' no 2. Pietermaritzburg: Council of the Natal Museum.

Denbow, J. 1990. 'Congo to Kalahari: data and hypotheses about the political economy of the Western Stream of the Early Iron Age'. *African Archaeological Review* 8: 139-176.

Denbow, J. 2012. 'Pride, prejudice, plunder and preservation: archaeology and the re-envisioning of ethnogenesis on the Loango coast of the Republic of Congo'. *Antiquity* 86 (332): 383-408.

CASE STUDY: PARTICIPATING AS A STUDENT IN AN IMPACT ASSESSMENT

Pascal Nlend[1]

Doctoral students, regardless of scientific field, usually seek to enrol in science programmes at universities and research institutes in order to pursue work that is often expensive to carry out. Archaeology is no exception, because it remains a costly science in which relevant results typically depend on the availability of financial resources. Even if some impassioned individuals manage to conduct excellent research on a tight budget and in isolation, the science of archaeology is best carried out by a team that these days is often interdisciplinary. This interdisciplinarity is necessary not only to augment our knowledge of humanity's past, but also to mobilize major financial resources. Today it is undeniable that archaeologists struggle considerably to mobilize funds without allying themselves with related sciences. If this situation is obvious in the West, in Africa it is even more prominent. In recent years, in Cameroon as in the rest of Africa, preventive and rescue archaeology offers a welcome solution. This new situation deserves attention (see the contributions of Mitchell, Arazi, Brandt and Oslisly in this volume), because it allows trainees to acquire tools from actual field experience.

I. FROM SCHEDULED ARCHAEOLOGY TO RESCUE ARCHAEOLOGY

In Cameroon, the question of student access to training is perennial. It had already been raised back in 1986 by several speakers at a conference on archaeology in Yaoundé (Essomba 1992). Many mentioned the crucial role of research programmes in solving the problem, and some pointed to the necessity of foreign archaeologists working in Cameroon to take on a greater number of local students. In reality, they already had, even if the number of students was insufficient. One of the projects that could be cited as an example was managed jointly by the Université libre de Bruxelles (ULB) and the Royal Museum for Central Africa (RMCA), led by P. de Maret, and focused on southern Cameroon. Some Cameroonians who participated went on to complete their doctoral dissertation. Others, meanwhile, were members of the Université de Yaoundé team and also participated in the archaeological excavations. In their work in northern Cameroon, J.-P. and A.M.D. Lebeuf also included in their team a student who had previously participated in missions with A. Marliac.

This period, which began at the dawn of the 1980s, can be considered the golden age of Cameroonian archaeology. In the early 1990s, a few research programmes continued to include local students: the Grassfields excavation of Shum Laka codirected by P. de Maret and R. Asombang; the archaeological component of the Tikarie project coordinated by M. Delneuf on the Tikar plain (central Cameroon); M. Eggert's team deployed in eastern areas of Cameroon's coastal province; even S. MacEachern's project in the far north.

In the early 2000s, some Cameroonians received training thanks to programmes such as that of the universities of Frankfurt and Tübingen in the eastern, southern and coastal provinces, as well as those of the universities of Nanterre (France) and Sofia Antipolis (France) and Bowdoin College (US) in northern Cameroon. It was thus to overcome the difficulty of obtaining more research funds for student training that in the late 1990s and early 2000s archaeologists dedicated themselves to building the awareness of public authorities, donors and businesses to incorporate the component of rescuing cultural heritage into the projects in which they were stakeholders.

II. IMPACT ASSESSMENT: A TRAINING AND RESEARCH FRAMEWORK FOR STUDENTS

Even if preventive archaeology programmes constitute an opportunity for the training of students, not all students can join, and are thus selected based on criteria unique to each team.

A. Student selection

The essential point in selecting students for archaeological assessments lies in their level of academic knowledge. The student must do everything he can to be above average in his university course. He must show a will to learn, consistency in his work, availability and, above all else, a good attitude. He must explore all leads and contacts that might help and guide him in his course. The majority unfortunately remain confined to the university without informing themselves of the myriad of available possibilities (fellowships from the cooperation services

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of Northern countries or research organizations, NGO internships, etc.).

In Cameroon, the first students to have acquired archaeological expertise were selected by IRD (Institut de Recherche pour le Développement) researchers based on the above criteria. In the case of the archaeological rescue of the Bertoua-Garoua-Boulaï road (eastern Cameroon), codirected by R. Asombang, M. Delneuf and C. Mbida Mindzié, the six students who were chosen performed monthly missions. For the archaeological inspection of the Lolodorf-Kribi-Campo main highway (coastal province) coordinated by R. Oslisly and C. Mbida Mindzié, seven students participated in missions each month. In the context of the protection of the archaeological heritage of the Ngaoundéré-Touboro road (northern Cameroon), supervised by R. Oslisly and B. Nizessété, approximately ten students collaborated on different missions.

B. Opportunity for research and student training

The inadequacy of practical training in archaeology at Cameroonian universities is explained mainly by the weak funding allocated to this subject and the lack of student financing. Students are encouraged to conduct their research in their home town in order to reduce costs – an approach that has the advantage of contributing significantly to the preservation of the national cultural heritage. These are archaeological rescue interventions that currently, to a great extent, allow students to conduct fieldwork that complements their theoretical knowledge and also provides the opportunity to defend theses and dissertations.

In Cameroon, four graduates carried out work related to preventive archaeological interventions. Archaeological inspection of the Lolodorf-Kribi-Campo main highway on the coast allowed for the defence of two master's theses, a DEA (diplôme d'études approfondies, 'diploma of advanced studies') thesis, and one doctoral dissertation. Along the same lines, a master 2 degree and a doctorate were defended in the context of the archaeological rescue undertaken during the construction of the Chad-Cameroon pipeline. A master's thesis was also defended in connection with the archaeological component of the Bertoua-Garoua-Boulaï road in eastern Cameroon. A doctoral dissertation currently underway relies on data from the archaeological inspection of the Kribi-Mpolongwé gas power plant on the coast.

The student who joins a team must seize this advantage to learn from more experienced colleagues. The experience not only entails analyses and excavations but also writing different types of reports in order to complement the training. Over time, he will learn to contact contributors to development projects, manage negotiations, and respond to bidding documents. Once he acquires a wide range of experience, he will logically be promoted to the rank of junior consultant.

1. From student in training to junior expert

The transition from student to junior expert implies a salary and more responsibilities. The effect of this change in status is firstly financial: the new junior expert is paid and signs a contract. He must know how to manage this transition and certainly not focus solely on financial gain. He should concentrate on his training, curriculum vitae and scientific production, which will allow him to apply to all firms recruiting experienced archaeologists.

Usually, expert assessments are coordinated by senior experts who rely significantly on junior experts. The latter lead teams in the field, analyse artefacts and collaborate on writing reports. They also participate in negotiations with donors and contracting authorities. The primary example is the archaeological component of the Chad-Cameroon pipeline. Three former Université de Yaoundé 1 students were recruited as junior experts under the coordination of a senior expert (Lavachery *et al.* 2010). Other teams subsequently adopted the same structure, including the archaeological inspections of the Dibamba and Mpolongwé power plants on the coast (see Oslisly, this volume).

2. Relations between the junior expert and the university

When the student becomes a junior expert, his relations with the university sometimes become complicated. He is solicited with increasing frequency for archaeological inspections, which has an impact on his academic curriculum. He has less time for class and often puts his studies on hold. To overcome this situation, he can, for example, decide to participate in assessments to gain experience and save money that will allow him to re-enrol at the opportune time in an academic institution. He must maintain contact with the academic world in order to facilitate his return. Professors, on their side, should accept and encourage the development of experienced junior experts. The ties between the junior expert and an academic institution provide the former the possibility to teach seminars, given his experience.

CONCLUSION

It is quite difficult to write an article on the role of the student in rescue archaeology assessments in Cameroon without being subjected to criticism. Despite this, what we learned is that anyone interested in joining archaeological impact assessments must be very intelligent, bold and patient. He has to focus on his training and not give priority to financial interests. His relations with the university must remain cordial so that he can, when appropriate, play a role in training younger researchers. The many challenges he will face include taking part in the publication of results of the projects in which he participates.

The examples presented here will be beneficial and help him to manage often complex situations.

REFERENCES

Essomba, J.M. (ed.). 1992. *L'Archéologie au Cameroun.* Paris: Karthala, 383 p.

Lavachery, P., MacEachern, S., Bouimon, T. & Mbida Mindzieé, C. 2010. 'De Komé à Kribi : archéologie préventive le long de l'oléoduc Tchad-Cameroun, 1999-2004'. *Journal of African Archaeology Monograph Series* 5, 187 p.

SURVEYING FUNERARY SITES

Isabelle Ribot[1]

INTRODUCTION

Prior to excavation, it is essential to document any potential site (e.g. location, historical context, and surface findings). This is especially true for a funerary site, as the latter often reflects a complex chronology and historical context. It is therefore recommended to work according to three main phases: firstly, search the archival, oral and historical records; secondly, locate the potential site *via* surface surveying and/or using Ground Penetrating Radar (GPR); and finally, plan the excavation. To illustrate these steps, a few African sites are taken as examples.

PRELIMINARY STAGES BEFORE EXCAVATING HUMAN REMAINS: DOCUMENTING THE POTENTIAL FUNERARY SITE

A. Archives and Oral History

For historical sites in particular, archival records (e.g. deed maps, written accounts, journals) can help to locate ancient graveyards. This is not always the case as informal graveyards are often undocumented. The latter are usually colonial cemeteries for low socioeconomic groups or African slaves, such as in South Africa (Prestwich Street) (Finnegan *et al.* 2011) and in the United States (New York African Burial Ground) (Perry *et al.* 2009).

In addition, oral history can sometimes provide hypotheses on the origin of a particular site (e.g. anecdotes, topographic names), although it is susceptible to being altered over time. For example, in Central Mali, the Tellem caves (a series of funerary sites in the Bandiagara cliffs dated to 11th-13th century A.D.) have been known by oral tradition to be used by people other than the present Dogon. In fact, these pre-Dogon groups were possibly trying to escape from the control of the Malian Empire. This hypothesis on the nature of the site and the identity of the burials helped archaeologists and bioarchaeologists redirect their research questions and reflect on the uniqueness of the Tellem burials (Huizinga *et al.* 1979).

B. Surface and/or Subsurface Surveys

Accurately locating concentrations of burials is one of the most challenging aspects of archaeology, especially when there is no archival data and little or no surface remains (e.g. tombstones, disturbances in the soil, exposed skeletal elements). Due to expanding cities, preliminary observations on the surface are very rare and cemeteries are often discovered by accident during construction work (e.g. historic cemetery, South Africa: Van der Merwe *et al.* 2010). Nevertheless, some funerary sites found in rural context and dated to the Iron Age, such as the Senegalese megaliths, are an exception to this rule as they have been identified by surface architectural structures (Thilmans *et al.* 1980).

Techniques to locate burials, prior to excavation, are directly influenced by their environmental setting (e.g. a site sheltered or unsheltered from external factors such as wind, rain, regular ploughing). Archaeologists or bioarchaeologists have to first start observing surface changes (e.g. soil erosion, soil compaction, presence of animal/human/artefactual remains and ecofacts, architectural structures) (Steyn *et al.* 2000). These changes have to be recorded, photographed and localized as precisely as possible, using global positioning system (GPS), in order to be able to pinpoint the site in the future. Written notes should include all possible soil disturbances (e.g. erosions, depressions, changes in soil colour and texture). If human remains are found during surface surveys, none of them should be collected unless they are threatened by soil erosion (e.g. on a beach and exposed to the waves) or imminent loss, but their position still needs to be recorded.

Disturbed surface soil as a result of natural erosion, faunal, or human activity can indicate hidden structures, such as funerary pits whose colour and/or texture of infill often 'demarcate' it from its surroundings. Human remains found on the surface may imply the existence of an exposed burial (e.g. prehistoric burials found in eroded paleodunes, Niger) (Sereno *et al.* 2008).

Surface concave depressions where a body was interred are some of the most obvious examples (**fig. 1**). This phenomenon can be seen in recent cemeteries where there has been less urban development obscuring or disturbing the surface (Steyn *et al.* 2000). Varying in size, these depressions are due to the fact that, with time, the soil used to fill the burial tends to compact, and in addition, the body also

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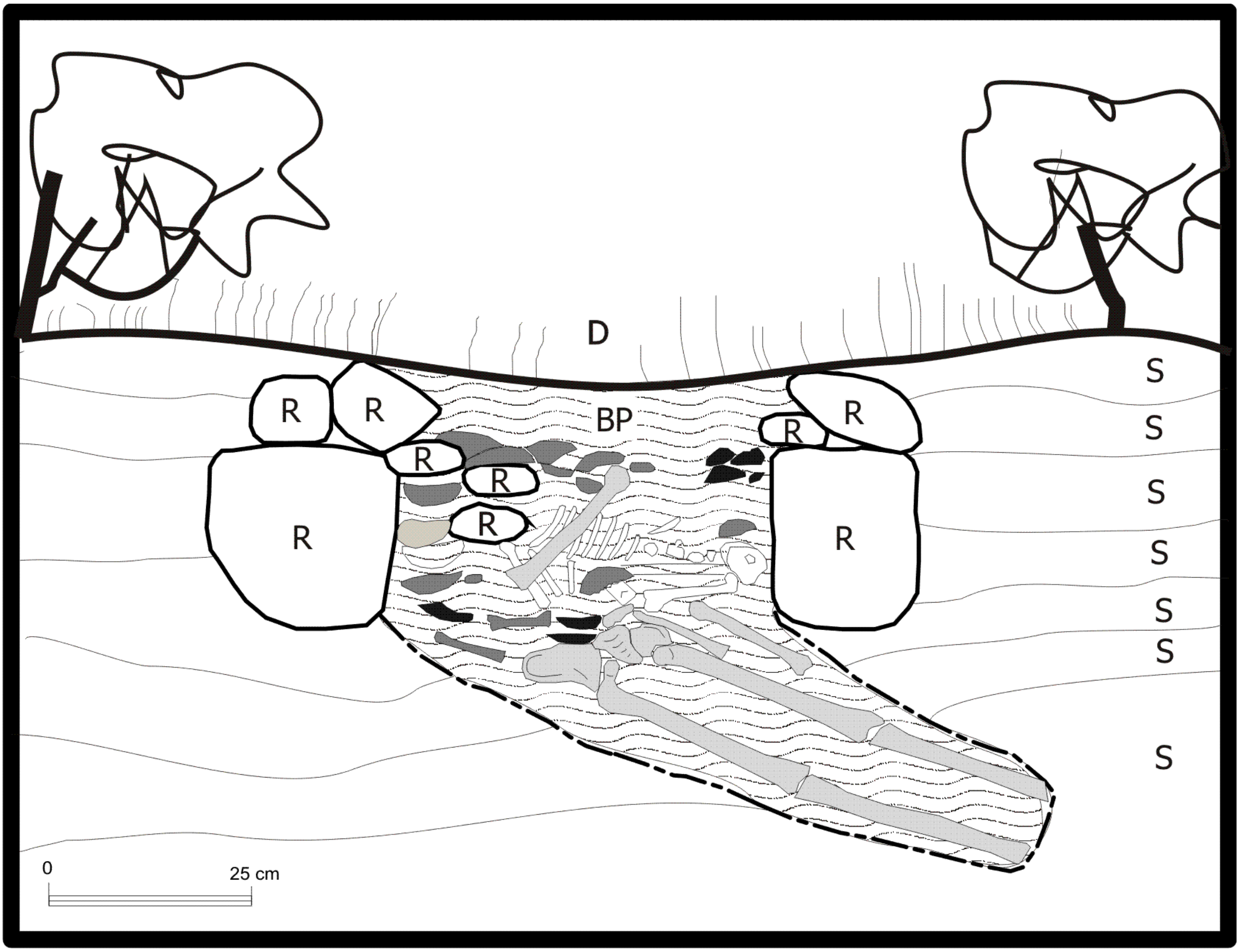

Fig 1. Stratigraphic section of a collective burial (containing several partly disarticulated individuals), showing both surface and underground features: D=concave depression on surface; BP=burial pit (disturbed stratigraphy); R=rocks; S=undisturbed stratigraphy. (Schematic drawing of I. Ribot.)

collapses during decomposition. However, if the soil is hard, rich in rocks and not well-watered, this phenomenon will not be as visible. Furthermore, even if ideal conditions are present (e.g. high quantity of water in well-absorbing loose soil), surface depressions tend to vanish due to the following factors: i) time; ii) vegetation growth; iii) subsequent soil accumulation; and iv) sub-surface disturbances from recent buildings or municipal works (e.g. South Africa: Van der Merwe *et al.* 2010; Finnegan *et al*. 2011).

New vegetation growth on the surface might also be taken into account as indicating the presence of fresh graves when body decomposition processes are still active. However, vegetation indices (e.g. weeds) are less reliable if the graves are too old (more than 50 years), especially when the body has decayed.

When there are sufficient funds, more sophisticated means to pinpoint historic graveyards without excavation are possible, including: aerial photography (e.g. landscape interpretations), metal detectors (e.g. presence of coffin nails) and/or Ground Penetrating Radar (GPR). The latter is a particularly good geophysical technique that complements other data (e.g. surface depressions) (Ruffell *et al.* 2009). Although very rocky and wet soils are not ideal, the GPR technique can detect underground structures such as grave shafts via magnetic anomalies, and therefore can locate funerary pits with no surface features (e.g. South African 19th century A.D. cemetery: Nienaber 2014).

C. Planning the excavation: ethical considerations, time and budget

Once the preliminary data have confirmed the presence of burials at a particular site, the researcher may need to consult the descendants, especially in the case of recent cemeteries. Ethical permits and legislation will vary from one country to another, as will procedures for acquiring an excavation permit. Heritage resources agencies of each country will make the final decision about exhumation, investigation and/or even reburying of human remains (e.g. South Africa: Van Der Merwe *et al.* 2010; Saccaggi & Esterhuysen 2014). The excavation can then begin, but its length often will depend on budget, and therefore the researcher may have to limit the number of test questions regarding the site under study.

CONCLUSION

These preliminary stages will help to explore the broad context of the potential site with as many lines of evidence as possible (e.g. environmental, historical, cultural, archaeological, ethical). In the ideal situation, if the excavation is the result of a long-term archaeological project with a detailed research agenda (e.g. survey of potential sites, questions to test), the nature and location of the site will be better anticipated. However, as funerary discoveries are often accidental, especially in the case of urban historical sites, these preliminary investigations are frequently initiated just prior to excavation (e.g. 18th century African graveyards: Van der Merwe *et al.* 2010; Perry *et al*. 2009; Finnegan *et al.* 2011). This is of course not an ideal situation, as ethical issues often need to be raised simultaneously, and they can slow down or even prevent a cemetery excavation. Nevertheless, even if the surveying phase is not followed by an excavation, the data obtained remains extremely useful for mapping unexcavated ancient funerary sites and can prevent the ancient site's future destruction.

REFERENCES

Finnegan, E., Hart, T. & Halkett, D. 2011. 'The "informal" burial ground at Prestwich Street, Cape Town: cultural and chronological indicators for the historical Cape underclass'. *South African Archaeological Bulletin* 66 (194): 136-148.

Huizinga, J., Bedaux, R.M.A. & van der Waals, J.D. 1979. 'Anthropological research in Mali'. *National Geographic Society Research Reports Projects* 11: 281-307.

Nienaber, W.C. 2014. 'The use of Ground Penetrating Radar to assess graves at Magogwe Anglo-Boer War (1899-1902) cemetery'. *Clinical Anatomy AACA or BACA Meeting Abstracts* (42nd Annual Conference of the Anatomical Society of Southern Africa, 13-16 April 2014, Stellenbosch): 9-10.

Perry, W.R, Howson, J. & Bianco, B.A. 2009. *The Archaeology of the New York African Burial Ground*. Vol. 2. Washington D.C.: Howard University Press.

Ruffell, A., McCabe, A., Donnelly. C. & Sloan, B. 2009. 'Location and assessment of an historic (150-160 years old) mass grave using geographic and ground penetrating radar investigation, NW Ireland'. *Journal of Forensic Sciences* 54 (2): 382-394.

Saccaggi, B. & Esterhuysen, A. 2014. 'Sekuruwe grave relocation: a lesson in process and practice'. *South African Archaeological Bulletin* 69 (200): 173-181.

Sereno, P.C., Garcea, E.A.A., Jousse, H, Stojanowski, C.M. & Saliège, J-F. 2008. 'Lakeside Cemeteries in the Sahara: 5000 years of Holocene population and environmental change'. *PloS ONE* 3 (8): 1-22.

Steyn, M, Nienaber, W.C. & Iscan, M.Y. 2000. 'Chapter 4. Excavation and retrieval of forensic remains.' In J.A. Siegel, P.J. Saukko, & G.C. Knupfer (eds), *Encyclopedia of Forensic Sciences*. London: Academic Press. pp. 235-242.

Thilmans, G., Descamps, C., Khayat, B. 1980. 'Protohistoire du Sénégal, recherches archéologiques, I: Les sites mégalithiques'. *Mémoires de l'Institut Fondamental d'Afrique noire* No. 91. Dakar: IFAN. 158 p.

Van der Merwe, A.E., Morris, D., Steyn, M. & Maat, G.J.R. 2010. 'The history and health of a nineteenth-century migrant mine-worker population from Kimberley, South Africa'. *South African Archaeological Bulletin* 65: 185-195.

FINDING ROCK ART

Benjamin Smith[1]

Fig. 1. Rock paintings in a typical African sandstone rock shelter context. The images were made using finger-painted white kaolin clay. Location: Limpopo Province, South Africa. (Photo © Benjamin Smith.)

Fig. 2. Multi-period rock engravings on an exposed sandstone boulder. The images are made by pecking; the animal was subsequently polished. Location: Twyfelfontein World Heritage Site, Namibia. (Photo © Benjamin Smith.)

In every part of Africa there are rich assemblages of images placed in rock shelters and on boulders. These do not require excavation in order to be studied and different sets of techniques are needed for their recording, analysis, and conservation. These images come in two main types: the first is painted or daubed onto rock surfaces using pigments. Typical pigments include purple, red, and yellow ochre (iron oxides), black charcoal, and white kaolin. Images made using pigments are termed **rock paintings** (pictographs in North America) and they are generally found on protected rock faces or in rock shelters (**fig. 1**). Unlike in Europe, Africa does not have art in deep caves and so the term cave painting is not appropriate. The second type of image is engraved into rock surfaces by pecking, gouging or scratching using a harder implement, usually a harder stone. These are termed **rock engravings** (petroglyphs in North America) and they are generally found on open boulders and exposed rock pavements (**fig. 2**). Collectively, these two types of images are termed **rock art**. In very rare cases, such as at a handful of sites in South Africa and Zambia, one finds painted engravings. In addition to rock art there are a variety of other forms of rock marking that often get recorded alongside rock art (**fig. 3**).

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Rock art is one of the most widespread forms of African archaeological heritage. It should be expected that rock art will be found in archaeological surveys in all parts of Africa where there is rock. In those areas where the geology produces cliffs, overhanging boulders, and rock shelters the typical type of art is rock painting. The most common rocks for painting upon in Africa are sandstone, granite and gneiss. Those areas with boulders and rock pavements, but where there is an absence of rock shelters, are more likely to have rock engravings. Typical engraving rocks are sandstone, ironstone, dolerite, andesite, quartzite and, more rarely, granite. In parts of Africa dominated by limestone, lava (e.g. basalt, gabbro) and marble, rock art is rare, but not always absent.

I. RESEARCH QUESTIONS

When starting any work on rock art the key first step is to ask why you are doing this work. What are the limits (geographic and temporal) of your study? What do you and others wish to achieve from this work? The answers to these questions will determine what you do. There are almost unlimited numbers of things you can observe and record concerning rock art. Whatever some may claim, you can never record everything: all recording is necessarily selective (Whitley 2011). Therefore the only sensible way to decide what to search out and to record is to consider what things you can collect that will be most

Whilst rock paintings and rock engravings make up at least 90% of African rock art, there are some other classes of archaeological artefact that are sometimes lumped with the term ‘rock markings’ (Rosenfeld 1999) such as man-made cups, hollows and grooves, cut into rock surfaces. Some of these are the by-product of the grinding of foods, minerals and pigments. In this sense they are not ‘art’, as they are unintentional marks left by a production process. However, they are often recorded along with rock art. Residue analysis can identify the remains of whatever was ground in the rock depression and thereby recognise why they were made. However, not all such marks are inadvertent; cupules and lenticular grooves are sometimes placed metres above the ground and on vertical surfaces where they cannot have served any practical function. These can be some of the oldest rock markings and can be of great significance (Coulson *et al.* 2011).

Another anomalous class of artefact commonly included within ‘rock art’ are rock gongs. These are resonant rocks that have been played by hitting them with another object, usually a stone. They can be identified from the stress markings that repeated hitting has left upon the rock surface. These should more properly be classified as musical instruments, but because they involve rock and are often associated with other types of art, they are sometimes recorded as rock art.

Mobile art in the form of loose pieces of rock, bone, eggshell or wood that have been carved or painted (and including painted and engraved burial stones) and then transported before being lost/intentionally deposited may also be included within ‘rock art’. These are typically located during excavation and are not commonly found in surface archaeological surveys. Mobile art is comparatively rare in Africa, but is becoming an increasing focus of attention because of important examples from some of the earliest modern human sites (Henshilwood *et al*. 2009; Texier *et al*. 2013a).

A final category that is generally included within ‘rock art’ is carved and/or painted monoliths. These are boulders that have been shaped and then erected. They are typically used to mark graves or shrines and are mostly found in West Africa and the Horn of Africa.

Fig. 3. Rock Markings.

useful to you and to others likely to use your data. If you work for a heritage agency then you will need to collect information relevant to the future management of the site, such as a list of the major stakeholders with interests in the site, the significance of the site, the cultural values of the site, its state of authenticity and integrity, the major conservation issues facing it, etc. If you are a conservator then a highly detailed study of the condition of the site, factors affecting this condition, and monitoring of previous conservation interventions at the site will be needed. If you work for a research institution and wish to interpret the meaning of the art, then a recording of the shape, size, colour, and style of each individual image may be necessary, together with a comprehensive recording of image overlays and juxtapositions within every art panel.

II. DESKTOP SURVEY

For a wide variety of purposes a comprehensive list of rock art sites will be needed. To create this begin by compiling all existing records held by heritage agencies, museums, universities, private collections and in past publications concerning the area in which you wish to work. This work, whilst laborious, will save you considerable time and money in the field and it can provide important information that is no longer available. It will also give you a baseline from which to monitor changes at the sites. This is often called a ‘desktop’ survey, although in practice it can rarely be conducted from your desk because much of this information will not be found online; a thorough job will require you to visit various institutions and archives. Set up a basic site database in which to store all of the information you collect. A typical format for a site database is by: site name or site number, district (or county), province, country. This database can be on paper in a filing cabinet, with each site having its own folder, or (better) on computer. Be careful how you name sites as this will become your primary reference for all of the data you record. People generally name sites either a) by 1:50 000 map sheet number and then consecutively on each sheet in the order in which they are found (so 1434A1 1, 1434A1 2, 1434A1 3 etc.) or b) by the local name of the hill, farm or area in which the sites are found and then by number if there is more than one site in the same named area (so Pahi 1, Pahi 2, Pahi 3 etc.). You may find during your ‘desk-top’ survey that there are multiple site naming systems already in place. Wherever possible follow the most commonly used and/or ‘offical’ (i.e. government authorised) system and record all other names as ‘alternative names’ so that no matter what name is used you will know to which site it refers.

III. SURVEY PROPER

With your 'desktop' survey completed you are ready to go into the field. Make sure that you have the necessary permits in place and that all necessary authorities, including traditional authorities, have been informed of your work before you begin fieldwork. When beginning a survey in an area in which sites are already recorded, it is common practice to start by visiting the known sites and then to expand the survey outwards from these sites in a systematic manner that ensures that all areas are covered. When working in an area in which no sites have been recorded, a common place to start is by consulting with members of local communities. They will generally know the location of major rock art sites; however it should not be assumed that people will automatically divulge their knowledge. Sites may be sacred and still used for important local ceremonies, such as initiation ceremonies. Their location may therefore be kept secret. Commonly, there can also be confusion around the term 'rock art'. Just as the concept of 'rock art' is vague in English, it also has no exact equivalent within most African languages. Translators tend to use terms equating to 'the written rock' and I have regularly walked for many hours to be shown an unusual geological formation, some tourist graffiti or a triangulation pillar. Even when one is able to convey the concept of rock art successfully, it is by no means guaranteed that all sites will be known to all locals. Often the larger more spectacular sites are known, and the smaller, more hidden and more faded sites are missed. When I began research in a fairly densely populated part of central Malawi, around 50 rock painting sites were known to locals. A full survey discovered 127 sites. So, local knowledge and engagement is essential to fieldwork in all parts of Africa and locals must be consulted and involved in all archaeological work, but this does not mean that local guiding can replace thorough survey.

IV. SEEING THE UNEXPECTED

One also needs to be cautious of one's own expectations. If one is used to looking for human and animal paintings then one tends to miss geometric images and handprints, especially if they are faded. Equally if one has recorded many images in shades of red, it is surprisingly easy to overlook even quite prominent images painted in white. And, if one is looking for paintings, one tends to miss engravings, other markings and so on. It is therefore important to go into the field with broad expectations and looking for a diversity of art. The traditional wisdom in the southern African Drakensberg, for example, was that rock paintings are restricted to the Drakensberg sandstones and do not extend to the overlying basalts. Many surveys have tacitly confirmed this expectation by not looking at the basalts. A recent survey in Lesotho looked equally at sandstones and basalts and found, for the first time, considerable evidence of rock paintings on basalt (Hugo Pint pers. comm. 2014). A thorough survey must therefore initially include at least a quick look at all sections of the landscape. If certain sections prove to be especially rich then these can be afforded special attention.

REFERENCES

Coulson, S., Staurset, S. & Walker, N. 2011. 'Ritualised behaviour in the Middle Stone Age: evidence from Rhino Cave, Tsodilo Hills, Botswana'. *PaleoAnthropology* 2011: 18-61.

Henshilwood, C.S., d'Errico, F. & Watts, I. 2009. 'Engraved ochres from the Middle Stone Age levels at Blombos Cave, South Africa'. *Journal of Human Evolution* 57: 27-47.

Rosenfeld, A. 1999. 'Rock art and rock markings'. *Australian Archaeology* 49: 28-33.

Taçon, P.S.C. & Chippindale, C. 1998. *The Archaeology of Rock Art*. Cambridge: Cambridge University Press.

Texier, P-J., Porraz, G., Parkington, J., Rigaud, J.-P., Poggenpoel, C. & Tribolo, C. 2013. 'The context, form and significance of the MSA engraved ostrich eggshell collection from Diepkloof Rock Shelter, Western Cape, South Africa'. *Journal of Archaeological Science* 40: 3412-3431.

Whitley, D.S. 2011. *Introduction to Rock Art Research*. Walnut Creek: Left Coast Press.

Chapter 3

How to protect archaeological sites

INTRODUCTION

Alexandre Livingstone Smith[1]

This chapter explains the principles of site protection and excavation. It discusses various methods of site analysis (coring, test-pits, extensive excavation) and the different contexts in which excavations can take place. In short, this chapter deals with identification of site formation processes and the degrees of precision with which archaeological facts can be recorded, as well as the importance of stratigraphic interpretation.

As regards site formation processes, it is absolutely crucial to understand how the artefacts and ecofacts associated with a site came to be where they are found today. One has to be sure that the objects present in a layer were left there by people, as they sometimes can be moved and deposited by natural phenomena. Finding very different types of objects together in the same units (i.e. example Early Stone Age lithic material associated with potsherds or metallurgical slag) is an indication that something is wrong on a site, but disturbances may be more subtle. Concerning recording precision, one has to bear in mind that once an archaeological context is excavated, it is effectively destroyed. Thus, it is essential to know as accurately as possible where the artefacts and ecofacts were collected and what they were associated with. But there are various degrees of precision an archaeologist can work with. In some cases, like a pit structure, it may be enough to know which layer the objects are coming from. In other cases, such as a Stone Age knapping site or camp, it may be useful to number all artefacts and ecofacts and record their position in three dimensions. Finally, although one may sometimes feel at loss, with no coherent explanation, it is imperative before drawing the profile of a dig to have an understanding of how things came to be as they are. People do things - they discard objects, they dig holes, they build things, etc. - and these things fall, decay, and fill in, generally according to the laws of gravity. Once gravity has done its job, animals will feed on organic remains and dig through the layers of the site. It is important to be able to describe the stratigraphic sections of a site, even if the detailed geological processes are not understood. One should make sure that photographs, records and drawings show something that will be understood by other people. If parts of a profile are not understood, it is important to mark them as such on the drawings. It will be easier to make sense of things afterwards.

The various authors who contributed to this chapter highlight these various points, making sure that a variety of contexts are presented. As these contributions consist only in a basic introduction to the field, they generally offer some guidelines for further reading. Together they provide a series of guidelines for the excavation of various types of sites in various contexts.

Ralph Vogelsang tackles the very large topic of Stone Age excavations. He outlines the specific characteristics of this kind of archaeology, where there are no traces of built structures and archaeologists can only reconstruct the behaviour of early humans indirectly. This situation explains why the characteristics of the objects and their relationships, the context of the finds, are so crucial – indeed this is *the* most important concept in archaeology in general. Also, one should bear in mind that every type of site, such as open air or rock-shelters, may reflect specific aspects of human activities. To record this information and to be able to interpret a site, it is necessary to record all the finds in three dimensions. In this regard, the author explains a simple way to obtain effective data without the use of sophisticated equipment. Digging and recording techniques are considered next, with various options in the recording of artefact positions. Finally, advices are given on the way to backfill a site. This is important to preserve unexcavated parts of the sites and facilitate future excavations.

Hans-Peter Wotzka's contribution is focused on the excavation of villages. As it is difficult to dig a complete village and its surroundings, one will need to define the aims of the excavations carefully, based on the questions one wants to answer. The author offers a series of research questions, but points out, that at this stage, village archaeology in sub-Saharan Africa cannot be too selective! Clear research questions are always important, however, and affect the overall research design as well as excavation strategies. Concerning excavation strategies, a distinction is made between shallow and deep deposits. For both types of contexts, advice is given on how to open an appropriate window into the past. This contribution ends with general considerations of excavation methods and recording, as well as site protection.

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Alain Assoko Ndong examines the digging of pit structures step by step. Pit structures, their uses and their role in archaeological sites are explained. Recommendations are given about the lay out of the reference grid and the identification, cleaning and photography of pit structures. This includes the setting up of a cut axis, use of the Pythagorean triangle, and excavation proper. As regards the latter, he advocates use of artificial spits, within which distinct archaeological contexts can be separated. He also underlines the importance of a clear system for the labelling and bagging of material, the procedures for marking and numbering each individual find. Finally, he explains how the origin of the individual fragments, after refitting, can help in the interpretation of the history of a structure.

Jeffrey Fleisher outlines the complex process of urban excavations. He considers what can be learned from urban contexts, emphasising the variety of urbanisms and the renewal of their study - with a focus on the function of sites, rather than their typological characteristics. It is important to plan carefully the aims and the overall design plan of each excavation. He relies on established recording systems and a well-structured coordination of fieldwork, particularly as urban excavations generate very large amounts of data. Much of this data needs to be screened and processed in the field, a procedure that must be well crafted in advance. Finally, the author summarizes three essential aspects of this type of archaeology: site complexity, management of large datasets and safety.

Luc Laporte's contribution is dedicated to megaliths. He summarises the essence of archaeological excavation as a combination of planning and open-mindedness, before focusing on certain aspects of megalithic archaeology such as the variety of research questions, team work and the seasonal calendar of excavations. Fieldwork proper is considered step by step, with surveys, construction analysis, stratigraphic analysis and analysis of burial levels. Finally, he considers the importance of megalithic monuments as world heritage and the restoration of such monuments, as well as the conservation and publication of research results.

The contribution of **Caroline Robion-Brunner and Vincent Serneels** address the topic of metallurgical sites. They consider research strategies and field methodologies, starting with site inventory and site topography. They provide simple guidelines to site topography and technical characterisation, with a clear procedure for the excavation of a furnace and its surroundings, as well as a clear analytical grid for metallurgic waste, both slag and *tuyères*. Advice for the dating of metallurgical sites is also given, a very useful section considering the highly debated topic. Finally, procedures for the evaluation of production volumes and environmental impact are given. Figures and photographs provide visual support for each process.

For her part, **Isabelle Ribot** reviews the excavation of funerary sites, and associated tasks. Comparing the site to a crime scene, she starts with listing key tasks that the archaeologist has to bear in mind, although she stresses that the excavation of human remains is really a specialist's job. Some of these tasks are then discussed with a focus on locating the grave pit and uncovering the human remains. She provides a check list of the data to be recovered systematically, and finishes with advice on questions pertaining to exhuming and bagging the remains.

Benjamin Smith takes the reader one step further in the recording of rock art. His contribution is divided in two parts. First he considers the recording of rock art sites in general. He outlines the use of record sheets and the use of GPS to locate the site as accurately as possible, as well as various textual and graphic data that need to be recorded. This includes information ranging from the type of rock to the style of the art, and the mapping and recording of the site and its art by photography or tracing. A systematic approach is crucial for the study of any rock art project. Finally, he considers the input of specialists for, for example, image enhancement or pigment analyses.

Geoffroy Heimlich's contribution is dedicated to the specific case of the rock art sites of the Lovo Massif in DRC (Lower Congo Province). He advocates digital photography as a recording technique, coupled with digital enhancing (like Smith he recommends the use of DStretch), and gives an sample image treatment. He provides an appraisal of the use of GIS for the study of rock art, explaining how he built a simple database allowing for the 'aerological' study of rock art. He also considers problems related to graphic pigment analysis and dating. Finally, he considers the preservation of rock art in the province of Congo Centrale.

This last topic is central in the next paper, as **Benjamin Smith** makes a final contribution on the management and conservation of rock art sites. Here he considers three important aspects of the management and preservation of rock art sites: significance, training and conservation.

THE EXCAVATION OF STONE AGE SITES

Ralf Vogelsang[1]

INTRODUCTION

The African continent provides the most comprehensive record of the Stone Age period worldwide. Starting with the earliest evidence of tool-making dated to 2.5 Ma from Gona in Ethiopia (Semaw *et al*. 1997, or even 3.4 Ma ago, McPherron *et al*. 2010) and enduring in some regions until contemporary times (e.g. today's hide workers in the Konso region of Ethiopia that make and use stone scrapers (Brandt & Weedman 2002); it is by far the longest period of human history.

The Early Stone Age is also the only archaeological period with the coexistence of different kinds of hominids. However, the making of stone-tools is generally ascribed to a single genus – *Homo* – with several species, such as *Homo habilis* and *Homo ergaster*. The emergence of the genus *Homo* may coincide with the earliest archaeological evidence for stone-tool making but the correlation of cultural hominid evolution, represented by archaeological groups defined by stone tool types and technology, with anatomical hominid evolution, i.e. distinct human populations, is extremely problematic. Since 200 ka anatomically modern humans (*Homo sapiens sapiens*) seem to be the only surviving species in Africa.

The long duration of the Stone Age is however not reflected by an exceptionally large number of sites known from this period. On the one hand, population density was low during much of the Stone Age and on the other hand, sites were covered by such thick sediments that they are not accessible today or they were destroyed by natural or anthropogenic activities. The probability of post-depositional disturbance and destruction increases in time and impairs the number of Stone Age sites especially from the earliest periods.

I. THE SINGULARITY OF STONE AGE EXCAVATIONS

In contrast to the excavation of archaeological sites from later periods, most Stone Age sites are characterized by the absence of any preserved structures such as house floors, pits, graves or walls that we can analyze and interpret. At Stone Age sites, the presence of structures, activity areas (e.g. butchery sites) has to be recognised by the configuration and distribution of the lithic, bone, and organic tools (such as wood and leather) and their production debris. Further evidence can come from faunal/plant remains, ashes or stone arrangements that cannot be explained by natural phenomena such as rockfall, the deposition of volcanic ashes or bone accumulations by scavengers or birds of prey. However, quite often especially in the earlier periods, stone artefacts are the only preserved find category. The definition of relevant units of analysis and the interpretation of the patterning and distribution of finds for the identification of such 'latent structures' deserve a detailed as possible documentation of the original context (hence the extreme importance of the excavation grid system, the three-dimensional recording of the finds and the exact documentation of stratigraphic observations, described below). Idealized distribution patterns gained by experimental archaeology or by ethnographic analogy help to interpret archaeological patterns and to identify such 'latent structures' and activity areas (**fig. 1**).

The configuration and patterning of lithics can also tell about the choices made during stone tool manufacture (*chaîne opératoire*) and use. For example, large flakes occur mainly during the initial phases of tool production; high numbers of very small stone chips indicate the knapping of stone-tools on the spot. A low diversification of the tool spectrum indicates specialized inventories (e.g. hunting sites, raw-material procurement sites), whereas less specialized sites are characterized by a heterogeneous spectrum (e.g. long-term settlement sites). However, one should always keep in mind that the original composition and distribution of the assemblages might have been altered by later site formation processes (e.g. the loss of small chips by erosion).

II. OPEN-AIR SITES AND ROCK-SHELTERS: THE PROS AND CONS

Open-air sites and rock-shelters each record only a part of human behaviour and settlement patterns. To get the whole picture of a human population, both site categories have to be considered. Whereas rock-shelters were mainly occupied for protection from the forces of nature,

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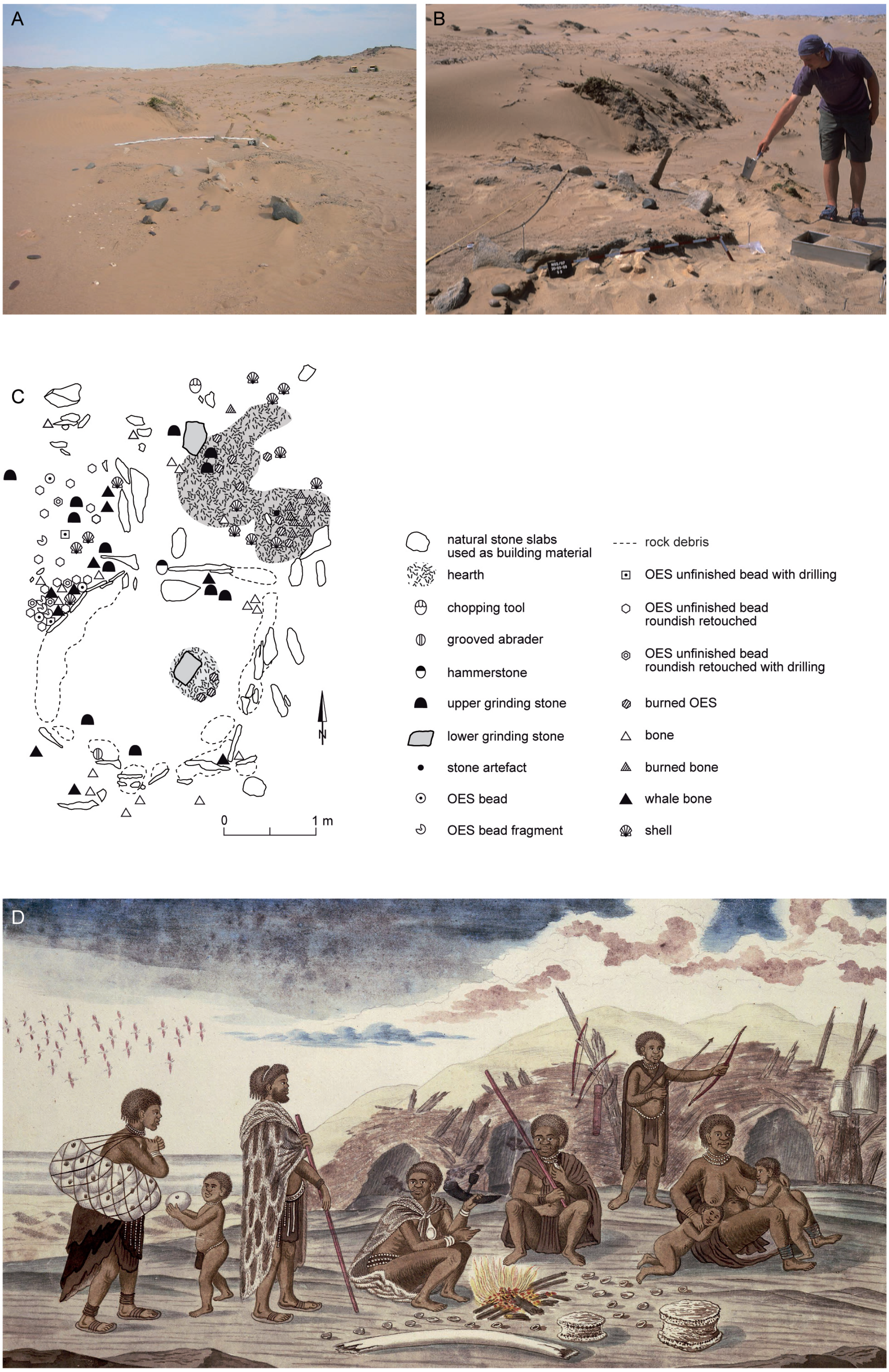


Fig. 1. Heavily eroded stone circle in the Skeleton Coast Park/Namibia (site N2002/7, circle 3) before (A) and during excavation (B). The distribution map (C) allows the reconstruction of the hut structure that is virtually lacking any finds in the inside. Two activity areas can be distinguished outside in the wind shadow of the former hut: an ostrich eggshell bead (OES) production area in the western part and a hearth with food remains (burned bones and mussel) in the eastern part. Remains of whalebones indicate their use as part of the hut construction. Four radiocarbon samples date the site around 850 calAD. A picture from 1779 (D), showing a Bushman family in front of their whalebone hut near the lower Orange River gives an idea of the assumed original state of such a settlement (Gordon 1779, source: Gordon atlas, Rijksmuseum Amsterdam). (Photos A and B © R. Vogelsang.)

open-air sites present a more diverse spectrum such as settlement, hunting, and raw-material procurement. Both have pros and cons regarding the preservation of archaeological remains. In arid regions, the number of open-air surface sites can be extremely high. In contrast to wetter regions, such as the central part of Africa, Stone Age sites were not covered by thick fluvial sediments and even artefacts from the earliest phases of the Stone Age can be found on the surface. However, such finds are not from a sealed context, so remains from different time periods might be mixed and the state of preservation (e.g. patina, weathering) can at best only be a relative chronological marker. A chronological differentiation is easier if artefacts are buried in sediments. If these sediments are undisturbed, there will be a succession from the surface (= young) to the basal layers (= old). However, not all assemblages found in sediments are *in situ*, i.e. in the place where they were originally located after their last use. In particular, fluvial (= river) activities might displace artefacts over long distances. For the identification of such post-depositional processes, the expertise of a specialist (geologist; geo-morphologist; geo-archaeologist) is highly recommended. If open-air sites are connected with favourable environmental conditions, such as a spring or a raw-material source, people and their ancestors might have returned again and again and a sequence of different archaeological layers, divided by natural sediments, might develop.

Rock-shelters are also favourable places for hominins and, in addition, they protect not only the human inhabitants but also their occupational remains and natural sediments. This is especially the case when large boulders at the opening formed a sediment-trap. For this reason, the potential of rock-shelters to preserve a stratigraphy with multi-sequenced settlement layers is relatively high. This is a great advantage and some rock-shelters are key-sites, offering a chronological and cultural frame for larger regions. The disadvantage of highly frequented sites is the danger of mixing of different occupational events. Especially in arid regions, the accumulation of natural sediments such as rock fall and other weathering products can be extremely low. In this case, archaeological horizons are not separated by sterile sediments, even if there is a hiatus of several thousands of years between the occupational events. This results in mixed assemblages, sometimes only identifiable by heterogeneous radiocarbon ages. Despite trampling and mixture the slow, gradual and long accumulation of sediments and archaeological material often offers sound cultural sequences that can be used as a starting point for relative and absolute chronology for single-phase occupation sites and even the classification of surface scatters.

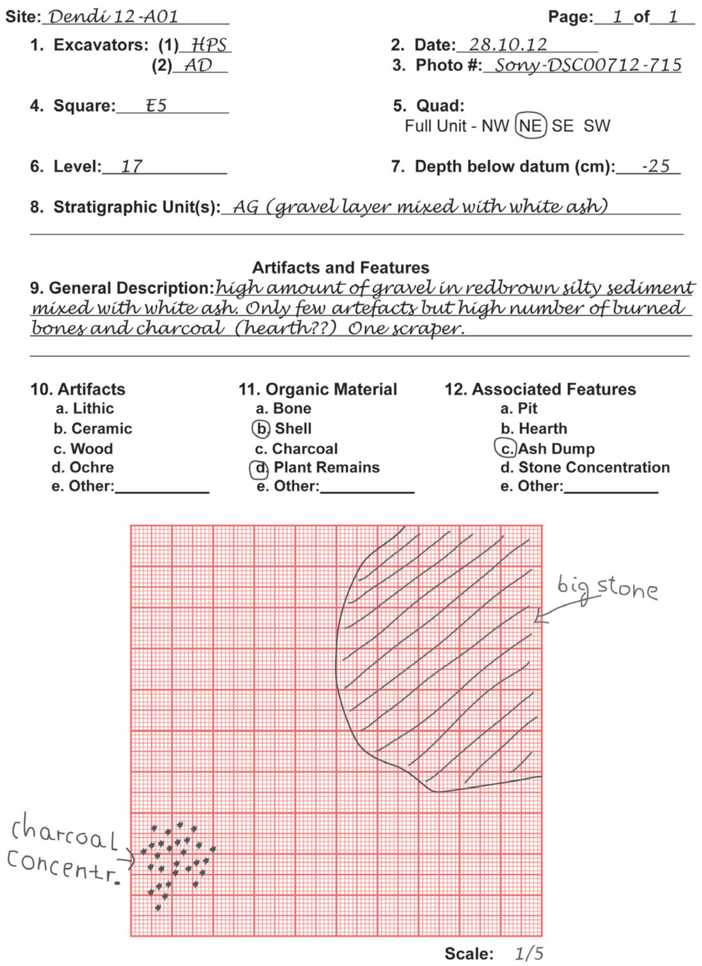
III. EXCAVATION METHODS

Information that has not been documented during the excavation is irretrievably lost for later analysis. Therefore, excavation methods and documentation should be as accurate as possible. The state-of-the-art field recording method for the subsequent spatial reconstruction of the distribution of finds (i.e. artefacts made of stone, bone, wood etc., but also faunal remains, charcoal, botanical remains) and features (e.g. ash-lenses, concentrations of rocks, pits, animal burrows) is the plotting of their x-y-z coordinates with a total station. The coordinates must be connected with a specimen number and provenience information. The coordinate data can then be processed with special Geographic Information System (GIS) software (such as ESRI ArcGIS or the freeware GrassGIS) to construct a three-dimensional model of the spatial distribution of finds and features (e.g. Marean *et al*. 2010: 239). However, this method requires expensive technical equipment, GIS expertise, and is time-consuming. Sometimes it is not possible to fulfil this sophisticated standard, especially during rescue excavations, when sites are endangered by construction work or by natural erosion. In this case, one has to act without delay but should follow some minimum requirements.

IV. PLANNING

Prior to the excavation, the current surface must be levelled, using a total station that records the x-y-z coordinates or using the grid system and a surveyor's level. In connection with the mapping of the topographic features of the site (e.g. shelter wall, large rocks, drip-line) these data allow drawing of a relief map of the site. For this task and all further measurements, one has to define a datum point (= 0) that must be marked on a durable feature, such as a big rock or the shelter wall.

The next requirement is the surveying and mapping of a square-metre grid system that should be orientated to magnetic north (x-axis =north, y-axis = east). The 1 m squares must be named in a systematic and distinct way, for example by using capitals for the x-axis and numbers


Site: Dendi 12-A01 Page: 1 of 1

1. Excavators: (1) HPS (2) AD
2. Date: 28.10.12
3. Photo #: Sony-DSC00712-715
4. Square: E5
5. Quad: Full Unit - NW (NE) SE SW
6. Level: 17
7. Depth below datum (cm): -25
8. Stratigraphic Unit(s): AG (gravel layer mixed with white ash)

Artifacts and Features

9. General Description: high amount of gravel in redbrown silty sediment mixed with white ash. Only few artefacts but high number of burned bones and charcoal (hearth??) One scraper.

10. Artifacts
a. Lithic
b. Ceramic
c. Wood
d. Ochre
e. Other:

11. Organic Material
a. Bone
(b) Shell
c. Charcoal
(d) Plant Remains
e. Other:

12. Associated Features
a. Pit
b. Hearth
(c) Ash Dump
d. Stone Concentration
e. Other:

Scale: 1/5

Fig. 2. Example of an excavation recording form, used by the author during his excavations in Ethiopia.

for the y-axis. Future extensions of the excavation trench should be considered when naming the first squares (do not start with square A1). The size of a trench depends on the main research question. For a first chronological classification of the settlement history, smaller but deep trenches (at best down to bedrock) are most appropriate, whereas spatial questions require the excavation of larger areas. Squares should be subdivided in 50 cm quadrants named after their bearing: NW, NE, SW and SE. The size of a quarter-square metre is in most cases small enough for the production of distribution maps.

V. DIGGING AND RECORDING

Excavations should be conducted in quadrants of 50x50 cm in regular artificial slices (spits), in general of 5 cm depth. The spits should be subdivided in case of visible sediment changes, which can be natural stratigraphic units or artificial features. These are documented in profile drawings ideally of the four walls and the ground levels of the trench or square at a scale of 1/10 and in photographs taken at regular intervals of both the profiles and the excavated surface. Often for Stone Age sites, drawings and pictures are made after every excavated spit and – as is standard archaeological practice – include an arrow indicating the North, identification of site, date, square, feature and a scale. All finds have at least an assignment to square, quadrant, sediment unit and depth within the 5 cm range of the spit. A quite simple way to control levels is by using a surveyor's optical level and a level rod. All information has to be recorded in a systematic way, at best using forms (**fig. 2**) that can easily be transferred in a form-based data-type system (e.g. Windows Excel). Sometimes, the excavation of 'natural' layers is regarded as a scientifically appropriate way. This might be the case at sites with clear sediment borders, but changes in the stratigraphy are, in many cases, fluid transitions and distinguishing a border would be arbitrary. However, even in the case of clear sediment layers, these do not have to correspond to archaeological layers but are quite often results of post-depositional processes. Treating these sediment units as equivalent to cultural units is incorrect and only pretends a greater scientific exactness. If an exact three-dimensional plotting of individual artefacts is not possible, the method of digging in artificial spits that are subdivided in case of sediment changes seems to be the second-best option.

Excavating in an optimal way is to plot all finds that were seen by the excavator in x-y-z coordinates by total station directly to a computer. Each find with precise 3D coordinates gets a specimen number and is separately bagged together with a label containing this number and other basic information (site, square, quadrant, level, excavator, date).

In the case of excavating in artificial spits, finds of one spit can be put together in a single plastic bag but should be separated according to find categories, such as lithics, pottery, bones and botanical macro-remains. Independent of the excavation method, the sediment of each unit (quadrant and level) should be sieved in several stages, using different mesh widths (e.g. 10, 5, 2.5 and 1 mm). As mentioned earlier, the size-distribution of stone artefacts can be a valuable factor to identify human activities (e.g. on-site knapping), but also of post-depositional disturbances (e.g. the loss of very small debitage by erosional processes). Therefore, even the smallest chips are important for our analysis.

VI. CLOSING AN EXCAVATION

Before closing the excavation all sections have to be protected with plastic tarps. The best way to refill trenches is by using sandbags. This method facilitates the re-opening of trenches in case of a continuation of the field-work and protects the walls. Sandbags should be covered with a loose surface layer of sediment that hides the borders of the excavation trench. This keeps the particular feature from piquing the interest of casual visitors and prevents them from disturbing archaeological sites out of curiosity.

CONCLUSION

This chapter cannot be more than a very short and basic introduction to the excavation of Stone Age sites and some topics, such as operational safety, photography and drawing are described in other contributions to this book. Further studies of the literature are highly recommended (e.g. Burke & Smith 2004, Kipfer 2006; guides to specific topics can be downloaded under: http://www.bajr.org/BAJRread/BAJRGuides.asp). However, nothing can substitute the participation in fieldwork with professional guidance and personal experience.

REFERENCES

Brandt, S.A. & Weedman, K. 2002. 'The ethnoarchaeology of hide working and stone tool use in Konso, Southern Ethiopia: an introduction'. In F. Audoin-Rouzeau & S. Beyries, (eds). *Le travail du cuir de la préhistoire a nos jours*. Antibes: Editions APDCA, pp. 113-130.

Burke, H. & Smith, C. 2004. *The archaeologist's field handbook*. Crow's Nest, NSW: Allen & Unwin.

Kipfer, B.A., 2006. *The Archaeologist's Fieldwork Companion*. Oxford: Wiley-Blackwell.

Marean, C.W., Bar-Mathews, M., Fisher, E., Goldberg, P., Herries, A., Karkanas, P., Nilssen, P.J. & Thompson, E. 2010. 'The stratigraphy of the Middle Stone Age sediments at Pinnacle Point Cave 13B (Mossel Bay, Western Cape Province, South Africa)', *Journal of Human Evolution* 59: 234-255.

McPherron, S.P., Alemseged, Z., Marean, C.W., Wynn, J.G., Reed, D., Geraads, D., Bobe, R. & Béarat, H.A. 2010. 'Evidence for stone tool-assisted consumption of animal tissues before 3.39 million years ago at Dikika, Ethiopia', *Nature* 466: 857-860.

Semaw,S, Renne, P, Harris, J.W.K., Feibel, C S., Bernor, R.L., Fesseha, N & Mowbray, K. 1997. '2.5-million-year-old stone tools from Gona, Ethiopia', *Nature* 385: 333-336.

VILLAGE SITES

Hans-Peter Wotzka[1]

The most difficult thing about excavating an ancient village in sub-Saharan Africa is to know whether one is actually dealing with one. Due to the disconnectedness and generally inconspicuous nature of village remains, their incomplete survival, excavators' selectivity, dating, and other problems, there is frequently no certainty during excavation as to whether the features under investigation once belonged together or what type of site they may represent. Large settlement mounds as well as sites exhibiting contiguous (agglutinative) architecture may constitute obvious exceptions, but in most cases villages are not simply unearthed but need to be (re)constructed by careful analysis and adequate synthesis of field documentation after the shovel and trowel have done their job. One of the challenges during the dirt phase then is to do proper justice to all excavated features and finds to allow such synthesis, and this even under favourable circumstances where a (nearly) complete or otherwise unambiguous village layout is visible right from the outset, be it on the ground, on aerial or satellite images, or on plans resulting from geomagnetic, geoelectric, georadar or other types of pre-excavation survey.

I. WHAT IS A VILLAGE?

To keep things simple, let us apply the term to any relatively dense agglomeration of houses permanently inhabited by a small sedentary community of several households. This type of settlement was the presumed typical home base and centre of all cultural practice for most non-mobile populations in sub-Saharan Africa from the terminal Late Stone Age through the Iron Age. Villagers gained their livelihood from within and around their settlements, usually involving some sort of farming (gardening + agriculture and/or animal husbandry). It is therefore essential to obtain an idea of the range of activities carried out in and around ancient villages, yet the task is not straightforward. Usually at least a few hectares in size and occupied over a number of generations, such habitation clusters along with their associated structures and features do not normally lend themselves to total excavation.

II. HOW TO EXCAVATE

Instead, effective village-level archaeology[2] requires some proper probabilistic sampling strategy, guided by the specific research questions asked (**fig. 1**). Ideally, pre-excavation survey should yield an (approximate) plan or at least reasonable estimates of the settlement's limits and size; careful analogy with well-known village sites from the same culture may, if available, complement these estimates.[3] As a rule of thumb, given such previous knowledge, an adequately selected small sample of all extant village remains will suffice to obtain meaningful data on the majority of issues generally relevant to this line of research.

As in all scientific enquiries, the quality of village archaeology depends on a proper research design, to be developed before any other activity is taken up. The first step is the identification of the particular research problems to be approached by any given project (**fig. 2**). This choice will be governed as much by theoretical considerations and the regional state of the art as by the available time and financial and staff resources; other factors such as personal preference and expertise as well as exceptional field situations calling for opportunistic strategies may also intervene. For example, in the face of some Early Iron Age house remains exposed by

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2 Units of archaeological interest below village level include residential quarters, households, houses, activity areas, and features. Beyond the village, research may focus, for instance, on micro-, meso-, and macro-regions, and on interregional networks. Although many pits, layers, middens, graves, furnaces etc. will once have belonged to villages, they need not necessarily be investigated at village level. For example, excavation and analysis of individual Iron Age pottery deposits, refuse pits, settlement layers, and burials scattered over a 700 x 400 km area in the equatorial rainforests of former Zaïre (Eggert 1983; Wotzka 1995) primarily aimed at the first-time establishment of a basic regional pottery sequence and an outline reconstruction of human settlement history in this previously unexplored terrain. Village-level archaeology, for which such a chrono-stratigraphic framework is a prerequisite, follows basically different objectives (fig. 1) and procedures (fig. 2); it is most usefully practised as part of a research design with a regional scope, such as Settlement Archaeology (e.g., Edwards 1999) or Landscape Archaeology (Fleisher 2013; Zimmermann *et al*. 2009).

3 Foot survey to determine the spatial scatter and variability of surface finds is a basic step in pre-excavation exploration. Where this fails to yield at least approximate site limits, and geophysical survey techniques like those exemplarily mentioned in the first paragraph are impractical or produce inconclusive results, a systematic soil coring programme by means of an auger (multiple traverse and/or grid coverage) may be of help. This should also prove useful for detecting soil and erosional variability across the terrain and help in assessing site history, environmental impact, and local archaeological potential.

- Site chronology, relative and absolute
  - Overall duration of settlement
  - Abandonment phases
- Locational factors and choices
- Village size (by period/phase)
- Village history (in relation to environmental and regional culture history)
  - Foundation; phases of growth or decline; continuous vs. discontinuous use
- Range of activities carried out within and around village limits; i.a., residential; subsistence (e.g., gardening; agriculture; animal husbandry; fishing; hunting); craft; burial; ceremonial and religious
- Village structure (synchronic and diachronic, i.e. by phase)
  - Size (dimensions; area; acreage of farmed/managed gardens, agrarian land, pasture, forest etc.)
  - Layout
    - Areas covered by residential buildings
      - Residential quarters
      - Persistent, newly built, and abandoned structures
    - Parcelling (lots; small holdings; farmsteads)
    - Non-residential zones (e.g., gardens; middens; activity areas)
    - Paths/lanes
  - (Average) number of contemporaneous houses
  - Public buildings/installations/features (e.g., village enclosures; earthworks; palisades; communal granaries)
  - Spatial organisation at house, quarter, and village level
- Housing and non-residential structures
  - Architecture (i.a., building materials; wall and floor construction; post pattern; roofing)
  - Dimensions
  - (Average) use-life of buildings
- Types of household, e.g.
  - Single-house
  - House + associated features (household cluster)
  - Farmstead
- Demography (synchronic and diachronic)
  - (Average) number of inhabitants per house
  - Total village population
  - Average house and population density (i.e., houses and persons per ha)
- Ancient function(s) of
  - The entire village (e.g. as inhabited special-purpose site)
  - Structures
  - Features (e.g., refuse disposal; loam/clay quarrying; structural elements of houses, enclosures etc.)
- Village/household specialisation (e.g., in agricultural, craft, exchange, or ritual activities)
- Position and role of the village within regional settlement hierarchy (where applicable)
- Sites and features associated with the village
  - Examples: Middens; workshops; furnaces; smithies; slag heaps; within-settlement burials; cemeteries; shrines; sanctuaries; harbours; markets; outpost camps
  - Geographic (incl. distances) and functional relationships to the village site
- Travel and transport infrastructure
  - Route ways to/from the village
  - Accessibility
  - Relative connectedness/isolation
- Site catchment (synchronic and diachronic, cf. Historical Ecology)
  - Potential, extent and patterns of human landuse around the village
  - Ecological impacts of human landuse (e.g., vegetation change; enhancement/diminution of biodiversity; landscape transformation; soil improvement; erosion; salinisation)
  - Potential, extent and patterns of human resource acquisition around the village
- Exchange relationships
  - Position and role of the village in (interregional) exchange networks
  - Nature and quantities of exchanged materials and items
  - Non-local plant, animal, and mineral resources: Whence and from what distances must they have come (cf. Flannery 1976b)?
  - Modes of exchange (e.g., reciprocal vs. asymmetric; directional vs. down-the-line)
- Position and role of the village in (interregional) ceremonial networks
- History of local and regional human nutrition
- History of local and regional social organisation, including
  - Family and clan structure
  - Social division of labour
  - Status behaviour
  - Power relations

Fig. 1. Examples of research questions relevant to village excavation. Although the list is not exhaustive it will usually be impossible to pursue more than a selection of these goals within a given project.

- Identification of research questions
- Location of relevant region
- Appraisal of available resources (time; staff; equipment; funding)
- Budget for analyses by external specialists (e.g., radiocarbon/luminescence dating; zooarchaeology; archaeobotany; pollen analysis; phosphate analysis; micromorphology; sedimentology; geology; archaeogenetics; stable isotope analysis)
- Research design
- Assignment of staff responsibilities
- Acquisition of photography, survey, and excavation permits (national; regional; local)
- Involvement of local communities (i.a., chiefs; titleholders; elders; landowners)
- Procurement of most up-to-date (ordinance survey) maps, aerial photos and satellite images
- Pre-excavation exploration of study area
  - Previous regional and local research (literature, museums, and archives survey)
  - Ethnographic/ethnohistorical (local museums, collections, residents)
  - Historical (e.g., documents; maps; photos; aerial views)
  - Computer screen survey of satellite imagery (where applicable)
  - Ground reconnaissance
    - Foot survey (fieldwalking)
    - Surface find surveying, registration, and sampling
  - Inventory of sites and relevant off-site features, each with
    - Place name (where applicable)
    - GPS coordinates
    - General description (topography; visibility; dimensions; access etc.)
    - List of collected surface finds
    - Thickness of deposits
    - Assessment of local archaeological potential relating to research questions
  - Coring and/or geophysical prospection of most promising areas to locate enclosures, houses, features, workshops, graves etc.
- Selection of site(s) for excavation
  - Detailed description of selected site(s), including environmental (geology; soils; vegetation) + landscape setting; circumstances of discovery; type of site (e.g. nucleated vs. dispersed village)
- Pre-excavation photography of selected site(s) and prominent features, including aerial, kite or drone photography as appropriate
- Pre-excavation surveying of selected site(s)
  - Location of trig stations with known coordinates (where applicable)
  - Site datum line and points
  - Site grid layout
  - Insertion into fixed point grid (where applicable)
  - Generation of overall site map including contour lines, topographic features, paths, roads etc.
- Probabilistic sampling
  - Shallow deposits: Test square sampling
  - Deep deposits: Transect sampling
- Pegging out and surveying of sampling units
- Excavation and documentation of sampling units
- Enlargement/fusion of excavated sampling units and/or excavation of additional areas as appropriate with regard to research questions
- Amendment of site map to show location, designation, and size of all excavated areas
- Refilling of all excavated areas
- Site protection measures as appropriate
- Presentation and publication of data, analyses, and results

Fig. 2. Village site excavation and protection: Workflow. (Partly after Joukowsky 1980.)

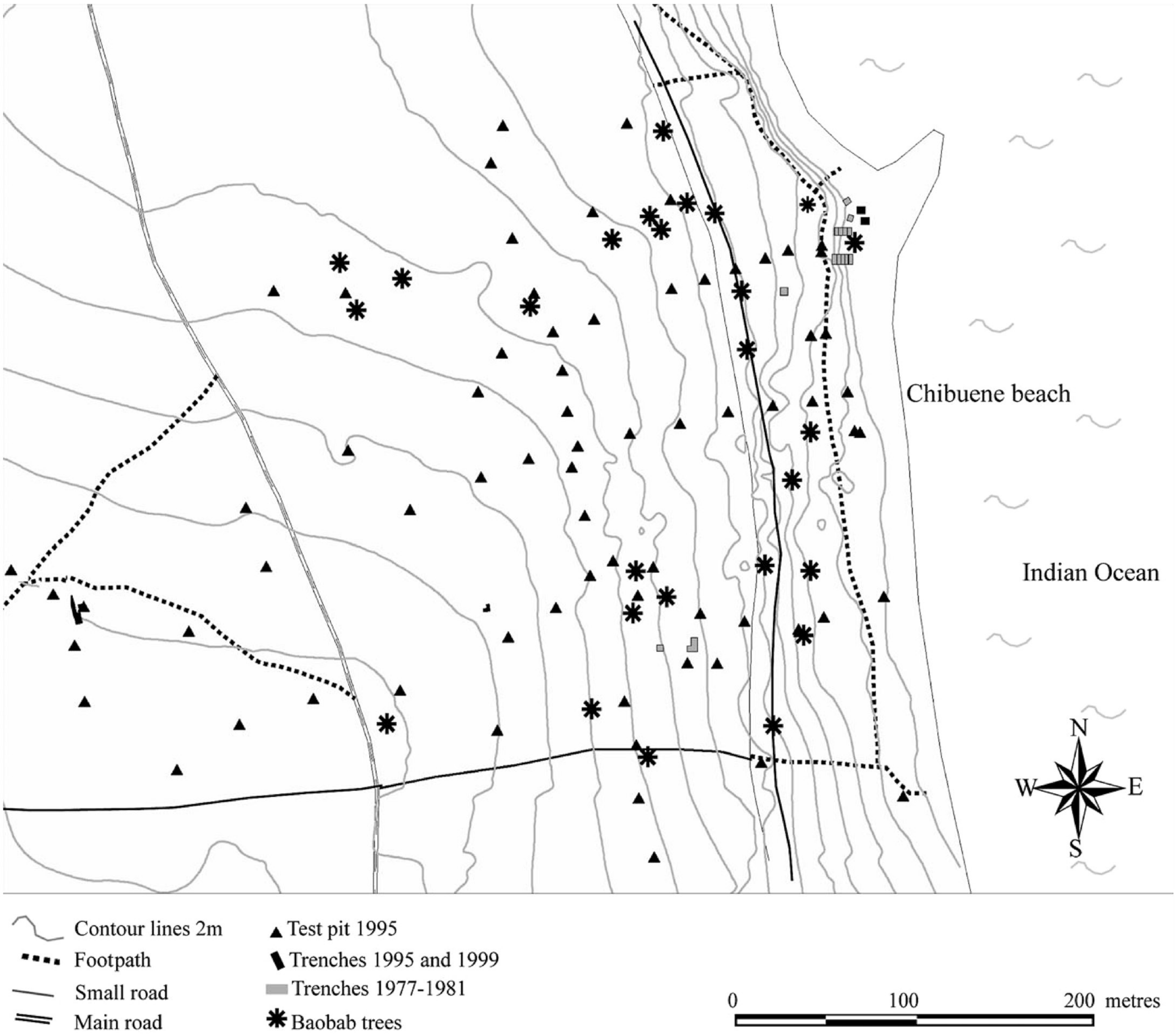

Fig. 3. Sampling units across a shallow Iron Age village site: The later first-millennium AD trade port of Chibuene on the Indian Ocean coast of Mozambique. (From Sinclair *et al*. 2012: 727 fig. 4.)

bulldozer activity it would clearly be unwise to engage first in a lengthy pre-excavation site survey, unless the variability of coeval houses from the same culture had already been sufficiently studied elsewhere in the region. Of course, more systematic approaches should be the rule, principally raising the question whether the specific state of previous knowledge might justify focussing new fieldwork on just one (or a very few) hitherto under-researched aspect(s) of ancient village life, such as house architecture, enclosures, middens, workshops or within-settlement burials, to the detriment of others. However, since village archaeology in most parts of sub-Saharan Africa has not yet reached a level allowing such selectivity, it will most of the time be important first to gain a representative sample of the entire range of relics present at the site of interest.

The sampling approach depends on the typical thickness of the sediments to be excavated. Estimates of this parameter may be gleaned from general site topography, previous work at the site, pre-existing natural or anthropogenic cuts, or from systematic pre-excavation coring.

A. Shallow deposits

Shallow deposits consisting of mostly disconnected sunken features less than about 2 m deep, such as (partially eroded) pits, postholes, ditches, or burials in virgin soil, may be investigated, for instance, by random sampling and complete excavation of an appropriate number of small 2x2 m squares (**fig. 3**); the same technique is adequate for once free-standing structures and features such as architectural remains, ovens, or middens covered by relatively shallow sediments. Smaller sampling units (e.g., 1x1 m) tend to hamper excavation, observation and documentation, and should be avoided if at all possible. Essential as such small test pits generally are for gaining an unbiased overview of shallow village sites, they will be insufficient when it comes to tackling more specific research problems. For instance, at some stage regional village archaeology will necessarily focus attention on the house as the basic structural module and central nucleus of family life at permanently inhabited sites. Questions relevant at this level, such as regularities and individual variability in dimensions, architecture, artefact categories, exchange objects, food remains, activity areas, and relationships to neighbouring houses (including distances, common orientations, shared installations etc.), obviously require considerably larger contiguous surface exposure optimally revealing complete house layouts.

Even more extensive windows into the past are needed in order to cover what has been called the household cluster in Mesoamerican archaeology, i.e. the house and all the surrounding storage pits, burials, middens, activity areas, ovens, and other contemporaneous features that can be reliably associated with that same structure (Winter 1976; Flannery 1976a). Depending on past cultural preferences of space use this may involve an area of 20 m diameter or more around any house. Therefore sampling units yielding house remains or other sufficiently preserved features of specific interest to regional village archaeology should by all means be systematically enlarged and/or joined as appropriate to be additionally excavated whenever this is compatible with the research strategy followed and the available resources.

Needless to say, if possible the maximum goal of any village project will be total excavation and generation of an overall settlement plan, unless regional village research had already reached a state making complete coverage dispensable. However, while total uncovering will remain an unrealistic objective in the majority of cases it may well be feasible little by little, for example during the course of several field campaigns in the framework of multi-season projects devoted to a single site. Even with such long-term strategies in mind it is advisable to start off by representative sampling and to join the initial sampling units successively later. In order to retain good stratigraphic control at all times excavation of adjoining squares should proceed in a chequerboard pattern. As with any sound archaeological field research design, this requires accurate insertion of sample and excavation squares into an appropriate overall site grid, preferentially by use of an electronic tachymeter, which optimally allows keeping surveying errors to within ±1 cm.

B. Deep deposits

Deep deposits resulting from accumulations of cultural debris as represented, for instance, by tell-like settlement mounds[4] require different treatment, mainly for two reasons: First, it would be unwieldy or even impossible to dig small squares down to several metres of depth, not to mention the difficulties this would entail with regard to documentation under poor lighting conditions and the observation of safety standards. Second, since such mounds are built up entirely of anthropogenic relics, such as debris from collapsed house walls, refuse, or the remains of craft activity, their whole sediment volume embedding individual features, artefacts and ecofacts is in principle relevant to village archaeology; it provides not only a matrix containing finds and potential sample materials for all sorts of scientific analysis, but also stratigraphic relationships and clues as to relative chronology, the nature and speed of site formation, building history, and phases of (partial) site abandonment, amongst other things. Ideally, and in contrast to most shallow contexts, a human-made deep village deposit can and should be analysed and understood as more than just the sum total of a number of spatially separate features and finds, namely as a coherent entity with more or less clear limits and a decipherable overall stratigraphy and formation history.

One approach suitable for exploiting the specific potential of deep village deposits is transect sampling in random directions. Optimally, this involves the complete excavation of several oblong trenches radially cutting through the entire site including its centre(s). Where this is impossible, one or two (partial) cuttings, if necessary only from one point at the outer limits to the centre, will

4 Not to be confused with shallow human habitation sites on natural elevations such as hillocks, rock outcrops, or dunes.

Fig. 4. Oursi hu-beero, northern Burkina Faso: Part of an excavated medieval village site composed of dispersed settlement mounds, dating to *c*. 1100 AD. For public display, a house complex in mudbrick architecture has been elaborately preserved and protected by means of a roofed structure admitting natural light. The site has its own museum, erected right next to it and opened in 2006 (Petit *et al.* 2011). (Photo © and courtesy of C. Pelzer, Bamako.)

have to suffice. Although this will frequently be inevitable, especially with large sites, it considerably decreases the likelihood of obtaining a representative sample.

For safety, cuttings through deep deposits must be wide enough at the top to allow for sufficient side battering or even stepping, depending on the stability and homogeneity of the deposit at hand. By way of example, cuttings into the Daima mound in northeastern Nigeria were up to *c*. three times wider at the top than at the bottom (Connah 1981: 104 fig. 6.3). The Daima transects were subdivided into parallel rows of 2x2 m squares and excavated in chequerboard pattern with individual documentation, a procedure generally recommended for exposing large surface areas. However, the long and deep sections resulting along the sides when transect excavation is complete are best photographed and drawn in a single pass after subdivision into one-metre squares by mason's string, although it is generally advisable to outline layers and features visible therein already right after exposition, i.e. before the sediment dries out and hardens. By virtue of their dimensions transects are usually superior to individual sample squares in offering more complete views of features, but they will eventually suffer from the same limitations and may therefore also be enlarged and/or supplemented later by further excavation according to research requirements and resources.

CONCLUSIONS

To conclude this cursory consideration of village excavation some more general suggestions seem appropriate. First, wherever feasible, excavation should follow natural or human-made layers and features instead of artificial horizontal spits, although a mixed technique will often be a reasonable and effective compromise; the many sections arising from archaeological work in small-area units as well as pre-existing cuts resulting, for instance, from erosion, mining, quarrying, or pit digging, may be used as convenient starting points for stratigraphically controlled exposure. Second, the investigation of village sites is likely to produce a wealth of varied observations on a multitude of features and structures. Keeping track of this complexity is greatly assisted by assigning unique feature numbers across the whole site, and using a documentation system involving separate data cards or sheets for each feature and fieldnotes that strictly follow a numbered activity log by feature and date. Third, unexcavated village remains are no different from other archaeological sites in that they are most effectively protected by leaving them untouched. Proper refilling of excavated areas is compulsory for various reasons, including site protection. The involvement of local communities in active site protection measures can be invaluable, but it may have adverse effects when it fails to prevent looting as a potential outcome of insufficient sensitisation (see David, this volume, pp. 49-52). A particularly felicitous example of the partial conservation and public presentation of excavated village structures administered by local residents can be found at the medieval site of Oursi hu-beero in northern Burkina Faso (**fig. 4**).

REFERENCES

Connah, G. 1981. *Three thousand years in Africa. Man and his environment in the Lake Chad region of Nigeria.* Cambridge: Cambridge University Press ('New Studies in Archaeology' series).

Edwards, D.N. 1999. 'Meroitic settlement archaeology'. In D.A. Welsby (ed.). *Recent research in Kushite history and archaeology.* Proceedings of the 8th International Conference for Meroitic Studies. British Museum Occasional Papers 131. London: British Museum Press, pp. 65-110.

Eggert, M.K.H. 1983. Remarks on exploring archaeologically unknown rain forest territory: The case of Central Africa. *Beiträge zur Allgemeinen und Vergleichenden Archäologie* 5: 283-322.

Flannery, K.V. (ed.). 1976. *The early Mesoamerican village.* New York/San Francisco/London: Academic Press ('Studies in Archaeology' series).

Flannery, K.V. 1976a. 'The Early Formative household cluster on the Guatemalan Pacific coast'. In: Flannery 1976, pp. 31-34.

Fleisher, J. 2013. 'Landscape Archaeology'. In P. Mitchell & P. Lane (eds). *The Oxford Handbook of African Archaeology.* Oxford: Oxford University Press, pp. 189-199.

Joukowsky, M. 1980. *A complete manual of field archaeology. Tools and techniques of field work for archaeologists*. Englewood Cliffs, New Jersey: Prentice-Hall.

Petit, L.P., von Czerniewicz, M. & Pelzer, C. (eds). 2011. *Oursi hu-beero: A medieval house complex in Burkina Faso, West Africa.* Leiden: Sidestone Press.

Sinclair, P., Ekblom, A. & Wood, M. 2012. 'Trade and society on the south-east African coast in the later first millennium AD: the case of Chibuene'. *Antiquity* 86: 723-737.

Winter, M.C. 1976. 'The archeological household cluster in Oaxaca'. In Flannery 1976, pp. 25-31.

Wotzka, H.-P. 1995. *Studien zur Archäologie des zentralafrikanischen Regenwaldes: Die Keramik des inneren Zaïre-Beckens und ihre Stellung im Kontext der Bantu-Expansion.* Köln: Heinrich-Barth-Institut ('Africa Praehistorica' series, vol. 6).

Zimmermann, A., Wendt, K.P., Frank, T. & Hilpert, J. 2009. 'Landscape Archaeology in Central Europe'. *Proceedings of the Prehistoric Society* 75: 1-53.

THE PIT: ARCHAEOLOGICAL EXCAVATION AND ANALYSIS

Alain Assoko Ndong[1]

INTRODUCTION

The pit is an archaeological structure frequently found in Central Africa, especially at sites dated between the Neolithic and the end of the Early Iron Age, or from the 9th century B.C. to 1300 A.D. Moreover, a large majority of archaeological research focuses on sites characterized by the presence of pits, and, with practice, it is not difficult to detect a site of this nature by examining soil, road embankments, recently levelled areas, etc. (see this volume, Oslisly, pp. 42-44 and Eggert, pp. 60-64).

This type of structure appears in different forms, but its excavation is quite standardized. It is a question first of understanding the structure's historical stages, covering its creation, use (for example, as a mud pit), possible reuse (for example, as a rubbish pit) and, in the end, natural filling in. The excavation method varies according to available time and resources but always respects a few important archaeological principles.

I. THE PIT

The pit is a hollow structure. It often contains relics used, adapted or made by humans and environmental remains likely to tell us something about their lifestyle and the climate they lived in. The motivation for digging a pit could vary, such as meeting the need for:

- graves;
- latrines;
- wells, ores, ceramic, etc.;
- aquaculture;[2]
- silos;
- mud;
- rubbish dumps, etc.

But whatever the motivation, the abundance, variety and state of archaeological remains in a pit confirms that it is anthropogenic and that it ultimately served as a rubbish dump.

The pit appears as a spherical feature in the ground, of a darker colour than the surrounding earth (**fig. 1**). Its morphology can also be in relief (**fig. 2**), owing to water erosion. Runoff waters attack the backfill and the surrounding earth with differing intensity. Ablation of the soil around the pit occurs more rapidly than that of the backfill, which ferrallitization hardened. This is why some pits are mound-shaped (Assoko Ndong 2000). The diameter of the pit barely exceeds l.5 metres. In cross-section, its profile can be conical or concave and its depth around two metres.

Digging a pit could be a large investment in terms of time and effort. Consequently, it seems feasible that the pit became the historical property – on par with latrines – of a nuclear or extended family.

II. PIT EXCAVATION TECHNIQUE

Typically, pits are isolated from one another, although it is not extremely unusual to see two pits superimposed. But since young researchers are too inexperienced to undertake the paleoethnological excavation of a site containing more than one pit, these structures are usually approached individually.

A. Grid

Nevertheless, given that archaeological excavation is a destructive activity, surveys at different scales should be planned, because they allow us to remember what has been destroyed. The first survey consists of superimposing a grid on the surface of the site. This facilitates measurements and recordings as well as indications of where structures and remains were discovered. In practice, the grid – made of rope – divides the site into several square sections. Each section is an excavation unit one to five metres wide and assigned an alphanumeric code (example: square C4 or A7, etc.). The grid is marked by an immovable point – the site's reference point – located outside the excavation area. This is the starting point for all horizontal measurements. If vertical measurements must be taken, the site level (or the theodolite) is positioned on the reference point, and its height is measured. This is the site's altitude zero. It is used to determine the depth of remains. The grid thus allows surveys to be undertaken at scale for the entire site.

B. Identification, cleaning and photography

After identification, the pit and its surroundings are cleaned in preparation for the first small-scale surface surveys, namely photo shoots and drawings.

During shooting, the camera is set so that the photo-

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1 Université Omar Bongo, Libreville, Gabon.

2 See Lanfranchi & Schwartz 1990: 495 and Mbida 1996: 217-219.

graphs will be up to standard in the event of publication. Among other things, a compass and a north arrow photo scale (**fig. 3**) are required. In photos, the north arrow photo scale will indicate magnetic north and allow for understanding the actual dimensions of the photographed structure.

A letter board (**fig. 4**) showing the site name, excavation date, structure number, etc., can enhance the photographic survey. Alternatively, a slate can be used.

Furthermore, a drawing board, graph paper, mechanical pencil and eraser are indispensable. The small-scale surface survey is complemented by drawing, which photography is not yet able to replace.

C. Determining the excavaton axis

To excavate such a structure, it can be cut into two or four parts. The following example describes a pit cut into two parts.

Using twine tied to embedded stakes, a right triangle is traced in the soil. The Pythagorean theorem, according to which ‘the square of the hypotenuse is equal to the sum of the squares of the other two sides’, is used to determine the length of the two sides that form the triangle’s right angle; the system is commonly called 3/4/5 (**fig. 5**).

The goal is to stake out a rectangle marking where to dig the trench in order to excavate the pit. This rectangle is obtained by repeating and inverting the right triangle (**fig. 6.1**) made using the 3/4/5 system. The length of this rectangle, passing over the pit, divides the latter into two equal parts (**fig. 6.2**); its perimeter is 14 m and its area is 12 m². The first small-scale (1/10) recording of the surface can be applied to the horizontal survey of the pit if its contours are reflected on the ground rather than in relief (**fig. 7**).

Without losing any information, the dimensions of the trench can be reduced: the perimeter to 12 m and the area to 8 m² (see hatched part of fig. 6.2). Note that the maximum diameter of the pit opening is typically less than or equal to 1.50 m. The first half of the pit to be emptied is within the hatched rectangle.

D. Excavation

Excavation can be performed by artificial stratigraphy of 5 to 10 cm, to below the base of its profile. The contours of this profile should appear clearly in the wall of the trench (**fig. 8**).

Within each artificial stratigraphic unit, different archaeological contexts can sometimes be distinguished. For example, the excavation unit from 10 to 20 cm can

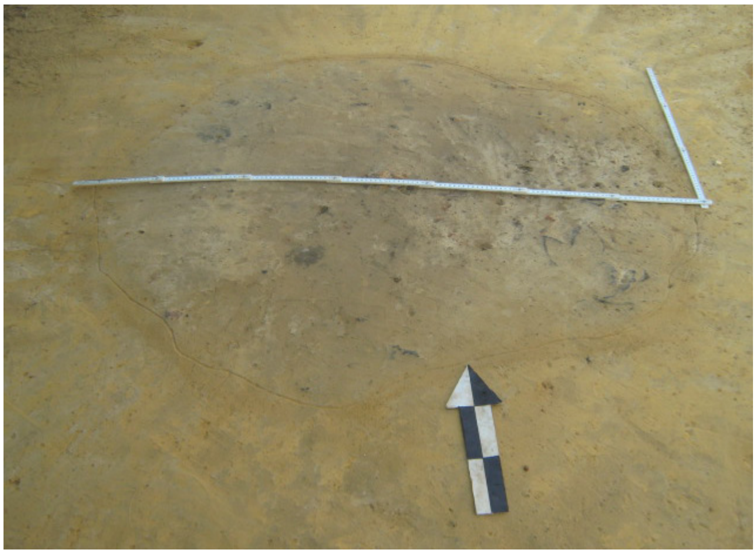

Fig. 1. Pit containing pottery shards and charcoal. (Photo © A. Assoko Ndong.)

Fig. 2. Pit in relief. (Photo © A. Assoko Ndong.)

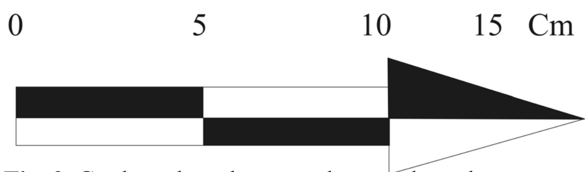

Fig. 3. Graduated north arrow photo scale scale.

Fig. 4. Letter board. (Photo © R. Oslisly.)

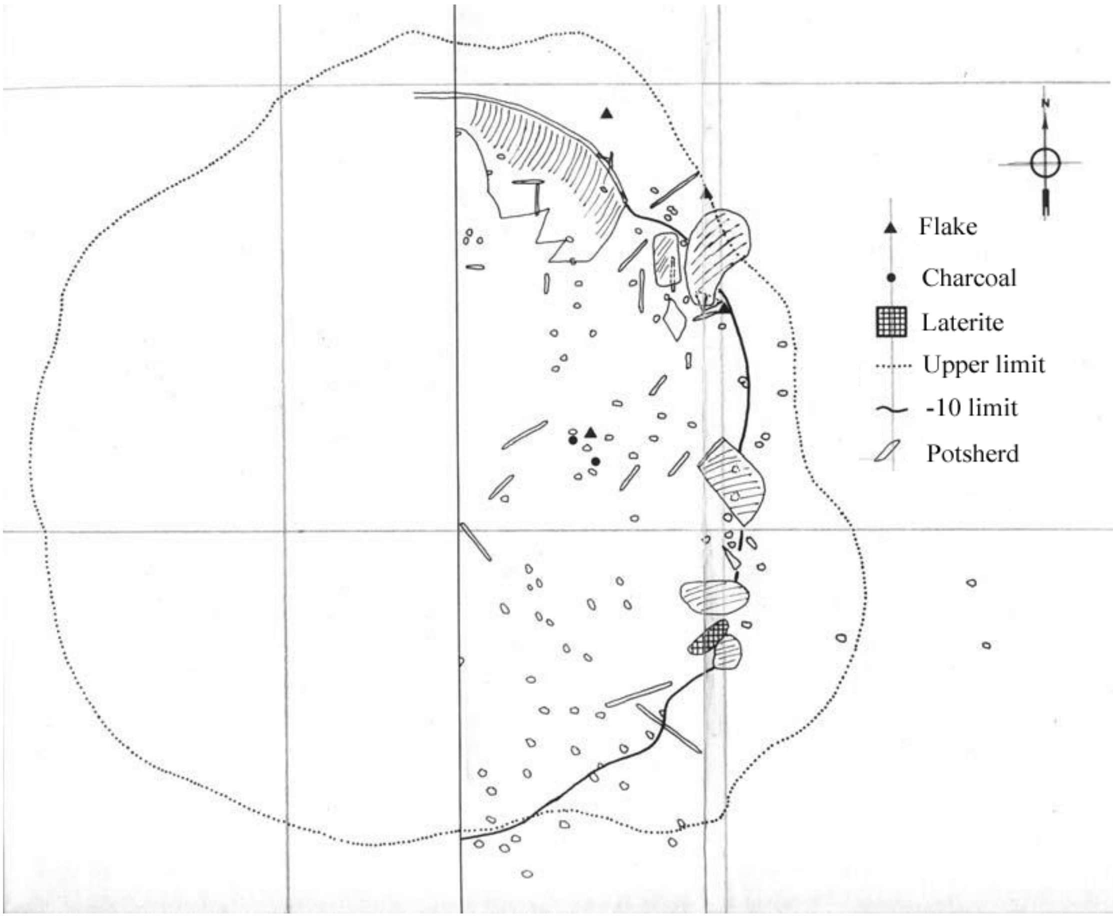

Fig. 7. Diagram of pit XXII of Okala (Clist 2005: 403). This site was excavated from 27/02/1989 to 10/03/1989, by Assoko Ndong and other students (PNUD/CICIBA training).

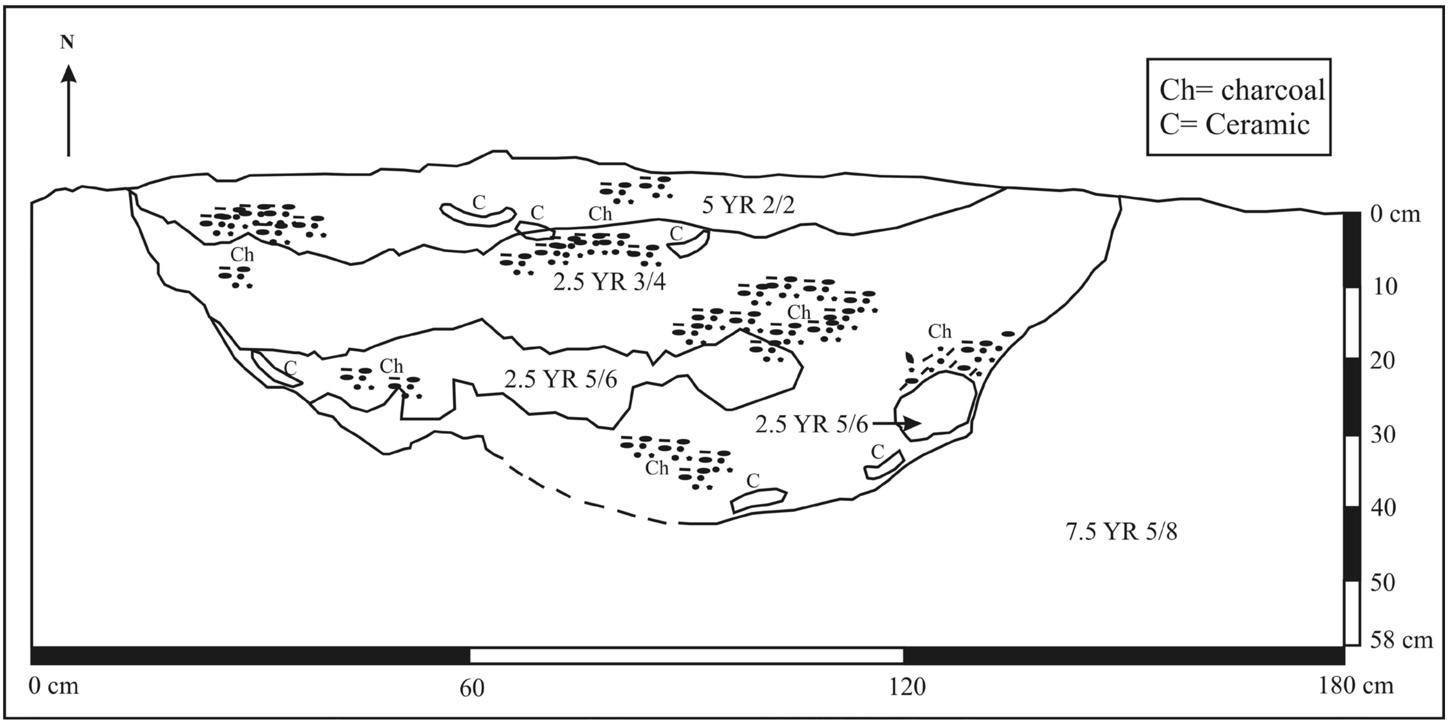

Fig. 10. Survey of a cross-section scaled 1/10.

include part of the surrounding soil, generally void of archaeological material, which will be called stratigraphic unit 1 (or SU1); a black sandy part rich in charcoal and archaeological material, which will be called stratigraphic unit 2 (or SU2); and a red clay part, with scant archaeological material, which will be called stratigraphic unit 3 (or SU3). These stratigraphic units must be distinguished during excavation, if a detailed description of the filling is needed. Another solution is to cut the structure into four pieces, like a cake. Two opposing quadrants are excavated in 10-cm increments, then after having surveyed the cross-sections (photography and drawing), the other quadrants are emptied by following the visible cross-sections.

Progressively, artefacts are collected in plastic bags labelled with the date of excavation and site, structure and layer references, etc. Charcoal and other environmental remains are preserved in separate referenced bags on which the depth of removal in particular is indicated (see Bosquet, this volume, pp. 152-156).

As soon as the entire profile of the pit can be discerned, the walls and bottom of the trench are levelled and cleaned. Artefacts embedded in the pit cross-section are left in place to be photographed and recorded in the profile-drawing (**fig. 9**).

The cross-section is reproduced on graph paper scaled 1/10, emphasizing, if possible, all visible natural and anthropogenic filling layers, which are also surveyed and referenced using soil colour coding (Munsell or Cailleux) (**fig. 10**).

Thereafter, the second half of the pit is excavated in the same way as the first. Removal of remains and samples will be performed according to the same principles of artificial stratigraphy.

In the laboratory, remains are cleaned, dried and numbered according to artificial stratigraphic layer. Each of the remains has a code (example: 7/-3-SU2): this code refers to the number of the structure (7) and that of the artificial stratigraphic layer from which the item was collected (-3, for the layer -20/-30 cm). SU2 refers, as the case may be, to the specific context identified during excavation.

The part of the code concerning the layer takes into account the pit's morphology. The digit referring to the layer is preceded by a + sign if there is relief (example: +3), by a - sign if there is none (example: -3).

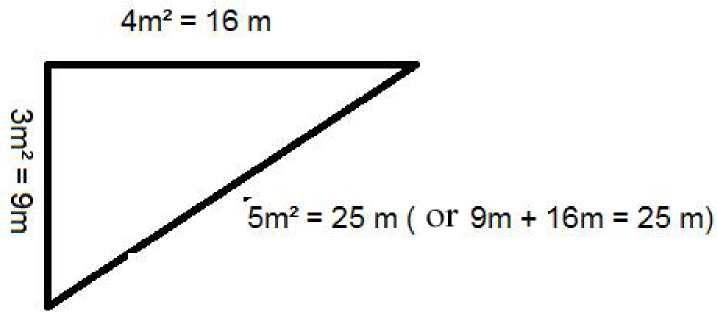

Fig. 5. Pythagorean theorem (3/4/5 system).

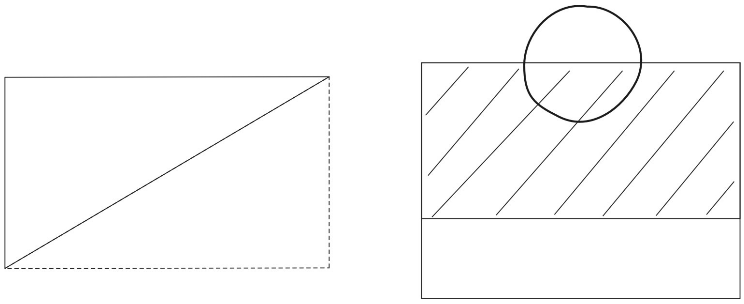

Fig. 6. 'Triangle rectangle' (6.1) and hatched trench excavation (6.2).

Fig. 8. Pit profile. (Photo © R. Oslisly.)

Fig. 9. Remains left in the trench wall. (Photo © R. Oslisly.)

Artificial stratigraphic layer – spits (cm)	Individual vessels (V)				
0 to -10	V1				
-10 to -20	V1				
-20 to -30	V1		V3		V5
-30 to -40		V2	V3		V5
-40 to -50		V2	V3		V5
-50 to -60		V2	V3		V5
-60 to 70		V2	V3		V5
-70 to -80			V3	V4	V5
-80 to -90			V3	V4	V5
-90 to -100				V4	V5

Fig. 11. Theoretical example of vertical distribution of shards.

III. WAYS OF INTERPRETING PIT BACKFILL

This part is founded on micro-stratigraphy and the vertical distribution of pottery shards. What fills the pit is simultaneously anthropogenic and natural. Anthropogenic backfill is comprised of domestic rubbish and archaeological remains. Natural backfill is comprised of sediment carried by runoff water.

Micro-stratigraphy is concerned with understanding the placement and deposit sequence of backfill layers and their number, dominant colour, thickness, texture, archaeological load, age, etc. It helps distinguish the surrounding earth from the pit's contours. When, for example, the pit remained open on a slope for a long time, runoff water erodes the walls, often resulting in an enlarged upper profile, indistinct pit contours and ambiguous layer colours.

Rigorous numbering of remains can help clarify how the pit filled up, mainly by interpreting the vertical distribution of pottery shards. This helps develop arguments on how long it took to fill a pit. Refitting potsherds (see Livingstone Smith and de Francquen, this volume, pp.173-179) leads to the identification of individual vessels and also helps determine any connections between layers (**fig. 11**).[3] Refittings spanning upper and lower layers indicate that all the backfill is almost contemporaneous and that the duration of filling had to be relatively brief – it is possible that use of the pit did not outlast a single generation. Conversely, lower and upper layers can yield containers that are in every way dissimilar. It is thus necessary to envisage distinct backfilling phases, and it could be interesting to date each layer.

CONCLUSION

One of the most widespread structures of the last 3,000 years, the pit is found very regularly in archaeological sites in Central Africa. As it was the property of a family, the pit is an archaeological structure that usually yields a rich and varied heritage that, when well analysed, can tell us about the lifestyles of prehistoric humans, their environments and the climates they lived in.

Such structures are excavated by cutting a trench that splits the pit in two, revealing within it the evolution of activities and industries.

Consequently, the archaeologist may try to discern layers of backfill and the distribution of remains therein, in order to interpret their placement and how long it took to refill the pit.

REFERENCES

Achard-Corompt, N., Marcigny, C., Moreau, C. & Riquier, V. 2009. *Les Sites à « fosses en V-Y » : émergence d'une problématique et d'un réseau au niveau national*. http://www.academia.edu. https://www.academia.edu/859968/.

Assoko Ndong, A. 2000. 'Peuplement holocène de la réserve de faune de la Lopé, Gabon'. Doctoral thesis, Université libre de Bruxelles, 594 p.

Boulenger, L. 2008. 'La protohistoire'. In Inrap (Institut national de recherches archéologiques préventives), *Sénart : archéologie de la ville nouvelle*. http://www.inrap.fr/userdata/flash/Senart.

Durand, J. 2008. 'Le néolithique'. In Inrap (Institut national de recherches archéologiques préventives), *Sénart : archéologie de la ville nouvelle*. http://www.inrap.fr/userdata/flash/Senart.

Mbida Mindzié, C. 1996. 'L'Émergence de communautés villageoises au Cameroun méridional : étude archéologique des sites de Nkang et de Ndindan'. Doctoral thesis, Université libre de Bruxelles, 721 p.

Oslisly, R. & Assoko Ndong, A. 2006. *Archéologie de sauvetage sur la route Médoumane-Lalara, vallée de l'Okano - Gabon*. Libreville: Éditions Wildlife Conservation Society, 56 p.

3 The distribution of shards of containers 3 and 5, contemporaneous with the other containers, suggests relatively rapid filling of the pit.

EXCAVATING IN URBAN CONTEXTS

Jeffrey Fleisher[1]

INTRODUCTION

The archaeology of ancient urban contexts is an extremely rewarding but complicated process. Cities and towns are often the locus of socio-political, economic, and religious power, and they contain crucial centralized features that are essential to the understanding of regional polities. However, because they are often densely populated and long-inhabited, they generally present deeply-stratified and complicated archaeological settings. This chapter will provide an overview of how to approach urban sites archaeologically, and the challenges that archaeologists of the continent face in investigating them.

I. WHAT CAN WE LEARN FROM URBAN CONTEXTS?

The study of urban contexts provides crucial information about the nature of regional power; it is widely recognized that urban centres are important loci to examine how power is configured, whether through the control over religious practices, economic production and distribution, and the ideological means through which these are established and maintained. The archaeology of urban contexts has changed significantly over the last 50 years, shifting from a more normative approach that was based on Near Eastern and Western urban examples (e.g., Childe 1950) to approaches that better recognize the diversity and variety of urbanism across the world. This shift in thinking may be understood as moving from a definition of cities based on their traits to one which focuses on their functions (McIntosh and McIntosh 1984; LaViolette and Fleisher 2005). Accordingly, the types of contexts that archaeologists have traditionally investigated in urban settings have included those that help to reveal their function, such as specialized religious structures and production areas, elite and non-elite housing, community buildings or other public monuments, and cemeteries or other memorial zones.

II. EXCAVATIONS

The issue of where to place excavation trenches is addressed in a previous chapter (see Fleisher this volume). Because urban sites are often occupied for long periods of time, they can contain deeply stratified deposits. Therefore, before excavation begins, the archaeologist must decide the aim of any excavation unit – is the goal to excavate through the entire stratigraphy, providing a full chronological/developmental understanding of the site? Or is the goal to recover particular types of contexts, from particular periods, which may be found at certain depths below the ground surface? These considerations will determine whether an archaeologist will decide to use vertical or horizontal excavations.

A. Approaches to excavations

Deep, vertical soundings are best suited to excavations that hope to recover the full stratigraphic sequence of a settlement. These excavations will provide a more detailed understanding of an urban site than the test pits discussed previously. Larger, horizontal excavations are more appropriate for understanding the relationship between features and artefacts within particular periods of the site – this type of excavation is necessary if houses or other built features are to be excavated and interpreted.

In either case, there needs to be careful planning to determine how long it will take to excavate a particular trench; such plans will necessarily include an estimate of the team required to excavate a trench and, if the excavation process will occur over a number of seasons, how the trench will be protected. Because of the rainy seasons found in many parts of Africa, it is often not advisable to leave excavations open between seasons and so trenches may be temporarily backfilled between seasons.

B. Recording the excavation

Because of the complexity of urban archaeological deposits, the excavation process needs to be well-planned, and with an established recording procedure firmly in place before excavation begins. It is wise to adopt an established recording system, such as that offered by the Museum of London Archaeology Service (MoLaS),

1 Rice University, Houston, USA.

Fig. 1. Paleoethnobotanist Sarah Walshaw working with flotation at Songo Mnara, Tanzania. (Photo © J. Fleisher.)

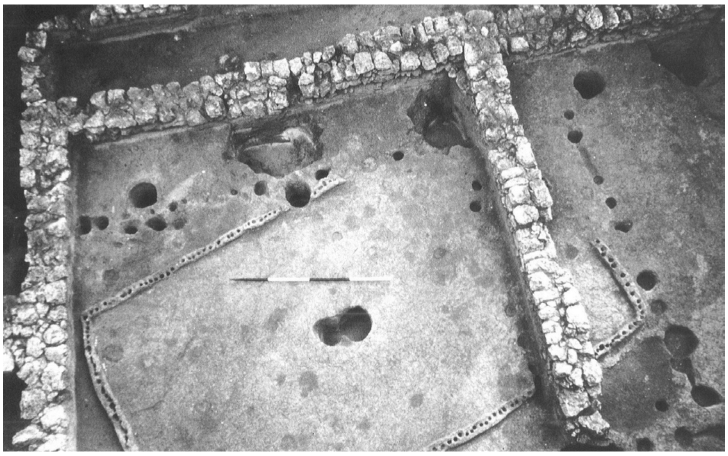

Fig. 3. Overlaying mosques at Shanga, Kenya (from Horton 1996).

which offers sample forms and a detailed description of all recording procedures. By adopting such a system, archaeologists guarantee that the recording of excavations will be consistent between trenches and different excavators. The use of forms ensures the uniform recording of data between layers and trenches; this includes complete recording of soils (texture, colour, compaction) and their inclusions, the thickness and extent of excavated contexts, the association of artefacts with particular contexts, and all additional data recording methods (maps, photographs, total station measurements). For all excavations, contexts should be recorded photographically (with a scale and north arrow) and scale plans and sections drawn. In addition to notes taken on forms, both trench supervisors as well as excavators should keep daily notebooks to record work completed, observations, and interpretation. There also needs to be a pre-established system of screening and sampling; in general, all soils are screened, at a mesh size appropriate to the soils and artefacts. Other sampling procedures – such as soils for flotation or geochemistry – should be established prior to the start of excavations, in consultation with project specialists (see Bosquet, this volume, pp. 152-156).

III. DATA PROCESSING IN THE FIELD

Because urban contexts often contain thousands of artefacts, a procedure to collect and process a full range of materials (e.g., lithics, ceramics, bone, glass, textiles, and metals) must be established. This procedure must cover the full path of artefacts, from the ground to long-term storage. This process includes the bagging and labelling of materials in the trench, washing in the field (if appropriate), preliminary sorting and analysis in a field laboratory, full cataloguing, analysis, and reporting. Many materials will require conservation prior to long-term storage, and this process should be considered before excavation begins.

In order to effectively and appropriately process the full range of archaeological materials from urban contexts, it is important to have a team of specialists to advise and oversee the field work, sorting and analysis. This will include ceramic, metals, lithic, and faunal specialists, as well as paleoethnobotanists and geoarchaeologists to assist with the soil sampling and processing (**fig. 1**). If it is not possible to have these specialists in the field, it is important to create excavation and conservation plans with them prior to excavations.

Increasingly, urban archaeologists are using integrated databases for their data collection and analysis, and a number of open source database systems are available, such as the Integrated Archaeological Database (http://www.iadb.org.uk/). Such a system allows for the different forms of information to be integrated into a relational database. Such a system allows for the correlation between strata and artefacts across an urban settlement, the basis of any interpretive work with large archaeological assemblages.

CONCLUSIONS

As described here, the archaeology of urban contexts must include multi-stage research that has been well-

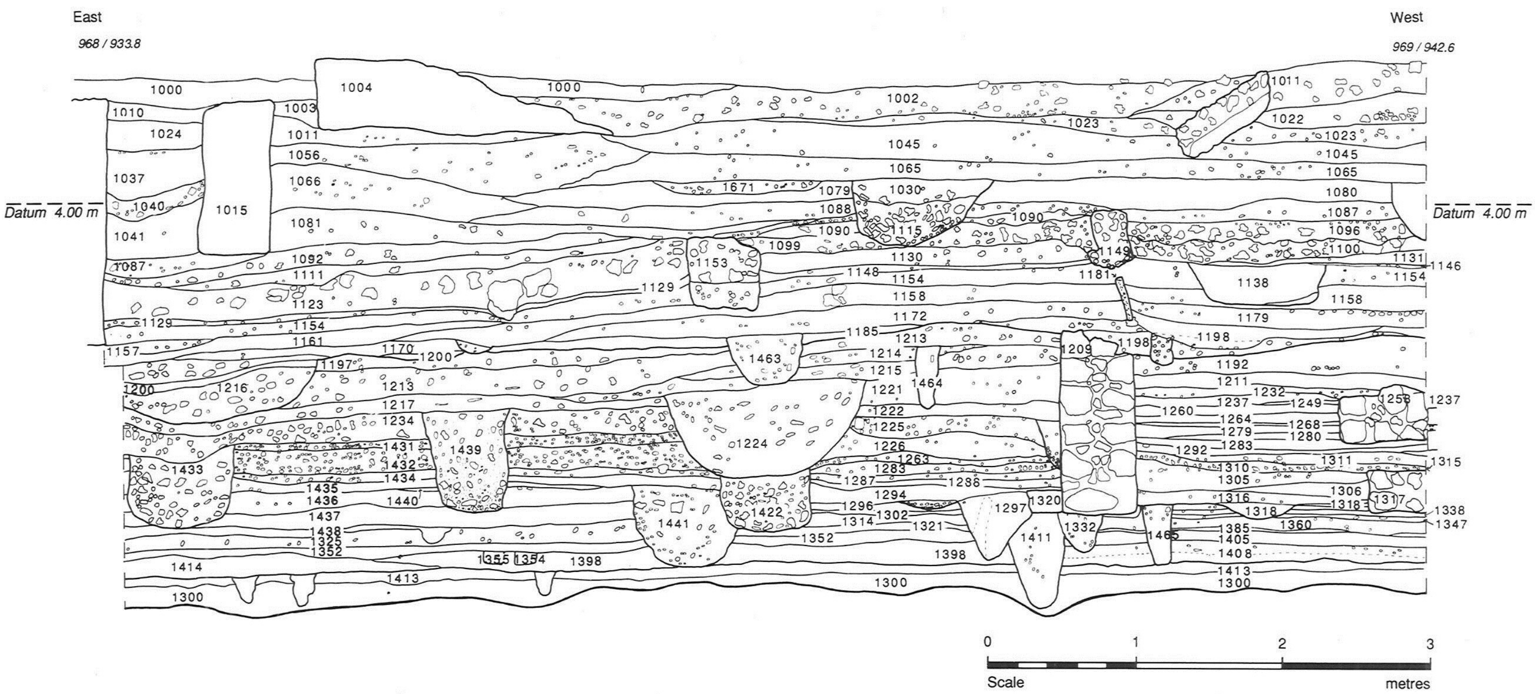

Fig. 2. Section drawing from the site of Shanga in the Lamu archipelago, Kenya (North section of Trench 1; from Horton 1996).

planned and crafted to address the research questions posed. As should be clear, the logistical challenges are great in carrying out research at urban contexts. Beyond these, urban contexts offer other challenges as well, including complicated stratigraphy and site formation processes, data quantity issues, and practical concerns such as onsite safety and site protection.

A. Dealing with complex sites

Because of the density and longevity of occupation, the stratigraphy of urban contexts is complex and challenging (**fig. 2**). This requires a firm understanding of how to disentangle the stratigraphic record, to learn what formation processes led to the creation of the archaeological record (**fig. 3**). Excavators must have good knowledge of the types of cultural and natural processes that likely contributed to the construction of the archaeological record: were strata deposited through active human deposition – such as trash disposal – or through the natural accumulation of soils – such as through windblown soils or erosion. Additionally, as the stratigraphy of urban sites build up through time, destructive processes (both human and natural) can remove evidence of previous occupations and activities, and urban archaeologists need to be able to assess and understand these processes.

B. Managing large quantities of data

Since urban contexts are often the location of dense human occupation, such sites often include tens or hundreds of thousands of artefacts. As already discussed, this requires established systems to excavate and track these artefacts. However, urban archaeologists also need to understand how and when to sample excavated contexts and artefact assemblages. Consistency and transparency in how and why assemblages were sampled is crucial; a well-analysed sample of material is much more useful than a large assemblage that remains unreported. For example, archaeologists often find thousands of fragments of locally-made pottery in urban excavations. If it is not possible to analyse all these fragments, an archaeologist might randomly sample a percentage of the assemblage – perhaps 10 or 25%. It is crucial that the archaeologists report fully the sampling procedure and how it was carried out. Sampling must aim toward ensuring that a representative sample is taken. In the case of ceramics, one must not, for example, take only decorated sherds – a sample should approximate the full range of materials in the assemblage.

C. Safety first

Finally, the health and well-being of both researchers and the site itself is of primary importance. Onsite safety includes an understanding of potential threats at the site (snakes, wild animals, weather systems, political disturbances). Onsite safety should include an emergency medical plan for hurt or sick team members, including medical evacuation protocols. Because urban contexts often involve the excavation of deep trenches, onsite safety also includes plans to keep excavators safe from wall collapse and other potentially dangerous situations.

REFERENCES

Childe, V. G. 1950. 'The urban revolution'. *The Town Planning Review* 21: 3-17.

Horton, M.C. 1996. *Shanga: The archaeology of a Muslim trading community on the coast of East Africa.* Nairobi: British Institute in Eastern Africa.

LaViolette, A. and Fleisher, J. B. 2005. The Archaeology of Sub-Saharan Urbanism: Cities and their Countrysides. *In:* Stahl, A.B. (ed.). *African Archaeology: A Critical Introduction.* Oxford: Blackwell Publishing: 327-352.

McIntosh, S.K. and McIntosh, R.J. 1984. 'The early city in West Africa: towards an understanding'. *African Archaeological Review* 2: 73-98.

MEGALITHISM

Luc Laporte[1]

INTRODUCTION

The excavation of a megalithic site is not fundamentally different from that of any other archaeological site. The constraints are the same: as field work progresses, observations can never be exactly identical to ones previously made. On this matter, the practice of archaeology bears some similarities with that of astronomers and astrophysicists whose measures describe an object of study that probably no longer exists in quite the same state.

Moreover, the success of any archaeological excavation depends on the relevance of the questions as well as on the excavator's capacity to disregard them when facing unexpected observations. Making oneself receptive to what is special about each site, each place, each vestige is part of the exercise. Consequently adapting the implementation of excavation techniques, study methods or analytical frameworks often requires extensive knowledge of the subject under study but also extensive know-how and relevant field experience. And then, as with all archaeological excavation, it is a question of teamwork and thus also of a human enterprise.

In this chapter, we will focus on a few of the features unique to the excavation of a megalithic monument. By megalithic monument we mean any human contruction at least partly made of very large stones, usually displaced, erected or gathered together, and that retain, to our eyes at least, something of their natural outcrop appearance. By extension, we include any contemporary architecture showing similar characteristics, even if they were built with different materials (**fig. 1**). Megalithic monuments are sometimes found in very different forms and contexts.

On the African continent, the works of G. Camps (1961) in the Maghreb and R. Joussaume (1974) in the Horn of Africa are among the most remarkable. F. Paris (1996) revealed funeral monuments in Niger nearly as old as the better known ones of Atlantic Europe. Other forms of megalithism were identified in Mauritania (Vernet 1993) and Mali (Person, Dembele & Raimbault 1991), as well as in Senegal and Gambia (Todd & Wolbach 1911; Jouenne 1918). Still others exist in, for example, Guinea, Burkina Faso (Millogo & Kote 2000), Cameroon (Asombang 2004; Notué 2009), Chad, and Central African Republic (Zangato 1995). Contemporary forms of megalithism have long persisted in Madagascar, while such traditions are still active in the Konso area of Ethiopia (Joussaume 2013).

I. ESTABLISHING THE MISSION

The issues raised by the archaeological study of a megalithic monument can be as varied as the perception of space and architecture, funeral and ceremonial practices, or technical systems. But they often also concern the chronological and cultural setting, territories, the symbolic, and the organisation of societies. As monuments are made of stone, the questions of the geographical origin of the raw material or, where applicable, how they were extracted are crucial. Any answers to these questions will have to be compared with many other fields of study related to, for example, settlements, archaeological materials, or interactions between humans and their natural environment. Finally, such considerations will benefit from further observation of the practices of the people still living on the continent (Joussaume 2003; Gallay 2012).

A. Teamwork

Attempting to answer these questions can no longer be the work of one person. Equipping oneself with the necessary skills to address the relevant questions is just as important as the search for funding, which so often takes precedence. Transferring this knowledge, while providing training for one's staff in the field, is equally impor-

Fig. 1. Wood (Waka) and stone steles from Konso. (Coll. R. Joussaume)

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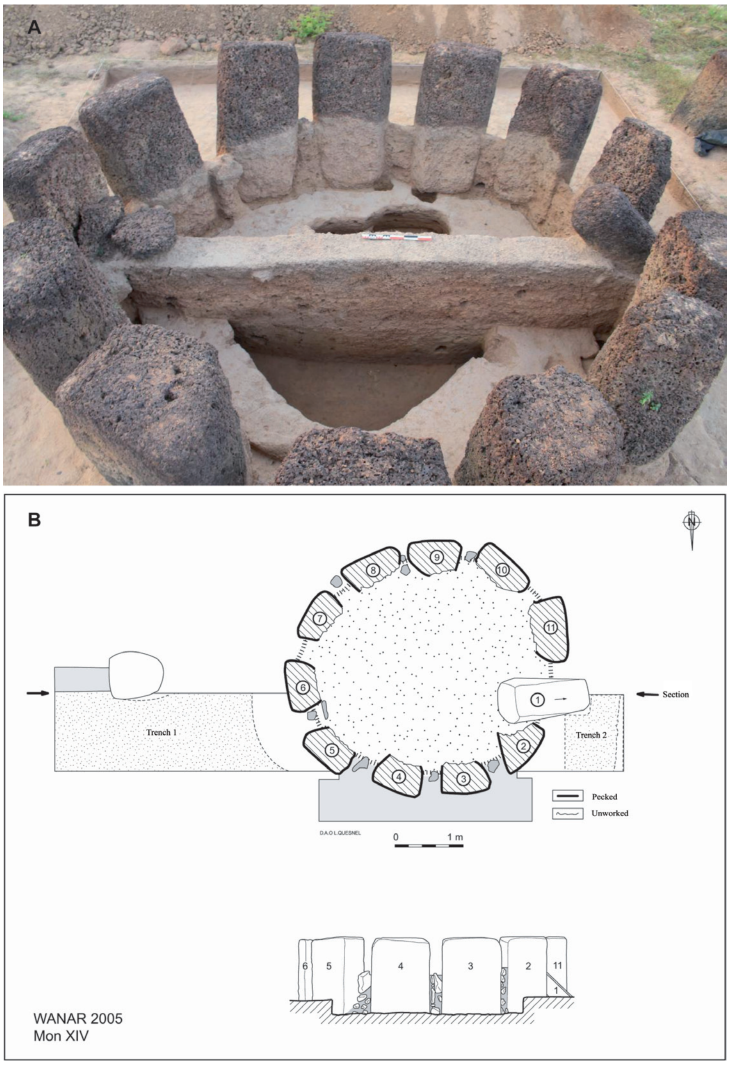

Fig. 2 Excavation and survey of Senegambian megalithic circles. (**a**) Monument XX of the Wanar necropolis (coll. L. Laporte); (**b**) Results of a first survey of monument XIV at Wanar.

tant. This of course includes students of different nationalities who might be involved in the project. But it also includes all technical staff. As an example, in the small village of Wanar, Senegal, some of the locals acquired skills on par with a qualified excavator from France's Institut national de Recherche en Archéologie préventive in just a few years . The quality of the results yielded by the excavation of the megalithic site of the same name owes much to them.

B. The choice of intervention period, and preliminary work

In a zone of contrasting seasons, the choice of when to intervene is crucial. We will see that it must match the goal in question. Material preparation for the field mission is an important phase in which on-site living conditions (particularly sanitation), accessibility, and personal security must be taken equally into account. To this point in sub-Saharan Africa, the implementation of large-scale, controlled mechanical stripping of soil around megalithic monuments do not appear to have been attempted, which may or may not be linked to questions of equipment availability or transport.

II. FIELD PRACTICE

The characteristic feature of a megalithic monument, compared to other archaeological ruins, is that it is often easier to notice in the field. Still today, it marks the landscape. Therefore, the research methods will be those the archaeologist applies to any type of architecture. Remember, however, that the bulk of information is initially invisible. This is firstly because the material elements we see today are quite often only the ruins of a now-vanished, more vast or elaborate structure. This applies to a single stone raised in isolation as well as to the many stones that constitute the framework of a dolmen. Secondly, most of this information is now buried, spared truncation by an erosion process that requires definition. A precise topographical survey of the exposed ruins is necessary before all further intervention.

A. Surveys

The best time to pedestrian survey is, of course, the dry season, when vegetation is low. In densely populated farming areas, planting season can also be favourable. An oral survey of villagers can prove very productive. To locate identified ruins, in the absence of sufficiently precise or current maps, satellite photos are now very easily accessible. Access to aerial photos can sometimes prove more complicated. Moreover, those taken during the colonial period are not always locally available. At the site scale, beyond the topographical surveys that require the use of suitable equipment, geophysical surveys help to identify many of the peripheral structures. Radar seems a particularly efficient method for sand burial mounds, especially to locate the burial chamber.

B. Construction analysis

The study of any architecture that is still standing requires specific records (maps, cross-sections, construction, axonometric or three-dimensional diagrams, etc.). On initial examination, manual drawings entry is often preferable as it sharpens our observation skills (**fig. 2**). Certain software programmes can now generate three-dimensional scatter diagrams from a sufficient number of digital images. This is the principle of photogrammetry.

Fig. 3. Extensive digging at the Wanar site. (Coll. L. Laporte.)

Scanner technology is continuously improving. Nevertheless, owing to the costs involved, it is necessary to first establish very stringent and precise specifications. Studying the building site is a supplementary component that, in addition to the nature of techniques implemented *in situ*, mainly includes the origin of raw materials, how they were transported, and the quarries from which they came – an economy of megalithism, in a way, which cannot be entirely dissociated from its social and environmental context (Laporte *et al.,* 2014).

C. Stratigraphic analysis

Owing to deflation or very active pedogenesis, many soils containing archaeological remains in sub-Saharan Africa are known for not revealing much stratigraphy. Our own experience tends to put this point into perspective, first showing that different stages marking the ruin of a monument often leave layered remains in the surrounding soil. They can thus be evaluated in relationship to the horizontal deposits (stone layers, gravel/cobble, etc.) buried in the immediate vicinity of the megaliths. Revealing such remains entails a very detailed and extensive excavation, somewhat like the famous excavations of the prehistoric site at Pincevent (Leroi-Gourhan & Brézillon 1966). Second, our experience shows that the moistening of sediments during the rainy season makes these stratigraphic elements a bit easier to read than they are during the dry season. In our case, an intervention at the end of the rainy season, or shortly afterwards, as soon as the site was accessible, helped us to identify pits (trenches, silos, post holes, etc.) at each soil level, and even to reveal what was once above-ground construction (earth walls). The use of micromorphology is sometimes necessary (**fig. 3**).

D. Analysis of burial levels

Not all megaliths are associated with graves. When the latter are present, they can be studied using methods developed by H. Duday (2005). Inspired mainly by concepts of forensic medicine, such analysis differs from other physical anthropology studies as it requires the on-site presence of a specialist. Failing this, the information gathered on burial methods and the decomposition of bodies risks being lost forever. More generally, accounting for the taphonomy of the burial levels also includes all deposited goods or features made of perishable materials. In addition, too few palaeogenetic tests have been performed to date; the reputation that fossil DNA preserves poorly in tropical climates warrants wider, case-by-case, confirmation.

III. RESTORATION AND USE OF RESULTS

The heritage aspect of archaeological research of megalithic monuments in Africa cannot be neglected. When well-managed, it is a field in which the production of new knowledge contributes to national wealth. Two sets of megalithic sites have been classified as UNESCO World Heritage: the megalithic steles at Tiya and in the Konso Cultural Landscape in Ethiopia; the stone circles of Sine Ngayène and Wanar in Senegal and Wassu and Kerbach in Gambia.

Maintaining excavation archives, as with archaeological material, is the prerogative of each state. But scientific publication of results – particularly in international journals – is also an important guarantor of data acquired during different field seasons. The publication of monographs is essential (Joussaume 2007). Particular attention has to be paid to increasingly abundant digital archives whose long-term conservation can sometimes encounter problems.

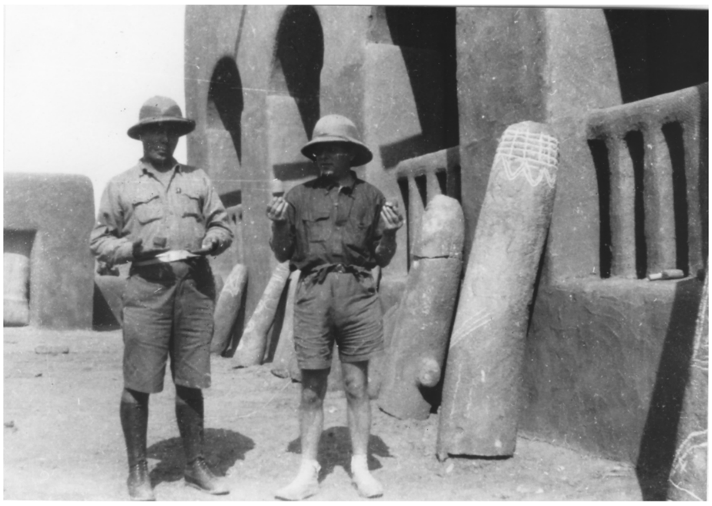

Fig. 4. Toundidarou megaliths. (IFAN archives, Dakar.)

Local authorities often request restoration of the site. On this topic, it must be understood that every restoration is also a reconstruction. To be understood by the general public, this reconstruction also assumes choices that are rarely compatible with the presentation of a single state, or even with the mythical first state whose restoration is often sought to ensure authenticity. On a megalithic site, the temptation is great to just pull a few stones upright again, move or gather together a few others, sometimes even without any preliminary investigation, all while forgetting to indicate, using physical markers, the nature of the physical transformation. This, unfortunately, is what occurred at the megalithic site at Toundidarou, Mali (**fig. 4**).

REFERENCES

Asombang, R.N. 2004. ‘Interpreting standing stones in Africa: a case study in north-west Cameroun’. *Antiquity* 78 (300): 294-305.

Camps, G. 1961. *Aux origines de la Berbérie, monuments et rites funéraires protohistoriques*. Paris: Arts et métiers graphiques, 628 p.

Duday, H. 2005. *Lezioni di archeotanatologia, archeologia funeraria e antropologia di campo*. Rome: Soprintendenza archeologica di Roma, 230 p.

Gallay, A. 2012. *Les Sociétés mégalithiques. Pouvoir des hommes, mémoire des morts*. Geneva: Presses Polytechniques et Universitaires Romandes, 139 p.

Jouenne, P. 1918. ‘Les monuments mégalithiques du Sénégal’. *Bulletin du Comité d’Études historiques et scientifiques de l’Afrique occidentale française*: 57-86.

Joussaume, R. 1974. *Le mégalithisme en Éthiopie, monuments funéraires protohistoriques du Harar*, Paris: Museum d’Histoire naturelle/CNRS, 115 p.

Joussaume, R. 1985. *Des dolmens pour les morts*. Paris: Hachette, 398 p.

Joussaume, R. 2003. *Les Charpentiers de la pierre.* Paris: Maison des Roches, 126 p.

Joussaume, R. (ed.). 2007. *Tuto Fela et les stèles du sud de l’Éthiopie,* Paris: Éditions Recherche sur les Civilisations, 271 pp.

Joussaume, R. 2013. ‘Mégalithismes en Afrique nord-équatoriale’. *Archéo-Nil* 23: 55-72.

Leroi-Gourhan, A. & Brézillon, M. 1966. ‘L’habitation magdalénienne n° 1 de Pincevent près Monterau (Seine-et-Marne)’. *Gallia Préhistoire* 9: 263-385.

Laporte, L., Bocoum, H., Cros, J.-P., Delvoye, A., Bernard, R., Diallo, M., Diop, M., Kane, A., Dartois, V., Lejay, M., Bertin, F. & Quesnel, L. 2012. ‘Megalithic monumentality in Africa: from graves to stone circles at Wanar, Senegal’. *Antiquity* 86: 409-427.

Laporte, L., Parron, I. & Cousseau, F. 2014. *Nouvelle approche du mégalithisme à l’épreuve de l’archéologie du bâti. Actes du colloque RMPR-Internéo de Marseille, juin 2012:* 169-186.

Millogo, A.K. & Kote, L. 2000. ‘Archéologie du Burkina Faso’. In R. Vernet (ed.), *L’Archéologie en Afrique de l’Ouest, Sahara et Sahel.* Nouackchott: CRIAA/Paris: Sépia, pp. 7-70.

Paris, F. 1996. *Les Sépultures du Sahara nigérien du Néolithique à l’islamisation*. Paris: ORSTOM, 2 vol.

Person, A., Dembele, M. & Raimbault, M. 1991. “Les mégalithes de la zone lacustre”. In M. Raimbault (ed.), *Recherches archéologiques au Mali. Les sites protohistoriques de la zone lacustre*. Paris: Karthala, 528 p.

Todd, J.L. & Wolbach, G.B. 1911. ‘Stone circles in Gambia’. *Man* 96: 161-164.

Vernet, R. 1993. *Préhistoire de la Mauritanie*, Nouackchott: Centre culturel A. de Saint-Exupéry/Paris: Sépia, 425 p.

Zangato, E. 1995. ‘Variantes architecturales des Tazunu du Nord-Ouest de la République centrafricaine et évolution chrono-culturelle régionale’. *Journal des Africanistes* 65: 125-143.

Other resources

http://wanar-excavations.jimdo.com/

METALLURGIC SITES

Caroline Robion-Brunner[1] & Vincent Serneels[2]

INTRODUCTION TO THE ARCHAEOLOGY OF IRON

The origin in terms of both time and place of iron metallurgy is a matter of lively debate. Iron is clearly evidenced during the second half of the first millennium before the Christian era in the Sahelian zone and the Great Lakes area. On the other hand, the archaeological data are insufficient to demonstrate any greater age or to retrace the stages of its spread through history. Those who work with iron often occupy a particular place in traditional society. Very little information exists to help us write the history of this social differentiation.

The priority is therefore to develop the study of metallurgic sites to accumulate more (and more precise) data. On this renewed basis, it will be possible to re-examine the major questions that remain unanswered.

I. RESEARCH STRATEGIES AND FIELD METHODOLOGY

A. Locating and mapping sites

As many authors have already noted in this document, inventory and site mapping are essential tools. Interviews with local populations are the best way to identify sites. This phase also helps understand the relationship between the current inhabitants and the remains. The information harvested can only be validated through site visits, taking GPS readings, describing the site, and establishing photographic documentation.

Inventory and site mapping are important not only for primary production sites, but also for mines, charcoal production sites, and forges. These data are related to the occupation of the land (homes, cemeteries, etc.).

B. A description of the techniques

Topographic surveys aim to reveal the spatial organisation of the site and to calculate the volume of the waste. Made to a precise scale (1/100 or 1/200), they show furnaces, related facilities (crushing areas, storage, etc.), discharge areas (scattered waste, slagheaps), and important topographical elements (roads, rivers, etc.). Surface morphology is studied to establish a relative chronology for large slagheaps.

This general approach covers a large area, several hundred or even thousands of square metres. It can be undertaken using simple surveying methods or with the help of tools. A topography created using a theodolite will be more precise, but this precision is not really required, because the boundaries of a slagheap are always unclear. Generally, we establish a survey axis that passes down the middle of the site, made visible using a series of nails or stakes. The orientation is taken by compass. A measuring tape is set in place. Then, we note the perpendicular distances to either side. If the distances are less than 10 metres, there is less chance of error. Some GPS data points are recorded.

Altimetric measurements can help determine the thickness of the slagheaps. A simple builder's level is all that is needed. It is also possible to revert to simpler methods using tape measures and a spirit level fixed to a pole. This method is very effective if the gradients are very high (more than 5 or 6 m).

To study furnaces (morphology, dimensions, construction materials, means of ventilation), it is essential to move on to an archaeological excavation. It is never enough to study visible structures. It is imperative that the lower parts of the furnace, which are covered in sedimentation that post-dates the abandonment of the site, be observed. The excavation centres on a well-preserved and representative furnace. The structure and the immediate perimeter are excavated in half, in order to obtain a stratigraphic section of the fill. It is important to bring to light the circulation around the furnace. At the end of the excavation, detailed diagrams (1/20 or 1/10) of the structures are made. As furnaces are not simple forms, it is important to establish a map and at least two sections, one along the axis of the opening, the other perpendicular to this. The various construction materials are described. A detailed report of a stratigraphic section through the furnace fill must be made, in particular to note the location of charcoal that will be used for dating. Furnaces are not the only facilities. There can be all sorts of annexes. Extensive excavations will be needed to bring these to light.

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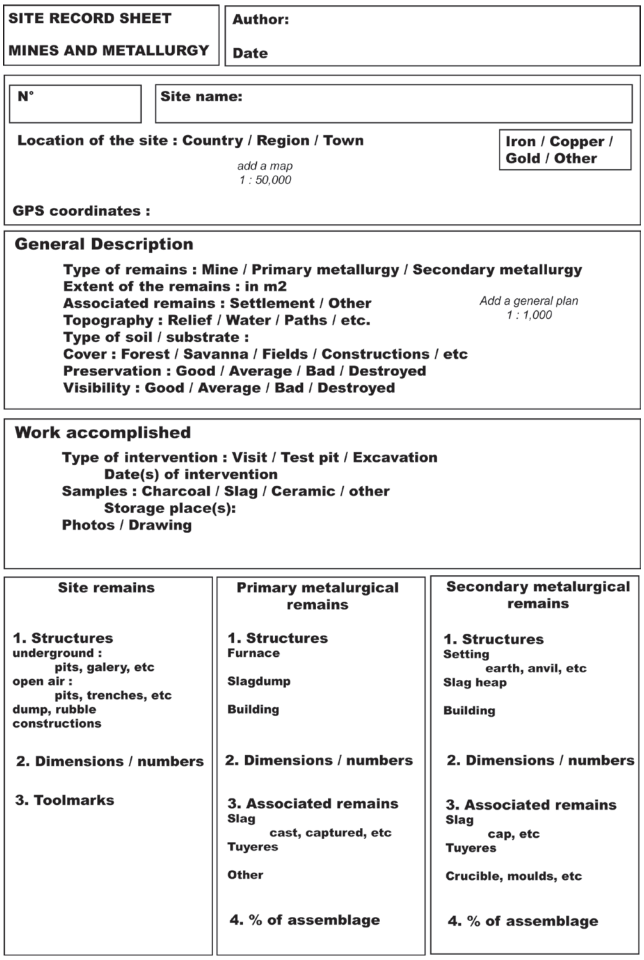

SITE RECORD SHEET
MINES AND METALLURGY

Author:
Date

N°
Site name:

Location of the site : Country / Region / Town
add a map
1 : 50,000
Iron / Copper / Gold / Other

GPS coordinates :

General Description

Type of remains : Mine / Primary metallurgy / Secondary metallurgy
Extent of the remains : in m2
Associated remains : Settlement / Other
Topography : Relief / Water / Paths / etc.
Type of soil / substrate :
Cover : Forest / Savanna / Fields / Constructions / etc
Preservation : Good / Average / Bad / Destroyed
Visibility : Good / Average / Bad / Destroyed
Add a general plan
1 : 1,000

Work accomplished

Type of intervention : Visit / Test pit / Excavation
Date(s) of intervention
Samples : Charcoal / Slag / Ceramic / other
Storage place(s):
Photos / Drawing

Site remains	Primary metalurgical remains	Secondary metalurgical remains
1. Structures underground : pits, galery, etc open air : pits, trenches, etc dump, rubble constructions	1. Structures Furnace Slagdump Building	1. Structures Setting earth, anvil, etc Slag heap Building
2. Dimensions / numbers	2. Dimensions / numbers	2. Dimensions / numbers
3. Toolmarks	3. Associated remains Slag cast, captured, etc Tuyeres Other	3. Associated remains Slag cap, etc Tuyeres Crucible, moulds, etc
	4. % of assemblage	4. % of assemblage

Fig. 1. Example of a specific survey sheet designed for ironworks.

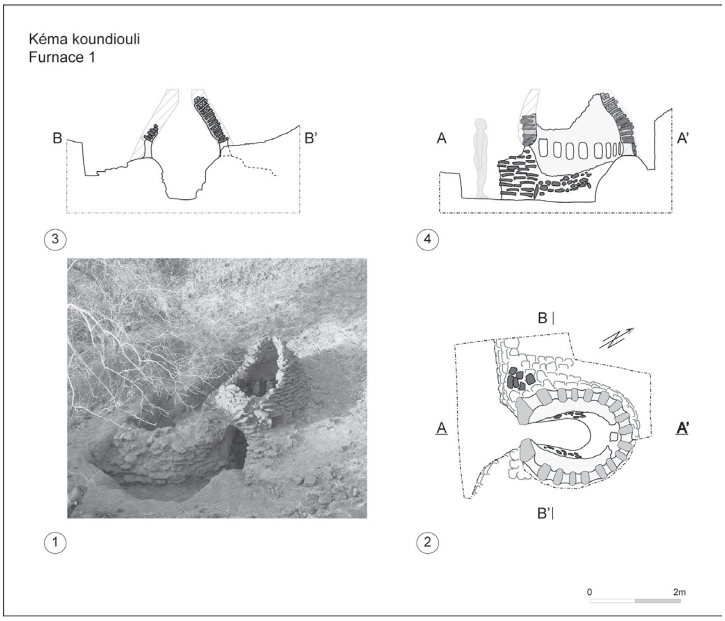

Fig. 3. Presentation of furnace 1 in Kéma Koundiouli (Dogon area, Mali; 2005 mission). **(1)** Photo of the furnace at the end of the survey; **(2)** map of the embrasures; **(3)** section BB' parallel to the charging hole; **(4)** section AA' perpendicular to the charging hole. (Photo © Robion-Brunner & Serneels.)

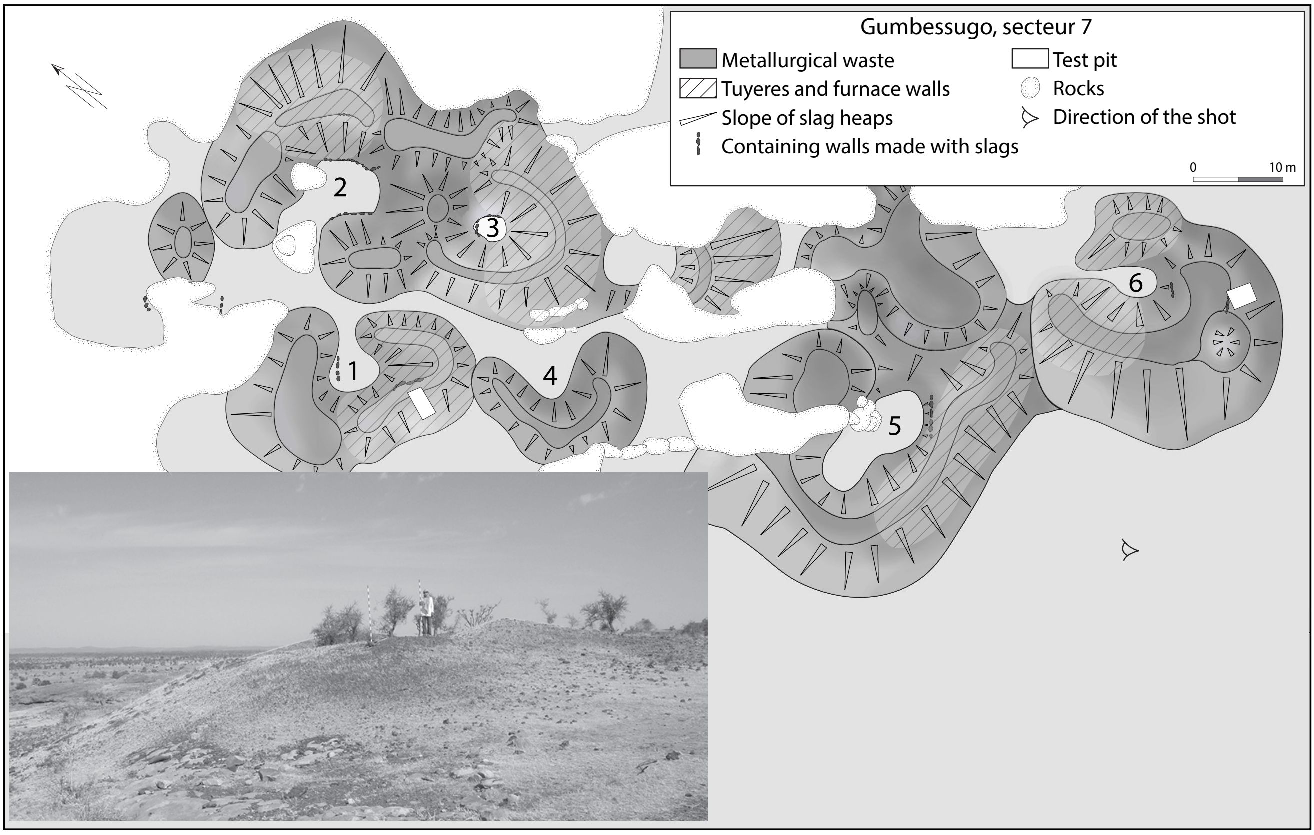

Fig. 2. Topographical survey of sector 7 in Kéma Gumbessugo (Dogon District, Mali; 2008 mission). Slagheaps have a thickness ranging from 1 to 5 m. Furnace locations are numbered from 1 to 6, from oldest to newest. (Photo © Robion-Brunner & Serneels.)

Metallurgical remains

	Sandy clay tuyeres	Dense grey tapped slags	Dense grey internal slags	Dense grey furnace bottom slag
Site 1	10%	80%	10%	-
Site 2	10%	-	-	90%
Site 3	10%	40%	10%	40%

Fig. 4. Example of metallurgical debris assemblies as a percentage for sites belonging to different technical traditions. (Photos © Robion-Brunner & Serneels.)

It is also important to describe metallurgic waste (slag and tuyeres) precisely. In the case of slagheaps, note is taken of their form (block, tapped slag, etc.), their colour (grey, brown, etc.), their appearance (compact, bullous, etc.), their apparent density (heavy, light), their weight, the presence of imprints from fuels (straw, wood, charcoal), etc. It is important to determine the orientation of the piece and to distinguish slag that has flowed in a horizontal position from one that was formed vertically. Broken surfaces showing the structure of the slag should also be noted. Homogenous materials can thus be distinguished from those that have inclusions; those that are compact from those that are porous. The quantity, size, and distribution of bubbles can be characteristic. We determine if the material is vitreous or crystalline. Several types of slag are present on a single site, and make up an assemblage. Each type must be described and the proportion (in %) of each type calculated.

It is useful to systematically describe at least twenty tuyeres, noting the shape of the section and measuring the diameter of the pipe. We can also note the distribution of thermal impacts on surfaces in order to deduce information concerning the position of the tuyeres in the furnace. It is also an occasion to note the presence of double tuyeres or linked tuyeres. It is not often possible to measure the length of the tuyeres, as they are almost always broken. As a default, we note the length of the longest unbroken section.

To characterise the materials that remain, interpret the physico-chemical conditions for slag formation, calculate production yields, and identify the minerals used, chemical and mineralogical analyses can be performed by a laboratory. In such cases it is necessary to collect samples characteristic of the waste. In the event that the pieces are too big to be removed in their entirety, sketches are made or photos taken. A sufficient number of pieces is required for each category, but laboratory analyses are costly. Experience teaches us that the analysis of five samples per category allows for interpretation. A finer characterisation requires twice as many.

C. Dating activity

To date furnaces, it is essential to localise samples precisely. Charcoal from fill (posterior) must be differentiated from that of the layer of use inside the furnace (contemporary) and that coming from layers that pre-date the construction. The question must be asked: is what we are dating from the last reduction, the construction of the furnace, etc.?

For dating in waste areas, the general map helps establish a relative chronology. Stratigraphic surveys of these areas are needed. In practice, these surveys are relatively delicate to perform owing to poor wall stability. A useful technique is to quickly open stepped trenches with steps of 1 to 1.5 metre in the slope along the edge of the cluster. At the foot of the cluster, the survey must reach as deep as the natural substratum, in order to judge the depth of recent sediment cover. The best charcoal samples are taken when the stratigraphic section is being diagrammed, and are linked precisely to the stratigraphic units shown on the drawing. It is best to take as many samples in the field as possible, even if only a portion will be used. We try to obtain two dates in each cut in order to obtain the start and end of operations and evaluate the slag accumulation rate.

D. Evaluating production

The evaluation of the amount of iron produced is a fundamental data point. To quantify the volume of slag, we use a map, which allows the calculation of the covered surfaces, and the altimetric reading, which provides depths. To calculate tonnage, the weight of some slag must be measured by volume (m^3).

Some sites have subsided, and the mass of slag is from 1000 to 1500 kg per m^3. In mounts that have not been compacted, it is generally from 500 to 1000 kg for the same volume. Proportions (in %) of the different types of waste must also be estimated.

The ‘cubing’ technique consists of excavating a known volume, for example an eighth of a cubic metre (a cube of 50 cm on each edge), and storing the material contained in that volume. Waste is then sorted according to a pre-established classification. Each category is weighed using a scale. Quantities per cubic metre are calculated based on the estimate for 1/8 cubic metre. If the waste appears homogenous, then one test pit is enough, but it is preferable to perform the operation at least twice.

Fieldwork establishes the tonnage of slag with relative precision. The number helps to establish the order of magnitude and make comparisons with other sites or other regions. On the other hand, the quantity of ore and the efficiency of techniques are variable. It is therefore not possible

Fig. 5. Example of ‘cubing’. All metallurgical waste from a known volume are sorted by category and weighed with a balance. (Photos © Robion-Brunner & Serneels.)

to calculate the quantity of iron produced directly on the tonnage of slag. For that, chemical analyses of the ore and the slag are required to establish the materials mass balance. On the basis of current knowledge, however, one can say that the amount of iron is of the order of 10 to 20% of the slag (100 to 200 g of iron for 1 kg of slag). Only extremely efficient techniques and rich ores allow superior proportions, sometimes as much as 1 kg of iron for each 1 kg of slag.

E. The environmental impact of iron production

Iron production consumes wood. Five kg of wood are needed to produce a single kg of charcoal. The mass of charcoal used is, normally, about once or twice that of the ore. Then there is the fuel needed for smithing.

These activities therefore have an effect on forest cover. This can be evaluated if the tonnage of slag, the length of activity, and the area's forest productivity are known. For metallurgy, preference is theoretically given to species with high calorific value, which is to say, dense woods. In some traditions, certain species were reserved exclusively for iron work.

Anthracological study helps identify the fuel-supply strategy by determining the types of wood used. For this, as much charcoal as possible must be collected during the survey excavation, and grouped by stratigraphic units. It is important to take charcoals of every size, as different species fracture differently. These are collected with the aid of a sieve (0.5 cm).

CONCLUSION

There are numerous metallurgic sites in Africa. They leave durable traces that testify eloquently to an essential activity of production that developed and diversified over two millennia. They are an integral part of the archaeological heritage and should be studied as such. Beyond a simple but vital census, they deserve deeper study (spatial organisation, technological characteristics, tonnage estimation, and dating). Laboratory methods (archaeometallurgy and anthracology) provide additional information.

REFERENCES

Alpern, S.B. 2005. 'Did they or didn't they invent it? Iron in Sub-Saharan Africa'. *History in Africa* 32: 41-94.

Killick, D. 1991. 'The relevance of recent African iron-smelting practice to reconstructions of prehistoric smelting technology'. *MASCA research papers in science and archaeology* 8 (1): 47-54.

de Maret, P. 1980. 'Ceux qui jouent avec le feu: la place du forgeron en Afrique centrale'. *Africa, Journal of the international African Institute* 50 (3): 263-279.

Robion-Brunner, C., Serneels, V. & Perret, S. 2013. 'Variability in iron smelting practices: confrontation of technical, cultural and economic criteria to explain the metallurgical diversity in the Dogon area (Mali)' In J. Humphris & T. Rehren (eds), *The World of Iron*. London: Archetype Publications, pp. 257-265.

Serneels, V., Donadini, F., Kiénon-Kaboré, H.T., Koté, L., Kouassi, S.K., Ramseyer, L. & Simporé, L. 2014. 'Origine et développement de la métallurgie du fer au Burkina Faso et en Côte d'Ivoire. Avancement des recherches en 2013 et quantification des vestiges de Korsimoro (Sanmatenga, Burkina Faso)'. *Jahresbericht 2013 der Schweizerisch-Liechtensteinische Stiftung für Archäologische Forschungen im Ausland (SLSA)*, Zürich & Vaduz, pp. 65-112. http://www.slsa.ch/wp-ontent/uploads/2014/07/SLSA_BurkinaFaso13.pdf

Also see

The reference list created in 1994 by D.E. Miller and T. Maggs: http://projects.exeter.ac.uk/mhn/Africa.html

The Metal Africa association's website:
http://www.metalafrica.info

EXCAVATING FUNERARY SITES

Isabelle Ribot[1]

INTRODUCTION

Whatever the age, the location of the site and the continent, there are some basic procedures when conducting archaeological excavations of human remains. The way in which human remains are excavated is crucial for the post-excavation analyses, in both human bioarchaeology (the study of past populations from archaeological sites) and forensics (the identification of recent deaths in relation to crimes or accidents) (Steyn *et al*. 2000; Martin *et al*. 2013). Although the objectives are very different between these two disciplines, a series of similar steps (e.g. surveying, excavation, *in situ* osteological observation) have to be followed to clearly document a funerary site. However, in comparison to forensic science, bioarchaeologists are dealing in general with burials that are more ancient and less unplanned, and therefore they use very different sources of information such as historical (e.g. archives, oral history) and/or archaeological (e.g. survey, excavation) data. These are essential for a detailed understanding of funerary sites and their broad context, especially in spatial-temporal terms. Some African sites in very different climatic and topographic settings will be used as examples, in order to highlight the diversity of situations (e.g. funerary practices).

EXCAVATION AND VARIOUS OTHER ASSOCIATED TASKS

Excavation of human remains will vary according to the nature of the deposits found (e.g. soil texture, hardness, depth, type of burial). Their complexity will increase drastically, from the simple case of a primary burial (one individual or more buried during a single event) to other cases with secondary burials (multiple burial events). As excavation itself is a destructive process, everything (e.g. stone structures, burial pits, skeletal elements, artefacts, ecofacts) has to be recorded *in situ* from the start (the surface) until the end (below the skeleton to the base layer) in reference to a three-dimensional grid set up for the whole site. Written notes (e.g. field notebooks, special forms for the graves), scaled drawings and standardized photographs (e.g. magnetic north, scale, board showing date, location or square number, grave number, depth) should document all the phases of the burial excavation (**fig. 1**).

A. Key Tasks

For both archaeological sites and crime scenes, the main tasks to be followed in recovering buried bodies are to:

- i) secure the site (tape off the area and establish a safe route to go to the site);
- ii) record what is visible on the surface before and after clearing the vegetation;
- iii) set up a grid and record all surface features disturbed or *in situ* (e.g. eroded deposits, soil differences, structures);
- iv) locate the grave pit *via* test pits and trenches, and uncover and document everything (e.g. human remains, artefacts, ecofacts, large stones, soil differences);
- v) uncover and document the human remains;
- vi) exhume, sample and bag the human remains.

The key tasks from iv) to vi) are developed below to illustrate the approach.

B. Locating a Grave Pit

Once the grid and a fixed elevation datum point are set up on the area selected for excavation, several test pits and trenches should be dug in order to locate the burials. This stage is probably one of the trickiest, as the layout of graveyards, although often in rows, varies through time and space according to various cultural factors. The general layout is also related to the size of the burials themselves, which can vary from a simple trench cut into the sediments to a more complex grave shaft built with walls in mud bricks (e.g. Egyptian Middle Kingdom burials: Herbich & Peeters 2006).

If there is no evident soil stratification (e.g. soil texture and colour), the excavation should proceed in spits that are horizontal arbitrary layers of fixed thickness (e.g. 5 to 15 cm). Various tools are used when searching for burial pits. Spades and pickaxes can be used to remove the top layers containing rubble, especially in the case of historic graves that can be more than two meters deep. Once soil

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Fig. 1: Standard photograph of a double primary burial from Shum Laka, Cameroon. (Photograph by P. de Maret, from Ribot *et al.* 2001.)

Fig. 2: Comparison of two skeletons completely articulated but buried in a different manner (Cobern Street site, 18th century, Cape Town, South Africa): Christian burial no. 34 (left photograph) with traces of nails (coffin); and Muslim burial no. 32 (right photograph) with no nails (shroud). (Photographs by O. Graf.)

differences are visible (e.g. of colour between pit infill and surroundings), trowels, paintbrushes and dustpans are better tools to remove layers at a relatively slow pace.

Then, once the human remains are uncovered, fine tools (e.g. dental picks in wood or bamboo preferentially, brushes of different sizes) will help to remove the soil surrounding the bones without disturbing them. At some point, it is also very important to record the section profile where the funerary pit has been identified, in order to place it temporally within the sites' stratigraphy (see also Fig. 1, p. 95). It is also recommended to sieve the soil with a 1.5 mm and 5 mm mesh, especially when immature skeletons are found, as skeletal elements can be very small (e.g. dental buds, unfused epiphyses).

C. Uncovering the Human Remains

An excavation should be expanded little by little in order to uncover, if possible, the whole skeleton. The position in which the deceased was buried needs to be understood, as well as whether there were any traces of the body being interred within a coffin or a shroud. At this stage, it is very important to consult a bioarchaeologist, in order to identify the bones *in situ* and to conduct particular osteological observations on site (Duday 2006). Is the skeleton fully or partially articulated? In which anatomical view (e.g. anterior, posterior, lateral, medial) do the bones appear? These questions will help to understand whether the burial has been disturbed intentionally or not, and whether it corresponded to single or multiple funerary events. For example, the excavation of collective burials, often complex accumulations of disarticulated bodies in one pit (see also Fig. 1, p. 95), will require recording of the position of each bone (e.g. in reference to the grid, anatomical view) before removal and excavating lower layers (e.g. prehistoric burial with children, Cameroon: Ribot *et al.* 2001). This approach will lead to an understanding of body decay processes and burial practices during post-excavation analysis. For example, if the skeleton is very well articulated and not displaced even around the joints that quickly decay (e.g. fingers, toes, pelvic symphysis), it is often a sign that body decay occurred in a filled space and not in an empty space (Duday 2006). In fact the earth used to fill the grave prevents other elements from falling into the burial and also fills in spaces provoked by decay of soft tissues (e.g. thorax, abdomen). However, this phenomenon (body decomposition in a filled space) varies according to various factors (e.g. soil texture, coffin material). A wooden coffin can decay rather quickly, and the empty space surrounding the body can be filled up by soil (especially fine grained) coming from the surroundings outside the coffin. Therefore, the degree of skeletal articulation might be as excellent, as in the case of a body interred in a shroud (body decay in filled space). Nevertheless, if artefacts are found, it is possible to differentiate between burial types, either in coffin (e.g. wood and/or nails) or in shroud (e.g. remains of fabrics and/or pins). Body position (e.g. generally fully extended and lying on its back in a coffin burial) can also be a good indicator (e.g. intensively used cemetery with various religious traditions, Cobern Street, Cape Town: Graf 1996; Apollonio 1998) (**Fig. 2**).

D. Summary of Basic Information to Document

In sum, here is a list of data that must be recorded on a field form for each grave:

i) location of the burial (e.g. exact grid square, depth, remarks about sediment);

ii) type of burial (e.g. internment or cremation, primary or secondary burial, single or multiple burial, general position of bones, degree of skeletal articulation);

iii) presence or absence of structures with their size (e.g. pit, stones, built grave shaft);

iv) position of the skeleton (e.g. flexed or extended, orientation in relation to top of cranium and face);

v) depths taken on key skeletal areas (e.g. cranium, pelvis, feet);

vi) drawing (in reference to the grid and with a scale varying according to size of the area excavated);

vii) artefacts recovered and approximate dates;

viii) reflections on body decay;

ix) visual and/or written osteological inventory and anatomical view observed for each skeletal element in the field;

x) various taphonomic and biological remarks (e.g. state of preservation, age, sex, stature, bone measurements);

xi) list of the samples taken for special analyses (e.g. soil, bones or teeth);

xii) list of the photographs taken in black and white, and in colour.

E. Exhuming, Sampling and Bagging the Remains

In general, the removal of the skeleton is a process that starts from the feet and moves up to the skull, but it depends on how the skeleton is positioned and accessible to the excavator. In exceptional cases (when the sediments are compact and solid), small burials are sometimes lifted as a block made from a moulding agent (e.g. plaster of Paris). This procedure allows one to both excavate and analyse delicate infant burials in a laboratory. For normal exhumations in the field, containers (e.g. cardboard boxes with bubble wrap) and plastic bags of various sizes need to be prepared with indelible pens and tags showing standard information (e.g. date, site code, burial number, square number, depth, layer). At this stage, soil sampling in different loci (e.g. outside the pit, within the pit, within the abdomen for presence of parasites) is also necessary, as the burial is 'destroyed' little by little during the removal of the skeleton. Teeth and bone for ancient DNA analysis is sampled preferentially on site using gloves, in order to eliminate contamination problems that tend to increase during post-excavation (osteological work).

CONCLUSION

These recommendations are a brief outline of what needs to be done in the field, and they are of course not exhaustive. It is highly recommended that people working on a funerary site should be trained properly *via* a field school in bioarchaeology. For any site under study, a methodological approach should be well set up in advance and follow all the steps mentioned above.

In short, burial discoveries are extremely diverse, ranging from the simplest types (e.g. primary burial with one interment) to more complex ones (e.g. secondary burials such as collective burials, or multiple primary burials such as mass graves). Therefore, the methods used (e.g. speed of excavation, techniques of recording) have to be adapted according to budget and time allowed within each archaeological project. Nevertheless, none of the tasks should be neglected or omitted. The excavation of burials remains a team approach, where the bioarchaeologist has to incorporate various pieces of information from the archaeologist and other specialists (e.g. geomorphologist) to fully understand the funerary site as a whole and not only in osteological terms.

REFERENCES

Apollonio, H. 1998. 'Identifying the dead: Eighteenth Century mortuary practices at Cobern Street, Cape Town'. Unpublished M.A. Thesis, Department of Archaeology, University of Cape Town.

Duday, H. & Guillon, M. 2006. 'Understanding the circumstances of decomposition when the body is skeletonized'. In A. Schmitt, E. Cunha & J. Pinheiro (eds), *Forensic Anthropology and Medicine: Complementary Sciences from Recovery to Cause of Death*. Totowa, NJ: Humana Press, pp. 117-157.

Graf, O.H.T. 1996. 'Cobern Street: a truly unique site in Cape Town, South Africa'. *Society for Clay Pipe Research Newsletter* 50: 25-35.

Herbich, T. & Peeters, C. 2006. 'Results of the magnetic survey at Deir al-Barsha, Egypt'. *Archaeological Prospection* 13: 11-24.

Martin, D.L. 2013. 'Best practices: excavation guidelines and taphonomic considerations'. In D.L. Martin , P.R. Harrod & V.R. Pérez (eds), *Bioarchaeology: an integrated approach to working with human remains.* Manuals in Archaeological Method, Theory and Technique. New York: Springer, pp. 93-116.

Ribot, I., Orban, R. & de Maret, P. 2001. *The prehistoric burials of Shum Laka (Cameroon, Late Stone Age – Iron Age).* Tervuren : Royal Museum for Central Africa (series « Annales de Sciences humaines », no. 164).

Steyn, M., Nienaber, W.C. & Iscan, M.Y. 2000. 'Excavation and retrieval of forensic remains'. In J.A. Siegel, P.J. Saukko & G.C. Knupfer (eds), *Encyclopedia of Forensic Sciences*. London: Academic Press, pp. 235-242.

RECORDING ROCK ART

Benjamin Smith[1]

I. RECORDING ROCK ART SITES

When you locate a rock art site (see the section 'Finding Rock Art'), what you record will be determined by your aims and needs. Typically, you will record useful information using a site record sheet, either one that you have designed yourself or one that was provided by your organisation. Your site record sheet may be paper-based or a digital system that is inputted in the field using a tablet/laptop. If you have to design your own recording sheet then it is wise to follow an internationally used data recording structure such as the CIDOC International Core Data Standard for Archaeological and Architectural Heritage. This will ensure that your records are compatible with many databases, that you use common terminology, and that you include all mandatory data fields. One of the mandatory fields in all record sheets will be the longitude and latitude (and/or the UTM) of the site. This is generally identified using a portable GPS. For rock art sites it is important to remember to stand slightly away from a rock shelter or cliff face in order to get an accurate reading. The device needs to interact with satellites and this interaction will be obstructed by rocks and dense vegetation. When taking a GPS reading at a rock engraving site remember that such sites can span more than a kilometre and you should either take a set of readings to locate the edges of the site or record the centre point and the average radius (the distance from the centre to the edge). Another important thing to remember is to change the GPS factory setup and to choose the correct map datum. Almost all parts of Africa now use the WGS84 datum. A failure to set the datum correctly could lead to your site location having an error of as much as a kilometre.

Typical rock art specific textual data that you should record include information on the type of rock, number of rock art panels, techniques (brush painted, daubed, incised engraved, pecked engraved etc.), pigments/colours used (if any), subject matter (or motif), size, overlays, juxtapositioning of images (e.g. intention to create scenes), relative degrees of fading/patination and the number of motifs (for more details see Smith *et al.* 2012). The manner of depiction (or style) can be particularly important as this is often used to assign age and authorship. The manner is the way in which the three-dimensional subject has been transformed into a two-dimensional image. Giraffe, for example, are painted in many different African art traditions, but the style in which they are painted – their outline form, the nature of their patterned fill, their particularly emphasised/omitted details – can help determine whether they were painted/engraved by a San, Northern Sotho, Sandawe, or Maasai artist. Aspects of style, because they are culturally learned rather than 'normal' or 'natural', are necessarily local and particular and therefore identifying the rock art 'tradition' is archaeologically useful. The tradition may help you to determine whether the art was made by hunter-gatherers, pastoralists, or farmers and thereby help you to give it an estimated age (see Smith 2013). Consulting specialist rock art publications will assist you in recognising different traditions.

Typical graphic records that can all be made within a few days at a rock art site include: a site plan (**fig. 1**), a

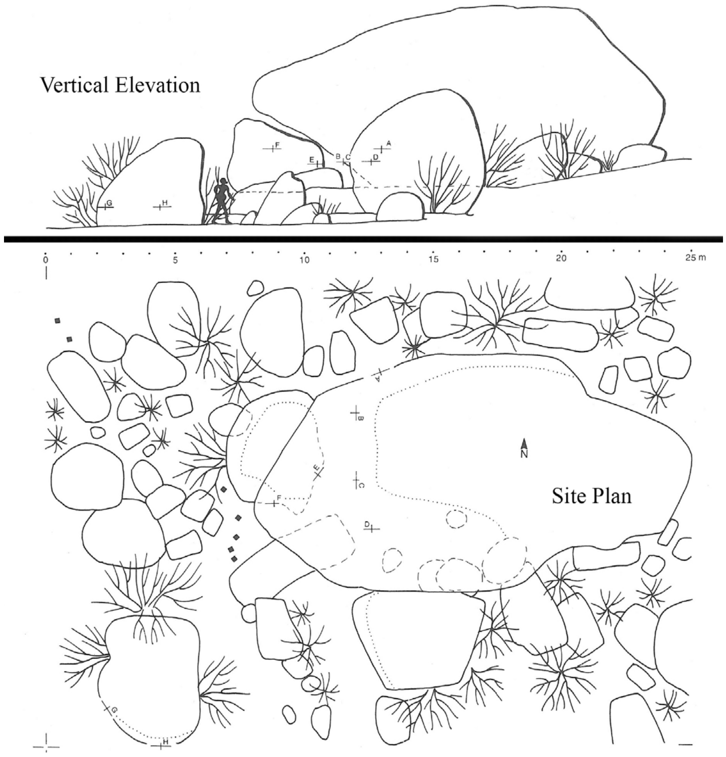

Fig. 1. An exemplary rock art site vertical elevation and plan. (After Pager 2006: 247.)

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Fig. 2. An example of a sketch of a rock painting site. Location: Chongoni Rock Art Area World Heritage Site, Malawi. (Sketch © B. Smith.)

vertical elevation if you are recording paintings (**fig. 1**), sketches and photographs. Sketches are particularly useful for rock art (**fig. 2**). They force us to look carefully at the art and ensure that we tease out the details of even the most faded image. And, do not ignore the faded art: it is likely to be the oldest art in the site and could therefore be highly significant. You will be familiar with basic photography, but rock art poses a few particular challenges. Paintings are often in poor light and look dull in photographs. Artificial lighting or bounced lighting (using a reflector) may help to draw out fine and faded details. A tripod will help to keep the camera still at slow shutter speeds. High quality SLR cameras and fixed focal lenses perform significantly better in low light conditions than standard point-and-shoots and are a worthwhile investment for anyone working regularly with rock art. Engravings are often blasted by intense sunlight and their lines show little contrast with the natural rock when photographed. Night photography, with obliquely angled artificial lights, helps to show off their finer details. If night photography is not possible, then early morning or late afternoon oblique natural light and/or the use of polarising filters may be beneficial. Because the time of day can have such a profound effect on the way rock art is recorded it is always advisable to record the time. People who later view the art under worse lighting conditions may assume that the art has 'deteriorated' when in fact the clarity of your photograph was simply a product of your good timing, lighting and skill. As in all archaeological photography, using a scale is important but it is valuable for rock art work if this incorporates accurate colour swabs (either RGB or CMYK) for later digital colour calibration.

A particularly time-consuming but also finely accurate form of recording is tracing. Tracing is a technical skill that requires specialist training in order to ensure that it is done accurately and that it does not damage the art. Tracing should not be attempted without specialist training. Three-dimensional models of rock art panels and sites can be made using a laser scanner. Again this is a specialist technique that needs to be done by a specialised team. It has proven more useful for rock engravings than paintings, because scanners record surfaces rather than colour. For paintings, photographs can be integrated with the scan to create a 3D colour model, but when done at the resolution needed to see the fine details in a rock art panel, this tends to produce such a large digital file that it cannot be manipulated on standard computers. 3D laser scanning is extremely costly and is not necessary for most research, management and conservation purposes. If 3D is desired, standard photographs can be manipulated by photogrammetric software to create cheap 3D recordings

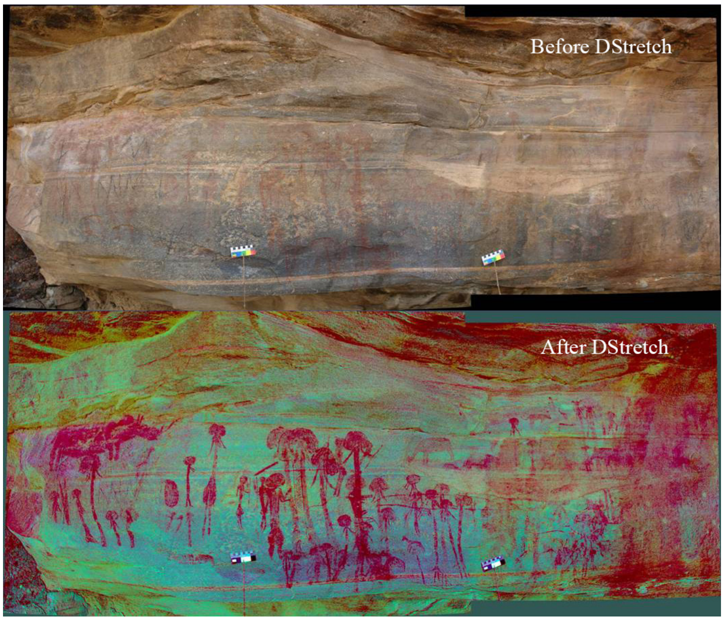

Fig. 3. DStretch rock art image enhancement at work. Location: Kondoa Rock Art World Heritage Site, Tanzania. (Photos © J. Harman.)

Fig. 4. Portable Raman Spectroscopy being used to identify pigments at a rock painting site. Location: Maloti-Drakensberg World Heritage Site, South Africa. (Photo © L. Ronat.)

that are accurate enough for most purposes. For the majority of purposes, you will therefore find that site record sheets, plans, sketches and photographs will meet all of your recording needs. Always take more photographs than you think is necessary. Take photographs of all sections of the site including close-up details and views of unpainted parts of the site – these may be crucial for monitoring conservation change at a later point in time. Take contextualising shots of the site in its landscape and views of surrounding vegetation/settlement – these could be vital later to relocate the site and to monitor change.

Whether for management, conservation or research, recording the context of rock art is important. Attention should therefore be devoted to recording associated archaeological materials, any ongoing uses of the site, as well as relevant local beliefs, ceremonies, histories, and traditions. To do this well it will be important to speak to most of the families who live close to the site. You should already have consulted the traditional authorities before starting your work, but a second consultation during your fieldwork will usually prove valuable. Producing local language pamphlets on the aims and outcomes of your study that can be distributed amongst the local people and schools in the area can provide an important opportunity to inform the local community about the nature and purpose of your work. The more integrated your planning around public engagement and involvement in your project, the easier you are likely to find it to continue productive work in an area.

II. SPECIALIST TECHNICAL ANALYSES

There are a number of more specialist analyses that can be conducted at rock art sites that you may wish to consider. If the art is faded and you are struggling to see it clearly then you may wish to use image enhancement software. A commonly used programme developed specifically for rock art enhancement is *DStretch*, developed by Jon Harman and made available by him for free. This programme can even be loaded onto cameras and tablets for use in the field. It helps in the observation of faded details in rock paintings (see **fig. 3**). If you wish to know the chemical composition of the pigments this can also now be done without damage to the art by using a handheld XRF analyser. These devices, when pointed at a rock painting, are generally able to identify the full spectrum of chemicals contained in pigments. You can therefore see whether two paintings were made using identical pigments and you may be able to start to trace the source of some pigments through their distinctive inclusions.

In general, sampling of rock art is not advisable and should be avoided. The only thing that one can learn from sampling most pigments is their chemical composition and this can now be done satisfactorily without damaging the art by using XRF or another technique such as Portable Raman spectroscopy (**fig. 4**). A few rock art pigments, such as organic pigments (beeswax, charcoal, and soot) and a few naturally produced microscopic layers over and under rock paintings, can be dated by using small samples. Where a section of a rock art panel is actively flaking, it may be possible to collect a small piece without doing significant damage to the panel. In such cases it could therefore be beneficial to call in a rock art dating specialist to collect samples. However, the bulk of red, yellow and white pigments contain no directly dateable material and so pigment sampling is unjustifiable. If you wish to understand more details about the art you should contact a specialised rock art research institution, the largest in Africa being the Rock Art Research Institute in Johannesburg, South Africa. They can advise you on what specialist technical analyses and recording techniques will be worthwhile at your particular site and can give you more information on the age, authorship and meaning of your rock art.

Rock art gives us a unique glimpse into the minds of long ago. Trying to unravel how and why it was painted, and what it means, is part of the magic of archaeology that captivates people from all parts of the social spectrum across Africa as well as internationally. African rock art is well known around the world and it is now strongly represented on the UNESCO World Heritage List. Working with rock art is a privilege and a pleasure but it also brings important obligations. Rock art is an especially fragile part of our inheritance from the past; with poor management a site can be lost in a single generation. Rock art requires special vigilance to curate it in a manner that maximises its value to current generations while conserving it as a resource that will also be of benefit to future generations.

REFERENCES

Pager, H. 2006. *The Rock Paintins of the Upper Brandberg.* Part VI*: Naib, Circus and Dom Gorges*. Cologne: Heinrich-Barth Institute.

Smith, B.W. 2013. Rock art research in Africa. In Lane, P. & Mitchell, P. (eds). *Handbook of African Archaeology.* Oxford: Oxford University Press, pp. 145-162.

Smith, B.W., Helskog, K. & Morris, D. 2012. *Working with Rock Art: recording, presenting and understanding rock art using indigenous knowledge*. Johannesburg: Wits University Press.

DOCUMENTING AND STUDYING A ROCK-ART SITE: THE EXAMPLE OF THE LOVO MASSIF

Geoffroy Heimlich[1]

I. CENTRAL AFRICAN ROCK ART

Unlike the rock art of the Sahara or southern Africa, that of Central Africa remains largely unknown. Although first reported in the 16th century by Diego del Santissimo Sacramento, the rock art of the Lower-Congo has never been the subject of any broad study, and even its age remains uncertain. Thus Pierre de Maret suggested I undertake a study of the Lovo massif, which he had studied in 1972 and 1973 (de Maret 1982). Since then, no other study of the rock art of the Lower Congo had been undertaken until 2007, when I had the opportunity to embark on a preliminary field research to the Lovo massif (Heimlich 2013). With 102 sites (including 16 decorated caves), this massif contains the largest concentration of rock art sites in the entire region, which represents more than 5,000 images (**fig. 1**). Hundreds of limestone ruiniform massifs, pierced with caves and rock shelters, rise across nearly 400 km^2.

In short, my study aims to go past a simple iconographic analysis by combining the data obtained with those being used by historians, ethnologists, archaeologists, and linguists. I have attempted to demonstrate that rock art, like historic sources and oral traditions, can offer historians an important source of documentation contributing to the reconstruction of Africa's past. Using the Lovo as a case study, I will now explain step-by-step my precise manner of working.

II. TECHNIQUES FOR RECORDING AND DIGITALLY ENHANCING IMAGES

The bulk of my work was creating the most comprehensive inventory possible of the Lovo massif.[2] Making no contact whatsoever with the surfaces, I generated records by processing digital images, following the image processing method developed by Jean-Loïc Le Quellec (Le Quellec *et al.* 2015). Although it is still often practiced in Africa, the technique of direct tracing, which alters works, has been completely abandoned by today's parietal art specialists in favour of digital photography and image enhancement software. Combining field notes and drawings, photographs of the whole and of details, I use Adobe's paid Photoshop software program, and, above all, DStretch, a free plug-in for ImageJ created by Jon Harman.[3] While allowing more complete inventories with more precise and objective data, DStretch's presets make possible a quick learning curve and fast results with a minimum of subjective intervention. As noted by Jean-Loïc Le Quellec, 'it makes visible information that already existed in the image but was barely or not visible to the naked eye' (Le Quellec *et al.* 2015).

Using the example of a decorated panel from Songantela, I am going to describe the approach used from the taking of the photo through to the preparation of the report. The first stage involves making an exhaustive photographic study of the entire decorated panel, then the images are manipulated directly using DStretch. Using an image of the entire panel, each rock image, even if partial, is given an inventory number. Close-up photographs are then taken. In the field, other techniques can be very useful and complementary, such as high-resolution panoramas of the site (such as those obtained using Gigapan) or photogrammetry and 3D scanning, which allow the creation of three-dimensional models of decorated panels.

Figure 2 is an unmodified photograph of one of the main Songantela panels. Note how difficult the details are to discern. **Figure 3** shows the same photograph after it was processed using DStretch LRE, chosen for its efficiency in improving the visibility of red pigments. Using this software, it is possible to remove all non-red colours. These are then extracted and placed over a non-enhanced image of the wall. Finally, a scale is added and the luminosity slightly adjusted. The result is shown in **figure 4** after having modified the contrast (and lowered the saturation) and introduced a slight Gaussian blur, with a slight transparency in the layers to obtain a more natural image.

III. GIS USE IN ROCK ART

Thanks to the creation of a georeferenced database and the use of statistical methods, I was able to offer new results on the history of the population of the Lovo massif. Using the free software QGIS, a georeferenced database was

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2 Site identification was calculated automatically using Africode software, developed by Jean-Loïc Le Quellec, available for free from this address: http://rupestre.on-rev.com/page78/page624/page624.html

3 DStretch, a plug-in for the shareware ImageJ, is available here: http://www.dstretch.com/

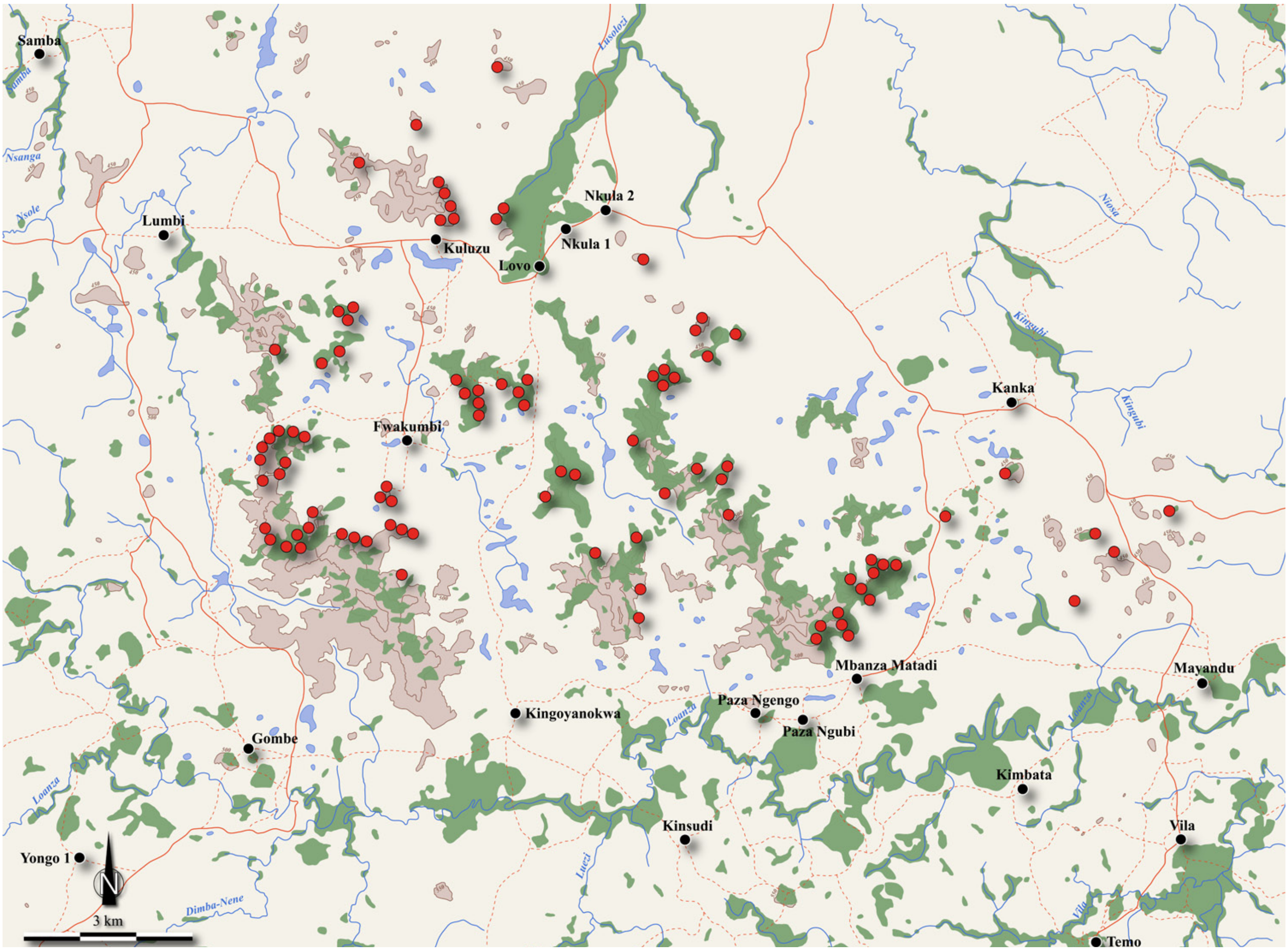

Fig. 1. Distribution map of rock-art sites identified in the Lovo massif (CAD Geoffroy Heimlich).

created for the 5,039 rock art figures found in the massif.[4] Each image was described according to theme, composition, and technique. For each of these criteria, the database allows the entry of '1' for 'present', '0' for 'absent', and '?' when the image cannot be characterised with certainty. Among the themes are anthropomorphs, zoomorphs, therianthropes, signs, alphabetical inscriptions, objects, and corporal sections. Morphological characters were chosen for the anthropomorphs, zoomorphs, and therianthropes. For anthropomorphs, for example, I distinguished the head, torso, arms, hands, genitals, legs, feet, posture, dress, equipment. In terms of composition, note was also taken of the spatial disposition, the orientation, and the situation of figures. In terms of graphic approach, the criteria considered were drawing technique and colour.

Once completed, this database allowed me to perform a general 'areology', or study of the areas of distribution. As the database is georeferenced, it can generate maps for the distribution of any selected criterion or any combination of criteria. In the case of the 224 anthropomorphs armed with a rifle found in the Lovo massif, a visualisation of all the data shows, for example, that they are all confined to the massifs near Ndimbankondo and Miangu, with a single exception at Mampakasa and Ntoto. This distribution relies in good part on a bias attributable to the state of the documentation and the criteria selected by the analyst, which must be taken into account during the study.

Other statistical methods can also be used in addition to area analysis in order to confirm results, such as the application of geneticists' tools to the comparison and statistical study of rock images. In the future, the same base should allow the application of this type of method to my documentary material.

4 The free QGIS software, developed by the Open Source Geospatial foundation, is available at this address: http://www.qgis.org/en/site/

Fig. 2. Red paintings from Songantela in the Lovo massif. (CAD Geoffroy Heimlich.)

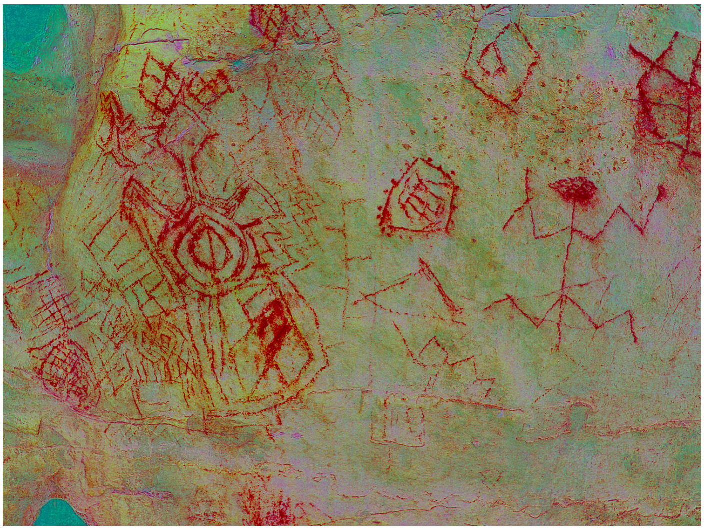

Fig. 3. The same photo, after being processed using DStretch LRE. (CAD Geoffroy Heimlich.)

Fig. 4. Final image. (CAD Geoffroy Heimlich.)

IV. COLLECTION OF PICTORIAL PIGMENTS, ANALYSES, AND DIRECT DATING

During this study, I was able to make use of recent technological developments in order to refine and improve the conditions of observation, analysis, and recording of engraved and painted traces. Over the past fifteen years, awareness of rock-art sites has been enriched with age estimations, physicochemical micro-analyses of pigments, and pictorial techniques for describing the cultural practices of the creators of this art. The physico-chemical analysis of pigment samples at the Centre for Research and Restoration of the Museums of France allowed me to study the techniques for pigment production, in order to perform direct dating of pictures made with wood charcoal, which has never previously been done in this region.

Each sample was located with the help of sketches, films, and photographs, and the sample, duly documented (date, place, various characteristics, etc.) were placed in a sample box. To take samples, previous researchers had wet and rubbed the surfaces in order to draw out images that were more or less hidden beneath a layer of calcite. As exposure to water, the use of a damp cloth on one surface then another, or contact with tracing paper had polluted the surfaces, I was obliged to concentrate my efforts on sites that had not previously been studied, where the surfaces are well preserved, in order to avoid the risk of contaminating the pigments with modern carbon, an important source of error in radiocarbon dating.

In the case of black drawings which had been sampled, observation using a scanning electron microscope with energy dispersive X-ray spectroscopy (SEM-EDX) highlighted the presence of wood charcoal. The SEM-EDX analysis also indicates that the wood charcoal was applied directly, as with a pencil or a fingertip. For the first time, I was able to date the rock images of Lower-Congo directly using carbon 14 accelerator mass spectrometry (AMS) (Heimlich 2013). Dating rock art in Africa is a challenge, as only very few direct dates have been obtained. In total, nine direct dates have been established for drawings in the Lovo massif, of which eight are from the Tovo cave, which is as yet unequalled in Africa.

Until now these analyses have for the most part been the result of direct sampling that caused alterations to the images. The recent development of portable measuring and recording devices makes certain physico-chemical analyses possible *in situ*, and without direct contact with the work, thus minimising damage from sampling. These non-invasive analyses and micro-analyses, such as X-ray diffraction and fluorescence techniques or Raman spectroscopy, refine and improve the conditions in which these works are observed, analysed, tested, and conserved.

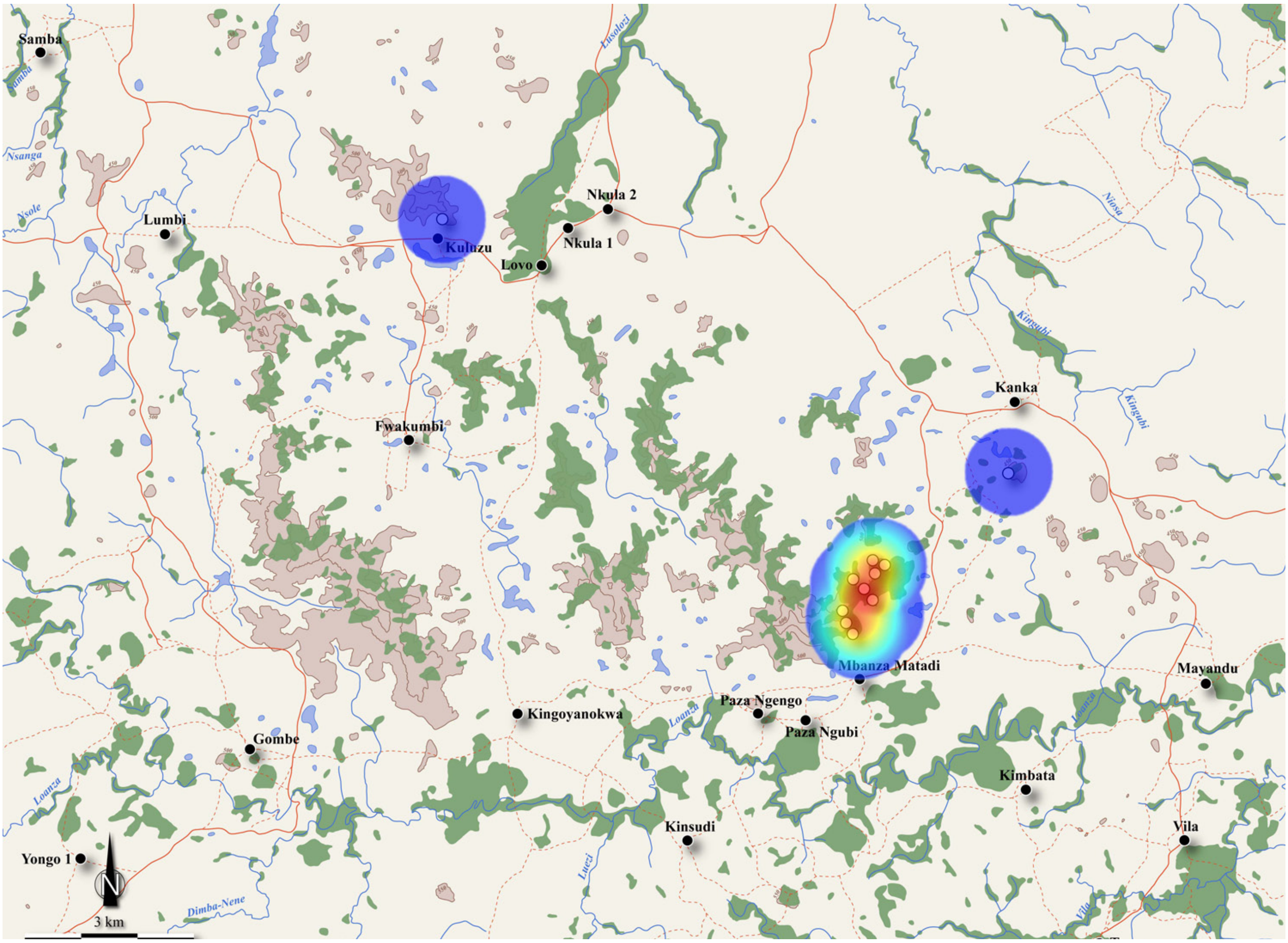

Fig. 5. Distribution map of anthropomorphs armed with rifles. Their highest density is indicated in red. Densities were obtained using QGIS software. (CAD Geoffroy Heimlich.)

V. THE LOVO MASSIF, CONSERVATION AND VALUE ENHANCEMENT

The result is an entirely new reading. By crossing ethnographic, historical, archaeological, and mythological points of view, I was able to show that rock art does indeed play an important role in Kongo culture. And that very simple images, such as the cross, for example, can be made to 'speak', once they are dated and situated within a precise cultural context (Heimlich 2013).

The inventory of the zone under study is thus enriched by precious documents of great interest, as much for the archaeologist as for the historian, ethnographer, linguist, or conservationist. Unfortunately, the Lovo massif is currently under threat. Certain major sites of rock art have already been destroyed. Industrial exploitation of the massifs will continue, and even be ramped up, over the coming years. In order to save this important heritage, it is vital that measures be taken to protect it. We have therefore proposed, with the Congolese authorities, a pilot initiative to register this rock art on the list of UNESCO World Heritage sites.

REFERENCES

de Maret, P. 1982. 'Rock Art'. In F. van Noten (ed.), *The Archaeology of Central Africa.* Graz: Akademische Drück- u. Verlagsanstalt, pp. 97-99.

Heimlich, G. 2013. 'Rock Art as a Source for the History of the Kongo Kingdom'. In S. Cooksey, R. Poynor & H. Vanhee (eds), *Kongo Across the Waters.* Gainesville: University of Florida Press, pp. 34-37.

Le Quellec, J.-L., Duquesnoy, F. & Defrasne, C. 2015. « Digital image enhancement with DStretch®: is complexity always necessary for efficiency? ». *Digital Applications in Archaeology and Cultural Heritage* 2 : 55-67.

ROCK ART MANAGEMENT AND CONSERVATION

Benjamin Smith[1]

Rock art, because it is exposed and immediately accessible, requires greater management attention than most other types of archaeological heritage. In terms of planning out rock art management strategies, standard consultative archaeological, stakeholder-driven, management planning processes apply also to rock art (McDonald & Veth 2012). One must start by identifying the nature and extent of the rock art site and then determine its significance in consultation with all interested and affected parties.

I. SIGNIFICANCE

A key point when assessing rock art significance is to ascertain all of the values that the site holds within society, because it is these values that must be managed, rather than the images themselves. In this way both the intangible and tangible rock art heritage values will be included and managed. This is vital for rock art sites, where the living values are often more significant to surrounding communities that the art itself. A myopic management focus on the rock art alone can have disastrous consequences for the conservation of the site, as the case of Domboshava in Zimbabwe has illustrated (Taruvinga & Ndoro 2003). With the values of the rock art site understood in the relative regional context, one then needs to consider all of the issues affecting these values and what needs to be done to address these issues. Good rock art management planning must include thinking about how to mitigate threats, but it should also go beyond this to think developmentally about how to fulfil the potential of the rock art site within society. A simple SWOT (strengths, weaknesses, opportunities, and threats) analysis is generally useful. This management process will culminate in the writing of a rock art site conservation-management plan. This is an action plan that lays down a five-year (generally) plan of interventions at the site that will meet the collective needs and aspirations of all interested and affected parties. Every rock art site needs at least a basic management plan and large public rock art sites will need complex plans. Assessing relative site significance, and the degree to which sites are at threat, will provide you with the means to prioritise how time and resources should be allocated between rock art sites.

II. TRAINING

Most heritage managers in Africa will have to manage at least some rock art sites as part of their work. A certain amount of specialised rock art training will therefore be important. Look out for suitable training workshop opportunities. Many of the natural and human factors affecting rock art are particular. For example, you will find some rock art surfaces are actively exfoliating. This may be caused by water running across the rock, water moving through the rock, salts within the rock, heating and/or cooling, fire, wind and sand, vibration, silica decay, animal rubbing, abrasion by plants, human vandalism, or a combination of these factors. To identify the causal factor will require training and field experience. To know how to intervene successfully usually requires the engagement of a specialist. For example, if the major problems are fire and running water then cutting the encroaching vegetation to prevent fire damage could expose the site to greater levels of wind and rain and thereby exacerbate the problem. In some parts of Africa people have installed silicone drip-lines to protect rock art from water running directly over rock art. This sometimes solves the problem, but in other cases it does not. For example, the water may play a vital role in maintaining the silica skin layers that protect the art and in such case the installation of a drip-line disturbs this process and leads to the rapid destruction of the art panel. Great caution must therefore be taken before making any major management interventions at a rock art site and specialised training is always useful.

III. CONSERVATION

As a general rule, any rock art site that is thousands of years old, whatever its outward appearance, is probably comparatively stable, otherwise it would not have survived. Intervening in the natural decay of the site, given the risks, should not be attempted without the specialist advice of a conservator. A rock art conservator is someone with professional training in technical conservation

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and with a practical specialisation in rock art; to be credible, they should be a member of an international professional conservation association. If a rock art site is found to be decaying rapidly, it is most likely to be caused by a recent change in the site's conditions. This could be a human change made to the natural environment such as land clearance/disturbance (expansion of farming, mining, urbanisation), chemicals leaching into the ground water (e.g. sewage, fertilisers), changes in the water table (from dam construction or pumping) or a new burning strategy. If there has been a significant change of this kind then this change should be reversed wherever possible, or at least measures should be taken to mitigate the unwelcome new condition. Where tree clearance is the cause, replacement with local indigenous trees is almost always the best solution. Exotics such as Eucalyptus or Pine, while fast growing, also change the acidity level of the soil and can significantly affect the local water table.

The most common causes of rapid rock art deterioration in Africa are: 1) the introduction of new large mammals (cattle, sheep, goats or game animals) into a landscape, and which then rub against the art; 2) an increase in human activity within a site or its immediate environs. Damage by people most commonly comes from their touching or rubbing the art (e.g. tourists), from graffiti, vandalism, theft, small-scale rock quarrying, and the lighting of fires in shelters. Fire is an especially serious problem. An entire site can be destroyed by a single fire lit against a rock art surface. These common decay factors, whilst often the most damaging, are also the most successfully controlled by effective managers. Fences can help to control animals, but humans almost always break through or steal fences. Fire damage can often be controlled simply by trimming vegetation around the site and ensuring that there is no firewood available near a site. Appointing site custodians and site guides, erecting signs, putting up psychological barriers, building fireproof walkways (**fig. 1**) and running rock art sensitisation programs are the most effective ways to control the bulk of human damage. Experiences in many African countries have shown that a rapid rise in visitor numbers in the absence of adequate management planning creates immediate and serious rock art conservation problems. Rock art tourism development must therefore always be preceded by management planning. However, when sites are managed effectively, tourism need not be seen as being in opposition to conservation. In fact, tourism can enhance protection as it helps the sites to become an increased source of local income and pride (Duval & Smith 2014).

Fig. 1. An example of a wooden boardwalk from a rock painting site in the Free State. The wooden boardwalk and wooden signs burnt in a bush fire, causing considerable damage to the rock paintings. The site was restored using entirely non-flammable materials such as a stone floor and metal signboards. (Upper photo © G. Blundell; lower photo © B. Smith.)

REFERENCES

Duval, M. & Smith, B.W. 2014. 'Seeking sustainable rock art tourism: the example of the Maloti-Drakensberg Park World Heritage Site'. *South African Archaeological Bulletin* 69 (199): 34-48.

McDonald. J. & Veth, P. 2012. *A Companion to Rock Art*. Chichester: Wiley-Blackwell.

Taruvinga, P. & Ndoro, W. 2003. 'The vandalism of the Domboshava rock painting site, Zimbabwe'. *Conservation and Management of Archaeological Sites* 6: 3-10.

Chapter 4

Analysis of materials

INTRODUCTION

Alexandre Livingstone Smith[1]

Because it clarifies the reasons for much of the practice of fieldwork, it is good to know what can ultimately be learned through the analysis of artefacts. This chapter explains the work of an archaeologist after the excavations and focuses on the main categories of material culture analysis. The following contributions examine topics pertaining to sampling procedures, the cataloguing of finds and the analysis of lithic, pottery or metal artefacts.

Dominique Bosquet's contribution relates fieldwork practices to laboratory analysis. First, he considers sample types and sampling methods for archaeological artefacts. Here he separates disturbed contexts from *in situ* contexts. Advice is given on the way to pack artefacts in the field and the best way to store the material. As regards ecofacts, he explains what should be sampled and how. Emphasis is put on the need to properly record the excavations before sampling, and to properly locate the origin of the samples (see also Ozainne). Proper labelling is also crucial if one wants to relate the analytical results to their context of origin. Although, as usual, the type and quantity of samples depends on research questions and specialists' opinions, the author reviews general principles and provides simple and efficient procedures on how to sample.

Sylvain Ozainne summarizes a major component of the relationship between fieldwork and laboratory analysis: the cataloguing of finds. He stresses that one needs to design the cataloguing system before going in the field and, although field catalogues may vary according to the type site, he reviews a series of essential elements. The use of the catalogue in the field is considered next, with recommendations on its regular use and back-up, among other things. Catalogue use is also related to the later conservation of the material, and here the author considers museums and laboratories that may have specific requirements. Finally, he gives a series of tips on things to do and things to avoid with the last, clean version of the catalogue. Here he also considers the potential use of the catalogue as an analytical tool, as well as its conversion into a database.

Nicholas Taylor explains how the study of stone artefacts can shed light on the behaviour of past peoples and provides vital clues for identifying site formation processes. After a short note on the broad subdivisions of the Stone Age and Mode I to V classifications, he discusses the initial analytic steps of grouping lithic artefacts according to raw materials. He points to the importance of taking measurements, for both technological analysis and for assessing site integrity. The typological approach implies identifying common attributes of flaked and detached pieces, retouched and shaped tools, polished/ground items, and modified and unmodified pieces. It is based on the concept of *chaine opératoire,* or the sequence of stages from raw material procurement to tool exhaustion/discard. He briefly comments on the conditions and reasons for applying more specialist interpretative analyses (experimental stone tool production, refitting, residue and use-wear analysis).

Using the example of the Shum Laka rock shelter in Cameroon, **Els Cornelissen** describes, step by step, how to proceed with the analysis of a lithic assemblage. Starting with the definition of the unit of analysis which corresponds to the way lithic artefacts were recorded during excavation, a grid of analysis is created using a simple spreadsheet. She lists the characteristics that were taken into account when describing the typological and technological features of the various assemblages, which are organized according to raw materials. As an illustration, she gives two examples that address the issue of raw material choices through time.

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The present author and Cécile de Francquen develop an initial approach to the analysis of pottery. They consider the successive process from the field to the first steps of the analysis. Recommendations for the field are short and emphasise the proper labelling of the material. Laboratory work involves referencing, refitting, description and then analysis. For each step, simple procedures are suggested. These procedures are by no means universal, but they provide a researcher with a straightforward way to deal with an significant amount of pottery. Finally, the authors consider further analysis, hinting at approaches that may lead to the reconstruction of pottery manufacturing processes.

Tom Huffman takes pottery analysis a step further, considering the definition of ceramic styles. Here he separates two main types of interpretation: one aimed at the characterisation of group identity, and one aimed at the development of a culture history sequence. As regards the first, the author starts by outlining the general procedure and proceeds with the notion of stratigraphic distribution. As regards the second, he examines how two build a chrono-cultural sequence and how to approach questions of continuity and discontinuity, as well as questions of boundaries and interaction. Although, there is no room for a detailed contribution, he provides a simple and efficient way to express complex pottery assemblages.

David Killick outlines what can be done with iron artefacts. After a brief reminder of what one can expect to find during the excavations (see also Robion-Brunner & Serneels, this volume, pp. 129-133), he focuses on post-excavation treatment. In this, he first outlines questions pertaining to conservation, summarising the mechanisms of corrosion and the best ways to prevent or delay it. He considers the potential of metallographic and chemical analysis, summarising the techniques to be used and the type of information they can yield on materials used and artefact production methods. The author then explains why the provenance of iron can very rarely be determined. Finally, he notes the possibility of dating iron objects directly.

Laurence Garenne-Marot gives an overview of copper use in sub-Saharan Africa. The characteristics of the material are considered first, and compared to iron. She considers the characterisation of productions techniques for copper artefacts, through compositional and metallographic analysis. The potential of these analyses is outlined and two practical examples are explained. She also appraises the relative weight of cultural and technical choices, and finally considers the limits of technical analysis of copper-based objects.

Nicolas Nikis takes the analysis of archaeological copper-based objects one step further, with a case study on copper ingots from central Africa. He explains how one needs to catalogue, describe and analyse the finds. He reviews the history of copper ingots, using their typology and geographic distribution through use of a free GIS program. He suggests possible avenues of interpretation of geographic patterns of distribution, showing how one can move from the analysis of the artefacts to a more holistic view of this type of object, and to the wider social and economic context.

FROM THE FIELD TO THE LAB

Dominique Bosquet[1]

INTRODUCTION: THE BASIC PRINCIPLES OF INTER-DISCIPLINARY ARCHAEOLOGY

This chapter is devoted to the principles and methods of sampling in the field: artefacts (pottery, lithics, glass, worked bone, etc.) and samples for specialists in archaeology's partner sciences: anthropology, archaeobotany, archaeozoology, geology, pedology, etc.

It is important to organize digs in detail. Choices made in the field will have repercussions on laboratory analysis and thus on subsequent results. Whatever the type of archaeological work – preventive, rescue, or scheduled – we can never investigate, acquire, and store everything. Scientifically, it is much more interesting and productive to focus a dig on the matter under investigation. Digging calls for permanent choices, depending not only on scientific questions (which, incidentally, often change during the search), but also logistical requirements that make up a crucial link in the archaeological chain of operations: human, financial, and material resources frame the field of operation and processing of laboratory data. For example, if you do not have the means to store 100 pollen samples under suitable conditions, you will need to make your search more specific. Samples are taken from one structure because it occupies an interesting position in relation to other structures on the site, because the fill mode suggests that pollen rain was trapped there, because its depth means it is likely unaffected by recent disturbances, etc. This will avoid having unproductive or contaminated samples unnecessarily cluttering up your reserves because they probably would never be studied. Acquisition shouldn't be made on the basis of 'We'll see what comes of it'.

On the other hand, as excavation destroys all or part of a site, the samples taken should be sufficient in quantity and representative of the different structures that make up the site. Indeed, some samples are used by several specialists and some analyses are repeated, requiring additional sampling. This second sampling is not possible in the event that too little material was taken. One should also remember that, since results are often analysed statistically, if the amount of material is greatly reduced by treatment (screening, extraction, etc.), the very validity of the results is open to question.

A fundamental principle follows from the above: to sample correctly, you must be familiar with the disciplines for which your samples are destined because, more often than not, the experts involved will not accompany you to the field. Therefore, before you even start a project, meet them in order to learn what questions they might eventually be able to answer and what their requirements are for sampling. The types of materials studied, sampling and spatial-registration methods, required quantity, storage conditions, sieving patterns, any special precautions, are all parameters that you will need to control to improve the chances of getting quality results and avoid unnecessary sampling.

It may seem an enormous amount of knowledge to acquire, but modern archaeology cannot function without these disciplines. Frequently complementary, they offer extremely rich and varied methods of interpretation that are often decisive when it comes to understanding your site.

I. IN THE FIELD: SAMPLE TYPES AND SAMPLING METHODS

A. Archaeological material

Two scenarios are most often encountered in the field: either archaeological material comes from detrital contexts into which it was cast loose, forming a mixture of all kinds of daily waste, or the equipment is found in place (or *in situ*)* in domestic contexts (habitation deposits, foundations, buried basements, homes ...), or those related to funerals or worship.

1. Detritic contexts

In detritic contexts – pits or ditches – archaeological material will be collected gradually throughout the search and classified into categories (ceramic, stone, iron, bone, etc.) that will be packed separately. These materials will be put without cleaning[2] into plastic bags[3] in quantities

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2 Objects should never be cleaned in the field, to avoid the risk of destroying organic residues and other micro-elements (phytoliths, grains, etc.) present on many archaeological objects and rich in a variety of information.

3 If no other material is available, paper bags can be used.

appropriate to their state of preservation: fragile objects must be packed separately, possibly wrapped in paper or plastic to protect them from shocks. Inside each bag (not stapled to the outside of the bag) should be placed a paper label (itself wrapped in plastic) with the following information written in ballpoint pen or pencil (not permanent marker): site name, date, sector number, structure number, letter or square number in which the material was found, stratigraphic unit and/or depth of discovery and any observations. Avoid writing directly on the bag: this fades too easily, resulting in permanent loss of contextual information. The bags should then be placed next to (not on top of) one another in wooden, plastic, or cardboard crates on which will be noted the type of material present and its references, to facilitate the post-excavation treatment. This will avoid having to unpack all the boxes to find the materials needed to establish, for example, a preliminary chronology of the site.

***2. Domestic, funerary, and religious contexts preserved* in situ**

In this type of context, be it a tomb, a habitation deposit, or a religious deposit, the material must, at first, be dealt with in place before any sampling. Before dismantling, the relationship of each object to its neighbours should be recorded in detail and in three dimensions in order to recreate the deposit taphonomy,* the *sine qua non* of a precise interpretation of the archaeological fact. Once this is done, we can dismantle all the objects that have been recorded and package them in accordance with the principles set out in the previous chapter and, if necessary, continue the dig using the same method, removing the layers one after another until everything has been removed.

B. Samples intended for use in the natural sciences

Taking samples for natural scientists occurs during excavation of structures that have been completely recorded as maps and sections using drawings and/or photographs. First of all, because the sample destroys part of the remains from which it is taken, and thus a part of the archaeological information (**fig. 6**), and also because it has to be perfectly located in space, both in terms of the map and the stratigraphy. If you do not map your structures and stratigraphy is not carefully assigned, there is no point in taking samples, because no correct link can be made in the laboratory between the bag and the structure and layer from which it comes. A bag or a box that does not contain the name of the site, structure number, excavation square number, and identification of the layer from which the sample was taken (or, failing that, the depth at which it was taken) will be refused by the specialist to whom it is sent! Also, a drawing and/or photo must **always** illustrate this information (see below, 'How to sample'), with a comment in the notes that justifies and explains the sample. Finally, an up-to-date list of all samples is kept in the excavation records. They are numbered **consecutively** over the whole of the dig, from 1 to x. For example, samples 1-8 were taken in pit 12, layers x, y, and z, and samples 9 to 24 in pit 21, layer w. This way, if you forget to write down the pit number on a label or a bag, you have one more chance to find the information in the samples list. If, however, we start at zero in each pit, you will end up with several samples numbered 1, several samples numbered 2, etc., from the same site, which dangerously increases the risk of confusion. This system can be used on a year-to-year planned excavation, so as not to confuse No. 1 from 2014 with No. 1 from 2013 if the year is not mentioned on the bag. These principles also apply to artefacts, and while they may seem trivial, small distractions are inevitable, and there is always a moment when you forget to indicate information on a label or a bag. It is therefore essential to provide the means to find it in another way.

Now we have to answer the following questions:

1. What should be sampled?

Insofar as the analysis of bioremains* contained in your sample is supposed to answer a series of environmental, cultural, and historical questions you have about your site, it is essential that the sampling done on the ground be statistically representative of remains present on the study site. In other words, if you only sample what you can see, average and large remains (2 mm to several cm, called macroremains) will be over-represented, while very small and microscopic remains will be systematically absent from your material. That is why the sediment forming the walls of archaeological excavations will be taken for laboratory analysis: they potentially contain all the site's bioremains. Picking the 'best bits' by eye is not forbidden, but, again, the study of these fragments alone will not reliably deal with issues related to the paleoenvironment and how it was used by man.

Moreover, as it is not possible – or even relevant – to sample everything systematically, we must then ask another question:

2. Where should sampling be done and in what quantities?

Samples are taken preferably from the areas and/or layers in which bioremains are known or believed to be significant and/or about which there are questions that could be at least partially answered through paleoenvironmental study. These are usually detritic layers of dark colour, but not always. In this context, we can never emphasise enough that regular contact with the specialists for whom this material is intended is desirable because they will be the ones to develop a coherent and balanced sampling policy with you throughout the excavation.

The sample amount can vary depending on the context (pit, tomb, ditch, etc.) and the known or supposed wealth of bioremains, itself influenced by the chemical and physical characteristics of the substrate. We can nevertheless give sampling quantities that are valid in most cases, conventionally expressed in litres of sediment, as around 20 litres for macroremains and 0.2 litres for microscopic remains. These quantities may sometimes correspond to significant portions of the sample layer or area. As such, they cannot always be attained when the layer is not plentiful, which should, however, not prevent sampling: interesting results can sometimes be obtained on a small amount of sediment.

3. How should samples be taken?

Depending on the excavation technique, the morphology of the layer or unit to be sampled, and the analysis/es to which the samples will be subjected, samples should be taken loose or as a block, flat or as a cross-section.

a) Loose samples

These samples are made using plastic bags, and mainly concern macroremains. They may be taken flat, while excavating, where concentrations are encountered (**fig. 1a**), or as a cross-section, once one or several squares have been emptied (**fig. 1b**). The samples are then taken from preserved squares (**fig. 1c**). The latter method allows greater control of the stratigraphic location of sampling and is preferable to samples taken flat during excavation, although the two methods can be practiced together in order, for example, to achieve the right amount of samples for a thin layer. In loose samples taken from several layers within a single structure, it is imperative to avoid mixing, within a single sample, the content of different layers: each layer should be a separate sample (**fig. 1b**). To do this, try to take the central part of the layers without touching the interface between layers as much as possible – which is not always easy when the layers are thin.

b) Block samples

These samples are most often cross-sections and are primarily intended for the analysis of microscopic remains. They may be made with the help of a can or metal bracket (such as those used on construction sites) or, if the sediment is sufficiently compact and coherent (clay rather than sand), as blocks which are directly cut in sediment and subsequently packaged in plastic wrap (like cling film used for food). The procedure is as follows:

Step 1: clean the cross section from top to bottom,[4] removing at least 2 to 3 cm to eliminate pollution (pollen in the atmosphere, on tools, hands...);

Step 2: Avoiding bioturbations, desiccation cracks, and other recent sources of pollution, **determine the locations** of your samples and explain in the field book why you will take samples from this layer. Draw the blocks to be sampled and their numbers directly onto the profile using a knife or trowel (you can also number them with plastic letters; **figs. 2a, b and c**).

If you use cans (with lid) or brackets (without), drive them directly into the desired location with a mallet if the sediment is very soft, or, to facilitate penetration, cut the sediment around the box/angle with a thin knife.

Important note: samples from the bottom of a structure must always extended at least 5 cm into the natural substrate* from which this structure was excavated (**fig. 3**);

Step 3: **Orient** the blocks by cutting a small arrow indicating the top of the block into the upper left corner (**fig. 4a**);

Mark the can/angle: With a permanent marker, record the site, the numbers of the placement, cut, and sample, on the top and bottom of the can/ bracket and possibly the boundaries and SU (stratigraphic unit) numbers of the main layers (**fig. 4b**);

Step 4: photograph the entire sampling area (**fig. 5a**), and each block separately (**fig. 5b**) and **draw** your samples on your drawing of the section.

Step 5: **extract** the block by first cutting around the edge of the sediment (**fig. 6a**) and, once the proper depth is reached (at least 6 to 7 cm) cut along the back of the block to remove it. Holding the block in your hand, flatten the back with a knife.

To extract the can/bracket, first loosen the sides (**fig. 6b**) and then cut the settlement at the back of the

4 If you clean from bottom to top, sediment will fall back onto the part that has just been cleaned, and this is of course to be avoided.

Fig. 1. Carbonaceous layer before flat sampling (a), loose sampling of a debris layer in a pit (b), carbonaceous layer preserved in the unexcavated squares B and D of a pit (b). (Photos © D. Bosquet.)

Fig. 2. Samples are drawn and numbered on the cross section (a, b) or map during excavations, here on a layer of decomposed wood (b). (Photos © D. Bosquet.)

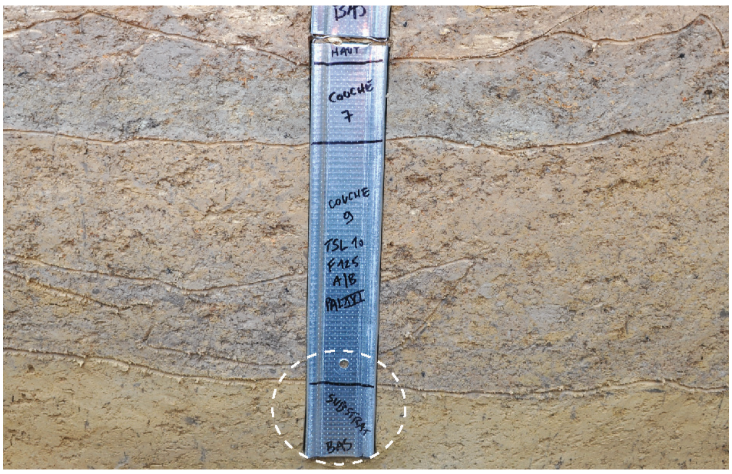


Fig. 3. Sampling from the bottom of a pit; the box should extend into the natural substrate. (Photos © D. Bosquet.)

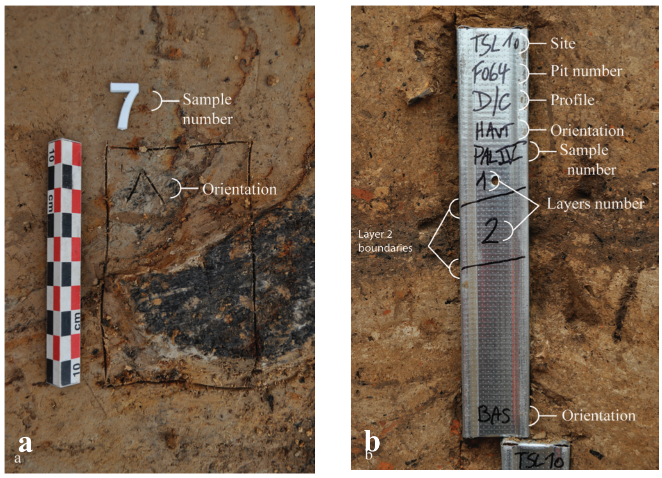


Fig. 4. The block is oriented using an arrow, engraved here in the upper left corner (a), while the background information, sample number, and orientation are all listed on the box (b). (Photos © D. Bosquet.)

can in order to remove the cut, then cut away the excess sediment so the cover can be put in place;
Step 6: **wrap** the block in 4-5 layers of plastic wrap, and then mark the site, the numbers of the placement, cut, and sample directly on the plastic, and then wrap in 4 or 5 additional layers and annotate again with the same information on a different side of the block (**fig. 7a**). After placing the lid of the box, secure the whole with adhesive tape or a layer of plastic wrap (**fig. 7b**). If there is no cover (bracket), wrap tightly in plastic wrap;
Step 7: **store** your samples in a refrigerator or, failing that, somewhere cool and not too dry, if possible.

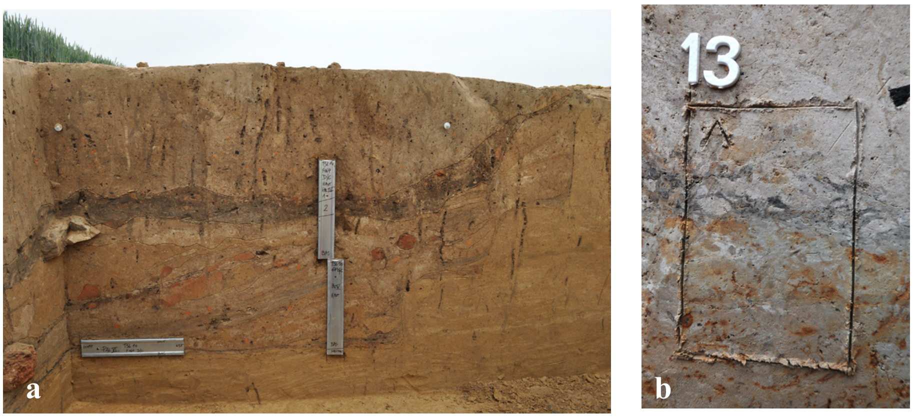


Fig. 5. Photograph of a group of samples (a) and detail of an oriented and numbered block (b). (Photos © D. Bosquet.)

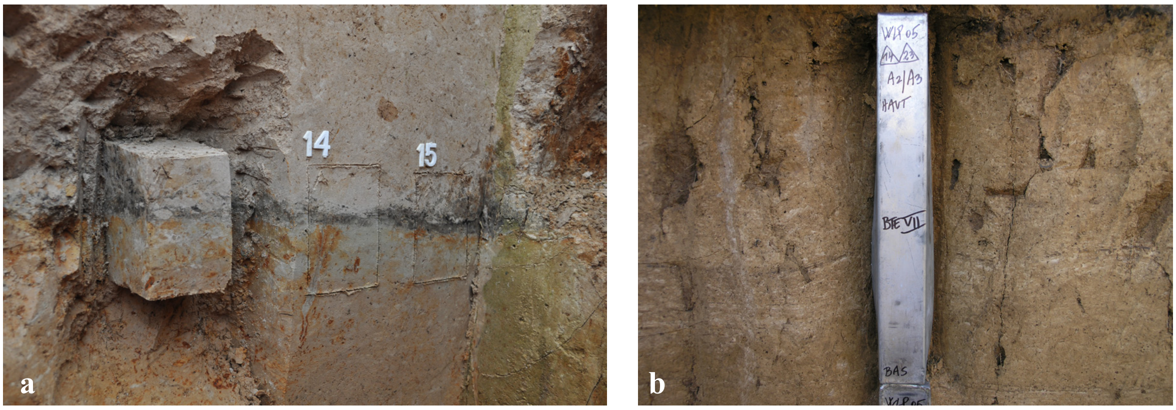
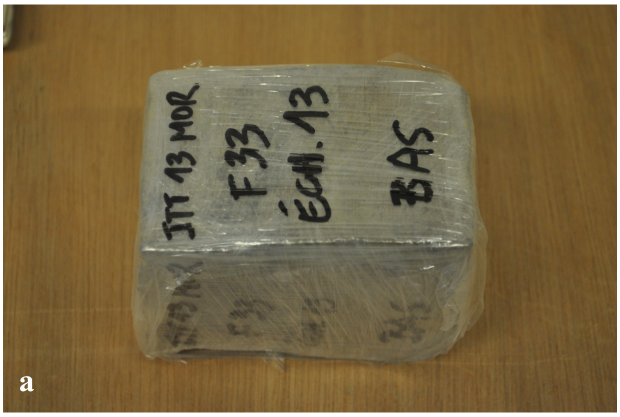


Fig. 6. Clearing a block cross-section (a) and one obtained using a can (b). (Photos © D. Bosquet.)



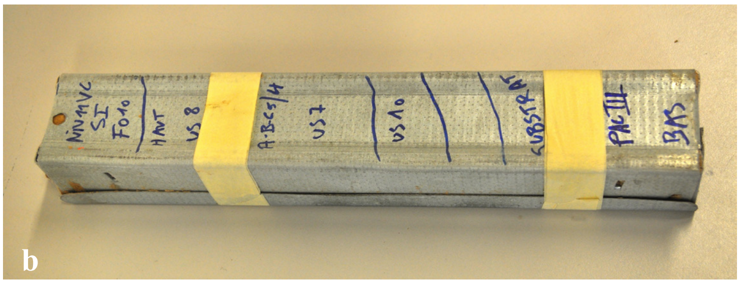


Fig. 7. Samples in blocks (a) and cans (b) ready for storage. (Photos © D. Bosquet.)

GLOSSARY

Taphonomy: history (often complex) of disturbances, alterations, and natural (burrowing animals, roots, erosion, etc.) or human (handling, sorting, looting, etc.) movements that an archaeological site suffered between its establishment several centuries ago, and the time of its discovery by archaeologists.

In place or *in situ*: refers to remains undisturbed since their burial in the ground, of which the location is believed to be close to its original placement.

Bioremains: all remains of biological origin, organic or otherwise, contained in an archaeological site: charcoal, fruits, seeds, pollen, phytoliths, starch grains, bones, etc. These remains may be macroscopic (visible to the naked eye or by using binocular magnifiers) or microscopic (visible under a microscope at high magnification).

Substrate: natural sediment or geological layer which contain archaeological items (or structures) that make up an archaeological site. Substrates may be sandy, clay, calcareous, etc.

CATALOGUING FINDS

Sylvain Ozainne[1]

INTRODUCTION

The catalogue recording objects collected during excavations, surveys, or studies is an important tool. It establishes an interface between several major stages of archaeological research: fieldwork, and analysis and preservation of material. Its main role is to provide a permanent link between the collected items and the context of discovery, without which archaeological objects irretrievably lose their scientific value. The catalogue should be above all simple but effective, and allow the researcher to find contextual information easily for each piece discovered. The number and nature of the different headings may of course vary depending on the nature of the dig. The continued existence of these data is crucial not only for post-excavation analysis but also for the conservation of objects, which in some cases may have to stay in a drawer in a laboratory or museum for many years before being studied by researchers other than those who carried out the excavations.

I. DESIGN AND PREPARATION

The catalogue should ideally be designed before any fieldwork by all the researchers involved, whether in field research or post-excavation studies. It is important to design it in a spirit of collaboration between field researchers and specialists, especially if the latter do not participate in digs.

Specifically, it is also advisable to select a marking system for archaeological pieces when designing the catalogue format. The marking system can thus be employed in cataloguing, whether physically or digitally. If the catalogue is accurate, but the code marking pieces or bags is not explicit, there is a risk that information will be lost.

The list of topics to examine in the field (using a dig log or a site/sector/survey/m^2/etc. sheet) for inclusion in the final catalogue should be discussed by researchers taking part in the search, especially for essential background information: stripping, altitude, spatial coordinates, provisional stratigraphic ascription (stratigraphic unit and/or layer), provisional general cultural attribution, etc. (**figs. 1** and **2**).

The different sections of a field catalogue can of course vary depending on the type of research undertaken, but many essential items should be included systematically, such as: card number or catalogue page, complete date, name of the researcher (the person who completes the sheet), name or site number, GPS coordinates (**figs. 1** and **2**). The form/page number and the site name and number help manage and control the information collected and facilitate the preparation of a database post-excavation (see below). The date and the name of the person completing the form will make it easier to understand and correct any errors found after the excavation or survey. If the archaeologist does not have a GPS device or an accurate map, he must collect enough information (approximate location relative to the village and/or the closest geographical feature; possibly a sketch of the terrain) so that site coordinates can be found following fieldwork. Back in the lab, this will allow him to relocate the site using an official map or an online resource such as Google Earth.

II. FIELD CATALOGUE

In the field, the catalogue should be filled in if possible as the work progresses (**fig. 2**). It is unwise to wait until the end of operations. Indeed, there is a significant risk of loss of information between the time of the fieldwork and laboratory analysis. Although the final version of the catalogue is established after excavation and possible correction, it is important to record information concerning pieces as soon as possible in the field. It is not always possible to prepare a catalogue in the field, for example during surveys or small studies with limited teams in hard-to-reach areas, during which researchers will not necessarily have the time to make a catalogue as the work progresses. In this case, it is crucial that the material collected, even summarily classified in the field, be associated with specific contextual information (survey or site sheet; **fig. 1**) that will allow the catalogue to be generated as soon as possible.

A field catalogue should be easy to use. Ideally, this should be done initially on paper (a binder with good quality paper: wind and/or humidity can easily degrade pages) or a notebook of the best possible quality. It is also crucial to keep this first paper version safe; it will

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SURVEY SHEET/GPS coordinates	Number		Sector	
Date		Person in charge		
GPS 1		GPS 2		
GPS coordinate no.		Site_Name		
X deg min sec (E or W)		Y deg min sec (N or S)		
X decimal		Ydecimal		
Site_Type		Site_Context		
Info_type archeo		Info_type environment		
Notes				

SURVEY SHEET/GPS coordinates	Number		Sector	
Date		Person in charge		
GPS 1		GPS 2		
GPS coordinate no.		Site_Name		
X deg min sec (E or W)		Y deg min sec (N or S)		
X decimal		Ydecimal		
Site_Type		Site_Context		
Info_type archeo		Info_type environment		
Notes				

Fig. 1. Example of a survey record, documenting the contextual information that will be associated with archaeological finds in the final catalogue. This type of document is easily prepared using a word-processing program, although it is recommended that they be created directly in a spread sheet (MS Excel is a widely used application) that will also be used for digital data entry.

Site name/year: Kéli Sogou 2006								**Sheet N° 15**
Date:02.05.2006		Researchers: Bemba, David						
Sector	**Stripping**	**N°**	**M2**	**Material**	**X**	**Y**	**Z**	**Notes**
7	2	1	AO121	Sherd			3,09	
7	4	1	AO120	Sherd			2,86	
7	4	2	AO120	Sherd			2,86	
7	4	3	AO120	Sherd			2,85	
7	4	4	AO120	Sherd			2,85	
7	4	5	AO120	Sherd			2,86	
7	4	6	AO120	Sherd			2,85	
7	4	7	AO120	Sherd			2,83	
7	4	8	AO120	Sherd			2,84	
7	4	9	AO120	Sherd			2,84	
7	4	10	AO120	Sherd			2,84	
7	4	11	AO120	Sherd			2,85	
7	4	12	AO120	Sherd			2,87	
7	4	13	AO120	Sherd			2,86	
7	4	14	AO120	Sherd			2,86	
7	4	15	AO120	Sherd			2,87	
7	4	16	AO120	Sherd			2,86	
7	4	17	AO121	Sherd	175	160	2,83	Noted on map n° 3
7	5	1	AO120	Sherd	138	43	2,82	Noted on map n° 4
7	5	2	AO120	Sherd	106	34	2,82	Noted on map n° 4
7	6	1	AN120	Sherd			2,59	
7	6	2	AN120	Sherd			2,57	
7	6	3	AN120	Sherd			2,58	
7	6	4	AO120	Sherd			2,59	
7	6	5	AO120	Sherd			2,60	
7	6	6	AO120	Sherd			2,60	
7	6	7	AN121	Sherd			2,61	
7	6	8	AN121	Sherd			2,69	
7	6	9	AN121	Sherd			2,60	
7	6	10	AN121	Sherd			2,61	
7	6	11	AO121	Sherd			2,61	
7	6	12	AO121	Sherd			2,62	
7	6	13	AO121	Sherd			2,63	
7	6	14	AO121	Sherd			2,65	
7	6	15	AO121	Sherd			2,63	
7	7	3	AO120	Sherd			2,52	
7	7	4	AO120	Sherd			2,54	
7	7	5	AN121	Sherd			2,49	
7	7	6	AN121	Sherd			2,56	
7	7	7	AN121	Sherd			2,54	
7	7	8	AN121	Sherd			2,57	
7	7	9	AN121	Sherd			2,55	
7	7	11	AN121	Sherd			2,58	

Fig. 2. Example of a field catalogue, used during a survey of the Kéli Sogou site (Mali). This is a clean version of an identical sheet filled in by hand in the field.

help to understand and correct errors that might occur, for example, during conversion to digital. It is also simply the primary version of input, and a necessary physical supplementary archive to the digital format.

The use of paper is often essential during surveys or ex-extensive fieldwork programmes, as it is suitable for very mobile researchers with little logistical support. In this context, logistics are often reduced to the bare minimum, and researchers obviously will not have access to digital resources. Even during excavations, it is not always possible to have a computer in the field, for logistical and/or financial reasons (cost and fragility, access to electricity). On long digs, it is recommended that a digital version of the catalogue be made in the field, or as near to it as possible.

Ideally, the paper catalogue comes from a digital document (a printout of an MS Word or Excel file, for example). The advantage is that it will use exact the structure and fields defined by the research team before excavation and thereby facilitate future data entry (**fig. 2**). If the catalogue is to be made by hand directly in a notebook, it is suggested that this be prepared before starting the work.

The key is to have a systematic catalogue completed according to the techniques and topics chosen prior to the search, whether on paper or directly in electronic format. It is possible to correct or delete some items if the catalogue is complex and it becomes clear during excavation that some fields are unnecessary. In this case, all the researchers in the field must be involved in the decision, and the information must be transmitted to all stakeholders. Ideally, especially if some experts who participated in developing the catalogue are not present in the field, it is best to avoid significant changes to the catalogue during excavations.

III. THE CATALOGUE AND CONSERVATION OF MATERIALS

If the institution through which the research was conducted (laboratory, museum) has its own cataloguing system for the conservation of materials, archaeologists can of course develop their catalogue based on this system. Again, good collaboration between the different actors involved in fieldwork and the analysis and storage of materials is essential.

If the catalogue is developed entirely by archaeologists, a final version may be reprinted back in the lab, possibly corrected or improved for readability if flaws are found during the dig. It is important to maintain identical field-entry orders and topic names when making updates, whether this is done regularly in the field or afterwards in the laboratory.

The definitive version of the basic catalogue for conservation must be kept in physical format (printed) and in the form of several computer backups, one ideally on a server in the lab. The sustainability of physical and digital versions should be ensured (for computers, make backups and manage format changes, saving in a new application format if required, etc.).

It is very important that a copy of the catalogue be printed and kept physically associated with the material. This version, in workbook form or as sheets in a folder carefully arranged in a cardboard or plastic container or a sturdy envelope, will accompany the box or carton containing material when deposited in a laboratory or museum. This crucial baseline information should always remain with the material. This is a security measure and important safeguard in case the museum or institute that houses the equipment relocates. This also offers security in the event of disaster, theft, or any other event which may result in the loss of computer files or folders from a laboratory or a museum.

In any case, it is necessary to communicate well with everyone involved and inform everyone who will be responsible for the conservation of the material, be it the staff of a laboratory or a museum, of your approach. Keep in mind that in some cases the material brought back from excavations may be studied only several years later, and by people who did not participate in the excavations. These researchers will need access to contextual information about the objects, otherwise any scientific study will be impossible.

IV. THE FINAL CATALOGUE AND ANALYSIS OF THE MATERIAL

When the material is first analysed, certain pieces may need to be removed from the catalogue, for example if it turns out that an object registered during the excavation as a potsherd is actually a lithic fragment without any archaeological value. In this case, it is important to cross out the entire entry in the notebook and/or delete the record (database) and/or the line in a computer file. All related information is suppressed. The object number is deleted and no longer used, otherwise there can be serious problems later. It is better to have a list with non-consecutive numbers rather than trying at all costs to have a clean list with consecutive numbers and risk creating serious errors during the renumbering.

Pottery inventory / Decorative motifs

Site_Name	Horizon	Sherd_N°	Motif_code
Kélisogou	KH4	840	////TRMOBLSER/
Kélisogou	KH4	841	////TRMOBLSER/
Kélisogou	KH4	842	/////
Kélisogou	KH4	908	/////
Kélisogou	KH4	909	////TRMOBLSER/
Kélisogou	KH4	910	////TRMOBLSER/
Kélisogou	KH4	911	/////
Kélisogou	KH4	912	////TRMOBLSER/
Kélisogou	KH4	913	////TRMOBLSER/
Kélisogou	KH4	914	////TRMX/
Kélisogou	KH4	968	////TRMOBLSER/
Kélisogou	KH4	969	////TRMOBLSER/
Kélisogou	KH4	970	////TRMX/
Kélisogou	KH4	1289	////TRMOBLSER/
Kélisogou	KH4	1290	////TRMX/
Kélisogou	KH4	1792	/////
Kélisogou	KH4	1793	/////
Kélisogou	KH4	1794	/TRMOBLSER////
Kélisogou	KH4	1795	////TRMX/
Kélisogou	KH4	1885	////TRMX/
Kélisogou	KH4	1886	////TRMX/
Kélisogou	KH4	1887	////IND/
Kélisogou	KH4	1888	////TRMOBLESP/
Kélisogou	KH4	1889	////TRMOBLSER/
Kélisogou	KH4	1890	////TRMX/
Kélisogou	KH4	1894	////TRMX/
Kélisogou	KH4	1895	////TRMOBLSER/
Kélisogou	KH4	1896	////TRMOBLSER/
Kélisogou	KH4	1897	////TRMOBLSER/
Kélisogou	KH4	1898	////TRMOBLSER/
Kélisogou	KH4	1899	////TRMOBLSER/

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Fig. 3. Example of a catalogue of ceramic sherds, generated from a database. The sherds were sorted by site, horizon, and sherd number. The catalogue also already includes some analysis, as the last column contains a descriptive code for decorative patterns observed on each sherd. In a single field, this code describes observable decorative patterns sorted by placement on the vessel (edge, lip, neck, body, etc.), each part being separated by a slash (/). This example only records fragments from body sections, most showing a tightly printed basket-weave decor (TRMOBLSER). Sherd 911 on the other hand displays no decoration. When using this type of cataloguing, the coding information must of course be available to anyone likely to work with the document in future.

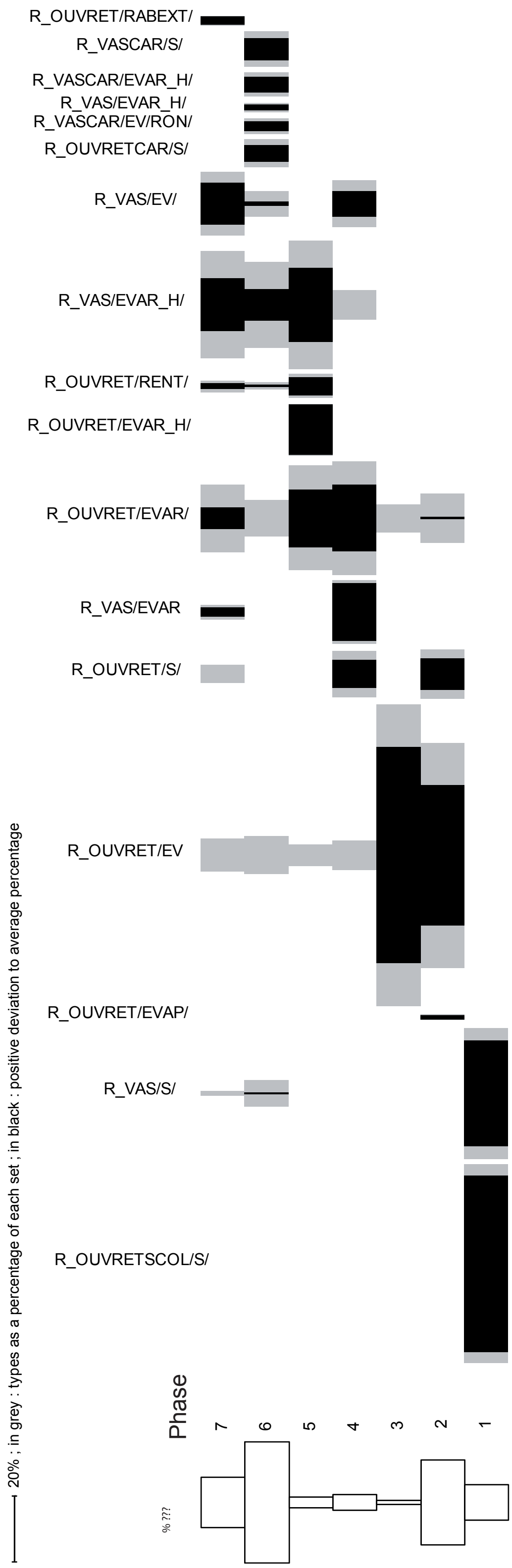

Fig. 4. Example of serial ordering of Neolithic ceramic types from the Dogon district (Mali) created using a database synthesising information from multiple catalogues. The coding of the types analysed (horizontal) was generated by the database from several sections of the original ceramics catalogue. Serial ordering was performed using the seriograph tool designed by B. Desachy (2004). (Based on Ozainne 2013, fig. 62, modified.)

Once data entry and layout are completed, either during or after the dig, the catalogue may be used immediately to develop a more complex database for analysis. It creates a link between the field data and the analytical process that will allow the archaeologist to offer interpretations.

A complex catalogue can also be designed as a database or an intermediate step towards the creation of a database. This comprehensive approach should be considered systematically if the researcher knows that they will oversee the entire research process, from excavation to publication, particularly in the context of a doctoral thesis. In this case, the researcher will gather more data in the field. This approach should also be considered when the researcher knows that they will not study the material extensively on site for logistical and/or financial reasons. If this approach is adopted, the cataloguing may be more complex, and include information related to a broader range of topics. This creates an analytical catalogue, one which collects and codifies basic information and raw descriptive information that can be used directly by the researcher who conducted the excavation or other researchers who study the material at some later date (**figs. 3** and **4**).

This type of analytical catalogue naturally requires that the documentary language employed (codes, abbreviations, etc.) be recorded, transmitted, and preserved. This more complex approach will not prevent the creation, afterwards, of a simpler catalogue for the conservation of materials. It also aids in the swift preparation of specific catalogues to accompany publication.

REFERENCES

Desachy, B. 2004. 'Le sériographe EPPM: un outil informatisé de sériation graphique pour tableaux de comptages'. *Revue archéologique de Picardie* 3-4: 39-56.

Ozainne, S. 2013. 'Un Néolithique ouest-africain : cadre chrono-culturel, économique et environnemental de l'Holocène récent en pays Dogon (Mali)'. *Journal of African Archaeology monograph series* 8 (*Peuplement humain et paléoenvironnement en Afrique de l'Ouest* 3). Frankfurt am Main: Africa Magna Verlag.

MAKING SENSE OF LITHICS

Nicholas Taylor[1]

INTRODUCTION: FRAMES OF REFERENCE

Lithic artefacts are the most enduring and ubiquitous feature of the African archaeological record. Found across all of the continent's major geographic regions, in some areas they provide a record of early human (hominin) and modern human (*Homo sapiens*) activity from 3.3 million years ago until recent historical times. Scientific understanding of the technical processes or 'reduction strategies' involved in the production of lithic tools means that when recorded at an excavation and recovered and treated carefully, their study can shed light on the behaviour of past people in a particular location – including subsistence strategies, economic activities, social organization, and cognitive abilities – and provide vital clues about the integrity of archaeological levels and sequences.

Knapped ('chipped') stone tools are always made from brittle rocks (e.g. chert, obsidian, quartz, quartzite, rhyolite, various lavas, etc.) that break in a predictable way when struck with a percussor made of stone or organic material (e.g. wood), while groundstone lithic tools are made by abrading tough, coarse materials (e.g. basalt, rhyolite, granite, hematite and sandstone), sometimes after an initial phase of knapping. The processes involved in stone tool manufacture are reductive and irreversible: once fractured or ground, the separated pieces of rock can never be permanently put back together to form the original whole – over time individual artefacts can only become smaller, while concurrently the overall number of lithics produced increases. While leaving a proportion of lithic material in the ground for future archaeologists to examine in context, it is strongly advisable to collect all lithic pieces from the excavated part of a site, since it is the study of whole assemblages – including very small and non-diagnostic pieces less than 1 cm in maximum dimension – that provide the detail needed to understand the past.

The African stone tool record is distinct from that of Eurasia and the rest of the world, but some parts of the continent – notably Central and West Africa – are still poorly documented and it is therefore best to study any lithic material based first on its own characteristics, rather than by imposing concepts or naming conventions developed for distant archaeological cultures. The three-age system, in which the African record is divided into sequential Early Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) periods corresponds roughly with Lower, Middle and Upper Palaeolithic European subdivisions, and offers a very broad framework into which an archaeological lithic assemblage can be placed to give a *general impression* of its relative age and content. Assigning a lithic assemblage to one or other of these periods is based on the identification of diagnostic tool types (*fossiles directeurs*) and dominant technologies. A system of categories that distinguishes between flake and core (Mode 1); bifacial (Mode 2); prepared core (Mode 3); blade (Mode 4), microlithic (Mode 5), and polished (Mode 6) lithic technologies offers a useful scheme for this purpose. It is important to remain mindful of the many examples of lithic archaeological industries and assemblages that contradict any notion of clear, sequential 'advances' in stone tool making techniques over time. However, assemblage characterisation provides a useful starting point on which to base the following stages of a lithic study.

I. INITIAL ANALYTICAL STEPS

A good idea is to lay out all material on a table (retaining excavation and stratigraphic context information with each piece, so its provenance can be tracked in all future work) and, for each stratigraphic or excavation unit, to group together all pieces by raw material type. Even without specialist geological knowledge, distinctive attributes such as raw material grain size (fine or coarse), translucency, and/or colour (including if relevant any subtle internal features such as rock banding) can be used. Since lithics of one rock type cannot result from the working of a different raw material, this grouping ensures some separation of technical sequences and allows for the comparison of similarities and differences within and between rock types and excavation units. Differences in the original form and physical characteristics of raw materials can dictate the strategy a stoneworker employed to make tools, and affect the size and form of the lithics produced. Occurring naturally as small pebbles or angular chunks, quartz for example is far less suited to the manufacture of long blades than larger blocks of chert or quartzite, while granite and hematite are rarely good for knapping but can make effective ground stone tools.

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Trends in raw material frequencies and sourcing can also be examined, revealing networks or efforts put into obtaining rocks – if a material is present in local geology it may have been sourced nearby, but other non-local ('exotic') rocks might have been collected and transported from many kilometers away.

Measuring the lithics in an assemblage provides essential information about individual pieces so that other researchers can understand their scale as well as artefact diversity across the wider assemblage. Within each raw material grouping per excavation unit, count the lithics by size class (for instance >20 cm, 10-20 cm, 5-10 cm, 1-5 cm, <1 cm) before measuring their maximum length, width and thickness (and weight too, if possible). Very small pieces usually reflect waste shatter or dust generated incidentally during tool knapping or grinding, and can instead be counted or weighed in bulk. Make a note of these details, to which further information about the typology and technology of each piece can then be added.

II. TYPOLOGICAL AND TECHNOLOGICAL APPROACHES TO ANALYSIS

A. Typological approach

Typological categorisation is based on the identification of recurrent shapes and forms in lithic end products according to a set of attributes and a shared vocabulary. This process can include very specific categories and sub-categories of types, but the application of any scheme should always reflect the lithic materials being examined and condense assemblage variability for easier description and comparison with other horizons and sites. Although many typological terms (e.g. scraper, handaxe) imply the function of each group, the actual use of lithic artefacts cannot be accurately determined based on their morphology or technological features; to understand function requires specialist microscopic analysis (see below). Certain morphological types might act as diagnostic *fossiles directeurs* of a particular industry or culture (e.g. Acheulean handaxes, MSA points), while others occur widely in time and space (e.g. flake scrapers, notches, burins).

With the lithics laid out as before, look both within and between raw material groups for artefacts with common attributes. An initial categorisation applicable to most lithic assemblages might discriminate between flaked and detached pieces, small retouched tools and shaped tools, polished/ground items, and modified and unmodified pieces. **Flaked pieces** such as cores show multiple negative scars indicating they were repeatedly struck to produce flakes. ***Simple cores*** can have just a few removals initiated from one surface near the edge (a single platform), while more ***complex cores*** have flake removals initiated from several platforms in multiple directions. ***Specialised cores*** including Levallois, discoidal, blade, and microblade types show careful preparation to form particular shapes designed to enable systematic detachments of flakes or blades the size and shape of which are controlled by the knapper. **Detached pieces** include all lithics knapped from a larger piece but lacking secondary modifications (retouch), including ***whole flakes*** retaining distinctive production features (a striking platform, point of percussion, bulb of percussion, and termination), ***broken flakes*** that split into pieces during knapping, elongated ***blades or microblades*** with parallel lateral edges and dorsal ridges, and ***angular fragments*** and ***waste*** of irregular morphologies produced as knapping by-products. **Shaped tools** can be divided into ***large cutting tools*** such as cleavers (**fig. 1**) and handaxes (**fig. 2**) showing bifacial working around the perimeter, ***heavy-duty tools*** like core-axes, picks, choppers and core-scrapers typically knapped from large cobbles or blocks of material, and ***light duty tools***, including points (retouched (**fig. 3**) and unretouched), microliths (**fig. 4**), scrapers, denticulates, burins, becs, and borers. **Polished/ground** lithic artefacts, with some degree of deliberate edge and surface abrasion or beveling, include ***ground and polished axes*** (**fig. 5**), ***grindstones*** with one or more smoothed, polished faces, pebble or cobble ***rubbers*** showing worn, smoothed faces from abrasive wear, and ***bored stones***. **Modified** pieces show some degree of surface alteration and or flaking caused by human activities, including items such as: ***hammerstones*** used as hand-held percussive tools for knapping which exhibit pitted and battered surfaces; ***anvils*** with percussive impact damage on one or more surfaces; and also ***pigment with rubbed surfaces***, soft stone pieces that can be worked into colourful powders through rubbing. **Unmodified** includes any lithic item brought to the site by people but which lacks any evidence of subsequent alteration. Care must be taken to ensure neither ***manuports*** nor ***unmodified pigment*** could have occurred naturally at the site, or been transported there by physical processes such as water action. The frequency of artefacts in each of these categories should be noted, and can be tabulated per excavation horizon and raw material to help identify trends in toolmaking.

B. Technological approach

Technological analysis focuses on understanding the processes involved in producing lithic artefacts and is based on a careful reading of the order and pattern of detach-

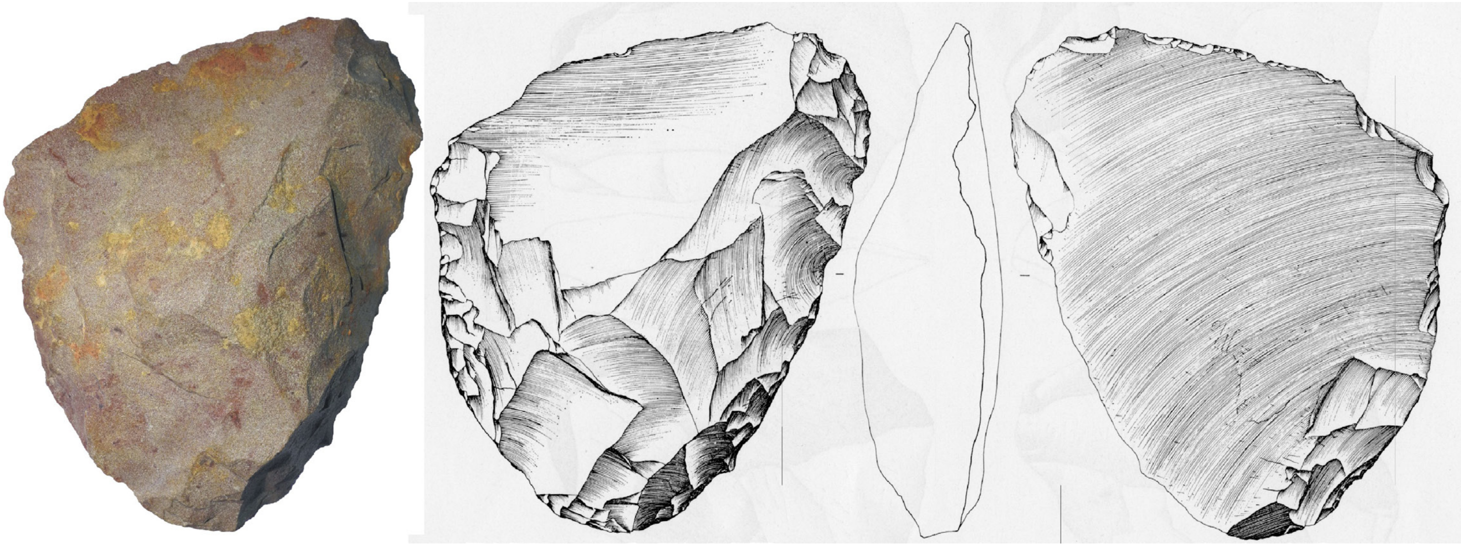

Fig. 1. Late Acheulean cleaver (20.6 x 17.0 x 5.4 cm) from Kamoa (Democratic Republic of Congo) in polymorphic sandstone. (Drawing from CAHEN, D. 1975. *Le Site archéologique de la Kamoa (région du Shaba, rép. du Zaïre). De l'Âge de la Pierre ancien à l'Âge du Fer* (series 'Annales in 8°, Sciences humaines', no. 84). Tervuren : RMCA, plate 1. Photo © RMCA.)

Fig. 2. Late Acheulean handaxe (16.6 x 8.8 x 3.7 cm) from Kamoa (Democratic Republic of Congo) in polymorphic sandstone. (Photo © RMCA.)

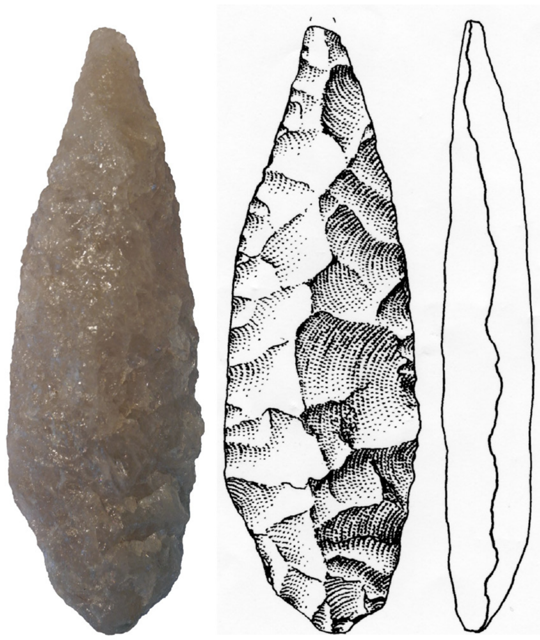

Fig. 3. Foliate point (12.8 x 4.2 x 1.8 cm) in vein quartz found during mining operations in a gravel layer at the Kasongo-mine (Democratic Republic of the Congo) and donated to the Royal Museum for Central Africa in 1939. (Photo © RMCA.)

ments or abrasive processes (grinding/polishing) that led to the final form of lithics. Scar patterns on core, flakes and shaped tools can be used to infer the repeated use of particular knapping patterns (e.g. bifacial, Levallois, blade, microblade, bipolar) reflecting the decisions taken by a knapper or group of stoneworkers at a site. These may reflect some collective cultural and social habit of a past community, with some techniques also requiring greater knapping preparation and forethought to complete, suggesting a greater investment of effort, increased skill, or more complex cognition. The typological examination already undertaken should provide strong clues about technological trends in the lithic assemblage; for example if there are many bifacially shaped tools, or numerous razor-like blades, microblades or blade/microblade cores, or groundstone items, this might indicate the repeated use of particular reduction strategies. Look for differences in the frequency or use of these techniques between rock types and excavation horizons. Considered with caution (see above) some technologies such as microlithic and polished/groundstone appear later than others in the African record, and may indicate a relatively more recent age for an assemblage. Microlithic technology should not however be identified based on the presence of 'small flakes' (which can result from any lithic reduction strategy) but rather the recognition of deliberately made geometric pieces, often from microblade or small bipolar cores. Similarly, artefacts with ground and smoothed surfaces occur alongside Acheulean, MSA, and LSA flaked technologies at some sites, making it important to distinguish between items showing grinding as a by-product of other activities (e.g. processing wild plant material or colourants) from carefully and deliberately made groundstone tools such as shaped and polished axes.

Detailed technological analysis can result in very high-resolution information about past behaviour. Excavated lithics are the outcome of dynamic, sequential stages that make up a *chaîne opératoire*, including: raw material procurement and testing; initial knapping (cortex removal); shaping/trimming or core preparation and flake manufacture; artefact use (including possible re-sharpening); secondary and subsequent transformations (reshaping into other tool types), and tool exhaustion/discard. All of these stages may be recorded in an assemblage, but some parts of a knapping sequence may be missing, especially if completed at another location. In their natural state, almost all rocks have a weathered outer coating – cortex – that is gradually removed as a rock is fractured or ground into tools. Per raw material and excavation horizon, record the percentage of the surface of each piece covered by cortex. The retention of cortex on any portion of a lithic piece by definition records the outer surface of the original piece of rock; if cortical artefacts of a particular raw material are absent or very infrequent in an excavation unit this may suggest the initial reduction phase was undertaken elsewhere (perhaps at the raw material source) and that flaking of this material was already at a relatively advanced stage when it was brought to the site. Similarly, if the assemblage includes mostly completely cortical artefacts, this indicates initial flaking took place at the site and, if no clear end-product tools of that material are present, that these were subsequently transported away for use at another location. The size-class information for each rock type previously recorded can be combined with this cortex data to further assess these possibilities, since the smallest and lightest fraction of material (<1 cm) typically represents knapping shatter resulting from on-site tool manufacture. Care should be taken here, however, since these light pieces are also the most prone to being washed or blown away by post-depositional processes – their complete absence from an excavated horizon may not mean knapping did not take place at the site. But, if absent for one rock type but present for another, it can be suggested that raw materials were knapped at different locations in the landscape.

GOING FURTHER: SPECIALIST INTERPRETATIVE ANALYSES

Other kinds of more detailed lithic analysis also help to understand the behaviours and technological decisions of past people. The **experimental knapping** of the same or very similar raw materials as those identified at a site can provide comparative information about the suitability and difficulty of making tools from particular rocks, as well as insights into the morphology, technology and size-range of artefacts that typically result, which can then be used to interpret more accurately the archaeological assemblage. For example, if very few pieces of small shatter are produced when knapping a rock, it might not be appropriate to explain the identification of only a few such archaeological pieces as relating to technical decisions (off-site knapping) or post-depositional disturbance of the materials.

Even higher resolution technological analysis can be undertaken by attempting to piece back together lithics of the same material into **refitting** groups. If two or more conjoinable pieces are present, this technical procedure likely took place at the site and, moreover, the integrity of the archaeological horizon has not been badly com-

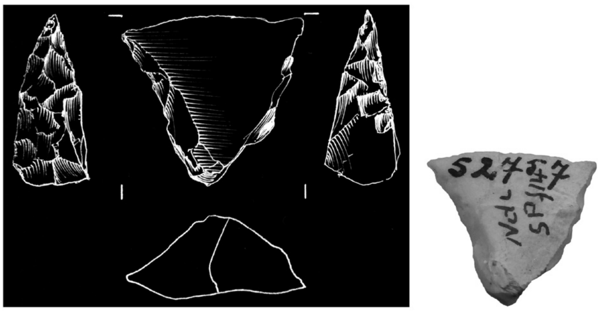

Fig. 4. Later Stone Age transverse arrowhead/*petit tranchet* (2.0 x 2.2 x 0.9 cm) in white patinated polymorphic sandstone, Ndinga Saint-Pierre (Democratic Republic of the Congo), 1952 excavations M. Bequaert. Note the inventory number of the Royal Museum for Central Africa (52757), reference to the site and pit (Ndi SP f 14). On the ventral side the depth (-1.20-1.25 m) at which the artifact was found and the date (23.v.52) are written. (© RMCA.)

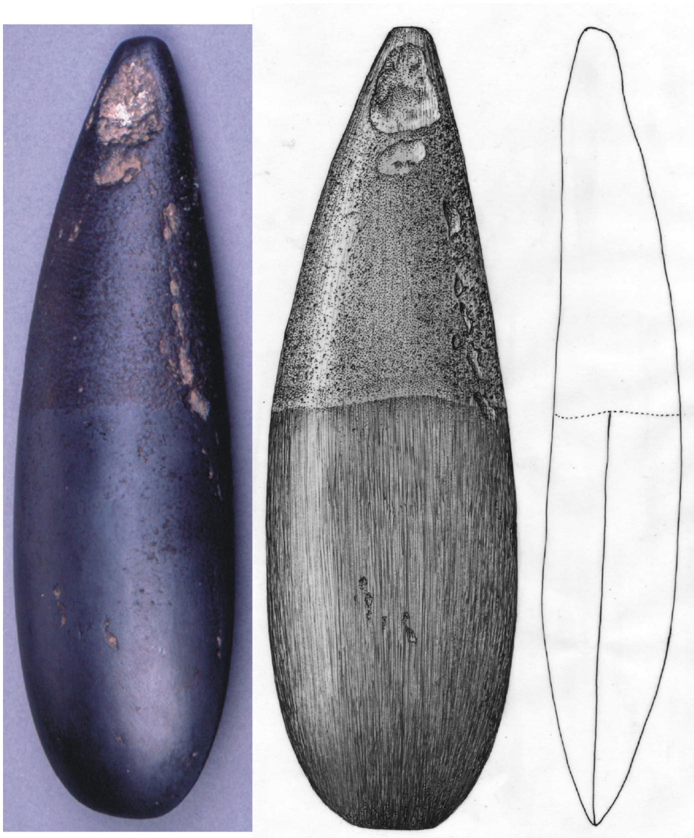

Fig. 5. Polished axe (20.4 x 6.1 x 2.7 cm) in hematite from Uele (Democratic Republic of the Congo), chance find and gift to the Royal Museum for Central Africa in 1898. (Photo J.-M. Vandyck © RMCA.)

promised since artefact deposition. Furthermore, if multiple pieces can be refit, it can be possible to identify very specific knapping decisions, including the number and sequence of core rotations and any accidents avoided or resolved, while the absence of certain lithics from the *chaîne opératoire* may indicate their preferential selection for transport and use at another location.

Functional analyses attempt to determine the actual use of archaeological lithic artefacts (whether flaked, shaped, retouched/unretouched, or ground) through the microscopic examination and interpretation of adhering organic particles (**residue analysis**) and/or the presence of patterned damage on their edges and surfaces (**use-wear analysis**). These are true scientific specialisms that take years to learn but, if considering their application, it is recommended as a first step not to wash after excavation any artefacts intended for residue analysis, and to retrieve some sediment samples from the excavation horizon so that residue types and frequencies on tool surfaces and the burial environment can be compared. To avoid contamination of any ancient residues, restrict artefact handling to a minimum; if possible only handling with powderless laboratory gloves or, if not available, with clean hands. After excavation, artefacts should be isolated inside two sealed (preferably Minigrip®) plastic bags before a lithic residue analyst is contacted for further advice. For use-wear analysis, restrict artefact handling and if it is necessary to remove sediment from surfaces, wash pieces lightly with a soft toothbrush (avoiding heavy scrubbing). Again, keep artefacts selected for further specialist analysis inside two sealed plastic bags and avoid as much as possible any percussive or abrasive contact as they are transported from the site to a laboratory environment.

SUGGESTED FURTHER READING

Inizan, M.-L., Reduron-Ballinger, M., Roche, H. & Tixier, J. 1999. *Technology and Terminology of Knapped Stone* followed by a multilingual vocabulary (Arabic, English, French, German, Greek, Italian, Portuguese, Spanish), translated by Jehanne Féblot-Augustins. Nanterre: CREP, 191 p.

Also at : http://www.mae.u-paris10.fr/prehistoire/IMG/pdf/Technology_and_Terminology_of_Knapped_Stone.pdf

Inizan, M.-L., Reduron-Ballinger, M., Roche, H. & Tixier, J. 1995. *Technologie de la pierre taillée* suivi par un vocabulaire multilingue (allemand, anglais, arabe, espagnol, français, grec, italien, portugais). Meudon: CREP, 199 p.

Also at: http://www.mae.u-paris10.fr/prehistoire/IMG/pdf/Technologie_de_la_pierre_taillee.pdf

A CASE STUDY: ANALYZING LITHICS FROM SHUM LAKA, NW PROVINCE, CAMEROON

Els Cornelissen[1]

I. THE GENERAL SETTING OF THE ROCK SHELTER

The rock shelter of Shum Laka was excavated as part of the Wide Bantu Homeland Project under the general direction of Pierre de Maret in two field seasons in 1991 and 1993. The incentive was to document the archaeological record in the area considered by linguists to be the cradle of the Bantu languages. The sequence of occupations turned out to date back to beyond 30,000 years (**fig. 1**) and yielded a substantial amount of lithic artefacts. As at any rock shelter, the re-occupation of the same area most certainly provoked disturbances of previous occupations that obliterated borders of separate horizons, but at the same time the gradually accumulated sediments and artefacts offer a chronological referential frame work.

The abundant lithic material at Shum Laka revealed a microlithic industry mainly on quartz starting in the Late Pleistocene, and a Holocene large flake and blade industry made on basalt. In order to assess the extent of continuity and variation through time between these two different assemblages, we compared a number of typological and technological features. Here I will focus on the patterning in the choice of raw materials over the 30,000 years that the rock shelter has been frequented. Below you will first find an overview of the units and general grid of analysis of typological and technological elements that we used, which are then applied to the specific question of the use of raw materials through time.

The general typological and technological approach and some of the specific analyses from Shum Laka will be useful to your own analysis; however, the first step is to lay out your own material and to look at it for any patterning that will guide your choice for applying a specific typology (see also Taylor, this volume, pp. 163-164).

II. UNITS OF ANALYSIS

All artefacts including lithics measuring ≥ 2 cm were recorded three-dimensionally out in the field. All sediment was collected in artificial spits of 5 cm over a square meter. This was dry- and then wet-sieved on 5 mm mesh. A unit of 1m²x 5 cm is thus the common smallest unit of analysis between sieved and 3-dimensionally recorded artefacts and according to which bones, lithics, pottery and charcoal retrieved from the sieves were bagged and labelled.

The choice at Shum Laka for excavation in artificial spits was made in the absence of clear stratigraphic or cultural units whilst excavating (see also Vogelsang, p. XX). Extensive geomorphologic studies lead to the identification of 6 large stratigraphic units (**fig. 1**) which are from top to bottom: a lens-shaped A-layer or loose ashes subdivided into grey (Ag) and ochre ashes (Ao) with correlating T-deposits that are fluvial sediments brought in by the fall at the entrance. These Holocene A- and T-deposits were further subdivided using radiocarbon dates from charcoal and from human bones. The underlying S-Si deposits and P-deposits belong to the Pleistocene. Except for the grey and ochre ashes, the stratigraphic units were hard to distinguish out in the field, hence artificial spits were grouped into one of the stratigraphic units after excavation. Depending on the slope of these stratigraphic units and lateral variation, some of the artificial excavation spits will be transitional, meaning that they belong partly to two of the large stratigraphic units.

III. GRID OF ANALYSIS

A simple Excel spread sheet was used to analyse various parameters in order to answer the questions listed above. Other software can of course be used but Excel spreadsheets and especially its Open Office equivalent are widely used and accessible. Its major convenience – that contents of cells can be changed at any time by simply overwriting – is also its major inconvenience. Columns will contain variables. Rows correspond to one single artefact, or to an assemblage of similar artefacts, e.g. 20 fragments non-cortical quartz fragments all measuring between 1 and 2 cm (or size-class 1). Questions such as ‘what is the number of quartz artefacts smaller than 2 cm in the level -120-130 cm in square B12’ can be answered by using the data filters in the various columns or by using specific Excel functions.

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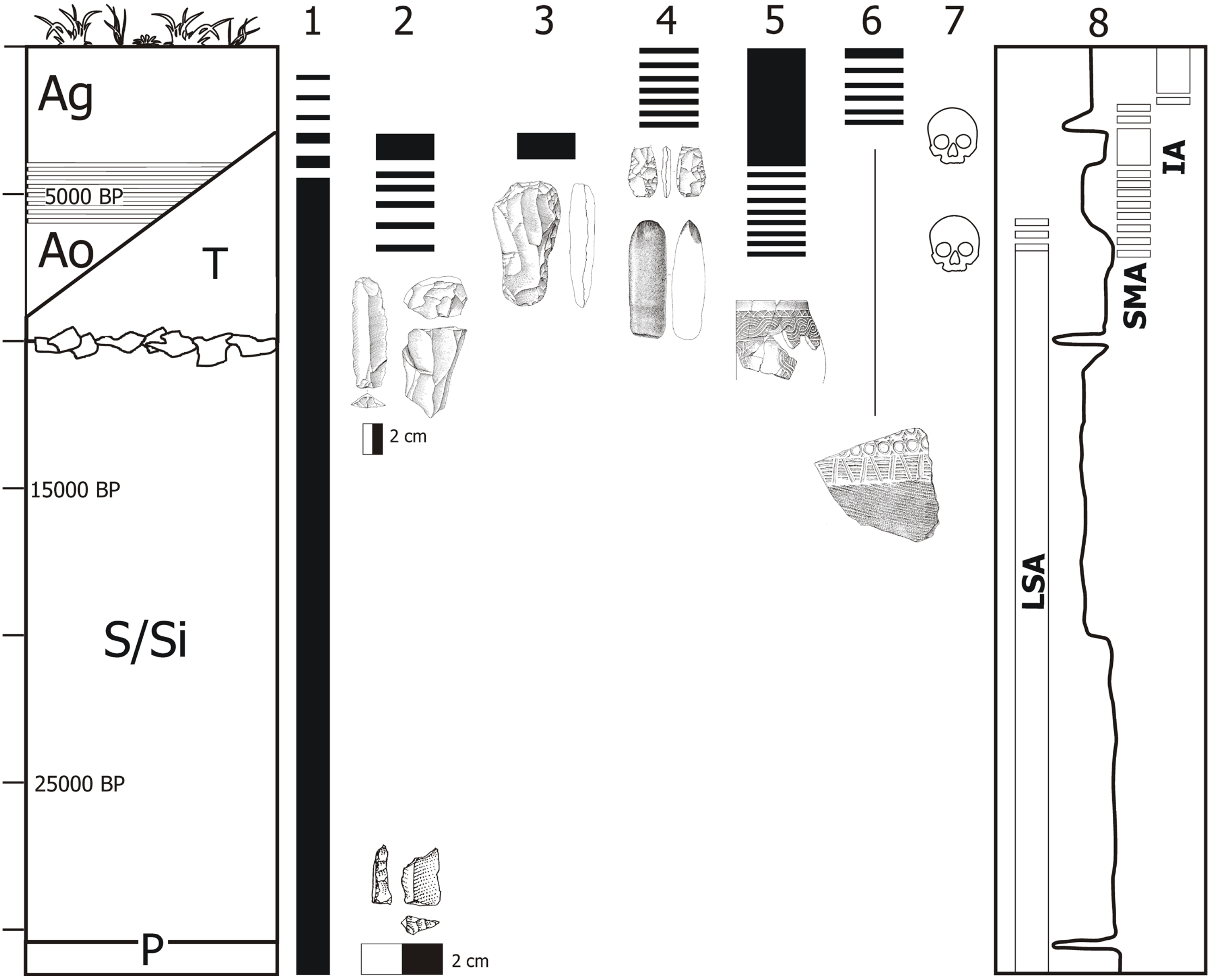

Fig. 1. Overview of results from Shum Laka. The left column represents general stratigraphy and red dots indicate position of radiocarbon dates. 1 to 6 are the technological traditions with appearance and disappearance: (1) the microlithic quartz industry, (2) macrolithic flake and blade industry on basalt, (3) bifaces of the axe-hoe type, (4) pecked grounded adze and arrow heads, (5) pottery and (6) iron objects. (7) indicates the two burial phases and (8) the oscillation between arid (on the left) and humid (on the right) climate conditions. LSA = Late Stone Age, SMA = Stone to Metal Age, IA = Iron Age.

In the list of parameters (in columns) for the analysis of lithics of Shum Laka we included:

1. Date of excavation
2. Site: official abbreviation LAK91 or LAK93; 91 referring to the field season 1991-1992 and 93 to that of 1993-1994.
3. Square: grid system of letters and figures
4. Levels or excavation spits expressed in cm below datum/surface: depth was calculated from an artificial datum set at 10 m and was afterwards recalculated as depth below surface.
5. Inventory number: only for artefacts with x, y and z recordings
6. N coordinates within square
7. E coordinates within square
8. Depth for individually recorded artefacts below datum/surface, see 4.
9. Number: 1 for a three-dimensionally recorded artefact or specific unique artefact, more for any given number of artefacts that share all characteristics recorded (e.g. 20 non-cortical quartz fragments of size-class 1)
10. Cortex: in order to assess the extent to which raw material had been processed prior to its introduction in the rock shelter, the presence (C)/absence (N) of cortex for all non-flakes was recorded. In the case of complete flakes the classification system of N. Toth (fig. 9, 1985)

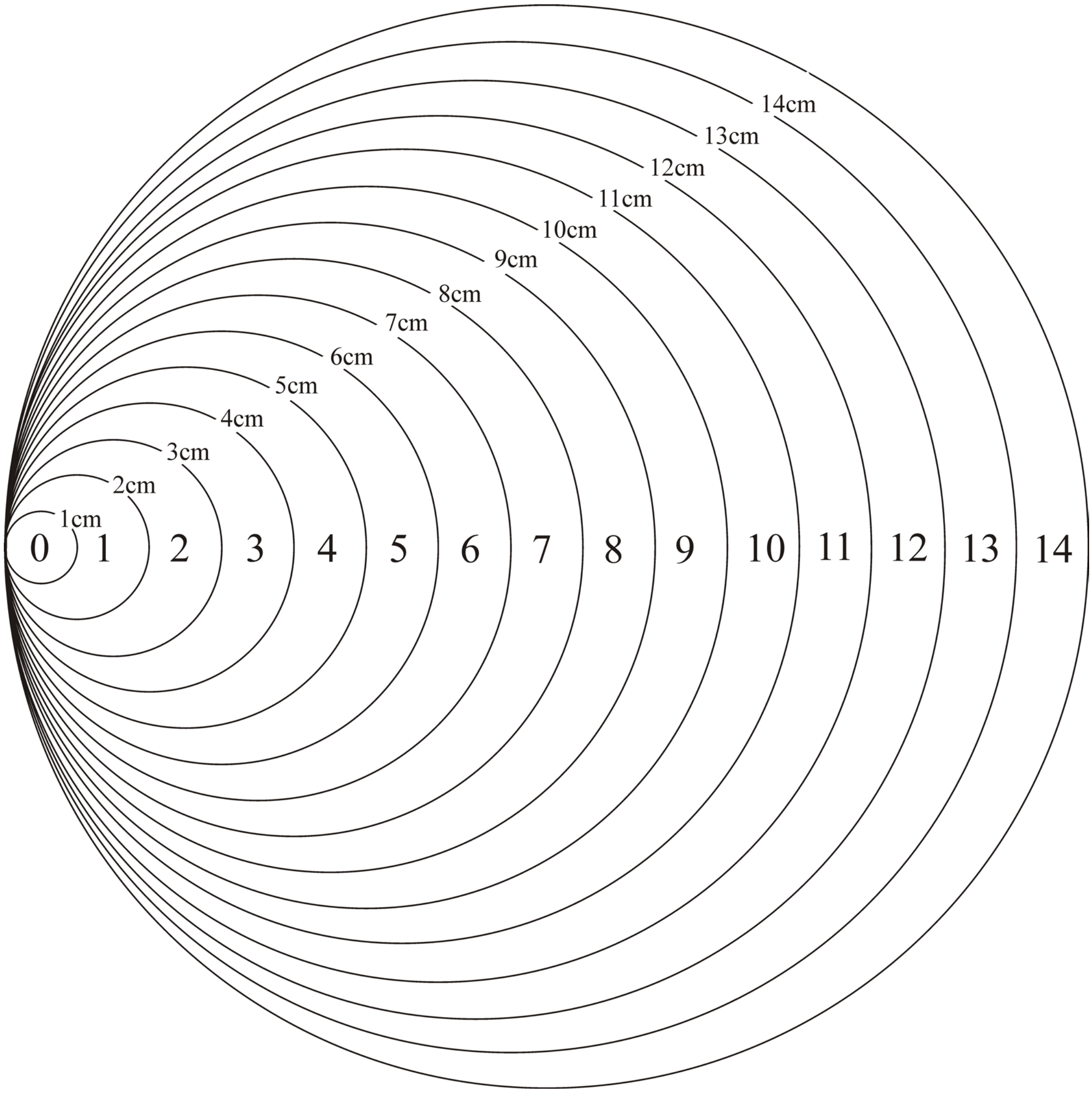

Fig. 2. Concentric circles are the easiest way of measuring the maximum dimension of any given artefact/stone. Class 0 corresponds to all items of which the maximum dimension is < 1 cm, class 1 to those ≥1 cm and < 2 cm, etc.

was followed. Six flake-types represent a combination of cortical/non-cortical flaking platforms and dorsal surface (50% or more, less than 50%, and no cortex). If raw material was processed on the site, flakes with cortical flaking platforms (types I-III) and cortex on the dorsal face (types I-II and IV-V) will prevail. Raw materials that have little or no cortex to begin with, like the vein quartz used at Shum Laka, yield mostly type VI flakes if any.

11. Raw material: codes refer to various raw materials. However, in the analyses we classified them into three large categories according to their flaking properties: (1) welded tuffs and basalts, locally available in the rock shelter that was carved into this type of rock; (2) all types of quartz – mainly vein quartz – which must come from granite layers in the surroundings of the rock shelter; and (3) all fine-grained rocks such as siliceous sandstone, obsidian, silicified mudstone, cherts which were carried into the rock shelter. All raw materials were available on site or nearby at a maximum of 5 km during the entire occupation of the rock shelter. Hence any variation in the exploitation of rocks and minerals can be interpreted as a deliberate choice to use one specific raw material over another.
12. Physical condition: fresh, weathered, rolled

For flakes (retouched, modified pieces, and complete flakes), the following measurements were recorded:

13. Maximum length, ML
14. Maximum width, MW
15. Maximum thickness, MT

The ratio of ML/MW of flakes is used for assessing tendencies in the general flake production. A distinction is made between lateral or side-struck flakes (ML/LW <1) such as for instance obtained during bifacial trimming, and end-struck flakes (ML/MW ≥ 1 and < 2) and blades (ML/MW ≥2).

16. For all artefacts the maximum dimension was recorded positioning them on concentric circles (**fig. 2**). This parameter allows visualisation of the size fractions present/absent for assessing site integrity (see also Vogelsang, this volume, pp. 104-108).
17. Type:
 At the time of analysis Shum Laka was relatively unique at a regional scale. Therefore we developed our own typological and technological framework essentially inspired by that proposed by M. Kleindienst and J.D. Clark in 1974 for the site of Kalambo Falls (Zambia). We did not consider Shum Laka similar to Kalambo Falls but their approach and terminology, developed for a site spanning Stone Age into Iron Age, allowed for an adoption and adaptation of material previously unstudied. In fact, they distinguish between four large categories through increasing modification or retouch and we followed those.
    (1) waste (detached pieces (FLAK for flakes, FRAG for fragments and CHUNks) and flaked pieces (cores) – CF or CB for Core for Flake- or Blade-production. This can be followed by a number referring to a specific type of core, e.g. 01 for one single flaking platform.
    (2) utilized (grinding stones or hammerstones),
    (3) modified pieces (retouched, notch)
    (4) shaped tools (arrowheads, bifaces): TC is a Core Tool and TF a Flake Tool; TCSC a core scraper and TFSC a flake scraper. Letters and digits can be endlessly added for more detail.
18. Flake shape using the position of maximum width at the proximal edge, intermediate, and distal edge for respectively convergent, intermediate and divergent shapes; triangular and rectangular –the latter two may point to the search of predetermined shape on cores
19. Flaking pattern and number of scars
20. Butt shape or flaking platform
21. Terminal release
22. Remarks: this is a useful column for noting down anything observed during analysis that does not fit into any of the previous categories, that might turn out to be absolutely irrelevant or a recurrent significant feature.

Columns can be added for listing numbers of drawings or pictures, for links to other databases, or for units defined after recording and in the course of analysis or as dating evidence becomes available.

More fine tuning of this general typology can be done in agreement with a specialist who may orient you in the enormous offer of specific technological studies.

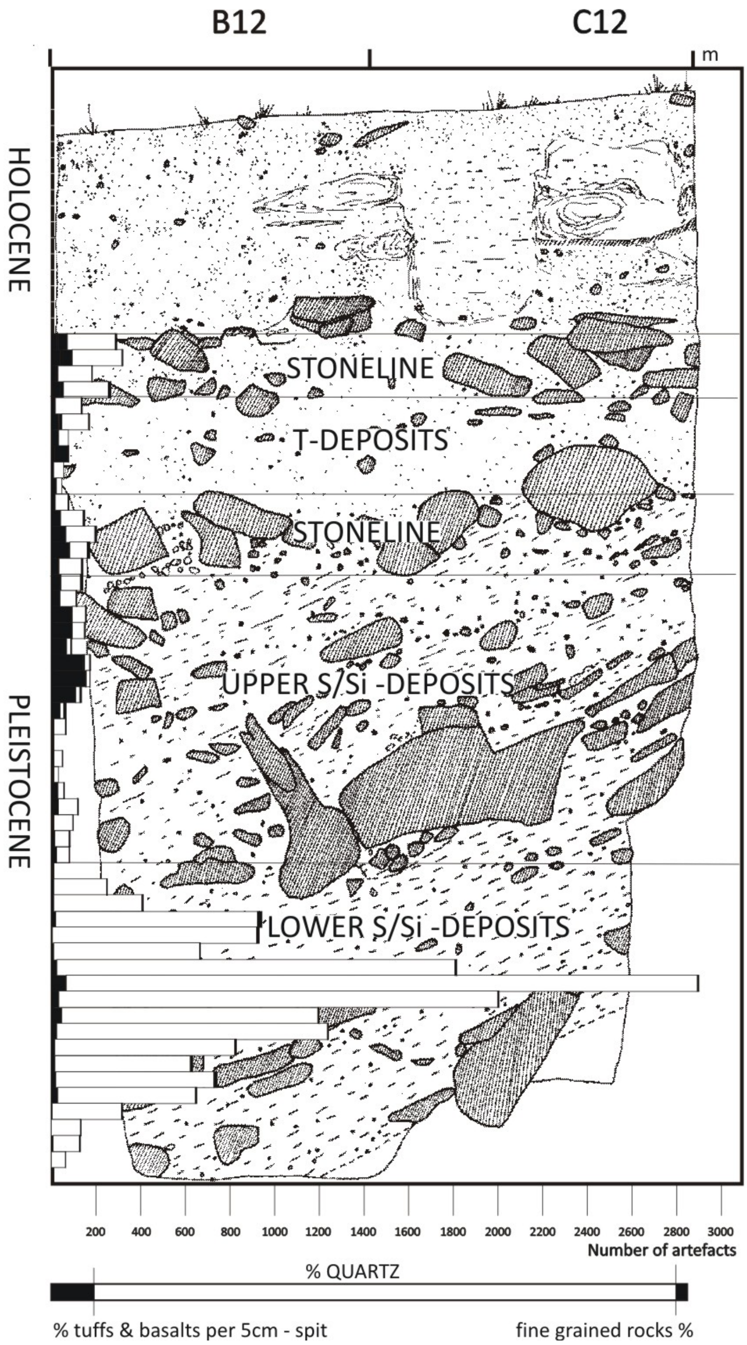

Fig. 3. Distribution of raw materials and density of artefacts throughout the Pleistocene lower layers based on the analysis per artificial spit in square B12. Projection of the artificial excavation spits onto the stratigraphic drawings allowed assignment of the spits to larger and chronostratigraphic units.

IV. EXAMPLE: EXPLOITATION OF RAW MATERIALS THROUGH TIME AT SHUM LAKA

A. From spits to chronostratigraphic units

A first step was to group the 5 cm spits in the various squares that were chosen for analysis into relevant chronostratigraphic units. This was based on the combination of geomorphological interpretation and C14 dates. **Figure 3** illustrates this for the lower levels. The resolution for the upper, Holocene ash-layers is

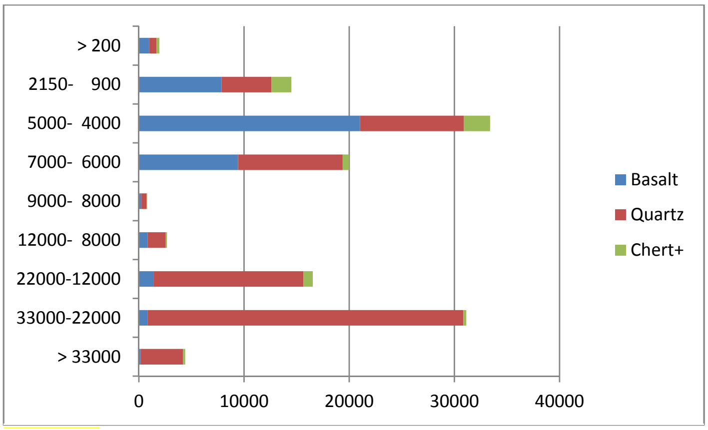

Fig. 4A. Number of raw materials per chronostratigraphic unit.

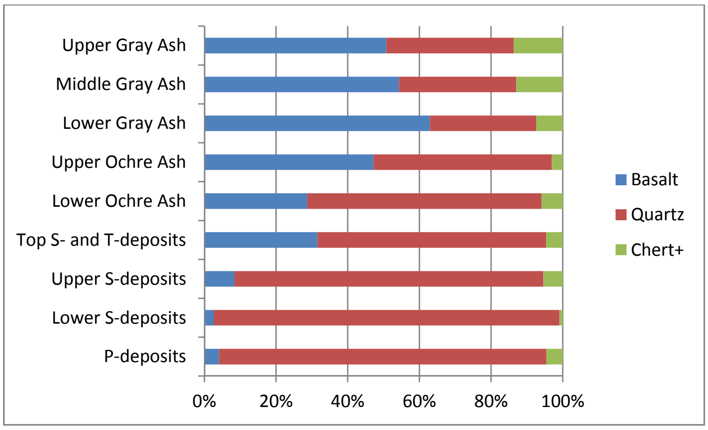

Fig. 4B. Percentage of raw materials per chronostratigraphic unit.

Fig. 4. Representation of three categories of raw material (see text) per chronostratigraphic unit. The chart in 4A shows the density or total number. Note that although the unit between 4000 and 5000 BP has yielded a comparable amount of artefacts as that dated between 33,000 and 22,000, a comparison is totally irrelevant because of the difference in time slice (1,000 versus 11,000 years). In chart 4B the proportion of each raw material is given making abstraction of the total number of artefacts. This shows a general tendency from bottom (P-deposits) to top (Upper Gray Ash) for basalt to increase at the transition from Pleistocene to Holocene and to a lesser extent for the category of cherts as well and a concomitant decrease of quartz artefacts. Based on Table II, Cornelissen 2003; Tables II, V, VII-IX Lavachery 2001.

higher than that of the lower Pleistocene layers both in terms of deposit description and formation and of dating (**fig. 4**). Because of that difference, the Holocene part can be compared to the Pleistocene record for general tendencies and similarities or differences in composition of artefact assemblages, but not for the density or number of artefacts.

B. From tables to graphs and interpretations (fig. 4)

For figure 4 the parameter (or column) 'Time BP' was selected in the Excel file together with the numbers of basalts, quartz and fine grained raw materials – mainly cherts – in figure 4A. For Figure 4B the column 'chronostratigraphic unit' was selected and the percentages of the three groups of raw materials calculated on the total per unit. These allow for different assessments of patterning through time (see explanation in captions). Quartz is clearly the prevalent raw material in the lower levels and since all raw materials were accessible and available throughout the occupation, this reflects a deliberate choice on behalf of the Pleistocene occupants.

This example serves to illustrate how simple means allow lithic analysis that answer questions on tendencies in the procurement and selection of raw materials. The same approach can be used for any other parameter like size distribution of each class of raw materials within the various Holocene ash layers, or comparing size distribution of a specific category of artefacts (e.g. quartz cores) throughout the entire sequence.

REFERENCES

Cornelissen, E. 2003. 'Microlithic quartz industries at the end of the Pleistocene in Central Africa: the evidence from Shum Laka'. *African Archaeological Review* 20 (1): 1-24.

Lavachery, P. 2001. 'The Holocene archaeological sequence of Shum Laka rock shelter (Grassfields, Cameroon)'. *African Archaeological Review* 18: 213-247.

Toth, N. 1985. 'The Oldowan Reassessed: A Close Look at Early Stone Artifacts'. *Journal of Archaeological Science* 12: 101-120.

Clark, I.D. 1974. *Kalambo Falls Prehistoric Site. II: The Later Prehistoric Cultures*, Cambridge: Cambridge University Press.

For further information on terminology, typology and technology, see

- Taylor, this volume, pp. 163-167
- http://www.mae.u-paris10.fr/prehistoire/IMG/pdf/Technology_and_Terminology_of_Knapped_Stone.pdf

POTTERY ANALYSIS

Alexandre Livingstone Smith[1] & Cécile de Francquen[2]

INTRODUCTION

Because it is at the same time enduring and abundant on most ancient sites, but also because it is very informative on past and present populations, pottery is an important part of many archaeological projects. Indeed, pottery, like all things made by humans, changes over time and, very often these changes can be related to changes in the ways of living. It is thus very useful, when trying to understand what happened in the past, to be able to recognize a specific kind of vessel and know when it was made and used. To be able to do so, one needs to process the potsherds found in the field and build a catalogue reporting the characteristics of the different vessels found in each context of an excavation. Once this is done it is possible to proceed with detailed interpretations. It is possible to identify different pottery styles (by looking at shapes and decorations) and outline their chronological and spatial evolution in the studied area (**fig. 1**).[3] One can then compare the characteristics of the various styles[4] and how they change over time, opening avenues of interpretations on the people who made and used the vessels. How does one get there, starting with a pile of dirty potsherds? There are many ways to proceed with archaeological pottery analysis and what follows must be considered as a very general introduction in this endeavour (see also Huffman, this volume, pp. 180-186).

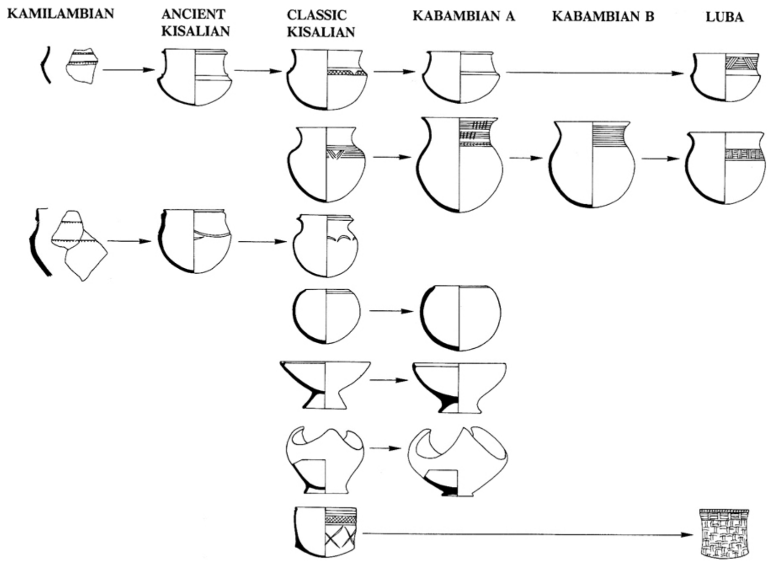

Fig. 1. At the end of the study, a pottery analyst can outline the evolution of pottery styles through time, in a given area. For instance, the typo-chronology established by Pierre de Maret in the Upemba depression of DRC summarizes the evolution of pottery styles in this area. It also shows in a simple manner that archaeological pottery in the area displays both elements of stylistic ruptures (related to distinct archaeological cultures) and elements of continuity. (Modified after de Maret, P. 1999.)

I. IN THE FIELD

Potsherds are generally cleaned in the field as there is no need to transport dirt around the world, but that is not a requirement. Cleaning should be done with water and

Fig. 2. Marking the potsherds. To make sure one always knows where each potsherd is coming from it is best to mark them clearly. The code should be short but allow for clear identification of the provenance of the potsherd (site, context, depth and potsherd number). (Photo A. Livingstone Smith, © RMCA.)

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3 For classic examples, see Pierre de Maret's work on pottery from the Upemba depression in Katanga (de Maret 1985) or Hans-Peter Wotzka's work on pottery from the inner Congo Bassin (Wotzka 1995)

4 Generally a style may be composed of a wide functional range of vessels (for cooking, service, storage, transport, etc.), but one may also observe that a style is associated to only one shape. It is thus important to establish the morphological range of each style. For instance near Tenkodogo in Burkina Faso, one may identify a style A (composed of cooking, storing and serving vessels), and a style B, displaying exclusively water bottles. All the potters live in the same area, belong to the same ethno-linguistic group, but consider themselves as distinct classes of specialist: Style A is produced by female specialists, while style B is made by male specialists.

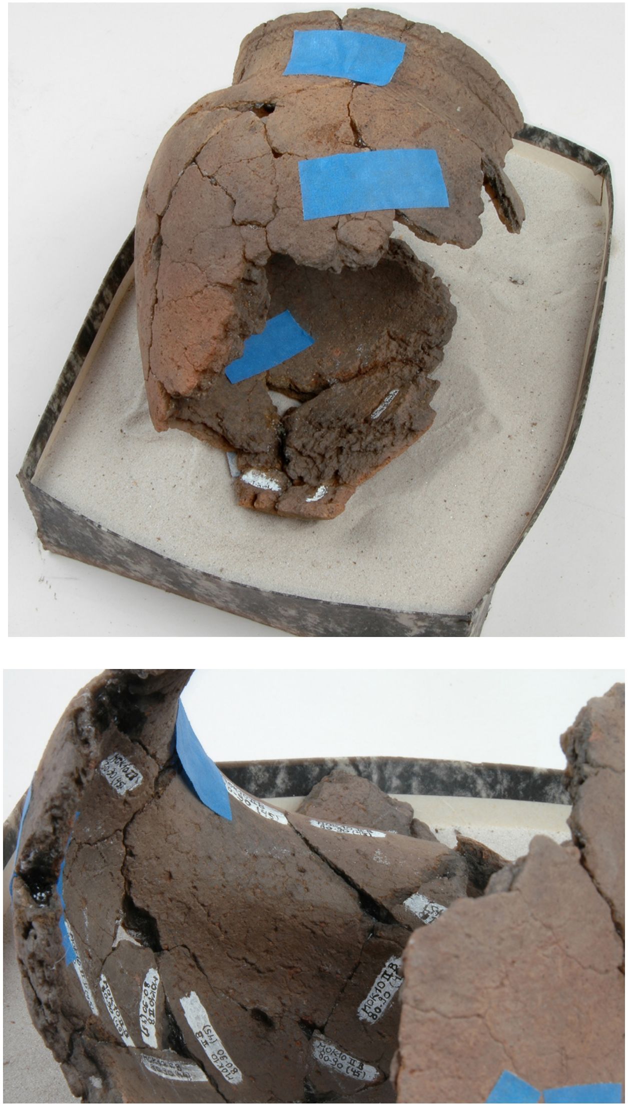

Fig. 3. If possible use reversible glue made with paraloid B72 (25%) and acetone (75%). When two sherds are refitted and glued together put them in a box filled with sand or rice grains to keep them in the right position while the glue sets. It is important to make sure the breaks are clean for a tight fit and that the curve is right. The accumulations of small errors change the curve of the vessel and can be very problematic towards the end. (Photo A. Livingstone Smith, © RMCA.)

soft brushes. Once dried, the potsherds are then put away in clearly labelled plastic bags. Whatever the reference system, make sure the bags refer to the *site*, *test-pit*, *context* and *depth* at which the pottery was found. Little holes should be made in the bags if the material is not completely dry when packed. If the material is in poor condition it is strongly advised to take pictures of the most diagnostic examples just after cleaning, as they may crumble during transport.

II. FIRST STEPS AT THE LAB

At the laboratory, the following steps are a minimum: (1) reference, (2) refit, (3) sort in different categories, (4) draw and/or photograph and (5) build a catalogue presenting the material. The material is then ready to be (6) analysed.

A. Reference

The first thing that needs to do be done is (1) to mark and number the potsherds. This will enable the researcher to take the potsherds out of their bags without losing track of their origin[5]. The marking has to summarize the information written on the bag (for example: a sherd excavated on the site of Birni Lafia 2014 in test pit 9, context 5 at a depth of 40-50 cm and numbered 514, may be referred to as follows: LAF/14/9/5/40-50/514). The mark should be small, but clearly written to avoid confusion (**fig. 2**)! One way to do it is to first lay a thin layer of varnish, before writing the code in Indian ink (black or white), depending on the colour of the sherd), then to apply another protective layer of varnish. It is important to make sure that all the marks are accurate and clearly legible.

B. Refitting

The next stage (2) involves refitting the potsherds, first within each context, then between contexts. This can be done by laying out the potsherds on a table, with their external surface showing up, and grouping them by appearance and fabric – a sort of family game. Then, one should look at each group of potsherds, turning them over in order to see their internal surface. It will then be possible to split the groups apart a little more depending on the characteristics of their internal surface. The analyst generally ends up with a few groups of potsherds that look very much alike and some isolated ones – the number of potsherds per group varies greatly depending on the archaeological context of origin. It is then possible to start looking for fragments that fit together within each of these small groups. When this is done, it is easier to look for further refits with other potsherds in other contexts. It is important to record the reference of the potsherds that fit together to facilitate further refitting and further analysis – one may add a pencil mark on the internal

5 If you are working on an enormous amount of material (i.e. tens of thousands), you may need to proceed first with steps 3a. and b. to reduce the quantity of material to be marked and numbered).

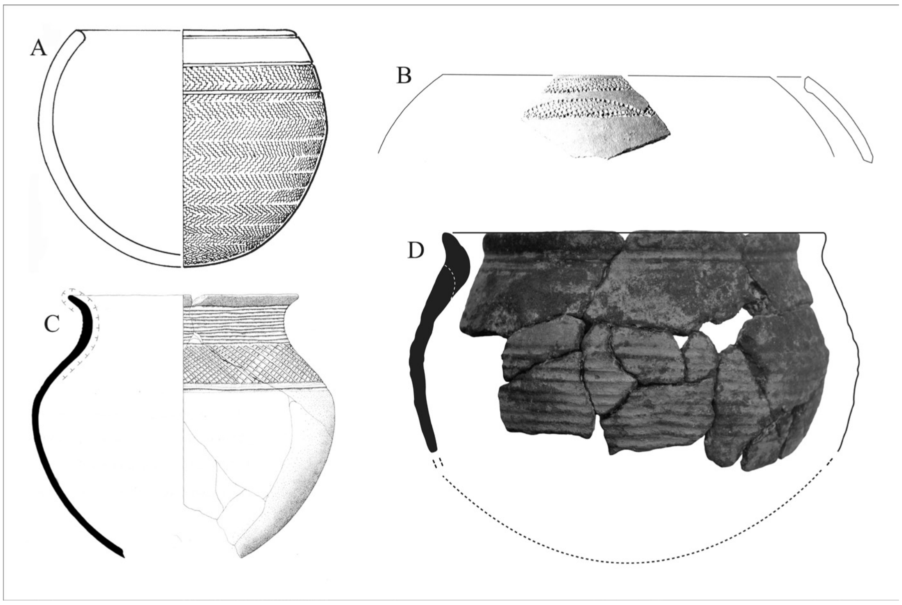

Fig. 4. Pottery finds may be illustrated in various manners depending on regional and academic traditions. This may be done by drawing the section and surface of the vessels as in A (after Mayor 2011) or C (after de Maret 1985) or by combining drawings and photographs with the help of computer programmes as in B (after Wendt 2007) or D. (after Delvoye 2012). Whatever the system it is important that surface treatments (including decorations) be clearly illustrated and photographed. Whatever the system, the final plates should include a reference to the exact origin of the potsherd (i.e. site and context of discovery).

surface and to keep them close when you store them. They can also be temporarily refitted with a piece of paper tape. When all the refitting potsherds have been identified, they can be glued back together to form vessels (or at least their profiles). To do so it is best to start with the bases, working upwards towards the neck (**fig. 3**).

Refitting is very time consuming. If there are tens of thousands of potsherds to study, one may arbitrarily decide the time spent on it. One may also save time and energy by studying first a representative sample of the site.

C. Sorting, counting and describing

To simplify the analytical procedure, the material needs to be sorted in different categories depending on their usefulness – this is particularly true on very large sites yielding over a hundred thousand potsherds. Indeed, a little fragment with an eroded surface does not yield as much information as a well-preserved decorated fragment or a set of potsherds refitted to form an almost complete vessel. Sorting them in different groups, a. eroded, b. small, c. body sherds, d. shapes (i.e. bottom to neck sherds) also reduces the quantity of material to be studied in detail.

(a) All eroded body fragments have to be counted and stored. Indeed, they give us very little information even though their composition can be informative at a later stage.

(b) Very small potsherds (less than 2 cm in diameter) whose shape and decoration are difficult to interpret should be counted and stored. Very small potsherds, like eroded ones, are very difficult to interpret and can be a waste of time on large assemblages.

The results of steps a. and b. can be summarized in a table or expressed as a function of the number of eroded or small potsherds per stratigraphic unit in a graph.

(c) Body sherds are then described, counted and stored. Fragments with complex designs may be kept apart for future reference and illustration.

(d) Bottom and neck potsherds (including refitted fragments whose shape allow for a reconstruction of a partial or complete profile) must be catalogued for further analysis. This group enables the calculation of the minimum number of individual vessels in each context and to establish a general typology.

In order to establish the catalogue, all the finds in the last group (d) must be photographed and inserted in plates organised by context and depth in the pottery assemblage (one may add some of the body sherds bearing complex designs as they are not represented elsewhere). This catalogue, which may constitute a teamwork document or an annex to a Masters or PhD thesis, is above all the complete report on what was found at a site.[6] A last sorting will be needed in order to select potsherds sufficiently well preserved, or particularly characteristic, to be drawn for the published version of the catalogue (which, depending on the budget, should at least display a figure for every type of vessel identified). As regards drawing, an internet search using keywords such as "archaeology, drawing, pottery" provides many drawing tutorials, but there are many different 'traditions' as regards how to represent the vessels and one should make sure to fit within regional conventions (see for instance Huffman, this volume, pp. 180-186) (**fig. 4**).

6 This is crucial as we know that collections may later be lost or deteriorate due to poor preservation conditions.

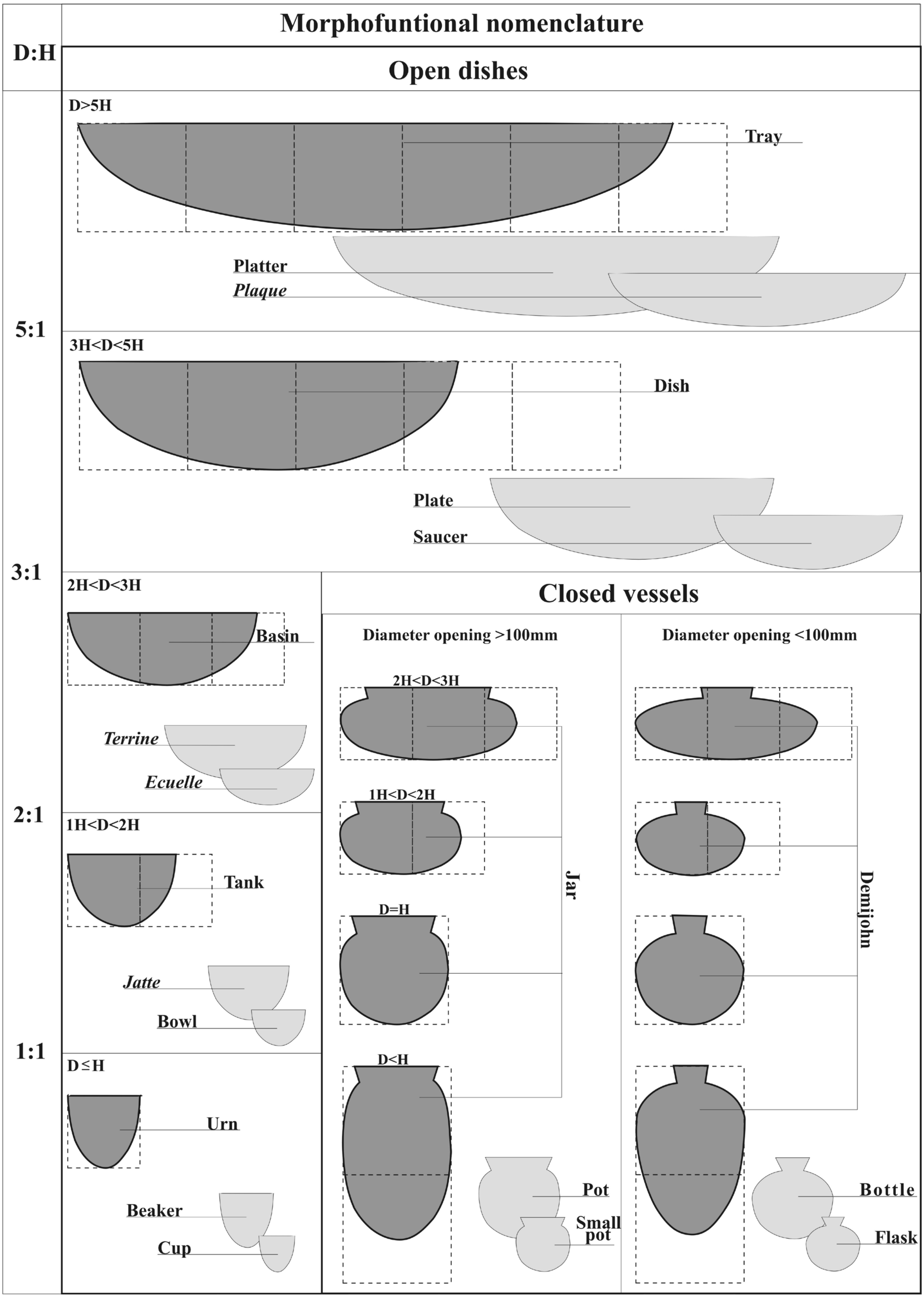

Fig. 5. P. de Maret (1985: 282), inspired by other researchers, suggested using a simple system to name the different types of vessels. This nomenclature should not be used as a strict classification system, as cases of continuum between some categories of vessels might occur, but it provides a simple way to sort out general forms, loosely related to broad functions. For example, once all the vessels that fall in the category of *bottles* have been identified in an assemblage, it is easy to go further and examine the various types of *bottles*. This scheme summarizes the various morphological categories and their nomenclature, it is based on a simple divide between *Open* and *Closed* vessels, sorted in three size classes, large (30cm<Diameter), medium (30cm<D<15cm) and small (D<15cm), depending on their maximum Diameter (D) - in each case the large size is in dark grey, with medium and small size in light grey. Open vessels are divided in four sub-categories depending on their diameter (D) to height (H) ratio. Closed vessels are divided in two sub-categories depending on the diameter at the opening (d): cooking & storing (d>10cm), liquid containers (d<10cm). Closed vessels with different D to H ratio are labelled under the same name because their function is essentially the same.

D. Analysis

Building a pottery typology can be done, theoretically, by confronting various existing pottery classifications or, intuitively, while building up the catalogue of finds. Here, we will focus on the second method. Indeed, it is rather easy, when building the catalogue of finds, layer by layer, to group vessels displaying similar shapes (**fig. 5**), and then with similar decorations (see Gallin 2011 for a robust decoration nomenclature).[7] Once the various categories of vessels in an assemblage are outlined (i.e. dishes, pots, bottles, jars, etc.), it is possible to distinguish different types within these categories (i.e. different kinds of bottles may be distinguished when considering the length of their neck or the shape of their belly, etc.). Unless the analyst is already very experienced, doing it gradually while laying out the pictures and drawings in correlation with the stratigraphy is easier than building a theoretical model in advance. The conclusion of this empirical and intuitive classification can be incorporated in a spreadsheet whose criteria include general information about the archaeological context of the vessel (latitude and longitude of the site, reference of the test-pit) and the detailed description of shapes, decoration, etc. (but see also Ozainne or Huffman this volume). This will permit the analyses of the spatial and chronological distribution of the various characteristics of pottery finds, at the site level (stratigraphic or plan analysis) or at a regional or continental level, using computer programs designed for this purpose (see for example http://www.qgis.org/en/site/, a free GIS software that can be used to make distribution maps).

Finally, it should be possible to establish typical pottery sets for a given area during a given period. A pottery set includes examples of all the types in each morpho-functional category, usually presented in one plate. It is useful, because it expresses in a simple way the range of vessels one may expect to find and highlights variations at the same time. For example, a certain type of 'cooking' pot may always be found in association with a series of other typical vessels (**fig. 6**). But it may also happen that in a given set, the type 'cooking' pot displays an important variability (**fig. 7**). Thus such sets make it more easy to identify stylistic variations that can be interpreted in terms of stratigraphic or cultural dynamics.

In many cases, it will only be possible to reconstruct partial shapes and some typologies are even built only on rim sherds. Whatever the case, the analyst should bear in mind that several shapes can share the same kind of opening or the same kind of base and frame their interpretation accordingly (**fig. 8**).

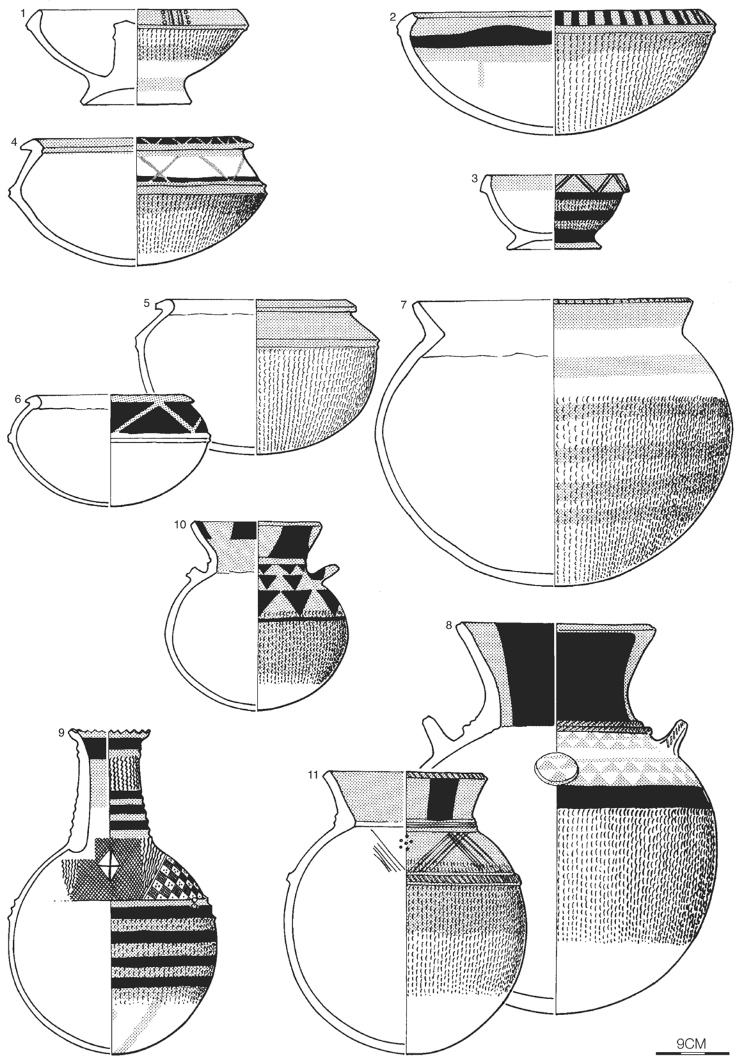

Fig. 6. Typical set of the Songhay pottery tradition of Mali, late 20th century AD (after Mayor 2011). As this material was produced by living potters their function is known: 1. ablutions; 2-3 washing; 4-6 cooking; 7-8 water storage; 10-11 water transport.

III. FURTHER ANALYSIS

When the typological and chronological framework of the pottery assemblages is firmly established, it is possible to answer some of the questions on stylistic variations by reconstructing pottery *chaînes opératoires* and studying their geographic distribution through time. Although there are important methodological gaps in the reconstruction of pottery manufacturing processes, a se-

7 Bearing in mind that the same shape may be represented several times with different decorations, but distinct shape may also be decorated in the same way. It is thus best to focus first on the shape and then on the decoration.

ries of analytical protocols are available (see van Doosselaere 2014 for a review) to identify raw materials and their preparation (combining mineralogical and chemical analysis), building methods (macroscopic examination of surfaces and fresh sections, x-radiography), ornamental methods (macroscopic examination and image analysis), firing techniques (archaeological data on firing structures and fuels combined with physical characteristics of the paste), post-firing treatments (no standardised analytical protocol), and use (macroscopic and binocular examination, analysis of food remains).

With minimal training, the observations and analysis can be done simply by looking at the potsherds (surface and sections) or examining them with a binocular microscope.

CONCLUSIONS

At the end, this process will allow the analyst to characterize typical sets of various types of vessels. For example, the typical set of an household assemblage will include vessels for service, cooking, storage and maybe some specific purpose items such as children's toys or sacred / ritual vessels. While the function of vessels is difficult to ascertain on archaeological pottery, it is possible to define broad morphological categories. It might then be possible to observe variations within a morphological category. For instance, one may observe that two distinct types of cooking pots were found on a given site or in an area. Differences generally mean that they were made by different people, but the question is 'how' different. The first possibility is that people were different because they did not live in the same time – in other words, one may observe diachronic variations (potsherds were found in the same levels, but they were made at different times and, later, mixed up in the archaeological layers). A second possibility is that vessels look different because people living more or less at the same time, but not in the same place, made them. Vessels can be carried far away from the place they were manufactured. But if different

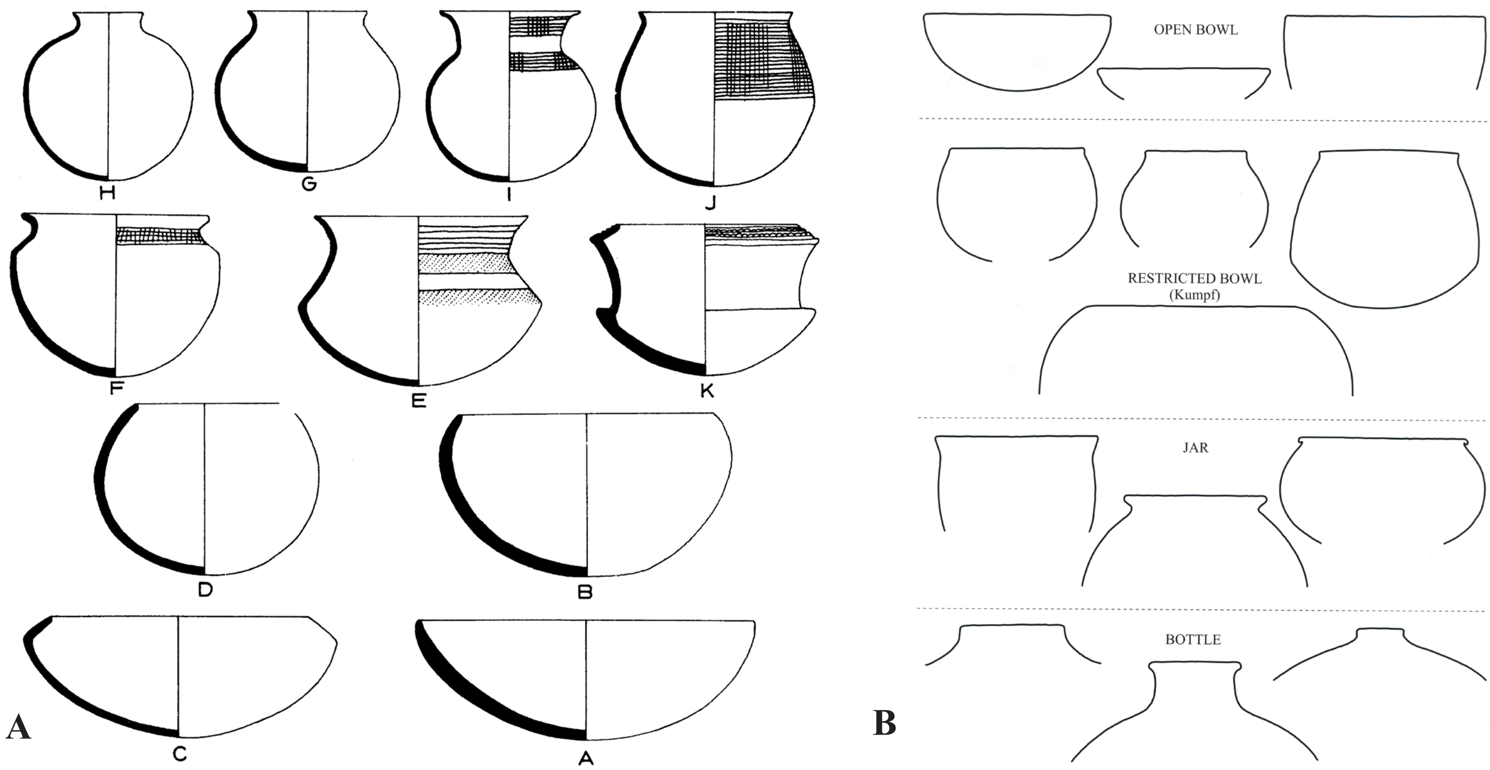

Fig. 7. Examples of archaeological pottery sets. **A**. Typical set of vessels that can be found in graves attributed to the Kabambian culture of the Upemba depression of DRC, 13th to 18th century AD (after de Maret 1985: 290) In this case, is it striking that the Kabambian funerary pottery set displays several types for the same category of *pots* (which can certainly be related to the chronological extension of this culture). **B**. Typical set of vessels found at the site of Gajiganna, Nigeria. They are attributed to the *Final Stone Age* and dated between 2500 and 3500 BP. The pottery material excavated from a settlement site did not yield as many complete vessel shapes as the aforementioned graveyards, but it is still possible to characterise typical pottery sets and outline variations within morphological categories. Exploring the chronological and spatial variation of such variations is the first step of interpretation.

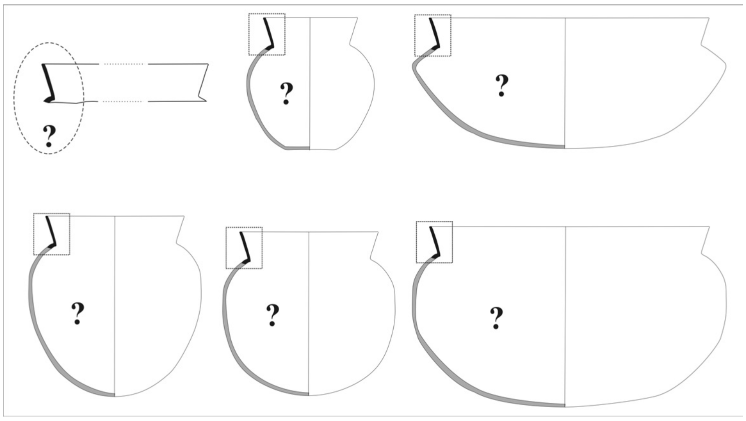

Fig. 8. One should be careful when using typologies based on pottery fragments only, as distinct categories of vessels may share, in part, similar profiles. In this example hypothetical case, based on archaeological observations, one can see that partial profiles offer a limited view of the assemblage. Refitting is crucial.

vessels from one morphological category were made at the same time and in the same place, they must have been made by people belonging to different social groups or sub-groups – for example, people belonging to different nations or distinct linguistics groups or even different sexes. In short, synchronic and local stylistic differences always mean that there is a certain degree of social distance between the producers.

The interpretation of pottery analytical results is a complex business. This contribution covers the first steps of the process and should be seen essentially as guideline. Ultimately, this protocol will need to be adapted to the archaeological material to which it is applied.

In the same way, interpretations drawn from this protocol will always be dependent on the questions the archaeological team will want to answer, but, ultimately, one should always bear in mind that archaeological pottery should inform us on the lifeway of past people. Before undertaking any analysis, always make sure it is going to achieve results that can be interpreted in terms of human behaviour.

REFERENCES

Delvoye, A., 2012. 'La céramique de l'aire mégalithique sénégambienne à travers le cas de la nécropole de Wanar (Sénégal). Étude des répertoires formels, décoratifs et approche technologique. Campagnes 2005-2011', in *Centre d'Archéologie et d'Histoire de l'Art de Michelet*. Paris: Université Paris I Panthéon-Sorbonne, 128 p. + 96 p.

van Doosselaere, B. 2014. *Le Roi et le Potier. Étude technologique de l'assemblage céramique de Koumbi Saleh, Mauritanie (5e/6e-17e siècles)*. Frankfurt am Main: Africa Magna Verlag.

de Maret, P. 1985. *Fouilles archéologiques dans la vallée du Haut-Lualaba, Zaïre.* Vol.II*: Sanga et Katongo 1974. Volume I: Textes.* Tervuren: RMCA.

de Maret, P. 1999. 'The power of symbols and the symbols of power through time: probing the Luba past', in S.K. MacIntosh (ed.), *Beyond chiefdoms: pathways to complexity in Africa*. Cambridge: Cambridge University Press, p. 151-165.

Gallin, A. 2011. *Les Styles céramiques de Kobadi : analyse comparative et implications chronoculturelles au Néolithique récent du Sahel malien,* Frankfurt am Main: Africa Magna Verlag.

Mayor, A. 2011. *Traditions céramiques dans la boucle du Niger : ethnoarchéologie et histoire du peuplement au temps des empires précoloniaux* (Series 'Peuplement humain et paléoenvironnement en Afrique de l'Ouest', no 2), Frankfurt am Main: Africa Magna Verlag.

Wendt, K.P., 2007. Gajiganna – Analysis of Stratigraphies and Pottery of a Final Stone Age Culture of Northeast Nigeria, Frankfurt am Main: Africa Magna Verlag.

Wotzka, H.-P. 1995. *Studien zur Besiedlungsgeschichte des* äquatorialen *Regenwaldes Zaïres: Die archäologische Keramik des inneren Zaïre-Beckens und ihre Stellung im kontext der Bantu-Expansion.* Köln: Heinrich Barth Institut.

DEFINING POTTERY STYLES

Tom Huffman[1]

INTRODUCTION

All classifications are arbitrary in that many variables could be selected: the choice depends on the purpose of the classification. One purpose is to identify real groups of people in the archaeological record. By 'real groups' we mean people who shared a common history, language and cultural norms in contrast to other such groups. Many groups at this broad scale have used material- culture signatures to demarcate, negotiate and recreate their identity. Indeed, people sometimes use their material-culture differences to distinguish themselves from other groups with whom they interact daily (Hodder 1982). The material-culture signature at the group level often includes a common repertoire of designs on different items, ranging from small wooden boxes, headrests and meat platters to drums, smelting furnaces, houses and granaries, as well as the human body.

Fortunately for archaeologists, decorated pottery is part of this larger 'design field'. In the recent past, some 47% to 75% of designs found on other media also occurred on pottery. We know from archaeological evidence that design fields existed in the past, for designs on stonewalls also occurred on the pottery in 13th to 15th century Zimbabwe culture palaces, while designs on the famous Lydenburg ceramic masks also occurred on the associated 8th century pottery (Inskeep & Maggs 1975). This is the empirical justification for using ceramic style as a proxy for people. As long as the makers and users were the same (and the style is complex), ceramic style can be used to recognize groups of people, their movements and interactions with other groups.

I. GROUP IDENTITY THROUGH STYLISTIC ANALYSES

It is possible to characterize a ceramic style by a multidimensional analysis that selects three variables: profile, layout and decoration.

Vessel **profile** provides different areas to be decorated, while **layouts** are the combinations of different **decoration** positions used on any one vessel, for example rim (position 1), neck (position 2) and shoulder (position 3). Note that these positions must be determined from the assemblage under study. The variable of decoration encompasses all motifs that occupy a single decoration position. Combinations of the three variables create a **stylistic type** and the complete list of types defines the **ceramic unit** (called a '**facies**' in my scheme). **Figure 1** illustrates a set of interrelated jar types belonging to the Ziwa facies in Zimbabwe. Because the types are the result of repeated choices, this approach captures the underlying structure of a ceramic facies (Huffman 1980).

Note that the Ziwa types are based on complete profiles. Analyses based on shards alone are deceptively attractive but inadequate. They appear scientific in that they often have numerical codes and are easy to count. However, shard analyses can not characterize a style because they ignore purposeful combinations. More detail about determining stylistic types will be useful.

A. Procedure

Preparations begin in the field. Many archaeologists sort

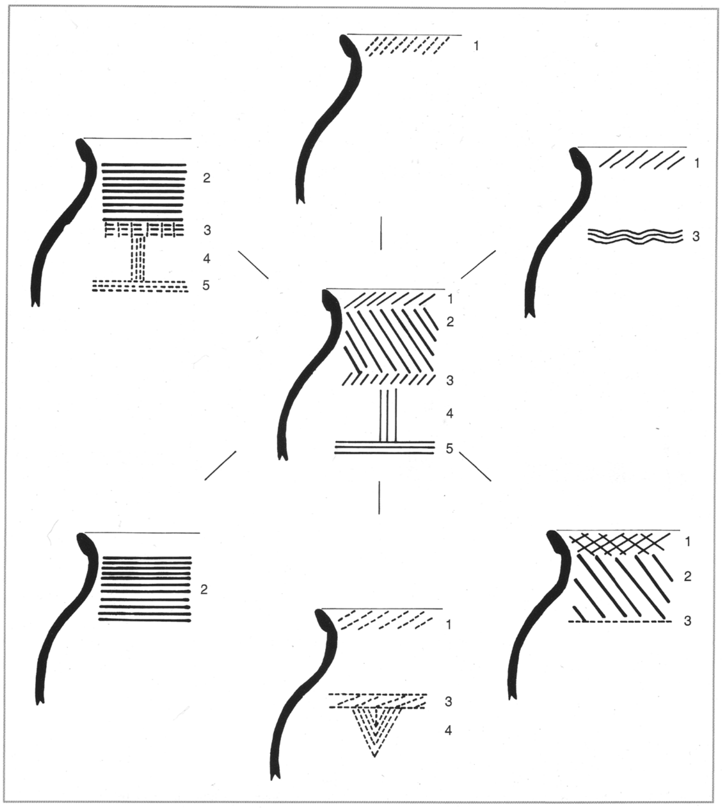

Fig. 1. Interrelated stylistic types of *Ziwa*. In terms of design layout, the outer types are simpler versions of the most complex type in centre. (From Huffman 2007: 112.)

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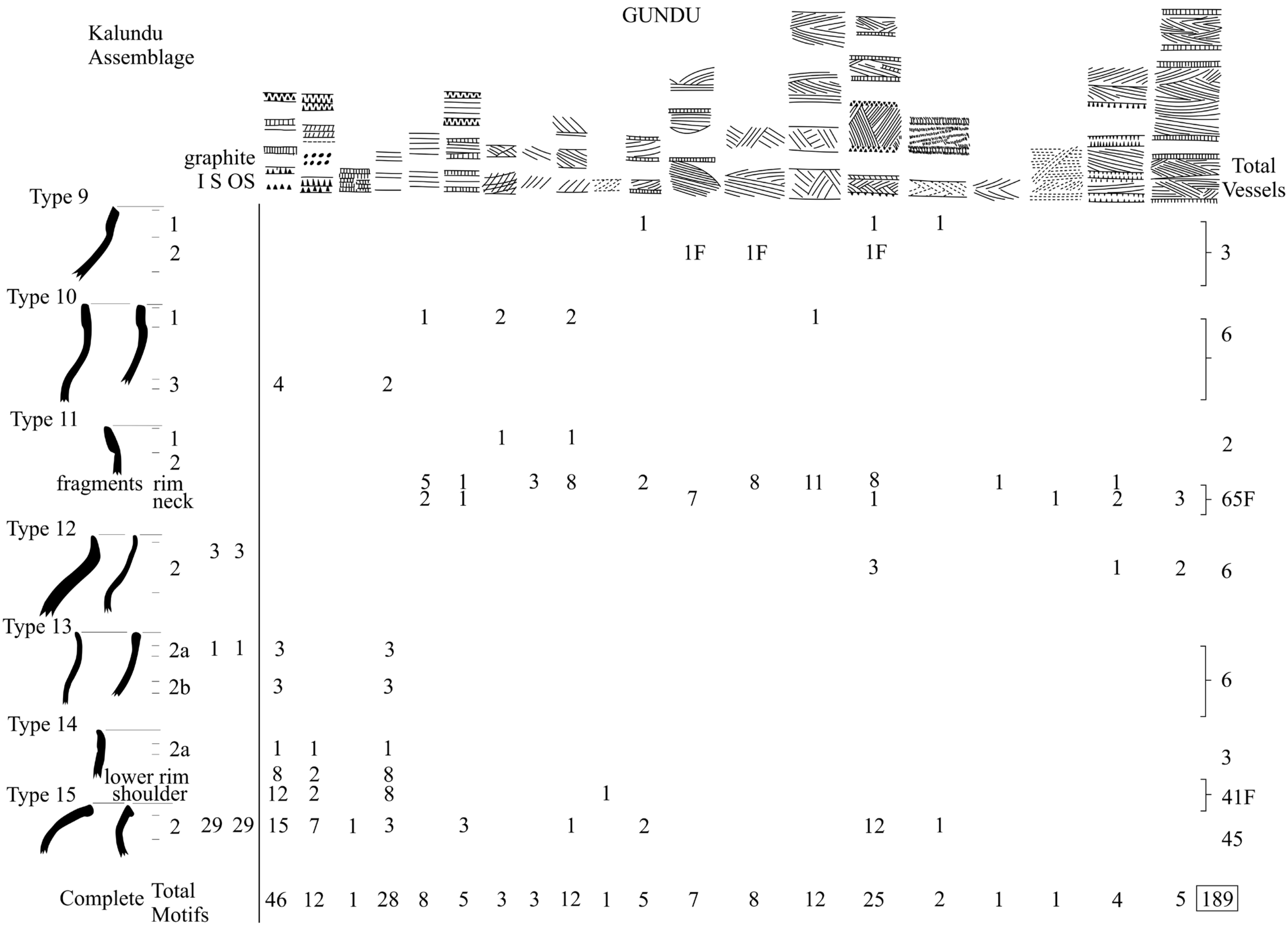
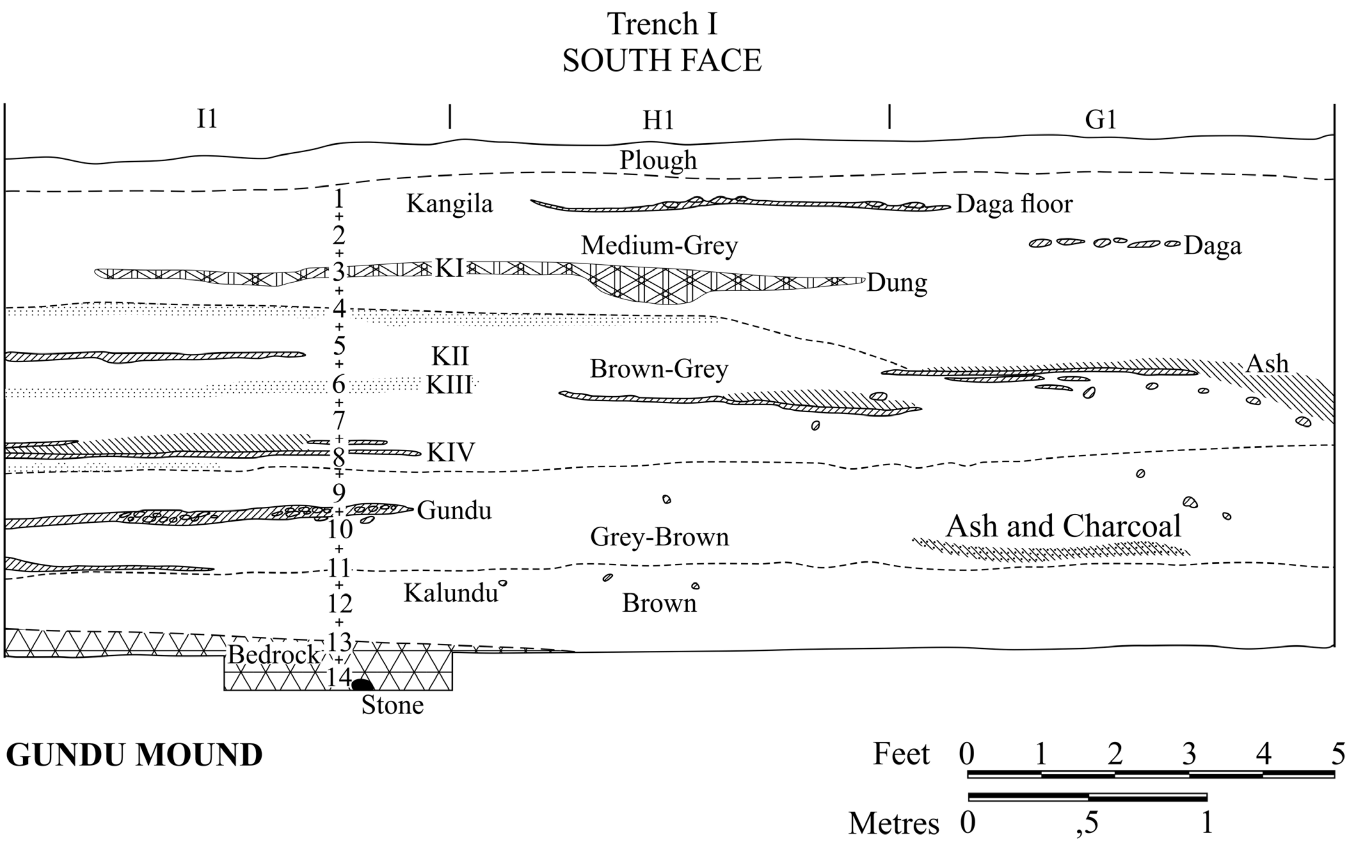


Fig. 2. Stylistic types of a *Kalundu* assemblage from the Gundu site in Zambia. (From Huffman 1989.)

on site, discarding small fragments and undecorated body shards (after counting them). One should keep a representative sample of different vessel parts for material analyses and fragments with a residue for functional analyses. If possible, the ceramic collection should be washed and labeled in the field. Ideally, the labels should be the excavation code (e.g. trench, square and level, or feature). At the least, there should be a number for each shard, from 1 to n. The analyst will want to return to the same vessel on different occasions and a unique number will prove invaluable. If this is the only number, excavation codes should be kept in a notebook.

Some simple steps help to save time and to organize the analysis. First, separate the shards into profile categories, for example recurved jars, straight-sided beakers and curved bowls. Refit fragments from the same vessel, and draw examples of each profile. Secondly, divide the profiles into vessels with the same layout; that is to say, decoration in the same positions. Refit fragments from the same vessel and draw examples of each layout. Vessels with the most decoration will help to determine the different decoration positions, as shown in **Figure 1**. Thirdly, divide the layouts by type of decoration, i.e. complete single bands, multiple bands, spaced motifs, animals, etc. Categories of decoration are more important than individual motifs. Once again, refit fragments from the same vessel and draw examples of each complete motif. You should now be able to determine stylistic types by the combination of profile, layout and motif. Draw examples of each type. The journals *Azania* and *Southern African Humanities* provide good examples. Good illustrations must be clear, easy to understand and representative.

A table is a useful format for describing types and it provides a check on the internal consistency of the analysis. A type that has decorations in positions 1 and 3, for example, should not have an example with decoration in



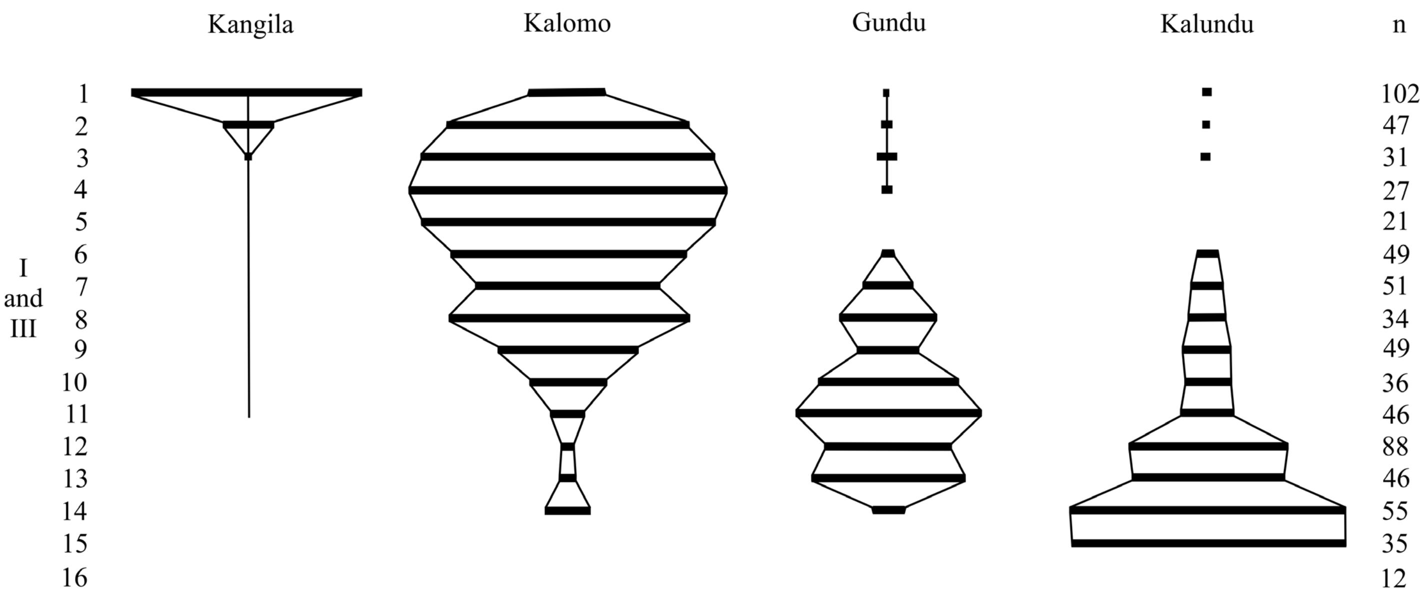


Fig. 3. Stratigraphic distribution of ceramic assemblages at the Gundu site in Zambia and section drawings of Trench I. (From Huffman 1989.)

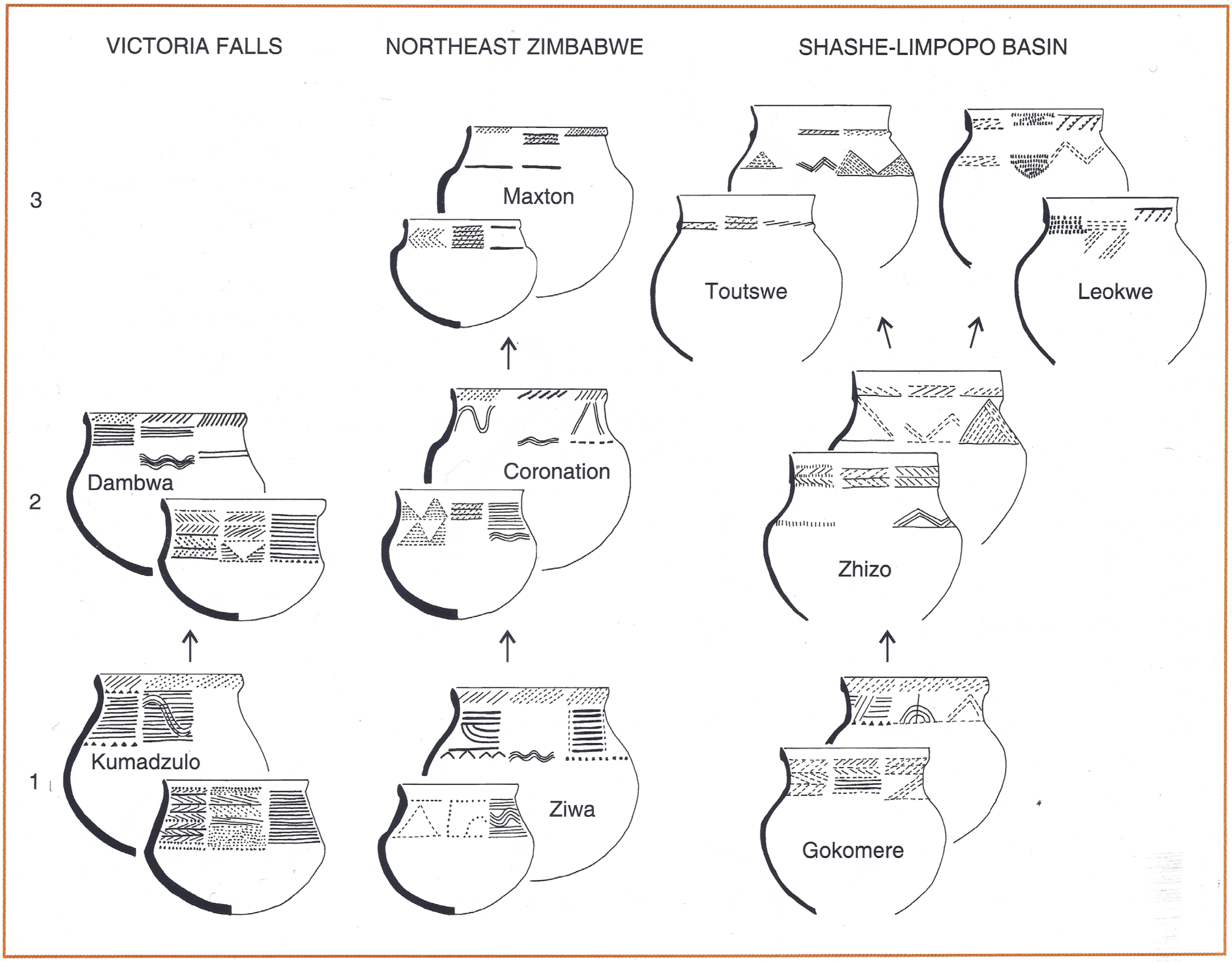


Fig. 4. Sequence of ceramic facies in the Nkope Branch of the Urewe Tradition; note the continuities. (From Huffman 2007: 114.)

position 2 (this was a common mistake of my students). Finally, compile a list of all complete motifs from the drawings. Here fragments can be useful. **Figure 2** lists the stylistic types for a Kalundu assemblage in Zambia (Huffman 1989); the range of motifs appears at the top, while profiles and positions of decoration are in the left-hand columns. Note how drawings are easier to understand than numerical codes.

Some analysts may wish to include plain vessels to be complete. One should remember, however, that plain vessels cannot form a multidimensional type because they lack a layout and decoration. Furthermore, a numerical comparison could create a spurious relationship between otherwise unrelated assemblages if both had many plain vessels (I return to numerical comparisons later). Plain vessels can nevertheless help to interpret site formation (See Assoko Ndong, this volume, pp. 120).

B. Stratigraphic distributions

Because much of a settlement is open space (up to 80%), overlapping village horizons are not always apparent during excavation. Ceramic distributions can help with this problem. First, large shards lying flat, or the location of reconstructed vessels, often mark a walking surface. Individual shards, on the other hand, can have a surprisingly wide horizontal and vertical distribution because of burrowing animals and because villagers themselves disturbed the ground by digging post holes, trenches and pits of various kinds (e.g. burial, soil and storage). This is another reason for refitting fragments. Furthermore, fragments of the same vessel in a midden, say, and house rubble link these two activity areas to the same horizon. But otherwise, the horizontal distribution of stylistic types reveals little about activity areas in a single village. Functional types based on shapes and sizes are better suited

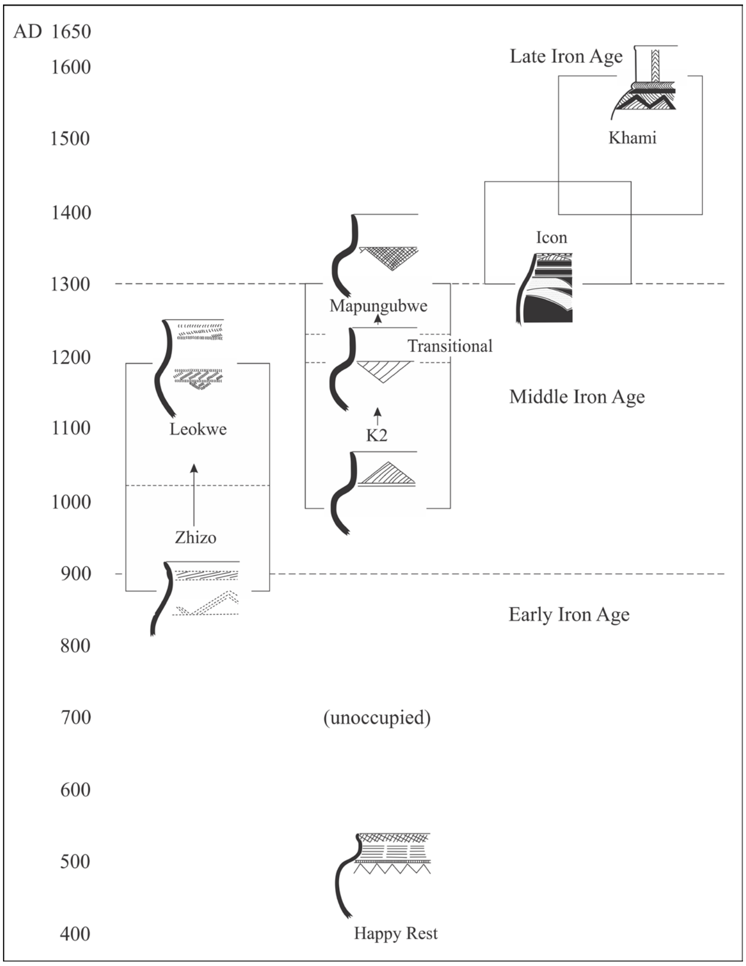


Fig. 5. Culture-history sequence for the Mapungubwe landscape.

for this purpose. In a large complex settlement, however, different styles in different areas at the same level may reveal group interaction.

Secondly, the vertical distribution of shards and vessels can reveal separate village horizons.In this regard, stratigraphic tables should replicate reality, so the deepest levels should be at the bottom. The oldest types will then be the lowest in the deposit. **Figure 3** presents one such plot for a site in Zambia with four components. Note that the proportions of each group are calculated in terms of the total for each horizontal level, not the vertical axis. Coupled with other excavation data, the Kalundu horizon in Trench I encompasses levels 15 to 14; the Gundu horizon levels 13 to 10; and the Kalomo horizon from levels 9 to 2. Other data show that the Kalomo horizon encompassed several separate village levels with the same pottery. Thus, the ceramic distribution needs to be coupled with other excavation data.

The vertical distribution of vessels can also help to determine whether a site was continuously or intermittently occupied. Fragments are not so helpful because of their mobility. In the case of reconstructed vessels and large fragments, vertically spaced clusters indicate that a site was not continuously occupied. **Table 1** presents a hypothetical distribution of vessels from three occupations: Group A from levels 11 to 9; Group B from levels 5 to 2; Group C in level 1. Note how the distribution of fragments suggests continuous occupation but not the vessels and large pieces. Rather than fragments, stratified house floors with the same pottery, as in the Kalomo levels in **Figure 3**, indicate continuous occupation.

The stratigraphic distribution of different styles at a number of sites forms the framework for a culture-history sequence: the who, when and where of the archaeological record.

II. CULTURE-HISTORY SEQUENCES

In areas with little or no previous research, a culture-history sequence is a primary goal. These sequences are basic to other studies, such as lifeways, paleo-environments and the explanation of change.

A. Continuity and discontinuity

A sequence is formed by comparing the ceramic styles from several sites and then arranging them in chronological order. Often, a visual inspection is sufficient, especially when the styles are based on multidimensional types. **Figure 4** illustrates a sequence of different facies in the same tradition. Note that the stylistic structure remains similar through time: changes occur in the popularity of specific layouts and motifs, and a reduction in the size of motifs and decoration positions. Clearly, ceramic change is not random: what occurred before conditions what is acceptable in the future. Ceramic change is also not random because it is constrained by the conventions of the larger design field

Besides visual inspection, it is possible to compare styles both quantitatively and qualitatively (see **Table 2**). In this case, one simply lists the types on one side of a table, put the styles across the top (either from sites or facies) and count the types in common, either by presence/absence, log scores or actual numbers: how one counts is not as important as what one counts. Table 2 presents a hypothetical example: here Style A is not related to either Style B (12.5%) or C (13.3%), but B and C are closely related (80%).

Figure 5 presents a sequence for the Mapungubwe

Level	Group A	Group B	Group C	Total
1	4 (1f)	11 (2f)	7 (5f)	**22 (8f)**
2	2 (5f)	7 (3f) large pieces	(3f)	**9 (11f)**
3	1 (5f)	6 (5f) large pieces		**7 (10f)**
4	5 (11f)	4 large pieces		**9 (11f)**
5	3 (7f)	3 (3f) large piece		**10 (10f)**
6	2 (9f)			**2 (9f)**
7	(3f) small			**(3f)**
8	4 (8f)	1		**5 (8f)**
9	14 (18f) large pieces	4		**18 (18f)**
10	5 (20f) large pieces			**5 (20f)**
11	7 (18f) large pieces			**7 (18f)**

Table 1. Hypothetical distribution of ceramic groups showing three occupation horizons: group A from levels 11 to 9; group B from levels 5 to 2; group C in level 1.

	Style A	Style B	Style C
Type 1	X		
Type 2	X		
Type 3	X		
Type 4	X		
Type 5	X		
Type 6	X		
Type 7	X		
Type 8	X	X	X
Type 9		X	
Type 10		X	
Type 11		X	X
Type 12		X	X
Type 13		X	X
Type 14		X	X
Type 15		X	X
Type 16			X
Total	**8**	**8**	**7**

A/B = 2/16 x 100 = 12.5%; **A/C** = 2/15 x 100 = 13.3%; **B/C** = 12/15 x 100 = 80%

Table 2. Hypothetical occurrence of types at three sites and their similarity indices.

landscape that includes unrelated facies. In this sequence, K2, Icon and Khami represent population movements because they have different stylistic structures (i.e. different layouts and motifs) and they occur earlier somewhere else. The sequence from K2 to Mapungubwe, on the other hand, represents an ethno-linguistic continuity (i.e. a continuity in history, language and cultural norms). Note that comb-stamping dominates Zhizo and Leokwe pottery in contrast to incision in K2, TK2 and Mapungubwe. These different decoration techniques are useful as keys to help identify different facies in the field. Field keys, however, do not define a ceramic facies because they are based on isolated elements; only multidimensional types serve that purpose.

This sequence illustrates a few other related points.

B. Boundaries and interaction

In Hodder's (1982) East African study, the degree of interaction did not create group identities: the identities were the result of shared histories, cultural norms and so on in contrast to other such groups. The boundaries between groups were most marked when there was economic competition. In the Mapungubwe landscape, the Motloutse River marked such a boundary during the Middle Iron Age: to the west Toutswe pottery was dominant, while K2 pottery characterised settlements to the east.

Because the origin of a style resides in group identity, when the makers and users are the same (and the style is complex), the distribution of the style mirrors the distribution of the group. But there are times when pottery of one style appears in another style area as a result of marriage alliances. In the Shona world, for example, a new bride is supposed to take various unused items from her maternal home to her new abode, and pots are one of these (Aschwanden 1982: 189-194). If the woman comes from a different style area, the marriage introduces a 'foreign' vessel into the husband's village.

In addition to marriage alliances, a ceramic style may not represent a single group. For various reasons, people may adopt another language and political identity. In such contexts, ceramic style may reflect the dominant group, while the social minority may retain other aspects of their material culture (such as household organization). In other contexts, material-culture signatures may not reflect a previous identity because the people were totally assimilated or because they merged to form new identities.

In complex social situations such as these, the relationship between ceramic style and real groups of people is not straightforward. This is why the study of group identity through ceramics is intellectually challenging.

REFERENCES

Aschwanden, H. 1982. *Symbols of life*. Gweru (Gwelo), Zimbabwe: Mambo Press.

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

Huffman, T.N. 1989. *Iron Age migrations: the ceramic sequence in southern Zambia, excavations at Gundu and Ndonde*. Johannesburg: Witwatersrand University Press.

Huffman, T.N. 2007. *Handbook to the Iron Age: the archaeology of Pre-Colonial farming societies in southern Africa*. Pietermaritzburg: University of KwaZulu-Natal Press.

Inskeep, R.R. & Maggs, T.M. 1975. 'Unique art objects in the Iron Age of the Transvaal'. *South African Archaeological Bulletin* 30: 114-138.

IRON OBJECTS

David Killick[1]

INTRODUCTION

Metallic iron is not stable under atmospheric conditions; in the presence of oxygen and water it corrodes to iron oxides and hydroxides. Iron is more reactive than copper, and thus copper objects are generally better preserved than iron objects where these occur together in an archaeological assemblage. The rate of corrosion of iron is greatly increased by the presence of chloride ions, so iron from shipwrecks and from coastal archaeological sites is usually much more heavily corroded than iron from sites inland. Conversely, where humidity is low and chloride ions are absent, as in tombs of Egyptian elites, the preservation of iron may be excellent – as seen for example in the iron dagger (probably of Anatolian origin) in the tomb of Tutankamum (died 1323 BCE).

I. EXCAVATION OF IRON FORGING SITES

Forges at which iron blooms were worked into iron artefacts are often difficult to recognize in Africa, where many smiths worked in the open air – the remains of the forge fire may be as simple as a small pit in the ground surface, and the anvil just a flat rock. The most recognizable artefacts associated with forges are the small planoconvex or cylindrical slags that accumulated at the bottom of the forge pit. These formed by reaction between iron oxide scale that flaked off the hot iron and the clay and sand at the base of the forge pit. They may also incorporate slag that was squeezed out of pieces of hot bloom during forging. **Figure 1** shows a forge site in Senegal that has been excavated down to the base level of the slag pits. Each of these pits was formerly underneath a forge fire. When the pit filled with slag, the forge fire was relocated over a new pit. The area of compacted soil is presumed to mark the spot where a rock anvil was once located.

Not all iron forges form such distinctive slags (e.g. Soulignac 2014), but around all forges one can find tiny thin flakes of hammerscale, and tiny spheres of slag (1-2 mm) that were expelled as liquid from the hot iron by the impact of the hammer, and solidified in travel through the air. These flakes and spheres are strongly magnetic, so the soil around a suspected forge should always be tested with a strong magnet. Any material attracted to the magnet should be compared to the excellent illustrations of hammer scale and slag spherules in Allen (1986). Small scraps of iron that were cut off, or fell off, the objects during forging are also often found on the ground around forges.

Fig. 1. A forge site in Senegal excavated down to the base level of the slag pits. (Photo © D. Killick.)

II. TREATMENT AFTER EXCAVATION

A. Conservation

There should in theory be no metallic iron remaining in thin iron objects (blades, hoes, wires, etc.) after a thousand years in contact with tropical soils, but in fact there sometimes is a core of metallic iron within the object. This has survived because an impermeable jacket of corrosion had formed, preventing water and oxygen from penetrating further into the object. The corrosion jacket is however easily cracked during excavation, which allows corrosion to begin again. A strong response of an 'iron' object to a magnet does not necessarily mean that there is any metallic iron left in the object, as the first product of corrosion is magnetite (Fe_3O_4), which is also strongly magnetic. The best way to find whether there is iron in the core, and to infer the original morphology of a heavily corroded object, is to take an x-ray image – a conventional medical x-ray system works well for this. If this is not available, a very careful cut into the side of an object with a hacksaw blade can establish whether there is an iron core.

Iron objects tend to corrode rapidly after excavation because of cracks in their corrosion jackets induced by

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trowels and other tools. Conservation of archaeological iron is difficult and expensive. The usual technique is to remove all chloride ions by multiple changes of distilled water, preferably assisted by electrolysis, and then to dry the object thoroughly. It must then be stored in a room with constant low humidity, or packed in a tightly sealed container with silica gel, which absorbs water vapour (and must be baked out 3-4 times per year to restore its capacity to absorb water). Iron objects should not be stored in standard paper bags or cardboard (which are made of acid paper) nor placed directly on wooden shelves.

If long-term conservation of iron objects is simply too expensive, then they must be documented before they are completely destroyed by post-excavation corrosion – which in humid environments can occur in as little as five years. Many iron objects are unrecognizable when excavated because of an irregular coating of soil cemented by iron hydroxides from the corrosion of the object. This coating can be removed by gentle scraping, or by a small electric grinding tool, until the original morphology of the object is revealed, at which point it should be drawn and/or photographed. The original surface will not be metallic, but can be recognized by change of colour and the absence of sand grains.

B. Metallography and chemical analysis

Surface techniques of chemical analysis, such as x-ray fluorescence, usually yield no useful information on iron artefacts because they do not penetrate through the corrosion. Scientific study of corroded iron artefacts is done on cross-sections or longitudinal sections removed from artefacts with a hacksaw or wafering saw. The sections are then mounted in epoxy or bakelite resin, ground flat and highly polished for the metallurgical microscope (Scott 2014). Etching of the polished surface with very dilute nitric acid reveals the grain structure of the metal, and whether the material is pure iron (ferrite), steel (0.3-2.0% carbon) or cast iron (>2.0% carbon). It can also reveal whether the artifact was forged from a single piece of metal, or assembled by forge-welding two or more pieces together, and whether steel (if present) was placed where it would be most effective – i.e. on the cutting edges of knives and axes.

The metallographer can also distinguish between steel that was slowly cooled in air (pearlite microstructure) and steel that was rapidly quenched in water (martensitic microstructure) and subsequently tempered in a cool fire to achieve a good balance of hardness and toughness (bainitic microstructure). Quenched and tempered steel is much harder than air-cooled steel, but at present there is little evidence for such treatment of steel in precolonial sub-Saharan Africa. This may simply reflect the fact that relatively little metallography of ancient African iron has been done outside South Africa (for which see Miller 2002). Much more metallography needs to be done in other parts of Africa before any reliable conclusions can be drawn about the technical skills of ancient or historic African blacksmiths.

The oldest objects of forged iron on the African continent are from Predynastic Egypt and date to about 3200 BCE (Rehren *et al.* 2013). Although they are completely corroded, they are definitely identified as forged pieces of an iron meteorite by the relatively high levels of nickel, cobalt and germanium in the corrosion products. Any iron artifact in Africa that is dated to earlier than ca. 500 BCE should always have the concentrations of these elements measured by some sensitive bulk technique, such as neutron activation analysis, to check whether the object in question is meteoritic or smelted iron. Meteoritic iron also has a characteristic appearance in metallography (Widmanstätten structure), though this may be significantly distorted by forging. The presence of nickel alone in iron does not necessarily prove meteoric origin. Nickel is concentrated in ultrabasic rocks, which are present in many parts of Africa, and nickel may accumulate in the laterites that form over them. Since nickel oxide is more easily reduced than iron oxide, the smelting of these laterites will produce iron-nickel alloys.

C. Provenance

Unlike copper, iron cannot usually be traced to a particular ore source. This is because iron is a common element (7.06% of the earth's crust by mass) whereas copper is a rare element (75 ppm) (Killick 2014, Table 2.1). There are therefore relatively few copper ore bodies, and these are of limited spatial extent and generally well separated from each other. The iron ore used in many parts of sub-Saharan Africa was laterite, which formed in the soil by tropical weathering. Laterites may form continuous sheets over hundreds or even thousands of kilometres on the major African cratons, and there is no reason to believe that would be chemically distinct regions within these that could be realistically distinguished as 'sources'. There are however some less common ores that leave chemical traces in the metal, so it may sometimes be possible to recognize the type of ore used, if not the specific location where it was obtained. Abdu and Gordon (2004) have shown that some post-Meroitic iron in Nubia contains distinctive levels of arsenic and phosphorus. African iron artifacts smelted by the bloomery process always contain minute stringers of entrapped slag, and the composition of these can be measured by scanning electron microscope or by electron microprobe. Slag stringers in archaeological iron from the Lowveld of north-eastern South Africa sometimes show high levels of titanium and vanadium, which result from the smelting of magnetite-ilmenite ore from Precambrian igneous intrusions (Gordon and van der Merwe 1984).

D. Direct dating of iron and steel

In precolonial Africa iron was always smelted with charcoal, not with coal, and forges were fuelled by charcoal or wood – or, in some arid areas, with dung. Any steel produced in furnace or forges using biomass fuel will therefore contain radiocarbon, and thus steel artefacts can be directly dated if necessary. Usually iron objects are dated by association with radiocarbon dates obtained on charcoal (preferably from annual or short-lived plants) but if there are doubts about the association of the steel object with the charcoal sample(s), then it makes sense to date the steel objects directly (e.g. Kusimba *et al.* 1994).

CONCLUSION

African iron artefacts have been much studied by art historians, but within archaeology much more attention has been paid to iron smelting than to iron smithing, and forged iron artefacts themselves have received even less technical study. Iron artefacts are a potentially important source of information on technological knowledge and skills in past African societies, but these can only be inferred from chemical and metallographic data. Iron typically deteriorates rapidly after excavation unless treated by conservators. If the expense of conservation cannot be justified, then full documentation (cleaning, photography, illustration) and scientific study must be done as soon as possible after excavation.

REFERENCES

Abdu, B. & Gordon, R.B. 2004. ‘Iron artifacts from the land of Kush’. *Journal of Archaeological Science* 31: 979-98.

Allen, J.R.L. 1986. ‘Interpretation of some Romano-British smithing slag from Awre in Gloucestershire’. *Journal of the Historical Metallurgy Society* 20: 97-105

Gordon, R.B. & van der Merwe, N.J. 1984. ‘Metallographic study of iron artefacts from the eastern Transvaal lowveld, South Africa’. *Archaeometry* 26: 108-127.

Killick, D. 2014. ‘From ores to metals’. In B. Roberts & C. Thornton (eds). *Archaeometallurgy in Global Perspective: Methods and Syntheses*. New York: Springer, pp. 11-46.

Kusimba, C.M., Killick, D. & Cresswell, R.G. 1994. ‘Indigenous and imported metals in Swahili sites on the Kenyan coast.’ In S.T. Childs (ed.). *Society, Culture and Technology in Africa*. Philadelphia: The University of Pennsylvania Museum (series ‘MASCA Research Papers in Science and Archaeology’, Supplement to vol. 11), pp. 63-77.

Miller, D.E. 2002. ‘Smelter and smith: metal fabrication technology in the southern African Early and Late Iron Age’. *Journal of Archaeological Science* 29: 1083-1131.

Scott, D.A. 2014. ‘Metallography and microstructure of metallic artefacts’. In B. Roberts & C. Thornton (eds). *Archaeometallurgy in Global Perspective: Methods and Syntheses*. New York: Springer, pp. 67-90.

Soulignac, R. 2014. ‘Les scories de forge du Pays Dogon: Ethnoarchéologie et Archéométrie des Déchets de Forgeage du Fer.’ PhD dissertation, Université de Fribourg.

COPPER

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INTRODUCTION

Copper's importance in sub-Saharan Africa was emphasised by Eugenia Herbert (1984) in *Red Gold of Africa*, an irreplaceable work on the metal's cultural, economic and technological history over the long term and across the continent. Copper recovered south of the Sahara has been circulating in the form of finished products and semi-finished ones such as ingots and other 'metal reserves' that, depending on the time and place, could be prestigious objects and other social status emblems, or monetary objects in the Aristotelian sense – that is, as a store of value, a medium of exchange, or even, in some cases, a monetary unit (see Nikis, this volume, pp. 197-201 and **fig. 1**). In some regions, its value was equal to gold's today. In the Muslim trans-Saharan trade, North African copper was, next to salt, the most sought-after product in exchange for gold, yet even its vast reach did not stop local exploitation of West African Sahelian deposits and perhaps even stimulated it (Garenne-Marot 1993 ; 2007).

Copper ore is much less widespread than iron ore, and modern mining often obliterated ancient remains, but deposits in West, Central and Southern Africa were largely exploited in the past.

Many remnants of ancient copper production exist: mines and ores, primary and secondary metallurgical installations, semi-finished (ingots) and finished objects. Copper metallurgical techniques all along the production chain vary according to region and period. Documenting all the chain's stages, from the mine to finished product, would of course be the ideal way of writing a history of copper metallurgy in Africa. But often the object, whether finished or semi-finished, is the sole witness of a metallurgical tradition. Nevertheless, if it comes from a dated archaeological context, the copper object holds information that targeted analyses will help to reveal.

I. MATERIAL CHARACTERISTICS

Copper has many qualities: hardness, durability, lustre but also sonority (it is the metal of bells!). Unlike ceramics, it is almost infinitely reusable with the same renewed capacities of plastic deformation. It is exceptionally resistant to being buried. Copper or copper alloy is often the sole evidence of long distance relations: in the case of the trans-Saharan trade, it is the main indicator of exchanges because salt, like other perishable goods, has disappeared from archaeological layers. On the other hand, copper-based metal's longevity and infinite reusability make its use as a chronological indicator highly relative.

A. Iron and copper: essential differences

Copper can be alloyed with other metals, altering its plasticity and aesthetic properties. This is different from iron. Before blast furnaces and the possibility of reaching temperatures high enough to melt and alloy iron with other metals such as nickel, chrome or aluminium, the only element with which iron could be alloyed was carbon, and steel types are determined by their amount of carbon content. Copper, however, is found in an entire range of metals known since ancient times: pure copper and alloys, whether binary (copper with lead, bronze or brass), ternary (bronze with lead, brass with lead) or even quaternary (**fig. 2**).

Copper's malleability allows a wide range of shapes and sizes. It can be formed by forging, hammering and stretching – the same techniques for shaping iron – but also by casting the liquid metal in open or closed moulds, which in the case of the lost wax (or latex) casting technique can produce a metal object of complex geometry (**fig. 4**).

II. CHARACTERISING METAL AND COPPER OBJECT PRODUCTION TECHNIQUES: AN 'AUTOPSY'

Studying metallic objects reveals their metal's characteristics and how they were made.

Visual surface examination can reveal signs of how the object was made, such as welds, casting defects, repairs, etc. The metal's appearance is, however, misleading: the archaeological object is covered with a layer of corrosion that completely masks its original colour (**fig. 3**). Pure copper is red/pink and becomes more or less golden when alloyed – though colour alone cannot determine with which metals. Only elemental analysis can determine the exact composition.

A. Metallic composition analyses or elemental analyses

These analyses determine the metal's composition. Two types of elements are highlighted: alloying elements, that

1 Heritage Studies service, RMCA.

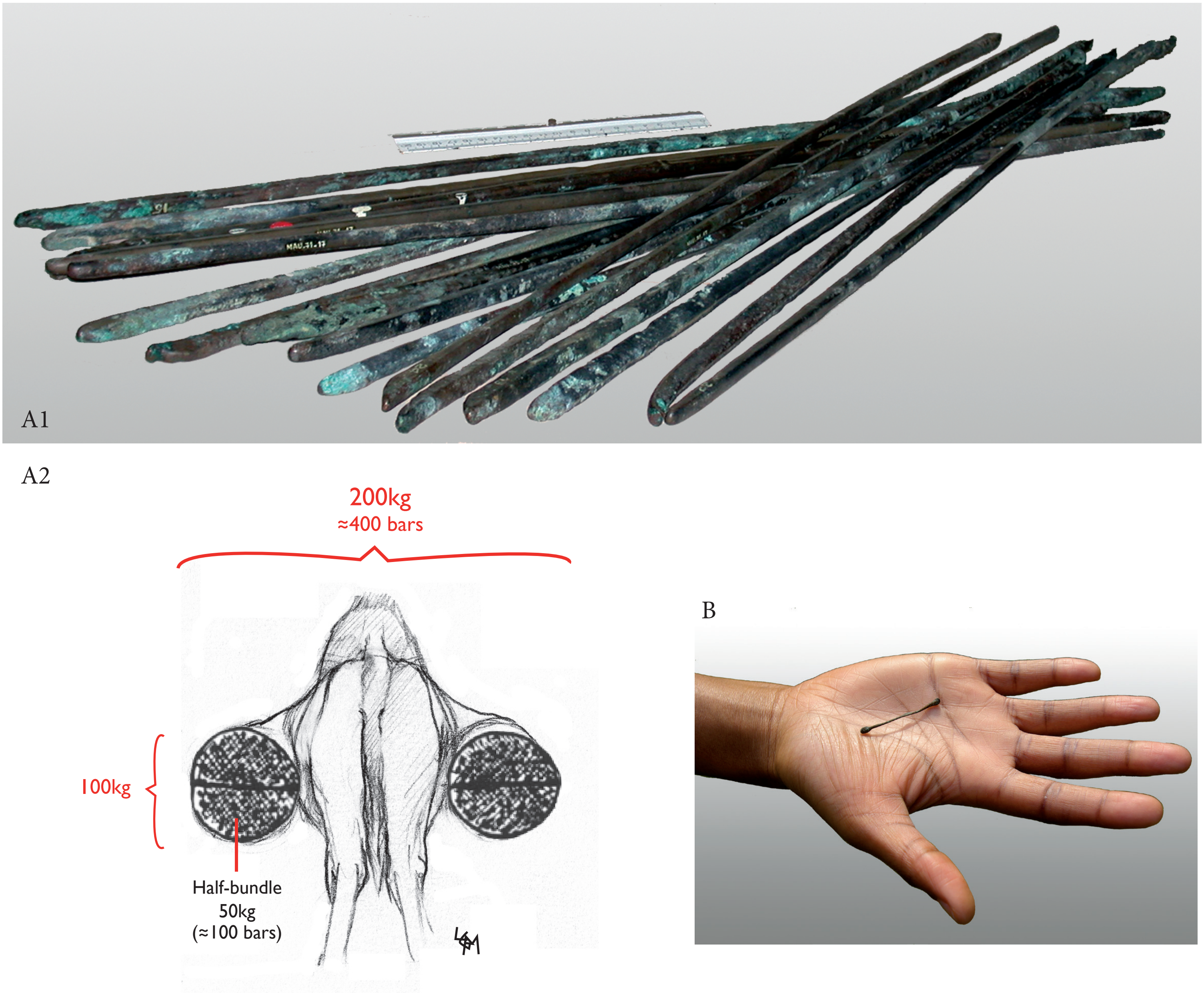

Fig. 1. A. 1: Some of the 2,085 brass ingots/bars from the Ma'den Ijâfen's lost caravan, discovered by Th. Monod in 1964 in the Mauritanian Sahara. Each bar is 70 cm long and weights about 500 g. **2:**They were arranged in bundles of about a hundred bars to be transported by camel. (Collection IFAN – Cheikh-Anta-Diop (Dakar); Th. Monod, 1969; photo and drawing © L. Garenne-Marot. **B.** One of the smallest forms of traded copper (averaging 35 mm long and weighing 4 g): the 'double-headed wires', interpreted as currencies, fractional 'coins' of low purchasing power, found in large numbers in the excavations of Koumbi Saleh (Mauritania). (Collection Centre d'Études des Mondes africains, Paris; photo © J. Polet.)

is, metals (tin, zinc, lead, etc.) deliberately added to the copper to modify its properties, and trace elements from ores. The analyses are conducted according to available equipment, the possibilities or not of obtaining a sample and working on the surface layers (patina, excavation conditions) or on the constituent metal.

B. Analysis of the metal's internal structure

1. X-rays

X-rays reveal the object's insides – whether hollow (with or without a core) or solid – how it was cast, presence of joining– welds, rivets, interlocking – and any repairs. In complex pieces, new techniques used in medical scanning, such as tomography, can provide a more precise reading of every structural feature without the interference of superimposing planes.

2. Metallographic analysis

This reveals the metal's microstructure and thus the thermal or mechanical processes it underwent, from which can be deduced how it was made (hammered or cast) and subsequent treatments (annealing and hammering).

Terminology	**Definition**	**Technical qualities**
Copper		
Rarely pure. It contains traces of other elements (zinc, arsenic, iron, lead, etc.) from ores		Malleability (copper lends itself remarkably well to bending and stamping operations), ductility. By hammering copper (to a lesser degree than bronze) can acquire a fairly high hardness. However, copper is a poor casting material.
Binary alloys		
Bronze	Copper is the major element and the rate of tin varies (on average 10%).	The mechanical properties of bronzes are an increase in hardness with the addition of tin to copper. The most notable qualities are those of foundry: bronzes flow easily. The melting temperature decreases as the proportion of tin increases (900° for a 20% tin bronze; 760° for a 30% tin bronze). Less than 13% of tin bronzes are cold workable. Bronzes with over 13% and less than 33% of tin can be forged hot. The properties of hardness, but also fragility and sound (the bronze of the bells is a 20% to 25% tin alloy), increases with the percentage of tin. Finally, the colour of the alloy varies with the composition: from a golden colour with 15% tin, it brightens to become almost white to the rates above 25% of tin.
Brass	Copper is the major element and the rate of zinc varies between 10 and 30% for ancient brasses.	Up to 40% of zinc, brasses have mechanical properties that are reminiscent of those of copper (e.g. ductility and malleability), well above that of bronzes. Thus they well tolerate processes such as hot and cold hammering, drawing, stamping, etc. Brasses have good casting qualities, especially for alloys with more than 25% of zinc. The melting temperature decreases when the percentage of zinc increases (1030° for a brass of 20% zinc; 950° for one of 30% zinc). The colour has a special importance: close to that of copper until about 10% addition of zinc, it gradually turns to a gold-like colour between 15 and 20%, with a more greenish gold colour around 25% and returns to a gold colour, of a clearer hue, around 40%.
Ternary alloys		
Leaded bronze	Same ratio of copper to tin as in binary bronze but with an addition of lead that could exceed 10%.	The amount of lead rarely exceeds 30% of the total weight of the alloy. This limitation is imposed by the difficulty in avoiding segregation of the lead (which isolates itself in fine globules during solidification), which grows with the percentage of this element. Beyond 2-3% lead, mechanical properties change rapidly: the alloy poorly resists the efforts of drawing, bending, and twisting; it is not very malleable when cold, and little more so when heated. On the other hand, it provides the alloys with two interesting properties: the melting temperature is significantly reduced when the percentage of lead rises; more interestingly, all methods that proceed by removing (or grubbing-up) metal shavings –working with limes and chisels, drilling, sawing, etc.- are eased (the phenomenon is probably related to the discontinuous texture of the alloy where the lead grains form a succession of weak areas that help in the removal of the metal shavings).
Leaded brass	Same ratio of copper to zinc as in binary brass but with an addition of lead that could exceed 10%.	
Quaternary alloys		
Copper + tin + zinc + lead	Varying proportions for tin, zinc and lead with copper remaining the major metal.	It is an alloy found regularly in archaeological contexts. The addition of alloying elements may be deliberate: this is the casting alloy of old and modern foundries. Indeed the zinc acts as a deoxidizer and improves the castability while lead improves the chiseling work. But it can also be the accidental result of a remelting of scrap material of different bronze and brass compositions.
In the art history books or those aimed at the general readership, one finds the term « bronze » often erroneously used to designate all non-analyzed objects of which copper is the main component while the 'true' bronze is an alloy of copper and tin.		
Comments on the technical qualities of copper and its alloys are inspired by Picon M., Boucher S. et Condamin J., 1966. Recherches techniques sur les bronzes de Gaule romaine, *Gallia* 24, 1 : 189-215. Of course alloys mentioned here are those known before the industrial era when other copper alloys such as the cupro-aluminiums, cupro-nickels, maillechorts (Cu, Ni, and Zn), etc. will be manufactured.		
Here are listed both functional and aesthetic qualities of the alloys because the criteria in the choice of a specific metal quality may not rely on just the mechanical or forming qualities but on other ones such as colour or sonority (e.g., the high tin bronze with over 13% of tin used for hammered vessels, requiring a difficult hot-forging forming but yielding white and sonorous cups and plates. Alloying was used for a variety of purposes: functional, aesthetic, ritual, and/or simply expedient. For example, the addition of tin to copper may have been done to increase strength and hardness for some objects, but may have been used to produce particular colors or fulfil ritual requirements in other objects. Or a mixture of alloyed scrap metal may have been the material available for a smith's selection. Also, different alternative exist to produce the desired effect such as hardness, colour, shape.		

Fig. 2. Table of copper and its alloys in the archaeological context of sub-Saharan Africa.

3. Specific analyses

The composition (clay, organic material) of any preserved core inside hollow castings can be analysed or even dated (using carbon-14 if carbon is present, or TL).

A good example of this kind of analyses of copper alloy objects was conducted by the British Museum Department of Conservation and Scientific Research (Craddock *et al.* 2013) in order to authenticate the 'Olokun head', which had been judged a fake in 1949. Scientists combined surface examination, metallographic, elemental and isotopic analyses, and analysis of its core – which identified specifically West African vegetation – to prove the sculpture's authenticity. It was indeed the original head discovered by L. Frobenius in 1910, and not a moulded copy.

III. ADVANTAGES AND LIMITATIONS OF THESE ANALYSES

A. Why analyse?

Analyses can identify some of the metallurgical techniques in question. Copper can be shaped in many ways: two objects seemingly identical in form could have been made according to very different production chains (*chaînes opératoires*). Choices of metal quality (pure copper, brass, bronze, etc.) and technical process are marks of past societies.

Analyses help describe the object in detail. Metal quality, technique and the *chaîne opératoire* constitute the object's internal typology. Comparing this with its external typology (shape and decoration) leads to a more accurate definition of typological groups.

Fig. 3. This statue of Montaigne, which faces the monumental entrance to the Sorbonne in Paris, replaced the stone original in 1989. This 'bronze' copy is more resistant to student pranks (and vandalism). Since then, several generations of students, out of superstition, habitually rubbed the statue's right foot on the eve of exams. As a result, the foot lost its patina and the metal – doubtlessly a quaternary alloy typical of modern foundries – remains its true golden colour, corrosion having had no chance to form between rubbings. More interesting, the acidity of hand perspiration acts as a chemical bath: up close the metal grain is fairly visible. To distinguish the microstructure, however, a microscope is necessary. (Photos © L. Garenne-Marot.)

These analyses establish relative chronologies. Metal characterisation can situate some objects in time in the case of objects deprived of an archaeological dated context.

Example 1: Jenné-Jeno (Mali) sequence, elemental analyses and relative chronology

Thanks to a deep-time stratigraphy in settlement context, Jenné-Jeno provided the first data on a sequence of alloys for West Africa. This series is based on only nine analyses yet gives an overview of the diversity of alloys used in a single place over centuries: copper in the oldest strata dating to around 400 A.D., bronze with 17% tin in the transitional phase of 800 to 1000, a quaternary alloy, and, finally, leaded brass in the phase beginning around 1200 (McIntosh 1994). This alloy chronology already presents, in the absence of comparable sequences, an initial ground for relative dating. Thus S.K. McIntosh remarked that the metal of the bronze bracelet from a Méma (Mali) burial dating to AD 780-1010, excavated by T. Togola, was consistent with that of the Jenné-Jeno sequence.

Example 2: the illustrative corpus of the bronzes from Igbo-Ukwu (Nigeria)

One of the earliest applications of these expertise techniques was conducted in the 1960s on some 600 copper and copper alloy objects from excavations at Igbo-Ukwu. Nearly a hundred elemental analyses divided the corpus into pure copper objects (with some rare examples of leaded copper) and leaded bronze objects. Metallographic techniques revealed a correlation between the

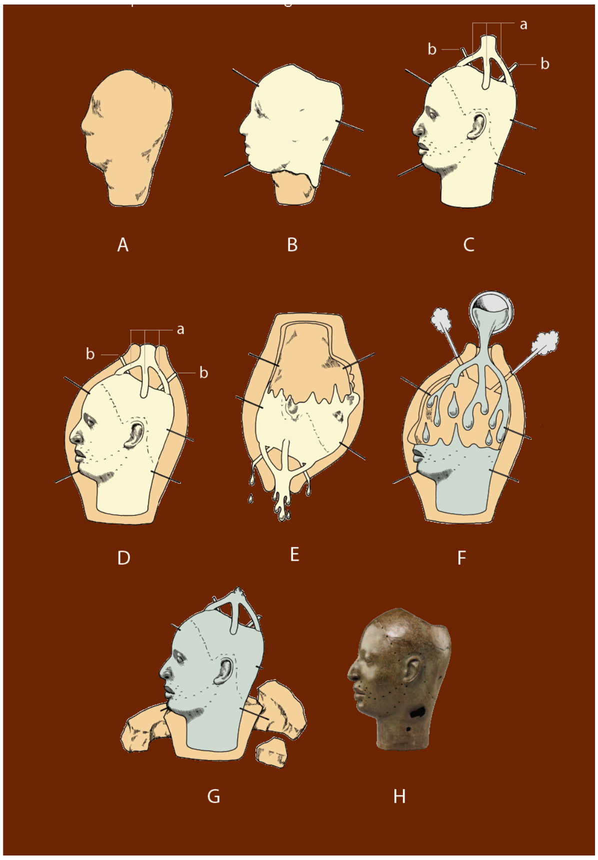

Fig. 4.1

Fig. 4.

1. Simplified sequence of direct hollow lost wax casting of an Ife (Nigeria) head. **A**. A core in the form of the sculpture is made in clay; **B**. The clay core is covered in beeswax. Iron rods are inserted through the wax into the core to prevent movement during firing; C. Fine details are sculpted in the wax. Tubes of wax, known as runners (a), are applied at the top. Separate wax vents (b) are inserted to allow gases to escape during casting; **D**. Layers of clay are applied directly to the wax surface, enclosing the vents (b) and runners (a) to form a mould; **E**. The entire mould is heated, melting the wax, which is drained away through the runners, and hardening the clay. The clay mould remains intact, retaining every detail of the former wax model; **F**. Molten metal is then poured through the runners into the gap between the outer clay mould and the inner core; **G**. After it has cooled, the clay mould is removed and the runners and iron rods are cut off to reveal the completed sculpture; **H**. The sculpture is polished to produce a smooth surface. (Drawing © The Trustees of the British Museum, 2010.)

2. Artisanal village bronze workshop near Ouagadougou (Burkina Faso), March 2008; **A**. wax work; **B**. making casting moulds; **C**. baking moulds close to a fireplace; **D**. metal casting; **E**. finishing statuettes. (Photos © L. Garenne-Marot.)

Fig. 4.2

composition of the metal and the technique of manufacture: pure copper objects were forged (hammered and twisted), leaded bronze objects were cast using the lost wax (or latex) casting technique. The choice seems to have been dictated by technical criteria: pure copper is easier to work by deformation techniques (hammering, twisting, stretching, etc., while repeatedly heating the metal to restore its ductility), whereas bronze alloy, and particularly leaded bronze (the lead makes the casting flow), lends itself better to casting than pure copper (see **fig. 2**).

One of the most beautiful leaded bronze pieces is certainly the 32-cm-high 'ropepot' – a vessel on a stand surrounded by ropework. Was this 'ropework' made separately and subsequently welded to the vase and pedestal? Metallographic examination of two sections in the vase wall where it meets the net revealed no welds but rather an assemblage of different parts via a special 'casting-on' technique. This technical trait, in addition to others, led P.T. Craddock (1985) to ascribe an indigenous character to the Igbo-Ukwu industry: everywhere else in the same period, from the 9th to 11th centuries A.D., the large bowls of Igbo-Ukwu would have been made more easily and directly by sheet metal work, and the decorative elements cast separately, then riveted or welded in place, instead of being cast in a single piece with the base.

B. Technical choices or cultural choices: the notion of 'technological style'

The choice of metal or forming technique for an object sometimes depends on something other than technical criteria. In some regions of Central Africa (see the example described by Childs 1991), the *chaîne opératoire* of copper-working is based on that of iron-working. Lost wax casting techniques flourished mainly in West Africa – the Cameroon Grassfields marking the south-eastern extension – with, for some workshops, variations in the technique, such as the joined crucible-mould method (Herbert 1984; Garenne-Marot & Mille 2007). The 'seated figure' from Tada hollow cast sculpture attributed to Ife culture (Nigeria, 14th century) is made of pure copper even though the material lends itself poorly to casting, as demonstrated by the many secondary castings intended to repair numerous defects. Colour could also determine metal choice, for cultural reasons (Garenne-Marot & Mille 2007).

C. Analytical limitations

1. Answering precise questions

Analyses have to respond to precise questions, because they are time-consuming, expensive and, in the case of metallographic analysis, highly invasive – that is, they damage the object to which they are applied.

2. Accounting for limitations inherent to the methods

The failure of provenance studies

Many attempts had been made to trace the origin of the metal of finished objects in order to establish the ore-metal-object link. The first were based on trace elements analyses, but failed (Pollard & Heron 2008). Indeed, several biases affect the approach:

- geographically separated deposits can have a similar geochemical signature (specific mineral associations);
- metalliferous veins are often heterogeneous;
- the spectrum of trace elements is altered at every stage of the *chaîne opératoire* (as shown in the pioneering work in experimental archaeology by R.F. Tylecote (1976)).

Some similar biases affect another method devised from lead isotope tracers. Recent work confirms changes in isotope ratios during ore preparation and reduction phases. (Baron *et al.* 2014). Other experiments show the significant transfer of the lead from the zinc ore in the final brass during cementation. This increase disrupts the copper's initial isotopic signature (Bourgarit & Thomas, forthcoming), which puts into question the validity of comparing measurements of isotope ratios between pure copper and alloys. Finally, recycling, which mixes materials of various origins, adds other disruptions.

Today these problems are unavoidable, though research to find better tracers continues. We must thus be circumspect concerning any grand synthesis on the origin and circulation of copper alloys in sub-Saharan Africa that relies essentially on the results of a single type of analysis and whose conclusions are based on a broad comparison and without accounting for the geological and/or archaeological particularities of the samples. Many archaeometallurgists and historians of metallurgical techniques base their arguments solely on alloying elements: for them, these added metals (tin, zinc, lead) are 'recipes' that echo the know-how of workshops and, as a result, potential production sites. Geochemical analyses, like those of trace elements and/or lead isotopes, provide additional support for these first 'composition typologies', by more accurately characterising groups of objects that could have been produced from the same metal supplies and/or workshops.

CONCLUSION

Analytical results should be inserted in a broader perspective. Remember that the copper object, which carries a history, is part of history: the research of Z. Volavka (1998) on a copper investiture object of Central Africa is a good example of what multi-thematic research that combines technical (object analyses but also surveys of mines and metallurgical sites), economic, social, ethnographic, or art history data can contribute to the writing of this history of copper metallurgy in Africa.

REFERENCES

Baron, S., Tamas, C.G. & Le Carlier, C. 2014. 'How Mineralogy and Geochemistry Can Improve the Significance of Pb Isotopes in Metal Provenance Studies?' *Archaeometry* 56 (4): 665-680.

Childs, S.T. 1991. 'Transformations: Iron and Copper Production in Central Africa'. In P.D. Glumac (ed.), *Central Africa, Recent Trends in Archaeometallurgical Research*, *MASCA Research Papers in Science and Archaeology*, vol. 8(1), pp. 33-46.

Craddock, P.T. 1985. 'Medieval Copper Alloy Production and West African Bronze Analyses: Part 1'. *Archaeometry* 27 (1): 17-41.

Craddock, P.T., Ambers, J., van Bellegem, M., Cartwright, C.R., Hudson, J., La Niece, S. & Spataro, M. 2013. 'The Olokun head reconsidered'. *Afrique : Archéologie & Arts* 9 : 13-42.

Garenne-Marot, L. (in collaboration with L. Hurtel). 1993. 'Le cuivre : approche méthodologique de la métallurgie du cuivre dans les vallées du Niger et au sud du Sahara'. In J. Devisse (ed.), *Vallées du Niger*. Paris: Réunion des Musées nationaux, pp. 320-333.

Garenne-Marot, L. & Mille, B. 2007. 'Copper based metal in the Inland Niger Delta: Metal and Technology at the Time of the Mali Empire'. In S. La Niece, D. Hook & P.T. Craddock (eds.), *Metals and Mines: Studies in archaeometallurgy*. London: Archetype Publications & British Museum.

Herbert, E.W. 1984. *Red Gold of Africa: Copper in Precolonial History and Culture*. Madison: University of Wisconsin Press, 438 p.

McIntosh, S.K. 1994. 'Changing perceptions of West Africa's Past: Archaeological Research Since 1988'. *Journal of Archaeological Research* 2 (2): 165-198.

Pollard, A.-M. & Heron, C. 2008. *Archaeological Chemistry.* Second edition. Cambridge: The Royal Society of Chemistry.

Tylecote, R.F. 1976 [1992, 2002, 2011]. *A History of Metallurgy*. London: The Metals Society, 182 p.

Volavka, Z. & Thomas, W.A. (eds.). 1998. *Crown and Ritual: The Royal Insignia of Ngoyo*. Toronto: University of Toronto Press, 411 p.

CASE STUDY: COPPER INGOTS IN CENTRAL AFRICA

Nicolas Nikis[1]

INTRODUCTION

Copper has played and still plays an important role both economically and symbolically in various regions of Africa. Particularly in Central Africa, it once had a value comparable to gold's in other parts of the world, and controlling its deposits was a major concern for many political entities. It was used alone, without alloys, until the arrival of European brass and bronze, and distributed mainly in semi-finished form that could assume a wide range of shapes (**fig. 1**), whether 'classic' ingots, cross-shaped ingots in southern Central Africa, or *ngele* in the Kongo area. For the sake of simplicity, I will use the generic term 'ingot' when not referring to a particular shape. This case study focuses on this type of object, but it is necessary to keep in mind that this is not the only form of copper in circulation. The metal can also circulate as, for example, wire, finished objects such as bracelets, and indeed as ore.

Studying these objects can reveal a variety of information, such as economic or political history and the reconstitution of metallurgical knowledge and processes. An ingot studied on its own reveals very little information – at best a clue about the copper's use in any given place and time and, possibly, its manufacture. To address research questions concerning the morphology or circulation of copper ingots, an entire set of objects is necessary, whether they come from a site or, most commonly, a region or larger area. Furthermore, to address questions concerning manufacturing techniques, the object will have to be taken as an integral part of the manufacturing process and thus studied as a step in the production. This will entail studying ingots above all from the perspective of the first question: circulation. The data used in this type of study come mainly from archaeology but can also be completed by historical and anthropological sources.

CATALOGUING AND ANALYSING FINDS

Like all archaeological objects, the ingot has to be documented (description, photograph, drawing, context, etc.: see *ad hoc* chapter). Next, as with ceramics, object characteristics such as shape, weight and size can be studied. When a classification for the type of ingot already exists, it is preferable to refer to it in order to avoid unnecessary multiplication of 'groups'. Otherwise, a new one will be created; the 'birds of a feather flock together' principle is generally the most convenient. Attention must be paid, however, to certain simple shapes, such as bars, which can be in use in far apart regions without being the result of contact. In this case, weight and size will be the discriminating factors. At this stage of the analysis it is possible to identify a potential standardization of the objects that suggests control over production on a certain scale (local, regional, supraregional, etc.). This analysis can also highlight an evolution of the shape according to places and eras. If it concerns a set in which all types were not found in an archaeological context, such as, for example, via surface collections, a relative chronology can be hypothesized.

The study of cross-shaped ingots or *croisettes* in Central and Southern Africa by de Maret (1995) is a good example of this type of analysis. In this study, de Maret shows an evolution in the shape of cross-shaped ingots over time (**fig. 2**). According to this diagram, he hypothesizes that the undated ingots, types Ia and HI, may be the 'ancestors' of type HIH *croisettes* based on their shape. Moreover, he observed a standardization of these ingots over time (de Maret 1981), by studying the size and weight of type HIH, HX and HH *croisettes* from the Upemba Depression.

Obviously, the context of the object's discovery

Fig. 1. Examples of copper ingots. 1. cross-shaped ingots HIH (top), HX (middle) and HH (bottom), Upemba Depression (Katanga, DRC); 2. *Ngele,* Makuti (Mindouli region, Rep. of the Congo); 3. Ingots, Nkabi (Mindouli region, Rep. of the Congo); 4. Crosses HH attached by a plant fibre, Upemba Depression (Katanga, DRC); 5. 'Treasure' of cross-shaped ingots HH (Katanga, DRC).

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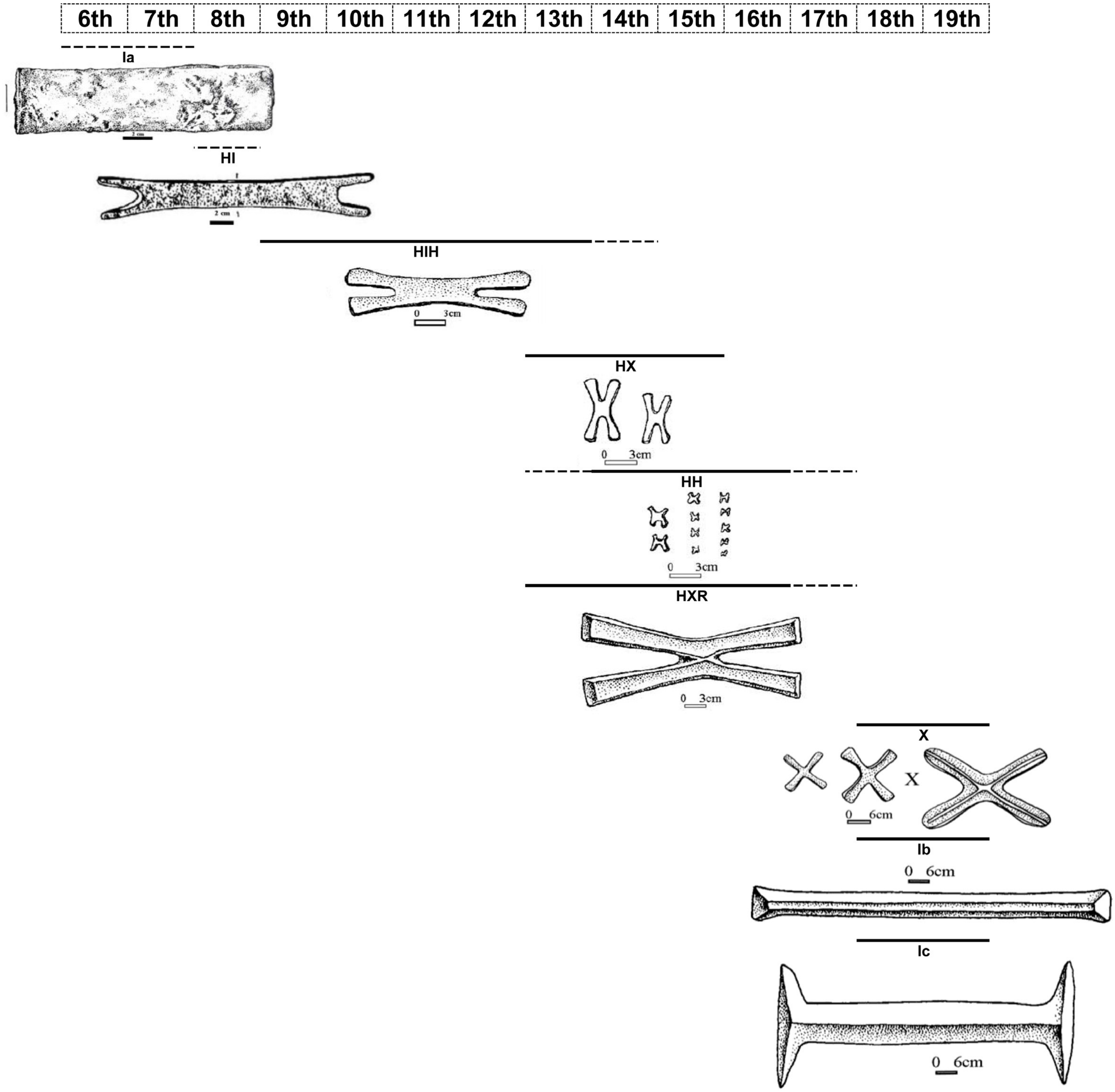

Fig. 2. Evolution of the form of ingots and cross-shaped ingots produced in the Copperbelt. The first two types are not dated and the dotted lines indicate uncertain dating, mainly concerning upper and lower limits. This figure takes no account of geographic location differences. (According to de Maret 1995)

provides information concerning its use. Thus in the Upemba, in a funeral context, according to the position and number of cross-shaped ingots, we pass from the use as status symbols of type HIH *croisettes* (they are located next to the chest and usually only one is found) to a more monetary use of type HX and HH *croisettes* (they are often placed in a group next to the hip or hand). This use is confirmed by the *croisettes* discovered in the form of 'treasure' or attached to one another (**fig. 1**). In absolute terms, group layouts could also reveal information on the population's system of numeration (decimal system, duodecimal system, etc.).

Mapping information concerning ingots makes it possible to define the distribution of the major types over time

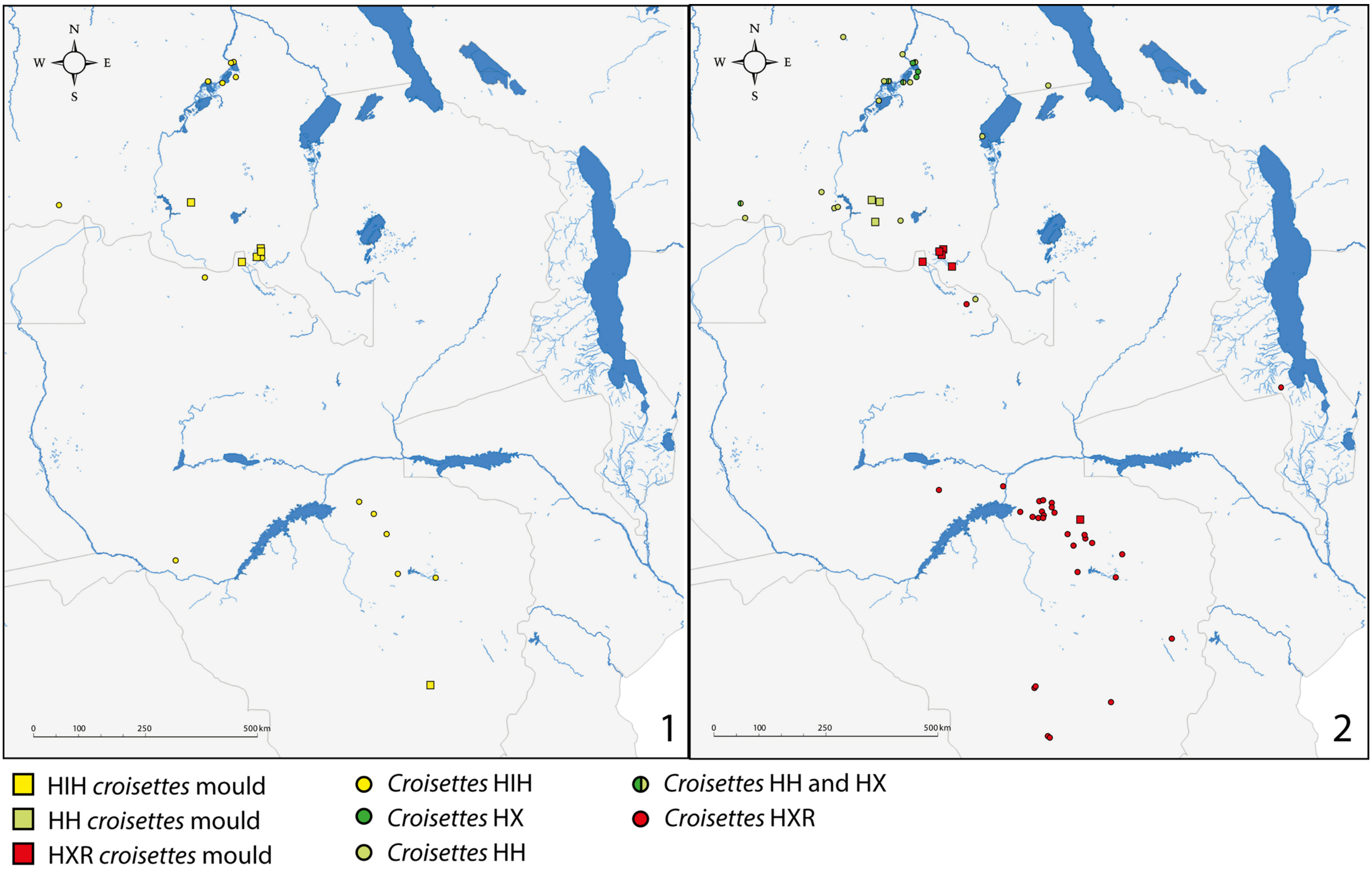

Fig. 3. **1**. Distribution of cross-shaped ingots HIH during 9th-14th centuries and **2**. crosses HX, HH and HXR during 13th-17th centuries.

and thus to clearly show socio-economic phenomena. Let us take the example of the distribution of cross-shaped ingots between the 9th and 17th centuries (**fig. 3**).[2]

The first map in figure 3 concerns the distribution of type HIH *croisettes* between the 9th and 14th centuries. We observe that this type of ingot is present from the Upemba Depression (Katanga, DRC) to Great Zimbabwe and that its production, attested by the presence of moulds, is located both in the Copperbelt (southern DRC, northern Zambia) and at Great Zimbabwe. We can therefore hypothesize an economic and cultural link between these regions, given that the same form was in use. However, as the production took place in several distinct areas, there was not necessarily regular and direct contact between the peoples of these regions.

The second map shows types of cross-shaped ingots in existence between the 13th and 17th centuries. The situation is different compared to preceding centuries, as this same area divides into two sets: in the south HXR type *croisettes*, and in the north HX type *croisettes* which evolve toward type HH. Likewise, production centres seem very distinct, with HXR type being produced in the east of the Copperbelt, in the region of present-day Lubumbashi and in the copper-bearing regions surrounding Great Zimbabwe, while HH type is rather produced in the centre of the Copperbelt. During this period, we therefore observe a clear demarcation, probably revealing the existence of two distinct zones of economic, cultural, and political influence, but also the regions toward which the production centres directed their trade.

Studying the geographic distribution of ingot types is thus already in itself extremely interesting. Ease of access to GIS (geographic information systems), such as Quantum GIS, now makes it possible to easily map other information and superimpose several levels of data. Consequently, for ingots, we can compare spatial-temporal data with historical, political, linguistic, etc., data and even with other aspects of material culture such as ce-

2 For a detailed interpretation of the phenomena presented here, see de Maret 1995; Swan 2007.

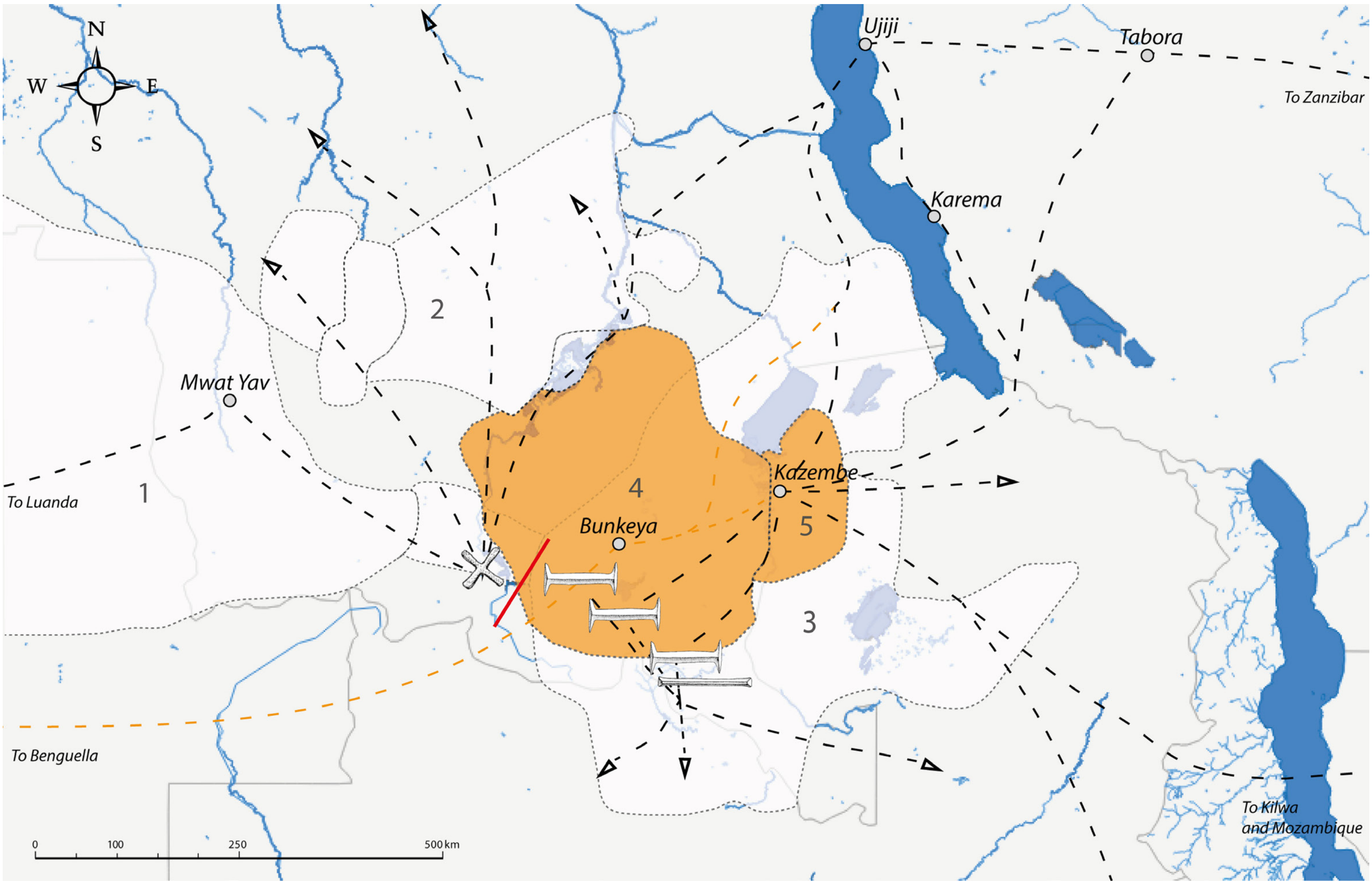

Fig. 4. Copper ingots and their trade routes in the 19th century compared with the boundaries of major political entities (1. Mwat Yav; 2. Luba; 3. and 5. Kazembe; 4. Yeke). The arrival of the Yeke in the second half of the 19th century and the decline of the Kazembe modify trade routes.

ramics. This makes it possible to visualize phenomena that would have been difficult to detect if data were considered in isolation.

In this way, for example, by examining the distribution of different types of ingots produced in the Copperbelt in the 19th century and their circulation routes, we observe, as in the preceding example, a boundary between X type *croisettes* and ingots Ib and Ic and that the routes taken to trade them diverge to some extent. By comparing this map with that of the major political entities of the time, it is clear that this boundary corresponds to two zones of influence, on one hand that of the *Mwat Yav* and Luba for the X type *croisette*, and on the other that of the Kazembe for the Ib and Ic bars. Furthermore, we see that the convergence of the circulation routes for different types is located outside these zones of influence and is explained by the fact that they join the Arabo-Swahili trade routes.

Nevertheless, it is necessary to avoid falling into certain traps in interpreting the data. The presence of the same type of ingot in several regions, sometimes spanning long distances, does not mean that populations had direct contact or migrated. An object, and all the more an object endowed with a certain commercial value, can travel via step-by-step exchanges over a long distance without the object's producer meeting its final holder. Likewise, some forms can be reproduced in regions far from the extraction centres by recycling old copper objects, as was observed for X type *croisettes*: some copper objects were remelted to cast new ingots in areas far away from the deposits (de Maret 1995).

Increasing use is being made of physical and chemical analysis of ingots, which can answer questions concerning, on one hand, the manufacturing process (especially possible additives to the ore as smelters) and, on the other hand, the metal's origin. Several methods exist to trace the ore's source, be it researching trace elements or – currently the most frequently used – analysing lead isotopes in the metal.[3] Objects of the same elementary or isotopic composition could have been manufactured using the same ore. However, things are not always as straightforward in practice, and many phenomena can skew the analysis: copper recycling, the addition or elimination of certain chemical elements during the metallurgical process, similarities of trace elements or isotopes between deposits, etc.[4] It is therefore recommended to perform these analyses with someone who knows the methods' limits and their applicability to archaeology. Moreover, when the goal is to solve a problem presented by archaeological data, it is essential, prior to undertaking costly analyses, to master the archaeological context.

REFERENCES

Baron, S., Tamas, G. & Le Carlier, C. 2013. 'How mineralogy and geochemistry can improve the significance of Pb isotopes in metal provenance studies'. *Archaeometry* 56 (4): 665-680.

Cattin, F., Guéntette-Beck, B., Besse, M. & Serneels, V. (eds). 2009. 'Lead isotopes and archaeometallurgy'. *Archaeological and Anthropological Sciences* 1 (3), special issue.

de Maret, P. 1981. 'L'évolution monétaire du Shaba central entre le VII^e^ et le XVIII^e^ siècle'. *African Economic History* 10: 117-149.

de Maret, P. 1995. 'Histoires de croisettes'. In L. de Heusch (ed.), *Objets-signes d'Afrique*. Tervuren: Musée royal de l'Afrique centrale, pp. 133-145.

de Maret, P. 1995. 'Croisette histories'. In L. de Heusch (ed.), *Objects-signs of Africa*. Tervuren: Royal Museum for Central Africa, pp. 133-145.

Pollard, A.M. & Heron, C. (ed.). 2008. *Archaeological chemistry*. Cambridge, UK: Royal Society of Chemistry, 438 p.

Swan, L.M. 2007. 'Economic and ideological roles of copper ingots in prehistoric Zimbabwe'. *Antiquity* 81: 999-1012.

3 For more details, see: Pollard, A.M. & Heron, C. 2008 or the special issue of *Archaeological and Anthropological Sciences* 1 (3) (2009).

4 Concerning certain limits of the method based on lead isotopes, see Baron, Tamas & Le Carlier 2013.

CHAPTER 5

Ecofacts

and related studies

INTRODUCTION

Els Cornelissen[1]

This chapter explains the potential and requirements of specialized analysis of the soils and sediments that provide the context of archaeological excavations, animal and human bone, and plant remains. It also addresses the topic of dating. Specialists in the various fields of pedology, sedimentology, archaeozoology and -botany, palaeontology and dating methods, discuss what needs to be done in the field to ensure the effectiveness of the different approaches, and the important things that archaeologists need to know when seeking their advice in order to avoid unwarranted expectations. All contributors draw attention to the fact that the type of site, research questions, and funding will orient the strategies prior to – but also during and after – excavation on what, when and how to sample. In addition, they emphasise that data and samples collected out in the field are the product of both natural and cultural processes for which keys, specific to their field of expertise, are needed to define to what extent natural or cultural agents are responsible. All underline the need for interdisciplinary interplay from one specialist to another in order to draw the right conclusions.

Alexa Hohn explains how plant remains provide dietary information on a human community as well as on the natural environment the community lived in, and on how they manipulated this through various subsistence and other exploitation strategies. Methods for sampling, processing and analysing are presented, with specific attention to the fact that most plant remains are retrieved from sediment samples taken during excavation but processed in lab conditions. Plant remains collected on-site represent only a fraction of the past environment, a selection explained by depositional and post-depositional processes, such as differential preservation of hard and soft plant tissues, as well as by various human decisions on which plants to harvest or collect and to process on that specific spot.

Wim Van Neer sets out the framework for the analysis of animal remains, varying between solid bone and fragile eggshell. He underlines the importance of correct sampling and packing in the field, different issues include sieving, avoiding bias in the selection of identifiable and non-identifiable bones, and the inclusion of (or at least mention of) worked bone in the sample submitted to the archaeozoologist. As with botanical remains, fauna serve to reconstruct the environment and subsistence strategies. Reference collections of modern skeletons are essential for correct identification based on bone morphology and size. After identifications, bone material is quantified using the Number of Identified Specimens or NISPs. In order to filter out natural agents in the accumulations, a taphonomic analysis of faunal assemblages has to be conducted prior to any reconstruction of the past environment and of the subsistence strategies or any other human exploitation.

Veerle Linseele proceeds by addressing the question of domesticated animals, and discusses the frequently encountered problem of distinguishing domesticated cattle from wild bovids. The wild ancestors of sheep and goat never occurred in Africa and hence no confusion is possible between wild and domesticated forms whereas in the Mediterranean zone, the Nile Valley, and other parts of northern Africa, wild cattle or aurochs were part of the local fauna. In West Africa, a special position is occupied by the helmeted guinea fowl. Domesticated animals may provide power, raw material, companionship, food (mainly meat consumption, but also milk, eggs or blood) or serve ritual ends. She provides examples of the interpretation and spread of domesticated animals over sub-Saharan Africa.

In his contribution, **Dominique Schwartz** stresses the fact that soils are open and active environments. Special attention goes to the ubiquitous ferralsols in sub-Saharan Africa and how cultural items and ancient surfaces become buried and incorporated in the soil. The challenge is to single out natural and human agents in site formation, as well as to identify which natural processes are part of the initial formation of the deposits or sediments and which processes are due to subsequent pedogenesis. This latter distinction between geological strata and soil horizons is illustrated with three field examples. Laboratory analysis of soil components yields valuable information, as in the example of biogeochemical studies using carbon-13 for environmental reconstructions. The author draws specific attention on how to read the temporalities of the soil.

Michel Rasse focusses on the accumulative and erosive power of river systems: their capacity to construct and bury archaeological material and also deconstruct and expose archaeological sites, to move sediments from upslope to downslope or cut through previously accumulated sediments. His case study is situated in West Africa. These processes of incision and accumula-

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tion are climatically induced and a careful interpretation leads to the reconstruction of palaeoclimatic conditions. Importantly, an understanding of the geometry of the sequences takes into account vertical as well as lateral shifting of layers.

In both contributions, you will find a glossary that facilitates reading the specialist literature on soils and sediments.

Human bones, as **Isabelle Crevecœur** writes, are best sampled during field work, if not in the presence of a biological anthropologist, then at least in close collaboration. Here as well, before proceeding with cultural interpretation, the taphonomic agents that may have intervened in the accumulation of human bones need to be identified. She lists principles of evolution and adaptation, the most current analyses performed directly on bone and teeth (minimal number of individuals, their age, gender, health, weight and other biometric and non-metric characteristics), biochemical analyses on their organic (collagen) and mineral (hydroxyapatite) constituents for radiocarbon and ESR dating, and reconstructing their diet and environment through stable isotopes. DNA analysis serves to reconstruct migrations and to identify affiliation or even degree of kinship between individuals, but also demands great care during sampling and when handling after field work. A special note is included, on multidimensional imagery as a means of rendering visibility to features invisible to the naked eye, facilitate access to collections and enable reconstructions and detailed measuring.

Dating implies a sound comprehension of the context on the site, in order to interpret relative or absolute dating. **David Wright** has compiled an overview of the various dating methods, this volume, p. 246. Three contributions are devoted to dating, which is pivotal since the chronology of many regions is far from established in Africa, as **Pierre de Maret** rightly points out. He elaborates more specifically on C14 dating and on what materials can be dated, but also the errors, calibration, uncertainties, risks of contamination before, during, and after sampling, and how to interpret results. We provide two fictional dates to illustrate the interpretation.

In the two last contributions, **David Wright** then continues explaining six other radiometric dating methods and four relative dating methods, highlighting the enormous array of methods but also their limits and caveats.

A cautionary note on archaeology's cornerstone

David K. Wright[2]

Like any scientifically-based discipline, older methods to measure radiocarbon used chemicals and instrumentation that have now become obsolete. This does not mean that older radiocarbon dates are inherently inaccurate, but those incorporating data analysed prior to AMS should be especially mindful of potential sources of error common during the early years of using the method. Such sources of error can include carbon-based counting reagents used for bulk radiocarbon gas- or liquid-scintillation counting, non-dissolution of authigenic carbonates from samples, use of bone apatite as a datable material, carbon reservoir effects in mollusc and ostrich eggshell, and sampling of 'old wood', to name just a few considerations.

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ARCHAEOBOTANICAL REMAINS

Alexa Höhn[1]

INTRODUCTION - WHY SHOULD WE CARE?

About 77,000 years ago, in a South African cave, people piled up plant beddings from sedges and grasses and topped them with aromatic laurel tree leaves with insect repellent properties (Wadley *et al*. 2011). Without archaeobotany we might have learned that Middle Stone Age people used plants and leaves to build a comfortable place, because the broken stems and leaves were visible even to the naked eye. But it was through archaeobotanical expertise that we discovered that the people of that time did not just take any leaves but carefully chose those leaves that kept their camp free from insects! Only the identification of different types of archaeobotanical remains like fragments of leaves, stems, culms and fruits, clay fragments with plant impressions, and phytoliths told the whole story.

Archaeobotany is always good for surprises: About 2,500 years ago, pearl millet was cultivated in the West Central African rain forest (Kahlheber *et al*. 2009, Kahlheber *et al*. 2014)! This was revealed by charred plant remains from sites in Cameroon and the Congo. As this was totally unexpected, the archaeobotanist had a hard time believing the identification in the beginning, but no doubt could remain: a cereal adapted to a savannah environment had been grown in places where it cannot be cultivated today because of too much rainfall. Analysis of wood charcoal from the same sites provided evidence that the cultivation took place in a disturbed but still forested environment. How was that possible? Palynological investigations in the same region attested that for several hundred years a climatic change had prolonged the dry season, not enough to replace the forest, but probably just enough for pearl millet to ripen.

Archaeobotanical remains tell fascinating stories, whether they are older than 70,000 years like the finds from Sibudu, or just a bit younger than 150 years. Maize remains from Ghana dating from around 1900 AD and associated charcoal remains point to a shift in processing technology – away from grains like pearl millet associated with grinding stones at around 1800 AD, and towards yams, cassava, and maize – crops usually prepared in wooden mortars (Logan & Cruz 2014). Archaeobotanical remains also allow reconstruction of the social and cultural role of food. Examples are feasting on the Gambia coast (Gjianto and Walshaw 2014) or the turn to Asian foodways on Pemba Island during a period of urbanization and Islamization. There, social and political rewards compelled this agricultural innovation between the eleventh and the fifteenth centuries, even though rice specialization was risky due to the scarcity of suitable land (Walshaw 2010). Archaeobotanical remains, as large as a forearm-long piece from a medieval charred house post (Höhn 2011) and as small as phytoliths that are not visible to the naked eye but indicate that wood was worked on a grinding stone (Radomski & Neumann 2011), show glimpses of everyday life in former times. Human life is always intertwined with the environment. Archaeobotanical research enables us to elucidate the botanical aspects of these interrelations. Manifold questions can be answered, depending on the sites, the time, and the context. But in order to do so archaeobotanical samples have to be taken.

I. MATERIAL : WHAT ARE WE LOOKING FOR?

Archaeobotanical remains are plant remains from archaeological contexts (as opposed to plant remains from natural soils, which are termed palaeobotanical remains). They are divided into two groups according to size: macroremains and microremains.

Macroremains are larger than 0.1 mm. They are whole or fragmented parts of plants (e.g. fruits, seeds, wood, tubers, fibres, leaf fragments). In sub-Saharan Africa most macroremains are carbonised. Due to low oxygen availability in parts of a fire they did not burn to ashes, but were charred. During this process the chemical composition of the plant part was altered to an inorganic state. This alteration is called fossil preservation. Imprints of plant parts – in ceramics for instance – are also called fossils because the original plant part was not preserved either. In subfossil preservation, the chemical composition of the plant part has not been substantially altered and still consists of organic material. This occurs through drying (in arid environments), freezing (in the mountains, in permafrost soils), or deposition in a

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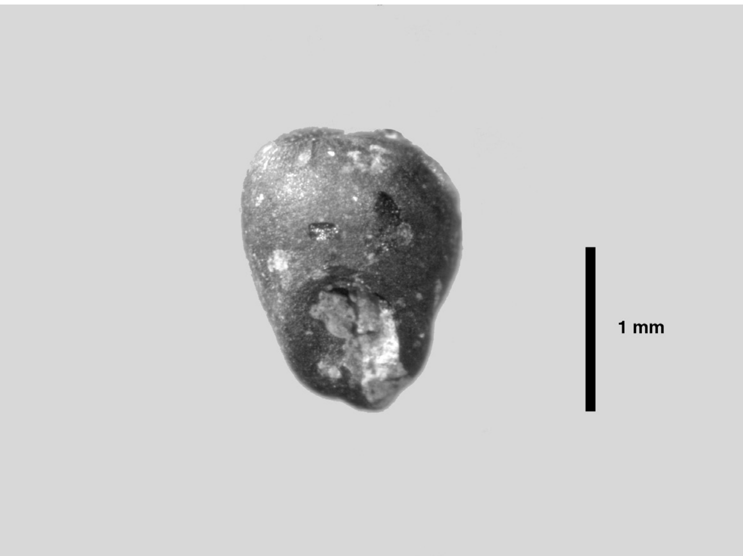

Fig. 1. Carbonized pearl millet (*Pennisetum glaucum*) from the site Bwambé-Sommet, Southern Cameroon. (Photo S. Kahlheber © Goethe-Universität Frankfurt am Main.)

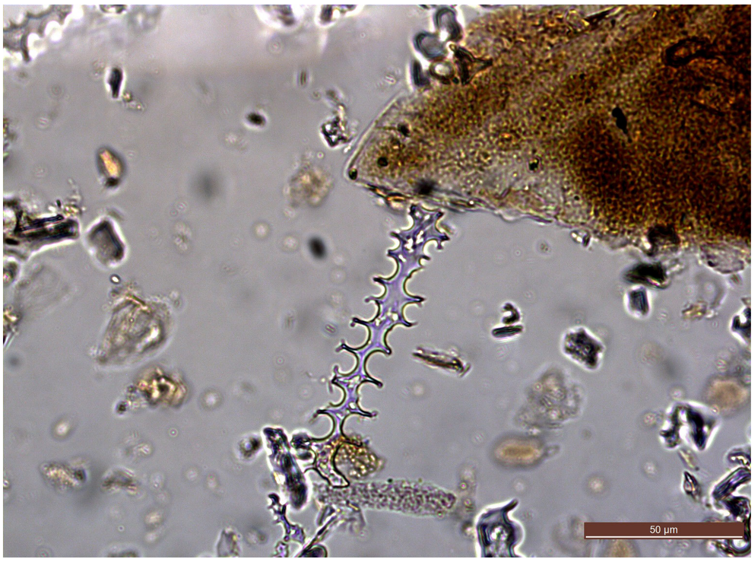

Fig. 2. Phytolith sample as seen in the transmitted-light microscope. (Photo B. Eichhorn © Goethe-Universität Frankfurt am Main.)

low-oxygen environment (in permanently wet soils). Contact with metal leads to subfossil preservation as well because the metal salts hamper bacterial and fungal activity.

Microremains are smaller than 0.1 mm and are therefore not visible to the naked eye. They can be pollen, spores, phytoliths, or starch. Pollen and spores are cells. Pollen is produced by seed plants, spores by fungi and non-flowering plants like ferns, mosses and algae. The cells themselves are not preserved, but only certain very resistant parts of the cell wall. Phytoliths and starch are produced by plants, but they are not cells. Starches are formed as sub-cellular food storage units and are organic like pollen and spores. Phytoliths are mineral microremains; they are composed of non-crystalline silicon dioxide, which was deposited by the living plant within its cells, in or on cell walls or in spaces between cell walls.

II. ANALYSIS : WHAT IS DONE IN THE LAB?

After sampling in the field (see Bosquet, this volume, pp.152-156) the archaeobotanical samples have to be processed. Macroremains are often sieved or flotated in the field, and only the processed samples reach the lab. The first step in the lab is sorting: fruit and seed remains are picked out of the sample under a dissecting microscope at low magnifications and similar remains are grouped together. Small bones or even artefacts are retrieved as well. The bulk of a processed (charred) macroremains sample usually consists of wood charcoal fragments, but modern intrusions like roots, insects and wind-borne plant parts are often present as well. Care has to be taken to separate these often partly-charred modern remains from the archaeobotanical remains.

Microremains are generally processed in the lab. Different, often chemical treatments are applied to separate the microremains from the soil particles. The isolated remains – whether starch, phytoliths or pollen – are then mounted on microscopic slides for analysis.

In the next step, the archaeobotanical remains are identified, i.e. assigned to a taxon, which can be a species (e.g. *Vigna unguiculata*), a genus (*Vigna*), a family (Fabaceae) or even groups of different taxa. These different levels of identification depend on preservation (whether it is possible to see diagnostic characteristics), but also on the possibility of differentiating between plant parts of different taxa at all. For instance, in some plant families the pollen grains of all species are very similar, or the wood anatomy of species from the same genus may look alike. In this case, it is impossible to distinguish between single plant species and we can assign the remains only to a group of plants. The identification of phytoliths is even more of a special case: Some phytoliths are typical for certain plant groups, for instance within the grass family, but in many cases different plants, even from non-related families, can produce the same kind of phytolith. This is known as ‘redundancy’.

Several types of microscopes are used for the identification of archaeobotanical remains: dissecting microscopes with lower magnifications for the identification of fruit and seed remains; incident-light microscopes for wood charcoal; and transmitted-light microscopes for microremains.

Reference collections are another essential tool. The comparison of archaeobotanical remains with recent fruits, seeds, wood, phytoliths, and pollen grains is necessary for sound identification. Images in publications or atlases usually depict one sample, but plant parts are variable. In order to fully understand how different seeds of one plant species may look, it is advisable to check several samples from several individuals of one species. It is important to keep in mind that characteristic traits of plants may vary within one species (intra-specific variability) and that similarities between different species, genera or even families exist (inter-specific similarities).

After identification the data is merged into tables, evaluated and interpreted. Again different methods can be applied – quantitative, semi-quantitative, qualitative, (presence/absence) evaluations, recording of ubiquity, calculating of percentages and various statistical methods – depending on material and sampling strategies.

CONCLUSIONS: WHAT TO CONSIDER

The archaeobotanical assemblage is by no means identical to the former vegetation around a site. Anthropogenic activities, the way of harvesting, storage and processing of crops, herding, gathering, fuel selection, and trade all influence which plants and which plant parts enter the settlement and become preserved. In charred remains even more information is lost because only plant parts entering the fire – whether on purpose (e.g. fuel, like wood or dung) or by chance (e.g. refuse, parts lost or discarded during cooking, blown into the fire) – are likely to be preserved. Depositional processes and the depositional environment, like soil characteristics, further influence preservation. To stay with the example of charred remains, more remains are preserved if the fuel refuse was put into a pit and thus protected from trampling and being blown away. The nature of the remains is also a factor. Lignified remains like the hard shells of the oil palm are more likely to be preserved than soft tissues such as those from yam tubers. The archaeobotanical assemblage is thus erratically reduced even before being recovered, but processing and analysis further decrease the accessible information.

In order to reconstruct past human lifestyles and the environment, the fragmentary data has to be interpreted. The human factor has to be considered, but so should abiotic factors at the site/in the region (soil, water, light, temperature) as well as other biotic factors (like animals). When formulating a hypothesis concerning environment and land-use based on an archaeobotanical assemblage these factors have to be considered. Consequently, the presence of the same plant in two archaeobotanical assemblages from different ecological settings may have a different significance.

A way to tackle this inevitable loss of information and get a better hold of the particular conditions at a given site is to explore several different archaeobotanical archives. As different types of remains have different taphonomy, information lost for one type of remain may be present in another. Different types of archaeobotanical remains also complement each other with regard to identification possibilities; for instance, some pollen types are identifiable only to family level but the wood anatomy of the respective family is different at genus or even species level, and *vice versa*. Moreover, the climatic and environmental background from which conclusions are drawn requires the consultation of regional palaeoarchives. Most important for a successful archaeobotanical analysis, however, is close cooperation with the archaeologists: the archaeological information concerning site type, chronology, technology and society is essential for putting the archaeobotanical information into the right frame. The resulting synopsis of archaeobotanical results with on-site information from archaeology, archaeozoology, and sedimentology and with off-site palaeoenvironmental data evaluated with ecological, agronomical, ethnobotanical, and anthropological knowledge, results in a sound and specific hypothesis on man-environment interactions in the past.

REFERENCES

Gijanto, L. & Walshaw, S. 2014. 'Ceramic production and dietary changes at Juffure, Gambia'. *African Archaeological Review* 31(2): 265-297.

Höhn, A. 2011. 'Analysis of the charcoal finds'. In L.P. Petit, M. von Czerniewicz, & C. Pelzer (eds). *Oursi hu-heero. A Medieval House Complex in Burkina Faso, West Africa*. Leiden: Sidestone Press, pp. 141-149.

Kahlheber, S., Bostoen, K., Neumann, K. 2009. 'Early plant cultivation in the Central African rain forest: first millennium BC pearl millet from South Cameroon'.

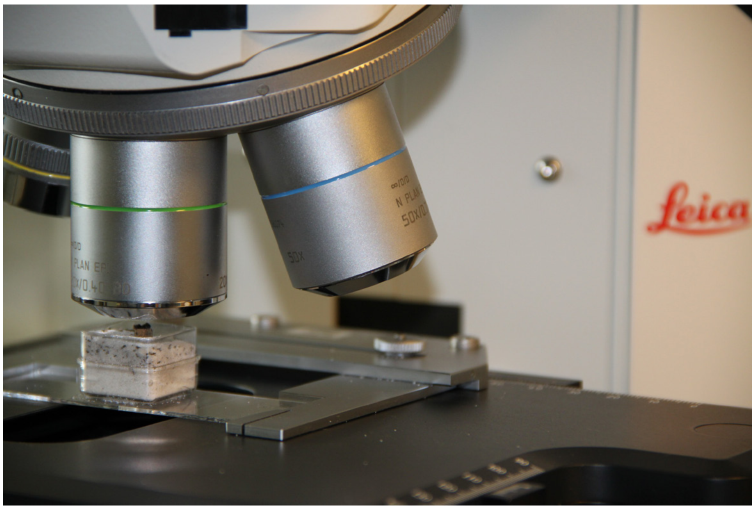

Fig. 3. Charcoal fragment under the incident-light microscope. (Photo A. Höhn © Goethe-Universität Frankfurt am Main.)

Fig. 4. 'Tools' of an archaeobotanist (clockwise): Dissecting microscope, wood collection, fruit and seed collection, reference literature, charred samples, wood slide collection. (Photo J. Markwirth © Goethe-Universität Frankfurt am Main.)

Journal of African Archaeology 7(2): 253-272.

Kahlheber, S., Eggert, M.K.H., Seidensticker, D. Wotzka, H.-P. 2014. 'Pearl Millet and other plant remains from the Early Iron Age site of Boso-Njafo (Inner Congo Basin, Democratic Republic of the Congo)'. *African Archaeological Review* 31 (3): 479-512.

Logan, A.L. & Cruz, M.D. 2014. 'Gendered taskscapes: Food, farming, and craft production in Banda, Ghana in the eighteenth to twenty-first centuries'. *African Archaeological Review* 31 (2): 203-231.

Radomski, K.U. & Neumann, K. 2011. 'Grasses and grinding stones: Inflorescence phytoliths from modern West African Poaceae and archaeological stone artefacts'. In A.G. Fahmy, S. Kahlheber & A.C. D'Andrea (eds). *Windows on the African Past. Current Approaches to African Archaeobotany*. Frankfurt am Mai: Africa Magna Verlag, pp. 153-166.

Wadley, L., Sievers, C., Bamford, M., Goldberg, P., Berna, F. & Miller, C. 2011. 'Middle Stone Age bedding construction and settlement patterns at Sibudu, South Africa'. *Science* 334: 1388-1391.

Walshaw, S. 2010. 'Converting to rice: urbanization, Islamization and crops on Pemba Island, Tanzania, ad 700-1500'. *World Archaeology* 42 (1): 137-154.

ARCHAEOZOOLOGY IN SUB-SAHARAN AFRICA

Wim Van Neer[1]

Archaeozoology or zooarchaeology deals with the animal remains found at archaeological sites. Together with archaeobotanical studies, the faunal analysis allows reconstruction of the past environment as well as the way people interacted with plants and animals in former times. Animal bones and teeth are the most commonly encountered remains, but mollusk shells, bird feathers, fish scales, eggshell fragments, insect remains, animal droppings are other examples of material that can be found.

Preservation conditions vary a lot in sub-Saharan Africa and certain regions yield very little fauna. The acid soils in large parts of Central Africa result in the dissolution of the mineral part of animal bone, teeth and shell. Faunal remains from that region are therefore mainly from cave sites or from particular structures, such as pits, in rather recent sites. Rapid and deep burial of animal remains is essential for good preservation as it will limit surface weathering and destruction by scavengers, bacteria and fungi. The different animal tissues also have different preservation chances: tooth enamel preserves better than dentine or bone, and compact bone of mammal preserves better than thin bird bone. These so-called differential preservation chances should be kept in mind when interpreting species ratios or skeletal element representation within a single species. The exclusive presence of large bovid tooth fragments on a site is likely to reflect poor preservation conditions, for instance.

In order to not bias the faunal assemblages preserved at a site, it is vital to carry out a correct **sampling**. During the excavation, animal remains can be hand-collected in the trench (**fig. 1**) but it is important that the sediment is sieved in order to retrieve the smaller bones that will otherwise be inevitable lost (**fig. 2**). Experiments have shown that not only small species are missed when no sieving is carried out, but that also smaller bones of medium-sized and even large mammals are lost. Depending on the type of soil, dry (**fig. 3**) or wet sieving can be done preferably with a mesh width of 2 mm. This will guarantee the retrieval of most mammal, bird, and fish bones. Smaller volumes of sediment can be sampled separately for finer sieving on a 1 mm and 0.5 mm mesh and will allow correcting of values obtained on the 2 mm screen. Such sediment samples can also be shared with archaeobotanists interested in macrobotanical remains and charcoal, and it is therefore useful to agree on the sampling strategies with other specialists prior to the excavation. When retrieving faunal remains in the field, it is important that no selection is carried out by the excavators. All animal remains, including those that may seem undiagnostic or too small to be identifiable have to be kept for analysis by the archaeozoologist. Moreover, the proportion of unidentifiable remains in an assemblage is also important as it is a measure of the degree of fragmentation and thus the state of preservation. It is evident that to prevent further breakage, care needs to be taken to wrap and bag the material adequately and to always include labels. When the bones are still humid, they should be allowed to dry slowly, avoiding exposure to the sun as this will result in splintering of the bone. On wet bones that are packed in plastic bags, mould will develop and labels may also be destroyed if they are not protected by plastic. There is no need to sort the faunal remains by animal group, which will be done by the archaeozoologist. However, making sure that smaller, fragile bones are packed separately from more bulky remains is vital as this will reduce damage. When worked or half-finished objects are found that are made of bone, ivory, or shell, these are often kept separate as artefacts. It is useful to show these items to the archaeozoologist so that information can be provided on the type of raw materials used.

Identification of the faunal remains is the next step: finding out, for each fragment, the animal species it comes from and the skeletal element from which it is derived. Identification is based on the morphology of the bones and on their size. Other information that can sometimes be retrieved from isolated bones is the age and the sex of the individual. Pathologies as well as traces left on the bones – by humans and animals – are recorded. All these data provide interesting information useful for the reconstruction of subsistence practices (hunting strategies, herding and culling strategies of domestic species, seasonality etc.). For an adequate

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Fig. 1. Hand-collected bone, consisting mainly of domestic cattle and large Nile perch, from a food preparation facility in predynastic Hierakonpolis, Egypt. The colours vary from yellow to brown, black, grey and whitish, illustrating different degrees of exposure to fire. The scale bar is 5 cm. (Photo © W. Van Neer.)

Fig. 2. Minuscule fish bones retrieved with a fine meshed sieve. Provenance: early Roman Quseir al-Qadim, Egypt. (Photo © W. Van Neer.)

Fig. 3. Dry sieving at an excavation in north-eastern Nigeria. (Photo © P. Breunig, Frankfurt, ref. SFB 268.)

Fig. 4. Modern skeletons of fish with known body length are used as comparison for the identification of archaeological fish bones . This allows establishment the skeletal element, the species, and an estimation of the length of the corresponding fish. (Photo © RBINS Brussels.)

identification, reference collections consisting of modern skeletons of animals that were correctly identified are needed. Ideally, faunal remains should be studied in a lab, institute or museum that holds extensive collections of comparative specimens (**fig. 4**). In Africa a few such places exist, for instance the National Museums in Kenya, or the IFAN at Dakar that also have the facilities to prepare skeletons. A well trained archaeozoologist can also do a major part of the identification on site, using a limited reference collection that he/she can bring. Identification guides, atlases, publications dealing with osteometry are helpful tools for the identification both in the field and in the lab, but their sole use by an unexperienced researcher should definitely be discouraged. Atlases (**fig. 5**) provide information in two dimensions only and do not reflect the morphological variation that exists within a single species. Identification of African archaeofauna can be problematic for particular animal groups because they may consist of numerous species of similar size and morphology. This is the case, for instance, for antelopes or for catfish. Certain skeletal elements can be very diagnostic (for instance jaws, teeth, or horn cores) but others, such as ribs or vertebrae, can usually only be attributed to a size class, and will then for instance be labeled as 'medium-sized bovid'. Besides the very varied African wild fauna, the archaeozoologist often also may have to take into account the possible presence of domestic animals. Recognising them is not always straightforward (see Linseele, this volume, pp. 214-217): in the case of domestic cattle, overlap in morphology and size may occur with African buffalo or the larger antelopes. In the case of sheep and goat, they will need to be discriminated from medium-sized antelopes (such as duiker, oribi, etc.). Identifying domestic chicken is not easy either because they need to be distinguished from the numerous wild galliforms that exist in Africa (guinea-fowl, francolin, partridge). Because so much importance is attached to domestication and the propagation of domestic animals, basic comparative anatomical studies need to be carried out that define the diagnostic criteria enabling the recognition of the domestics. This has been done already for distinguishing cattle and African buffalo, but other animal groups such as the galliforms still need to be analysed in detail. The fact that this has not yet happened is mainly due to an absence of sufficient comparative skeletons of the various species. Advances in our knowledge about domestic fowl will hence not only depend on the availability of new faunal assemblages, but also on parallel efforts to expand modern reference collections.

Once identifications are carried out, the data can be quantified and interpreted. **Quantification** usually consists of counting the number of identified fragments (the so-called Number of Identified Specimens or NISPs). An additional, alternative method involves the weighing of the individual bones, starting from the assumption that there is a relationship between bone mass and the amount of meat that was provided by that species. The establishment of the minimum number of individuals (MNIs) is no longer a current practice and is usually only done in cases where complete animals are encountered. This can be animals that were intentionally placed in burials or carcasses of individuals that died naturally and that were deposited in a structure that may have acted as a trap. The data are presented in tabular form and typically consist of species lists, indicating how many remains of each species were identified, and lists with skeletal element distribution per species.

The first step in the **interpretation** of faunal remains consists of understanding how the faunal remains were deposited and what happened to them between the moment that an animal died and when its remains were discovered during the excavation. This so-called '**taphonomical analysis'** should precede the reconstruction of the past environment and of the subsistence strategies. Although humans are usually the main accumulator of faunal remains on an archaeological site, other agents can contribute as well. This is particularly obvious in cave sites where animals can die naturally. This includes not only cave-dwelling species such as bats, but also wounded or sick animals that may have sought refuge in caves. Such animals can be recognised by the fact that their skeletons are more or less complete and by the intact state of preservation of the individual bones. Several raptor bird species can roost near cave entrances and the contents of their regurgitation pellets (bones of small mammals and birds) can accumulate under their resting places. Skeletal remains of larger animals can be brought in by carnivores such as leopards and hyenas; these are usually recognisable by typical modifications: gnaw and puncture marks, bones showing etching or polishing as a result of gastric juices. Another accumulator that also produces typical marks is the porcupine. This large rodent collects bone (and soft stone) on which it gnaws to sharpen its incisors (**fig. 6**). Another thing worth remembering is that not all the faunal material found associated with cultural remains is necessarily contemporaneous. Certain species are burrowers and can not only disturb the stratigraphy of a site, but also contribute skeletal material when individuals die in their burrows. Besides these so-called late intrusives, a faunal assemblage can also include geological intrusives, i.e. remains of much older animals that were already present in the substrate when humans started occupying the site, and that were reworked afterwards. It is obvious that late and geological intrusives should not be used for the **environmental reconstruction**. The so-called pene-contemporaneous species that were not intentionally deposited by humans, but that lived and died naturally at the site at the time of human occupa-

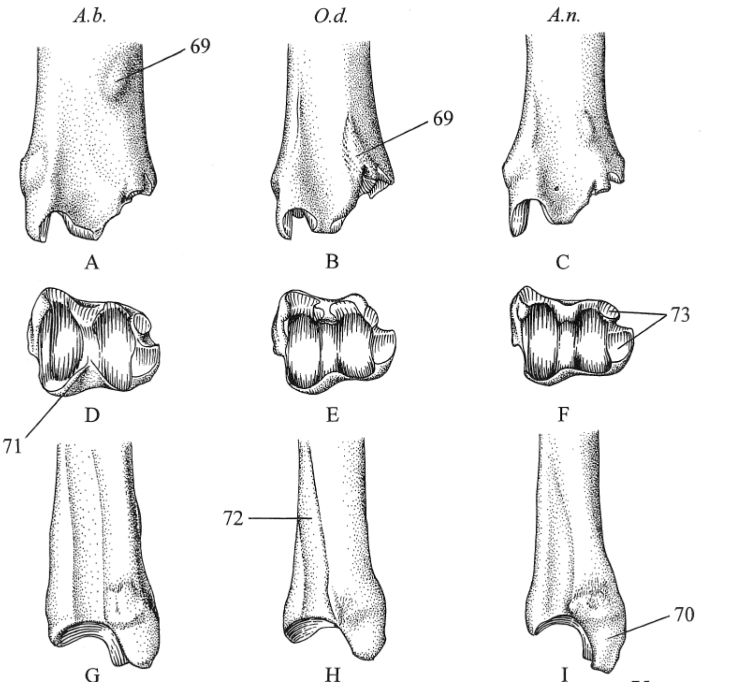

Fig. 5. Part of an identification atlas that illustrates diagnostic criteria for the distinction of three African antelopes: hartebeest, oryx and addax. This plate shows the distal tibia of hartebeest (*A.b.*), oryx (*O.d.*) and addax (*A.n.*). (From de Peters, J., Van Neer, W. & Plug, I. 1997. *Comparative postcranial osteology of Hartebeest* (Alcelaphus buselaphus)*, Scimitar Oryx* (Oryx dammah*) and Addax (*Addax nasomaculatus*), with notes on the osteometry of Gemsbok* (Oryx gazella) *and Arabian Oryx* (Oryx leucoryx*).* Series « Annales de Sciences zoologiques », no. 280. Tervuren : RMCA, 83 p.)

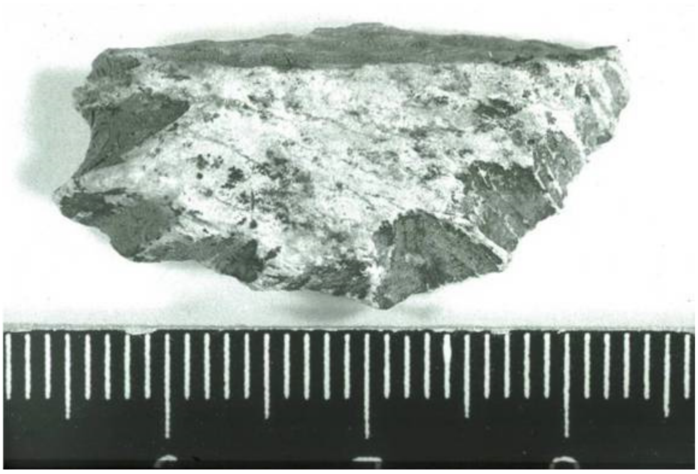

Fig. 6. Modified long bone fragment of a medium-sized mammal from a LSA level at Matupi Cave (Congo). The piece resembles to some extent a lunate tool, but is in fact a bone that was gnawed by a porcupine and is thus a pseudo bone tool. Porcupines are large rodents that sharpen their ever-growing incisors on soft stone and bone. (Photo © W. Van Neer.)

tion (small rodents, birds, lizards, etc.) can be included in the paleoecological analysis. Using the ecological requirements of the encountered animal species, it is possible to reconstruct the past environment, although this is generally less precise than using archaeobotanical data. However, often the fauna gives complementary information and, in cases where no plant remains are preserved, it is the only find category available for reconstruction.

The anthropogenic material of a faunal assemblage allows documenting the **interaction between humans and the animals** in their environment. This includes reconstruction of the food provisioning: was food obtained through scavenging, hunting and fishing or was domestic stock-keeping part of the subsistence strategies? Besides being a source of food, animals can also provide raw materials such as bone, ivory, horn, tendons, skins etc. Finished as well as half-finished objects or refuse of artisanal activities are worth studying as they allow reconstruction of the manufacturing process. Animals and their products often play a role in religious or ritual practices although proving this is not always straightforward. Obvious cases are animal burials or animals found associated with human bodies. Sometimes sites yield remains of animal species that do not occur in the region and in that case provide information on trade and exchange mechanisms in the past. Cowries are a typical example of such items that were exchanged over large distances. In the case of food animals, long distance transport will only be possible when some kind of conservation method has been applied (drying, smoking, salting).

CASE STUDY: DOMESTICATED OR WILD?

Veerle Linseele[1]

I. WHAT ARE DOMESTICATED ANIMALS?

After several generations of breeding and selection under human control, wild animals will become domesticated, showing different biological and behavioural traits than their wild ancestors. While domesticated animals can have had multiple purposes depending on the species, it is mainly those used as food resources that have profoundly changed human life ways. Their introduction marks the start of food-producing or 'Neolithic' economies. The main domesticated food animals in Africa are cattle, sheep, goat, and chicken. Stock keeping is often, although not necessarily, associated with crop cultivation. The identification of remains of domesticated animals from African archaeological contexts is in many cases not straightforward, but is crucial, particularly when studying the appearance of food production. However, also in later periods, it is of important interpretative value to know the domesticated animal species present at a site and their role in the economy.

II. IDENTIFYING BONE REMAINS OF DOMESTICATED ANIMALS

In African archaeology, there are some specific issues in the identification of domesticated animal species. The most frequently encountered problem is probably distinguishing between domesticated cattle, sheep and goat and wild bovids in their respective size range. Because of the difficulties in differentiation, in the species lists categories of unspecified bovids can often be found, usually divided by size class: small bovid, medium-sized bovid, etc. Another recurrent problem is the distinction between domesticated dog and jackals, its local wild relatives (but not ancestors!), which is in fact possible on only very few skeletal parts. Separating domesticated fowl (chicken) and guinea fowl from wild birds of the same biological order, the galliforms, on bone remains is also problematic. Depending on the part of the continent, other issues may arise.

The wild ancestors of sheep and goat have never occurred in Africa and no confusion is therefore possible between the wild and domesticated form. In the Mediterranean zone, the Nile Valley and other parts of northern Africa, wild cattle or aurochs were part of the local fauna during the Holocene. Therefore, when cattle are found in archaeological contexts, their status as either wild or domestic needs to be determined. On the bones themselves, size is the main criterion applied. The domesticated form is on average smaller than the wild one, but they overlap in size. Circumstantial evidence is therefore also often used. The importance of correct identifications is illustrated by the much debated domestic status of the early cattle from Nabta Playa and Bir Kiseiba in the Western Desert of Egypt (8th millennium BC). These cattle are not smaller (yet) than the wild form. They supposedly could not have survived in the area without humans taking care of them, hence the conclusion that they are domesticated. The whole argument in favour of local African cattle domestication revolves around these cattle. Only in the 6th millennium BC cattle that are commonly accepted as being domesticated appear in the Nabta Playa/Bir Kiseiba area. They are from then metrically distinct from the wild form and also accompanied by domesticated sheep and goat. In northern and eastern Africa, distinguishing between wild and domesticated donkey can also be problematic.

In West Africa, a special position is occupied by the helmeted guineafowl (**fig. 1**). The living conditions of animals kept in captivity are very close to those in the wild and the status of the animal as a domesticate is therefore debatable. Nevertheless, the West African subspecies has been named as ancestral to domesticated guinea fowl, now spread over many parts of the world. No criteria have been described to distinguish between wild and domesticated guinea fowl from their bones. Only one prehistoric site in West Africa, Gajiganna BII in Nigeria (early 1st millennium BC), is known with a relatively high proportion of guinea fowl bones. Although species spectrum change can be an indication for domestication, this criterion alone is probably insufficient. For now, the archaeological evidence does not allow researchers to decide whether the exploitation of guinea fowl in West Africa was an entirely local development, or if it was triggered by the introduction of the exotic chicken, as has been suggested.

Other issues when dealing with domesticated species is the separation of related taxa, like sheep and goat or horse and donkey. The latter can moreover produce

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Fig. 1. 'Captive' guineafowl in northern Nigeria. (Photo © V. Linseele.)

hybrids (mules and hinnies) which further complicates identification. A precise identification is also important here for the interpretation, horse being for example usually associated with wealthy people contrary to donkey.

III. DOMESTICATED ANIMALS IN SPECIES LISTS OF ARCHAEOLOGICAL SITES

In the species lists, domesticated and wild animals are usually separated, often with a third category of which the status as either wild or domesticated is not clear, due to identification issues. As an example the species list of Saouga 95/7, a late Iron Age site (1000-1400 AD) in northern Burkina Faso is given (**fig. 2**). There are two main systems of scientific names for domesticated species. Dog, for example, is called *Canis lupus* f. familiaris in the first system. The first two parts, in italic, refer to the wild ancestor, wolf in this case, after f. follows the specification of the domesticated form. In the second system dog is *Canis familiaris.* The first system emphasises the relation between the domesticated form and its wild ancestral species, while the second one, the so-called Linnaean system, involves a typological approach putting more emphasis on the morphological differences between the domesticated and wild form.

Goliath heron (*Ardea goliath*)	1
Helmeted guineafowl (*Numida meleagris*)	1
Pigeon or dove (Columbidae)	2
Identified wild birds	**4**
Identified domestic birds: domestic fowl (*Gallus gallus* f. domestica)	**4**
Identified wild or domestic birds: large galliform	**56**
Unidentified birds	**17**
Eggshell unidentified bird	30
African hedgehog (*Atelerix albiventris*)	4
White-toothed shrew (*Crocidura* sp.)	1
True hare (*Lepus capensis/saxatilis*)	19
Unstriped grass rat (*Arvicanthis niloticus*)	2
Small rodent	76
Mongoose (Herpestidae), genet or civet (Viverridae)	2
Sandfox (*Vulpes pallida*)	2
Common warthog (*Phacochoerus africanus*)	2
Bush duiker (*Sylvicapra grimmia*)	1
Oribi (*Ourebia ourebi*)	1
Bush duiker (*Sylvicapra grimmia*) or oribi (*Ourebia ourebi*)	8
Red-fronted gazelle (*Eudorcas rufifron*	4
Medium-sized antelope	1
Identified wild mammals	**123**
Dog (*Canis lupus* f. familiaris)	176
Horse (*Equus ferus* f. caballus)	1
Horse (*Equus ferus* f. caballus) or donkey (*Equus africanus* f. asinus)	2
Sheep (*Ovis ammon* f. aries)	7
Goat (*Capra aegagrus* f. hircus)	11
Sheep (*Ovis ammon* f. aries) or goat (*Capra aegagrus* f. hircus)	89
Cattle (*Bos primigenius* f. taurus)	46
Identified domestic mammals	**332**
Medium-sized carnivore	77
Small bovid	284
Identified wild or domestic mammals	**361**
Unidentified mammals	**6400**
Human (*Homo sapiens sapiens*)	**8**
TOTAL	**7848**

Fig. 2. Identified bird and mammal taxa of Saouga 95/7. Since among the canids, all diagnostic bones were of dog, they have all been classified as such. (Excerpt from table D.11 in Linseele 2007.)

IV. ARCHAEOMETRIC STUDIES OF DOMESTICATED ANIMAL BONES

Analysis of ancient DNA (aDNA) has proven particularly useful in studies of (early) domesticates. A striking example is a study of South African canid bones from multiple sites, identified as dog based on the fact that they were associated with other domesticated species, but that turned out to be jackal after aDNA analyses. Because it is important to adequately sample and store samples to be used for genetic studies, protocols should be planned ahead together with the specialists and taken into account during the excavations. When studying the early appearance of domesticated species, running radiocarbon dates directly on diagnostic bones should be considered. This allows researchers to finely and reliably reconstruct the timing of their introduction. Relatively new techniques, such as stable isotope studies, are also generally more frequently applied on remains of domesticated than of wild species. They can be used to reconstruct feeding and herding strategies. An interesting application from Africa was performed on horn preserved on cattle bucrania from the Classic Kerma period (1750-1500 BC) at Kerma in Sudan. The results suggest that the numerous cattle offered were brought to Kerma from different parts of the realm. In many parts of Africa, preservation issues will complicate the application of archaeometric techniques. Often only the mineral fraction of a bone is preserved, which means for example that aDNA studies are no longer possible.

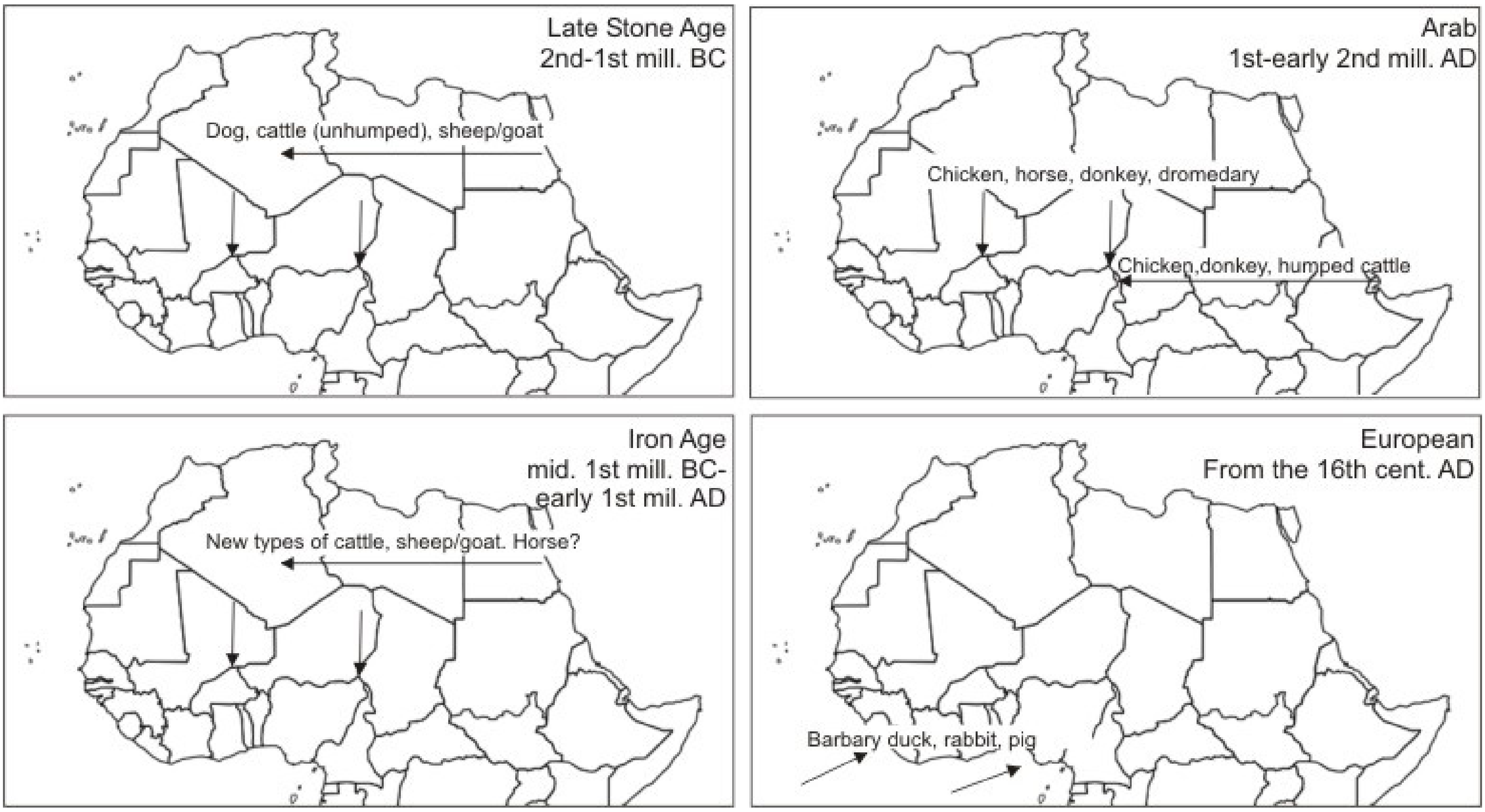

Fig. 3. The four 'waves' of introduction of domesticated animals into Sahelian West Africa (figures made by V. Linseele.)

V. THE TAPHONOMY OF DOMESTICATED ANIMALS

Before the actual interpretation, it should always be considered how and why the animals ended up at the site, which is part of the taphonomical studies. Domesticated animals may have been used for the power they can provide (horse, donkey, but also cattle), as a source of raw material to make all kinds of objects, or they may have been simply companion animals (e.g., dogs, cats). Most of the time, however, they have been consumed. It is a misconception among archaeologists that traces of butchery and/or burning are needed to prove that. Such marks are often missing, especially in prehistoric sites, and the simple fact that the animals are found disarticulated, and mixed in with other species, can be used as an argument for consumption. Nevertheless, for more unusual consumption animals, traces are useful. Cut marks on dog bones were for example used to argue that the species appeared on the menu at Saouga 95/7 in Burkina Faso (1st half second millennium AD). Burning is usually not related to food preparation, as meat adhering to the bones protects them from being directly exposed to the fire. Most of the animals found at archaeological sites are food remains and species that were of importance but not consumed can be difficult to trace. Carcasses of horse and dromedaries, for example, were probably most of the time dumped outside of the settlement areas, and have therefore little chance of being recovered.

VI. INTERPRETING REMAINS OF DOMESTICATED ANIMALS

While in north-eastern Africa a few species – including cattle, donkey and cat – (may) have been locally domesticated, no animals were domesticated in sub-Saharan Africa before the modern era, except for guinea fowl perhaps. This should most probably be explained by a lack of wild species with biological traits that make them suitable for domestication. The domesticated animal taxa from sub-Saharan Africa have all been introduced from elsewhere at some point. For the major species (cattle, sheep and goat), dates become generally younger as one moves away from north-eastern Africa but many gaps remain in our knowledge on their spread. The introduction of new taxa in a certain region at a certain time can be connected to movements of people and/or interregional contacts. For West Africa, four waves of introductions have been proposed for example (**fig. 3**). In domesticates, many types ('races') of one species exist. These types have often locally developed as adaptations to the local circumstances. In the more humid parts of West Africa, for example , dwarf forms of cattle, sheep, goat, and horse

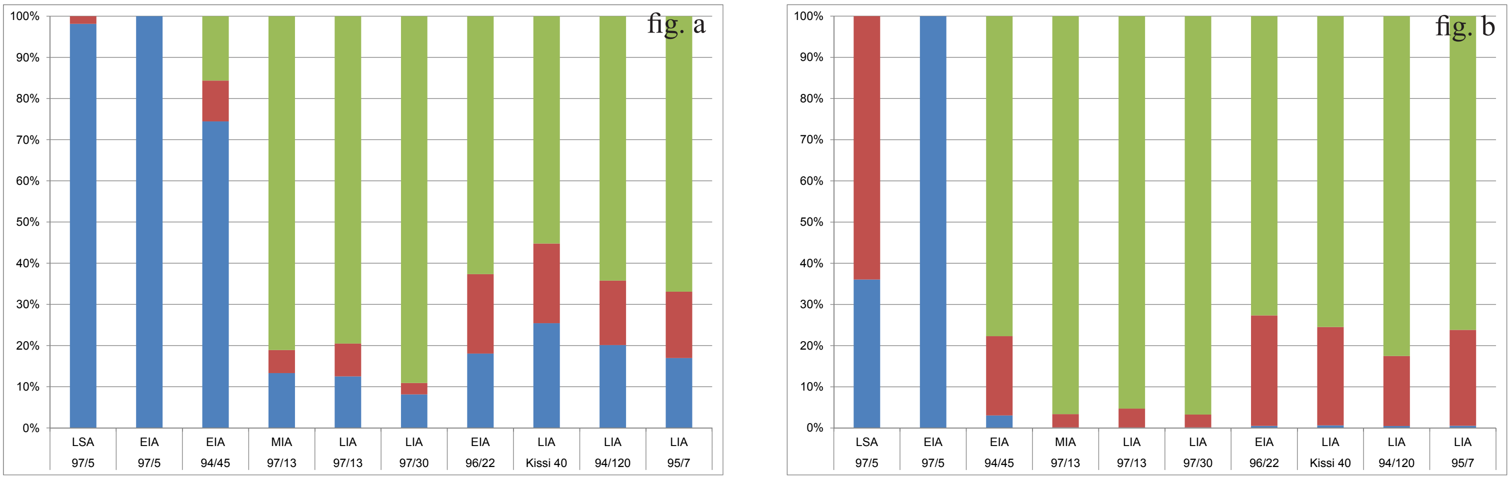

Fig. 4. Relative importance of different economic strategies for Late Stone Age (2200-1000 BC) and Iron Age (0-1400 AD) localities in northern Burkina Faso. Blue: fishing; red: hunting and fowling; green: domestic stock keeping. **a.** based on NISPs (numbers of identified specimens); **b.** based on NISP x average live weight (excerpt from fig. 49a and fig. 50b in Linseele 2007.)

occur . There seems to be a link between dwarfism and resistance to humidity-related diseases. Archaeozoological data, mainly metrical ones, allow tracing of the different types in the past.

In the interpretation, the quantitative importance of domesticated animals in the total faunal sample is usually considered. This can be done by looking at numbers of bones (**fig. 4a**), which mainly reflects frequency of consumption, or at numbers of bones multiplied by live weight, which reflects amounts of meat (**fig. 4b**), although multiple other ways are possible as well. There is a correlation with how suitable the environment is for keeping domesticates, and the numbers by which they are represented in the archaeological samples. In the wetter, lusher zones of West Africa, wild game is typically more important as livestock is prone to diseases. Furthermore, the proportion between the different domesticated animal species is investigated. More sheep/goat than cattle usually means more harsh environments, as these species are less demanding. A predominance of sheep/goat is the pattern seen for example at settlement mounds from the first and early second millennium AD in Burkina Faso. Animals kept by sedentary people are dependent on local circumstances, while nomadic herds can move in function of where the most suitable resources occur. In the archaeological record, the sedentary farmers are overrepresented compared to the nomadic herders, as the latter leave much fewer traces.

Age-at-death distributions, presented as mortality profiles, are made to reconstruct whether domesticated cattle, sheep, and goat were used for milk in addition to being slaughtered for meat. These require large sets of precise data on ages at death, preferably obtained from series of (complete) tooth rows. Unfortunately, preservation conditions in sub-Saharan Africa usually do not allow the gathering of sufficient data of that kind. However, other ways exist to trace the use of milk, like organic residue analysis of pottery, which has proven the extensive use of milk in the Libyan prehistory (5th millennium BC). Judging from data on modern breeds, most West African cattle are not very productive for milk. Blood is also sometimes used from living animals, but seems to play only a marginal role in the human diet. Eggs of domesticated fowl were probably also not important in the past, but this is hard to prove as precise identifications of bird eggshell remains are problematic.

From ethnographic evidence, for example from Talensi in Ghana, we know that (some) domesticated species must have been favoured for animal sacrifice. Particularly chicken is supposed to have been a popular animal in ritual spheres. The archaeological evidence is very limited, probably due to the sacrifice practices themselves, useful products that are taken away, and waste that is quickly removed by different kinds of predatory animals. Burials of domesticated animals, cattle but also dogs, are well-known from the Sahara and its southern fringes, for example at Adrar Bous in Niger.

REFERENCE

Linseele, V. 2007. *Archaeofaunal remains from the past 4000 years in Sahelian West Africa. Domestic livestock, subsistence strategies and environmental changes*. Oxford: Archaeopress.

SOIL COVER IN CENTRAL AFRICA: EXAMPLES OF GEOARCHEOLOGICAL APPROACHES, CONSTRAINTS, AND ASSETS

Dominique Schwartz[1]

Like sediments, soils conceal archaeological sites and record paleoenvironmental dynamics. But reading soil archives requires special keys, because soils are open environments. In addition, the soils of equatorial Africa (ferrallitisols: Baize & Girard 2008) have specificities that must be taken into account.

I. KEY FEATURES OF EQUATORIAL SOIL COVER

Ferrallitisols are very thick: a layer rising 2 to 5 m above the regolith is common. Their history is long, as they take about 100,000 years to form. The potential length of the soil record is therefore long, sometimes several hundreds of thousands of years. In Central Africa, however, we note that Acheulian or older occurrences are very rarely found in soils, unlike those of the Middle Stone Age which are very common in the two Congos, Gabon, and Cameroon and which are dated in the region between 40,000 and 70,000 years. With the exception of fresh excavations during the construction of roads, these remains are generally not observable because they are hidden deep in soil covered with forest. It is only in the eroded savannas (Nyanga, Lope, Niari, etc.) that they can be observed on the surface, albeit reworked and mixed with other, more recent materials. Furthermore, the general acidity of ferrallitisols – the pH varies from 4.5 to 6 –, the rate of water flow, and the intensity of weathering and biological activity limit artefact preservation and are likely to induce taphonomic biases. They preserve wood and bones very poorly, and they quickly alter ceramics and sometimes even stone.

II. BIOLOGICAL ALTERATIONS AND THEIR ARCHAEOLOGICAL IMPLICATIONS

The considerable churning of the soil by macrofauna, particularly termites, is one of the most remarkable aspects of biological activity in ferrallitisols. Some species have a tendency to bring large quantities of materials, collected at several metres' depth, to the surface. Soil can gradually cover large items, both natural and anthropogenic, which can be buried slightly. In temperate environments, the distribution of charcoal in soils has been explained by the activity of earthworms (Carcaillet & Talon 1996). The model also applies to the distribution of charcoal, pottery and lithics in ferrallitisols.

Two cases at least must be distinguished:

Archaeological sites from more recent times through the Neolithic are generally found under less than a metre of soil. Artefacts are often vertically dispersed over a span found 30 to 50 cm deep. This type of dispersal can be a sign that objects have moved due to biological activity in the soil, and that the level of artefact concentration doesn't correspond to an ancient surface covered by more recent sediments: rather, the ancient surface corresponds to the present soil surface and the objects originally on that ancient surface have been subject to a slight downward movement. Careful field study of the individual positioning of objects, especially of pottery sherds, is therefore required, and should afterwards be supplemented by granulometric and/or mineralogical analyses of the levels above, below, and surrounding each artefact. Such movement can also explain why structures such as postholes are not visible.

It has also been suggested that termite activity could explain the creation and covering of stone-lines, which occur so often in central African ferrallitisols. Schwartz (1996) discusses possible or impossible stone-line formation processes based on the nature of the terrain and their analytic characteristics. Their formation is complex. No single mechanism (biological activity, erosion, gravitationally-induced movement through the soil column, etc.) can explain their existence. In fact, they consist of an erosion level on which the Stone Age industries lie. Their covering of over more than a metre is due to the resurfacing, by termites, of fine materials, which are then transported by colluvial activity along watersheds.

III. THE NEED FOR A PEDOSTRATIGRAPHIC APPROACH

These two examples demonstrate the need to apply a pedostratigraphic approach in the field in Africa. This requires identifying, based on a study of the morphological characteristics of surface formations, which processes are part of the initial formation of the deposits and which are due to subsequent pedogenesis. This distinction is not trivial. Any confusion between geological strata and soil horizons can lead to serious misunderstandings, both in the

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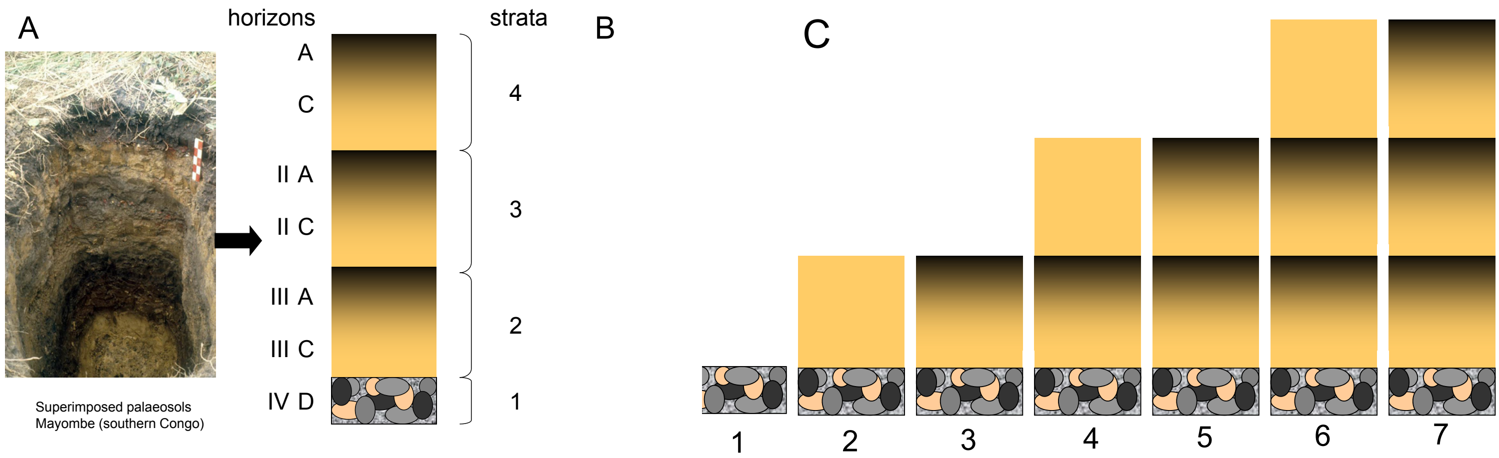

Fig. 1. Paleosols of Makaba (central Mayombe, Congo). **A**. soil profile; **B.** pedological nomenclature (left) and stratigraphic nomenclature (right); **C.** the different phases of material deposit and soil formation. (1): coarse alluvial deposits; (2) deposit of the first layer of colluvium; (3) soil formation and individualisation of horizons A and C; (4): cover by a second level of colluvium; (5) ditto (3); (6): burial under a third layer of colluvium; (7) same as (3) and (5). (Adapted from Schwartz 2012.)

understanding of the formation of the geological and pedological units as well as in the resulting chronologies and paleoecological interpretations.. The following examples serve to illustrate this.

A. The paleosols of Mayombe (Schwartz 2012)

In the savannas of Mayombe, we can observe superimposed paleosols at the bottom of slopes. In the section shown in the **figure 1**, we see at the base a layer of alluvial pebbles (IVD) covered by an initial layer of colluvial material (III), in which a minimally evolved soil has developed: above the colluvium undergoing pedogenesis (IIIC horizon) can be seen a surface humus horizon (IIIA). This soil is buried under a layer of colluvium, in which a soil layer (II) with an AC profile can be seen, and then the process repeats itself one more time. We can thus distinguish seven soil horizons, and four strata. To describe seven stratigraphic units would in this case be an error.

B. The 'white sand and peaty sandstone' of Bateke country (Schwartz 1985; 2012)

The 'white sand and peaty sandstone' of Bateke country and Malebo Pool were first described in the first half of the 20th century (Babet 1933; de Heinzelin 1952). For a long time, loose sand and 'sandstone' – in fact, spodic horizons cemented into hardpans by humic matter – were described as strata (**fig. 2**). Various interpretations have been put forward over the years by geologists and geomorphologists: Cretaceous strata and, after the discovery of stone tools, Quaternary formations. In fact, they are Bateke sands transformed by pedogenesis into podzols around 40,000/30,000 years ago. White sand and peat sandstone are two horizons, E and BP, which are of exactly the same age: the bleaching of the sand (E) by the destruction of clays, elimination of iron, and migration of soluble organic materials is accompanied by the formation of a humic accumulation horizon (BP) that later cemented. A stratigraphic reading of the two levels leads to errors in chronological interpretation that can damage archaeological interpretations.

C. Podzol in the ORSTOM concession in Brazzaville (fig. 3)

These two examples illustrate the need to understand soil processes for stratigraphic interpretation and its use in archaeology. The last case shows how archaeological indices can in fact help interpret pedogenesis. The podzol mentioned had a very complex history, revealed by the presence of a Tshitolian lithic industry (Later Stone Age) sitting on the humic hardpan (Schwartz 1988; Schwartz & Lanfranchi 1990). The presence of this industry, perfectly in place, undisturbed by biological agents, suggests that the hardpan was a circulation surface, and that there was no genetic relation between the overlying white-sands horizon E and the underlying spodic indurated BP-horizon. This 'pedogenetic heresy' was nevertheless confirmed by the phosphorus content of the hardpan, 30 times higher than normal, and the fact that this humic hardpan extends under the ferrallitisol, an environment in which it could not have formed. The explanation lies in the fact that an initial podzol was removed by erosion that stopped on the more resistant hardpan. After being covered by material resulting from a laterally weathering ferrallitisol, a second podzolisation took place, followed by other discrete phases of pedogenesis. In this case, it was the presence of the lithic artefacts that alerted the soil scientist and led to these conclusions. Without this evidence, these phenomena would have been impossible to interpret.

IV. IN ADDITION TO FIELDWORK, THE ANALYSIS OF SOIL COMPONENTS IN SUPPORT OF ARCHAEOLOGY

Field observations are extremely valuable if you can tell the sediment (deposit of materials) from the soil (post-depositional evolution). It is nevertheless clear that we must supplement these with laboratory analyses. Some are standard: granulometric analysis, or measurement of total phosphorus, levels of which are an indicator of human activity: for example, the content of 12‰ in the hardpan of the ORSTOM concession is 30 times higher than the average contents of soils the region and can be explained only by anthropogenic enrichment, probably related to a campsite. Other analyses, such as anthracological analysis, identification of pollen and phytoliths, are common practice and complement the archaeological research. It is always important in the case of these studies to clearly identify the nature, soil or sediment, of the studied material. Indeed, in soils, biological churning results in a particularly drastic mixing and degradation of biological evidence, due to the small size of these constituents.

Moreover, Central Africa is an ideal environment for biogeochemical studies using carbon 13. Indeed, forests, which consist exclusively of C3 photosynthetic-cycle plants, and savannas dominated by C4 plants, have a very different ^{13}C isotopic composition, which is transmitted to the organic matter in the soil. It is thus possible, using analysis of these organic materials, to know in what environment, forest or savanna, past populations evolved. Thus, coupled with carbon 14 age measurements, carbon 13 analysis of organic matter in the paleosols of Mayombe (see section A above) shows that they formed under savannas, and must be at least 1,800 years old. This demonstrated that, contrary to an opinion popular in the 1970s, savannas are not recent human creations caused by clearing. Spatially more substantial studies revealed that the forest diminished significantly in the late Holocene, which might have facilitated migration of Bantu technical skills, peoples, and cultures from north to south of the equatorial forest (Schwartz 1992).

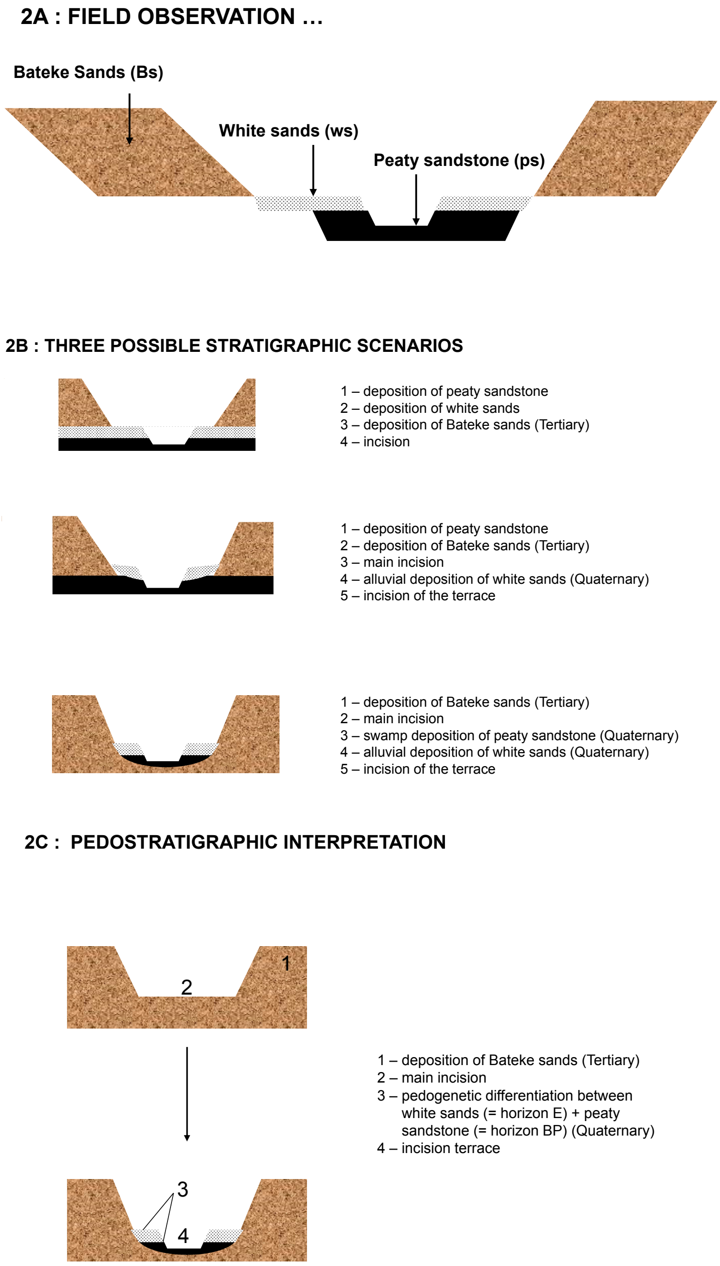

Fig. 2. 'White sands' and 'peaty sandstone' of Bateke country (Congo and Democratic Republic of the Congo). From field notes (**A**) to stratigraphic interpretation (**B**), to the proper explanation (**C**). (Extract from Schwartz 2012.)

V. THE NEED TO UNRAVEL THE THREAD OF TIME

A final important point should be emphasised: the need to know how to read the specific temporalities of the soil. These are fundamentally different from those of sediments, because, with the notable exception of buried paleosols, soils are open environments whose constituents have very different dynamics. Some of these constituents enter it only rarely or sporadically (charcoal, archaeological artefacts), others accumulate (the organic matter of humic hardpans), and still others are continuously renewed (organic matter in biologically active horizons, pollen, etc.).

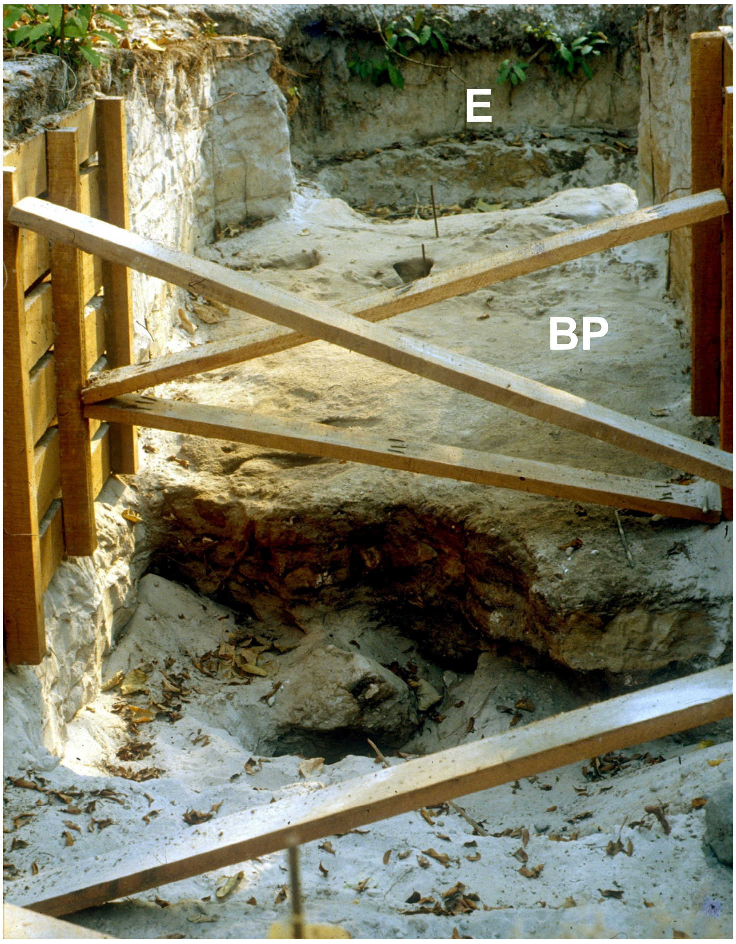

Fig. 3. Podzol in the ORSTOM concession (Brazzaville, Congo) in the course of being cleared (R. Lanfranchi excavations, 1982). Below, the eluvial horizon E ('white sands'); in the middle-ground, the indurated spodic horizon in humic hardpan (BP), exposed during excavations and corresponding to an ancient surface; in the foreground a rocky escarpment fossilised below the current topography. (Photo © D. Schwartz.)

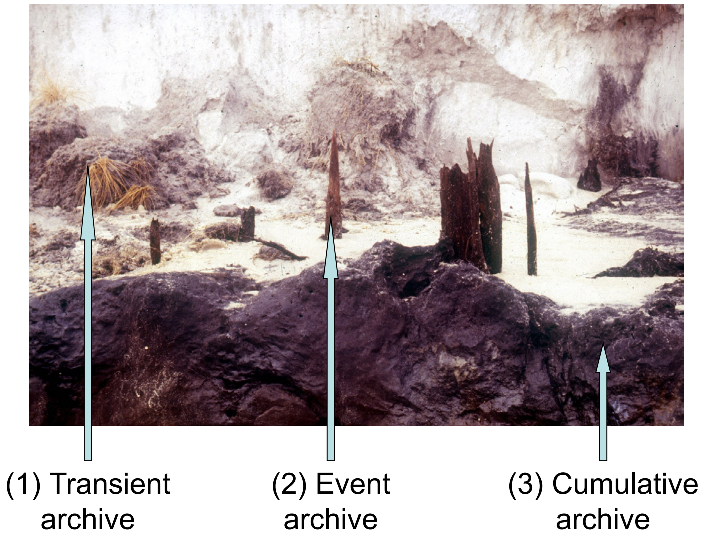

Fig. 4. Pedological archives (taken from Schwartz 2012). The three examples presented here are organic constituents. (1) Organic matter from surface horizons (here in crumbling lumps) is constantly renewed: it is typically a transient archive; (2) fragments of fossilised wood (or charcoal) enter into the ground and remain there very episodically, discontinuously: these are event archives. Carbon 14 dating of these root pivots range between 3000 and 7500 BP; (3) after migration from surface horizons in a soluble state, organics flow into spodic horizons where they form very stable organometallic complexes, and continue to accumulate. Over time, the stock increases: these are cumulative archives. (Photo © D. Schwartz, coast at Pointe-Noire.)

We can therefore define three types of soil archive (**fig. 4**): event archives, cumulative archives, and transient archives (Schwartz 2012). This last type corresponds to constituents present in the soil for a variable period of time before being removed by dissolution, mineralisation, or other processes. This phenomenon is expressed by the notion of mean residence time, which measures life expectancy. Thus, it is important to interpret age measurements based on material type. Carbon 14 dating of charcoal does not have the same meaning as C14 dating of organic matter, and to use for instance a C14 age on charcoal to give a time value to a carbon 13 measurement of organic matter is irrelevant (Schwartz 1997).

In conclusion, the examples discussed here illustrate the wealth of approaches that combine soil science and archaeology. Each discipline can be complementary to the other, allowing both to enhance the interpretation of field observations. Is it necessary to make any additional plea for more consideration of this complementarity in the training of researchers?

REFERENCES

Babet, V. 1947. 'Exploration de la partie méridionale des plateaux Bateke (1933)'. *Bulletin du Service des Mines A.E.F.*, 3: 23-56 (+ photos in annex).

Baize, D. & Girard, M.C. (eds). Association française pour l'étude du sol (Afes). 2008. *Référentiel pédologique*, Paris: Quae, 405 p.

Carcaillet, C. & Talon, B. 1996. 'Aspects taphonomiques de la stratigraphie et de la datation de charbons de bois dans les sols: exemple de quelques sols des Alpes'. *Géographie Physique et Quaternaire*, 50 (2): 233-244.

de Heinzelin de Braucourt, J. 1952. *Sols, paléosols et* *désertifications anciennes dans le secteur nord-oriental du bassin du Congo*. Brussels: INEAC, 168 p. (+ additional illustrations).

Schwartz, D. 1985. 'Histoire d'un paysage: le Lousseke. Paléoenvironnements quaternaires et podzolisation sur sables Bateke (quarante derniers millénaires, région de Brazzaville, R.P. du Congo)'. Doctoral thesis, University of Nancy I, 211 p., appeared in 1988, collection 'Études et Thèses'. Paris: ORSTOM, 285 p.

Schwartz, D. 1988. 'Some podzols on Bateke sands and their origins, People's Republic of Congo'. *Geoderma*, 43 (2/3): 229-247.

Schwartz, D. 1992. 'Assèchement climatique vers 3000 B.P. et expansion Bantu en Afrique centrale atlantique: quelques réflexions'. *Bulletin de la Société géologique de France*, 163 (3): 353-361.

Schwartz, D. 1996. 'Archéologie préhistorique et processus de formation des stone-lines en Afrique centrale (Congo-Brazzaville et zones périphériques)'. *Geo-Eco-Trop* 20 (1/4): 15-38.

Schwartz, D. 1997. 'Commentaire à la note de Richard Oslisly, Bernard Peyrot, Salah Abdessadok et Lee White, Le site de Lopé 2: un indicateur de transition écosystémique ca 10 000 BP dans la moyenne vallée de l'Ogooué, C.R. Acad. Sci. Paris, 323, IIa, 1996, 933-939'. *Comptes rendus des séances de l'Académie des Sciences de Paris*, 325, IIa, 5: 389-391.

Schwartz, D. 2012. 'Les temps du sol: interprétations temporelles de l'archivage pédologique dans les approches paléoenvironnementalistes et géoarchéologiques'. *Étude & Gestion des Sols*, 19 (1): 51-65.

Schwartz, D. & Lanfranchi, R. 1990. 'Les remaniements de sols sur sables Bateke dans la région de Brazzaville (Congo): une mise au point'. In R. Lanfranchi & D. Schwartz (eds), *Paysages quaternaires de l'Afrique centrale atlantique*. Paris: ORSTOM, pp. 167-182.

CASE STUDY IN A SUDANO-SAHELIAN FLUVIAL SETTING: EXAMPLES FROM THE YAME VALLEY (DOGON DISTRICT, MALI) AND THE FALÉMÉ VALLEY (SENEGAL)

Michel Rasse[1]

When working with archaeological records in Africa – as elsewhere – one must take into account the sedimentary conditions of their burial. When reconstructing past environments in an African fluvial setting, the coupled presence of water and of humans is associated with the coupling of erosion and accumulation so characteristic of river bank networks in the Sudano-Sahelien area. A nuanced understanding of how the archaeological layers fit into the stratigraphy* permits an understanding of site burial phases, but also of the phases of erosion that the banks experienced and the subsequent movements of artefacts. This might appear obvious, but we should not underestimate the difficulties of approaching sites in this context, and experience has shown that, as each study will have its specificities, each must be approached with great care and organisation if certain pitfalls are to be avoided.

Dealing with one or more prehistoric sites in a fluvial setting involves study of regional geomorphology* and stratigraphic conditions. An understanding of the site requires in-depth surveys in an environment that is sometimes difficult to access, and these surveys often benefit from the participation of a multi-disciplinary team (**fig. 1**). A 'reading' of the landscape made simultaneously by a geomorphologist, a pedologist,* an archaeologist, etc., in addition to raising questions that will be largely beneficial to all, broadens observations so that a research scenario can be implemented quickly, even if this will need to be changed in light of later discoveries. A rough understanding of the thickness, size, and geometry of the different stratigraphic units of the Pleistocene sediments of the Yame Valley (Bandiagara plateau, Mali) therefore required a minimum of three multi-week missions. The resulting stratigraphy could only be certified with the establishment of an absolute time frame using the OSL method.*

Understanding these topographies and the geomorphological processes that govern site evolution is also imperative. It is even more important because in the tight, often monotonous profiles typifying African landscapes, the processes must be understood prior to any explanation of deposits. Topographical analyses linked to fluvial activity permit researchers to distinguish several levels of *glacis** and terrace,* which also show evidence of the influence of lateral colluvial processes. Generally, the base *glacis* is followed by one, two, or even three secondary *glacis* (**fig.2**) which, cross sections show, are associated with the levels of alluvial terraces,* themselves multiple and often difficult to correlate laterally. Thus along the Falémé (Senegal), the level of recent terraces is recorded in the topography of bank erosion , which began in the early Holocene; structural characteristics (resistant bedrock*) and the lateral dynamic of water flow shaped their distribution. A simple reading of topographic levels based solely on altitude is therefore far from simple.

In addition to the fluvial effects are those of run-off, which occur at the expense of the main *glacis* formations. The *glacis* therefore appear successively as 'erosional *glacis*' located at the foot of the main terrace edges and exposing artefacts, and accumulation *glacis* downstream, where the colluvium* of each rainy season covers and fossilizes the most recent artefacts. In Ounjougou (Mali), the erosion of the fringing *glacis* revealed bifacial points from the eighth millennium BC, while only a few metres away the colluvium of recent centuries had covered protohistoric remains, thus creating a terrace fitting neatly into the landscape. It is therefore important to consider the surface differences between the erosion and accumulation zones. These same processes are of course responsible for shaping previous formations, and paleotopographies demonstrate the same processes that have been fossilised by recent events (with a former edge *glacis* completely fossilised by recent lateral deposits in Kokolo; **fig. 2**).

Understanding pedological processes is also extremely important in interpreting formations, as a single stratigraphic element can present itself in very different ways, with leaching* introducing variations both along the vertical axis and laterally, depending on water flow in the sediment. Variations of colour, bioturbation,* concretions, induration, and even important laterite must be considered in order to avoid misinterpretation. These considerations can often help in the recognition of different stratigraphic units, which are the result of periods of accumulation and erosion which were marked to greater or lesser extent by successive phases of soil evolution. Any unit might present pedological characteristics that could be looked for elsewhere, where the survey con-

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Fig. 1. Multi-disciplinary team survey in the gullies of the banks of the Falémé (eastern Senegal). The stratigraphic information (from *Colluvions* or colluvium to *Us* where U indicates Pleistocene formations) corresponds to the upper portion of the Toumboura I section from **figure 3**. (Photo © M. Rasse.)

ditions are less clear. Discrepancies related to surface stripping or major periods of erosion are almost always represented by lines of crushed stone, altered pisolites,* and sometimes by archaeological artefacts, which must also be considered in order to understand both the succession of sedimentary events and the extent to which the artefacts found have moved.

With this approach, the stratigraphy of formations helps to reconstruct (and often, in fact, to locate) the major stages of the fluvial dynamic. During Isotope Stage 3* of the last glacial period, the Sudano-Sahelian zone received large quantities of dust from arid regions subject to major soil erosion through deflation.* These wind-carried deposits overloaded the hydrographic networks, which, during the rainy season and then when rainfalls were reduced, deposited large quantities of sediment in the valleys, certain areas of which filled up for structural reasons. At Ounjougou, Isotope Stage 3 is represented by several stratigraphic units (U3, U4, and U5; **fig. 2**) featuring sedimentary discontinuities that seem to be attributable to Heinrich-type* events (Rasse *et al.* 2004; Lespez *et al.* 2008). Dates are not yet available for the Falémé valley, but the current study suggests that the watercourse, flowing from the south, was always fed by precipitation falling in regions further to the south (even during stage 2, characterised in Sudano-Sahelian Africa by extreme aridity) and therefore suffered less from the drier climate. The Falémé moved large amounts of silt and loam from watersheds, and deposited them downstream in areas with very little slope, between the last landforms in the southeast of the region and its confluence with the Senegal. The units referred to between Utp and Uc can be attributed to this period when watersheds received a great deal of material, and can likely be correlated with Isotope Stages 4, 3, and 2 (**fig. 3**).

The early Holocene, on the other hand, is marked by a rather sharp incision of rivers, development of fringing *glacis**, and major erosion of anterior formations. These

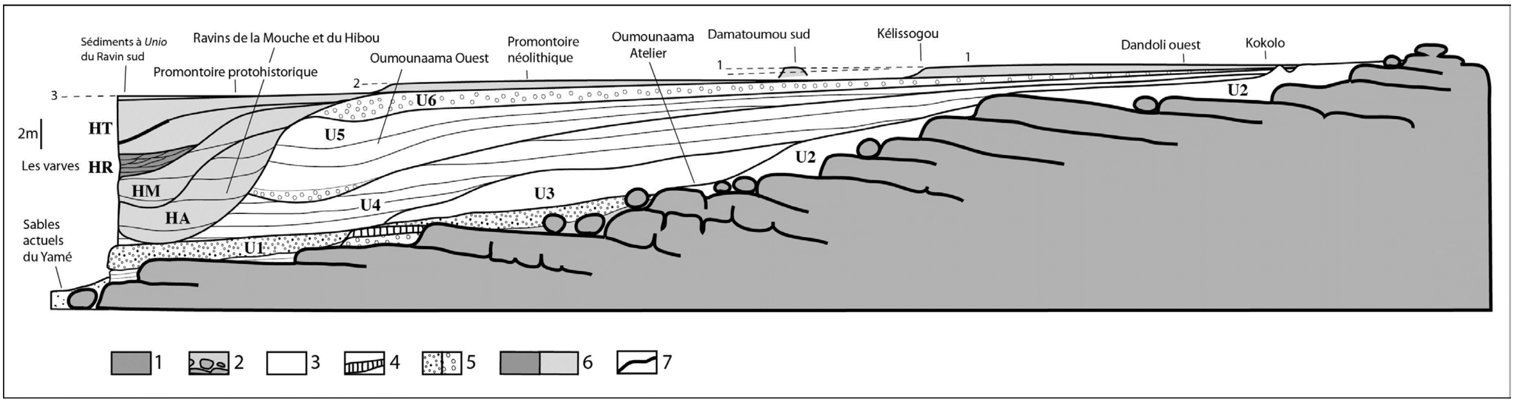

Fig. 2. Pleistocene and Holocene formations in the Yame valley (Dogon district, Mali). Cross-section based on various archaeological and stratigraphic sites. Key: 1: sandstone; 2: sandstone regolith; 3: Pleistocene formations (from U1 to U6); 4: ferruginous crust/laterite;* 5: coarse alluvium; 6: Holocene formations (from HA to HT); 7: crusting (from HR to HT). From Rasse *et al.* 2004.

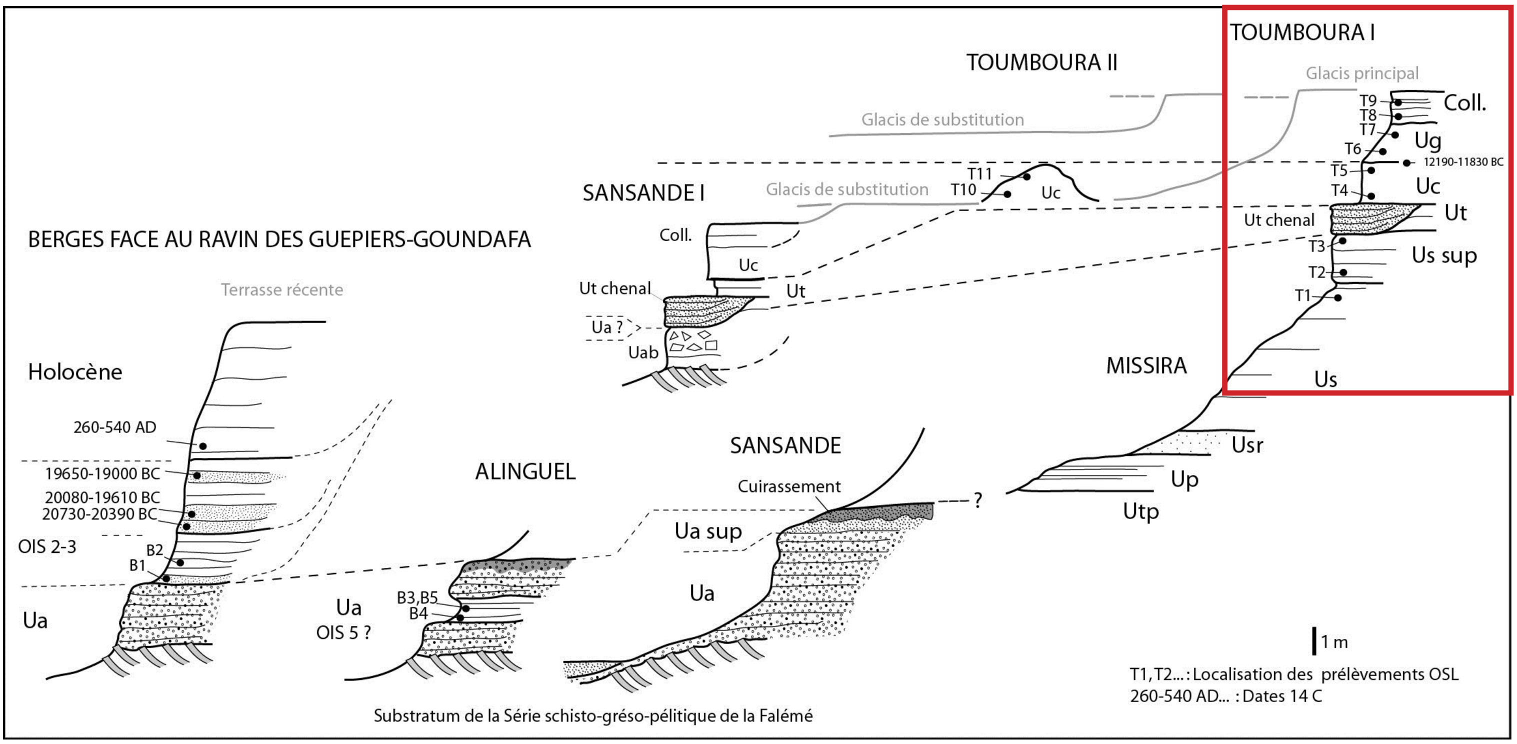

Fig. 3. First geometric reconstruction of the shapes and formations of the banks of the Falémé. Study from different sites with tentative correlations. Insert in red = **fig. 1**.

testify to a decrease in the amount of wind-borne dust, an increase in rainfall, and a concentration of more abundant flows of water. The sedimentary record of larger watercourses is not always the most interesting to study, however.

The case of the Yame, which runs through a valley more or less deeply incised into the sandstone of the Bandiagara plateau, allowed a very detailed study of the stratigraphy of the various Holocene sequences. Study has shown that, especially for the last ten millennia, fluvial records can demonstrate great paleoclimatic resolution, similar to the well-known lacustrine or marine sequences (Lespez *et al.* 2008; 2011).

After a phase of rapid incision into Pleistocene deposits, the first Holocene formations (11.5-8.5 ka cal BP) are coarse, interrupted twice by finer sediment, and are evidence of a greater capacity of the upper Yame than is seen today. After a sedimentary hiatus between 8.8 and 7.6 ka cal BP, the middle and recent Holocene (8.5-4 ka cal BP) are characterised by three sedimentary sequences that testify to a very different environment. Micromorphological and palynological studies indicate the filling of relatively narrow channels in a valley covered with dense gallery-forest of Guinean type. The most recent period (4-0.1 ka cal BP) displays a more rhythmic sedimentation that is clearly seasonal, and for which the rainfall conditions become progressively more and more irregular, progressively becoming more similar to current conditions, with rather long lulls interspersed with highly morphogenic episodes.

In contrast, along the Falémé, surveys so far suggest weaker signs of the Holocene, the dynamic of the waterways during the two last millennia having doubtless partially eroded the sedimentary record. Future research will surely bring answers to this question; we can in fact never exclude that, in the case of a better-fed watercourse, a number of traces have been conserved, buried in the sediment of the last great centennial floods.

Understanding the long-term of the sedimentary records in their geometry is absolutely not trivial. Not only does this multi-disciplinary approach allow an understanding of the succession of episodes of sedimentation and erosion, but it 'frames' the work done by the rest of the team. In fact, an understanding of the geometry of the sequences must precede – or at least be done concomitantly with the specialists in question – any sediment sampling for granulometry,* soil micromorphology, or analysis of bio-indicators for paleoenvironmental reconstructions, and for the purposes of absolute dating (charcoal for radiocarbon 14 and radiometric measurements for OSL). We know how much these laboratory techniques cost, and it is essential that they be as targeted as possible in keeping with the priorities and objectives of the mission.

If it is easy, for example, to understand how samples will be taken for paleoenvironmental reconstruction (pollen, phytoliths,* plant macrofossils, for establishing past vegetation regimes), the sampling methods for OSL dating (the method best suited for studying the Pleistocene in these valleys) vary according to the methods and goals of the mission and the precision required (see, for example, the localisation of samples in **figure 3** for chronostratigraphic* purposes). For this method, it is essential to take into account the thickness of the sediments that buried the levels under study. Reconstruction of the successive periods of accumulation and erosion allows the volume of sediments and the potential duration of sedimentary cover to be refined, and moreover allows a more precise definition of the proposed chronological units.

In order to understand the geometry of formations, therefore, we recommend a long period of fieldwork undertaken, to the extent possible, by a multi-disciplinary team. This work must precede all the in-depth chronostratigraphic and paleoenvironmental studies that archaeology today requires.

REFERENCES

Lespez, L., Rasse, M., Le Drézen, Y., Tribolo, Ch., Huysecom, E. & Ballouche, A. 2008. 'Signal climatique et hydrosystèmes continentaux entre 50 et 4 ka en Afrique de l'Ouest: l'exemple de la vallée du Yamé (pays Dogon, Mali)'. *Géomorphologie, Relief, Processus, Environnement* 3: 169-186.

Lespez, L., Le Drézen, Y., Garnier, A., Rasse, M., Eichhorn, B., Ozainne, S., Ballouche, A., Neunmann, K. & Huysecom, E. 2011. 'High-resolution fluvial records of Holocene environmental changes in the Sahel: the Yamé River at Ounjougou (Mali, West Africa)'. *Quaternary Science Reviews* 30: 737-756.

Rasse, M., Soriano, S., Tribolo, Ch., Stokes, S. & Huysecom, E. 2004. 'La séquence pléistocène supérieure d'Ounjougou (pays Dogon, Mali): évolution géomorphologique, enregistrements sédimentaires et changements culturels'. *Quaternaire* 15(4): 329-341.

GLOSSARY

Alluvium: any deposit (clay, sand, gravel, etc.) deposited by a river on its banks, on its floodplains, at its mouth, in a delta or estuary, etc.

Bioturbation: the disturbance of soils and sediments by biological agents, especially by burrowing and digging animals such as termites, ants, worms, or rats.

Chronostratigraphy: study of strata or terrestrial rocks for the chronological reconstruction of various geological stages. Modern dating methods mean this is now very precise.

Colluvium: relatively fine deposits at the bottom of a slope, made from elements stripped from the slope and having undergone small-scale transport by geomorphological processes (runoff, gravity, etc.).

Deflation: erosion by the wind carrying away the finest particles of sediment unprotected, by vegetation, as in a desert setting.

Fluvial competence: the capacity of a river in terms of its ability to transport sediment: torrential waters could transport large elements, such as pebbles, in suspension, while calm waters will only carry the finer portion of clay in suspension.

Geomorphology: the study of landforms and the physico-chemical processes that shape them.

Glacis: gently sloped surfaces on which sheet runoff occurs, eroding areas near the landforms and accumulating colluvium in the nearest part of the watercourse. *Glacis* can develop through destruction of other, older formations.

Granulometry: study of the size of the particles making up sediment (clay, silt, sand, gravel, pebbles), which permits its characterisation and the study of how the sediment was deposited.

'Heinrich': Heinrich-type events are short-lived climatic episodes associated with the calving of a large number of icebergs in the north Atlantic (first observed by H. Heinrich in the 1980s). These correspond to phenomena probably affecting the entire hemisphere and therefore must have repercussions at lower latitudes in some form or other.

Isotopic stages: paleoclimatic episodes defined by the isotopic ratios of oxygen ($^{18}O/^{16}O$) in cores of marine sediment or ice caps.

Laterite (ferruginous crust): in equatorial and tropical soils of a warm and humid climate (at least a part of the year, during the rainy season), pedological processes can cause an accumulation of iron (in the enriched 'B' or 'illuvial' horizon) which can, if the process is prolonged and intense, give rise to a real ferruginous indurate (or 'laterite') level which will look like a 'crust' if there is erosion.

Leaching: pedologic term indicating vertical movement of smaller particles (especially clay) from higher to lower levels as a result of rains infiltrating the soil.

Micromorphology: laboratory analysis (using a microscope) of thin sections of soil and/or sediments, allowing their history to be precisely reconstructed.

OSL: optically stimulated luminescence; a method of radiometric dating of sediments which can determine the time of deposit, and therefore the age of a formation. This method is very often used for the Pleistocene (see Wright, this volume, pp. 237-239).

Pedology: scientific study of soils, their structures, their evolution, and their history.

Phytoliths: microscopic pieces of silica that develop in certain cells in various types of plants. By their nature, phytoliths last for very long periods after the death and decomposition of the plant; the discovery of phytoliths allows the reconstruction, at least in part, of the vegetation cover, and thus, indirectly, of the climate.

Pisolite: ferruginous concretion (measuring millimetres or centimetres) in iron-rich soils in the tropics (see 'laterite crust').

Stratigraphy: study of the deposition, distribution, and deformation of sedimentary rocks in the earth's crust.

Substratum: bedrock (here referring to the substratum below the Quaternary sediments that may contain archaeological records).

Terrace (alluvial or fluvial): nearly horizontal sloping surface associated with sedimentary deposits by a watercourse. A terrace *stricto sensu* corresponds with the level of alluvium accumulation (floodplain); this becomes stepped when the watercourse erodes the deposit that it has previously deposited. This causes a 'terrace edge', which refers to the tiers.

HUMAN REMAINS

Isabelle Crevecœur[1]

The study of human remains found in an archaeological context makes no sense unless the field phase was completed under the best conditions for recording and sampling (see Ribot, this volume, pp.134-137). In this sense, it seems necessary that a physical anthropologist be present during the excavation phase, and for any interaction in the context of funerary deposits. Many synthetic works deal with recording and various analyses of human remains after the field phase (for example, Buikstra & Uberlaker 1994; Dutour *et al.* 2005; Jurmain *et al.* 2013). If these are indispensible to the proper analysis of data, the work of the physical anthropologist should nevertheless not be limited to an application of methodological recipes. Knowledge of human anatomy, of its variability, its evolutionary and adaptive mechanisms, as well as a comprehension of taphonomic processes, are all essential when choosing methods and interpreting biological data. We present here an overview of the analyses most commonly performed (1) directly on bone and teeth, (2) on their organic (collagen) and mineral (hydroxylapatite) components, and (3) using multidimensional imagery, in order to understand burial practices, biological identity, and the lifestyles of individuals and populations.

I. OSTEOLOGICAL AND DENTAL ANALYSES

A. MNI (minimum number of individuals)

Estimating the minimum number of individuals at a site, or within a structure, is the first stage in osteological analysis. Taphonomic and/or anthropological phenomena can be at the origin of anatomical under-representation that implies an under-estimation of the numbers. Counting each bone provides an initial estimate of the number of individuals present; this will serve as a basis when considering the integrity of the deposit. Calculation of the MNI is based on the frequency of the most common type of bone. In the case of paired bones,[2] the side found most often will be counted.

This MNI of frequency can then be refined through associations and exclusions. Through the association of paired bones belonging to the same individual, it is possible to exclude the left-side or right-side elements whose pairs can't be found. Exclusion by age at death also allows the addition to the MNI of those individuals who are not present in the category of retained bones, but are represented elsewhere.

B. Age at death and sexual diagnosis

Many methods exist in anthropology for estimating the age at death and determining sex (cf. Bruzek *et al.* 2005; White & Folkens 2005). We present here only those that are most reliable and take into account biological variability.

1. Estimation of the age at death

Techniques are based mostly on dental maturation or bone growth processes for immature individuals. The aging processes used to estimate age at death of adults are less reliable.

a) Immature individuals

Determining the age at death from dental maturation has the double advantage of being based on the human remains that are often best preserved – the teeth – and of being a more reliable indicator than bone maturation. The method by Moorrees *et al.* (1963a; 1963b) is the most common. It gives the standard deviation for estimates, which means the results are 95% reliable.

Estimating age at death based on bone maturation (*i.e.* the degree of epiphyseal fusion and diaphyseal length) is less precise, because growth is closely linked to environmental and nutritional conditions, as well as to population factors. There are several standards (including Buikstra & Uberlaker 1994), but they should be used carefully.

b) Adults

Estimating the age at death of adults (≥ 30 years; *i.e.* after the age of skeletal maturity) is a major obstacle in anthropology, given the intra- and inter-populational variability of senescence of the human skeleton. Areas of late ossification (*i.e.* after adolescence and dental maturity) in the pubic symphysis and the clavicle allow us to identify adults who died prematurely (that is to say, between ages 20 and 30). After the age of 30, estimates of the age at death are based on observation of morphological changes to the pubic symphysis or the sacroiliac surface. The

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2 Pairs: bones are described as paired if two versions (left and right) exist in the body.

Schmitt method (2005) is interesting because it takes into account European intra- and inter-populational variability. The scoring method uses four characters to calculate the probability that the individual belonged to a greater or narrower time period. This method favours reliability over accuracy.

2. Determining sex

The hipbone is the most important when determining sex, as in women its morphology is determined, whatever the population of origin, by the dual constraints of locomotion and parturition (Bruzek *et al.* 2005). Reliability decreases when we look at bones whose sexual dimorphism is linked to format and not function. In addition, there is no method for estimating the sex of children, as the sexual dimorphism of the pelvis appears only during puberty.

The sex of adults whose pelvis has been preserved can be determined based on its morphology or dimensions. The visual method developed by Bruzek (2002) is based on observation of morphological characteristics with 95% accuracy. The probabilistic sex diagnosis method uses a large body of data and is accurate to more than 97% (Murail *et al.* 2005).

C. Health status

By identifying and studying diseases affecting the bones, joints, and teeth, as well as traumas, it is possible to discuss the living conditions and the health status of populations or exhumed fossils.

Joint diseases such as arthritis and enthesitic changes[3] have multifactorial origins (genetic, biological, environmental, or behavioural).

Nevertheless, a study of the frequency, intensity, and localisation (for example, specific to an anatomic region, or to one side) can highlight important behavioural differences between individuals of the same group associated with a certain type of activity, such as archery (Thomas 2014). Given their interaction with the environment, teeth are an excellent indicator of an individual or population's health and diet. Dental disease can have a variety of origins: infection, degeneration, development, or genetics. The type and degree of development of a periodontal disease, an abscess, cavities, tartar, or hypoplasia, must be estimated according to established standards, which can be found in the specialist literature (see Hillson 2008).

3 Entheses: places where tendons, ligaments, and muscular fascia meet the bone.

D. Biometrics

The acquisition of metrics on cranial and infra-cranial bones allow characterisation of intra- and inter-populational variability. Two references are currently used: Martin (Braüer 1988) and Howells (1973). The latter has even published a free online database with the measurements of more than 2,000 skulls and fossils from all over the world (Howells 1996). The size of infra-cranial bones can be used to estimate the height and weight of individuals using current standards.

E. Non-metric anatomical variations

Non-metric anatomical variations (or discrete characteristics) are numerous minor non-pathological phenotypic variations of the bones or teeth. They are observed on the cranial bone (*e.g.*, extra sutural ossicles) and infra-cranial (*e.g.*, olecranon perforation) and the teeth (*e.g.*, the number of cuspids) (Berry & Berry 1967; Finnegan 1978; Turner *et al.* 1991). To the extent these characteristics are transmitted in part by genetics, they are an asset when researching familial groupings or phylogenetic links between populations. The exact determinism for the great majority of these characteristics is unknown, however. They are not all hereditary and factors linked to lifestyle can be responsible for their transmission.

II. BIOCHEMICAL ANALYSES

Bone, enamel, and dentin all possess an organic compound (collagen) and a mineral (hydroxylapatite) which vary depending on type, with enamel being the most mineral. A study of stable isotopes and the trace elements contained in these components allows dating, but can also reconstruct the lifestyles of individuals and their environment (Katzenberg 2008). Recent technological developments for extracting and sequencing ancient DNA offer new perspectives for understanding phylogenetic inter- and intra-populational relationships.

A. Direct dating

1. Organic compounds

Collagen extracted from bones or dentin are an excellent material for carbon 14 dating using accelerator mass spectrometry (for the dating method, see de Maret, this volume, pp.232-235).

2. Inorganic compounds

Radiocarbon dating using the contents of enamel and the mineral parts of the bone or dentin is an alternative to using carbon from collagen when the latter has been prematurely destroyed, as is often the case in arid environments.

The electron spin resonance (ESR) technique can also be used with enamel (Grün 1989). During diagenesis, electrons are trapped in the crystalline defects of the apatite. These electrons come from radioactive materials in the deposit or from bone and dental tissues. The intensity of the ESR signal depends on the number of trapped electrons, that is to say the irradiation dose and intensity. These two parameters must be identified to achieve ESR dating.

B. Diet, paleoclimate, and mobility

Diet is reconstructed based on the ratio of stable carbon ($^{13}C/^{12}C$) and nitrogen ($^{15}N/^{14}N$) isotopes present in the collagen. These ratios are associated with those recording the protein fraction of ingested food and distinguish sources of dietary protein (plant and animal). The $\delta^{13}C$ of hydroxylapatite carbonate represents carbon from throughout the diet.

It is also possible to study stable oxygen isotopes ($\delta^{18}O$) to reconstruct paleotemperatures, and therefore paleoclimates.

Lastly, several trace elements become attached to bones and teeth throughout the life of the individual. Among these, strontium (Sr) has the advantage of demonstrating an individual's mobility.

C. Ancient DNA

Thanks to recent developments in molecular genetics, it is now possible to analyse DNA from fossilised bone and teeth. The preservation of DNA depends to a great extent on the environment in which fossilisation takes place. Unfortunately, the fossil data are nearly non-existent for Africa (Campana *et al.* 2013).

Studies of ancient DNA focus on mitochondrial DNA (mtDNA), the Y chromosome, and nuclear DNA (locus, or complete genome). Analyses of polymorphisms of mtDNA and the Y chromosome are used to determine phylogenetic and phylogeographic links in the maternal or paternal lines of human populations. When nuclear DNA is well preserved, the analysis of short tandem repeats (STRs) can test the parental relations of an individual. Samples for DNA testing must be taken following very strict rules, starting in the field phase, to limit contamination of human remains by exogenous recent DNA.

III. ANALYSYS USING MULTIDIMENSIONAL IMAGING

Imaging methods using X-ray tomography (CT scan, microtomography (μ-CT), synchrotron) are a considerable contribution to the study of internal anatomical structures of human bone and dental remains, as well as to their preservation. In addition to accessing and visualising internal structures, these methods permit reliable measurements thanks to imaging software, reconstruction of missing sections, correction of deformations, and the virtual cleaning of remains found in a sedimentary matrix.

REFERENCES

Berry, A.C. & Berry, R.J. 1967. 'Epigenetic variation in the human cranium'. *Journal of Anatomy* 101: 361-379.

Braüer, G. 1988. 'Osteometrie'. In R. Knussman (ed.), *Anthropologie. Handbuch der vergleichenden Biologie des Menschen, 4. Auflage des Lehrbuchs des Anthropologie begründet von R. Martin. Band I. Wesen und Methoden der Anthropologie*, Stuttgart: Gustav Fisher Verlag, pp. 160-232.

Bruzek, J. 2002. 'A method for visual determination of sex, using the human hip bone'. *American Journal of Physical Anthropology* 117: 157-168.

Bruzek, J., Schmitt, A. & Murail, P. 2005. 'Identification biologique individuelle en paléoanthropologie: détermination du sexe et estimation de l'âge au décès à partir du squelette'. In O. Dutour, J.-J. Hublin & B. Vandermeersch (eds), *Objets et méthodes en paléoanthropologie.* Paris: CTHS, pp. 217-246.

Buikstra, J.E. & Uberlaker, D.H. 1994. *Standards for Data Collection from Human Skeletal Remains*. Arkansas: Arkansas Archaeological Survey Report Number 44.

Campana, M.G., Bower, M.A. & Crabtree, P.J. 2013. 'Ancient DNA for the Archaeologist: the Future of African Research', *African Archaeological Review* 30: 21-37.

Dutour, O., Hublin, J.-J. & Vandermeersch, B. 2005. *Objets et méthodes en paléoanthropologie*. Paris: CTHS.

Finnegan, M. 1978. 'Non-metric variation of the infracranial skeleton'. *Journal of Anatomy* 125: 23-37.

Grün, R. 1989. 'Electron Spin Resonance (ESR) dating', *Quaternary International* 1: 65-109.

Hillson, S. 2008. 'Dental Pathology'. In M A. Katzenberg & S.R. Saunders (eds), *Biological Anthropology of the Human Skeleton*. New Jersey: John Wiley & Sons, pp. 301-340.

Howells, W.W. 1973. *Cranial Variation in Man:a Study by Multivariate Analysis of Patterns of Difference among Recent Humans Populations*. Cambridge: Harvard University Press, 259 p.

Howells, W.W. 1996. 'Howell's craniometric data on the internet', *American Journal of Physical Anthropology* 101: 393-410.

Jurmain, R., Kilgore, L., Trevathan, W. & Ciochon, R.L. 2013. *Introduction to Physical Anthropology*, 2013-2014 edition. Stamford: Cengage Learning; 14th edition, 576 p.

Katzenberg, M.A. 2008. 'Stable Isotope Analysis: a Tool for Studying Past Diet, Demography, and Life History'. In M.A. Katzenberg & S.R. Saunders (eds), *Biological Anthropology of the Human Skeleton*. New Jersey: John Wiley & Sons, pp. 413-442.

Moorrees, C.F.A., Fanning, E.A. & Hunt, E.E. Jr. 1963a. 'Formation and Resorption of three Deciduous Teeth in Children', *American Journal of Physical Anthropology* 21: 205-213.

Moorrees, C.F.A., Fanning, E.A. & Hunt, E.E. Jr. 1963b. 'Age Variation of Formation Stages for ten Permanent Teeth', *Journal of Dental Research* 42: 1490-1502.

Murail, P. 2005. 'DSP: a tool for probabilistic sex diagnosis using worldwide variability in hip-bone measurements'. *Bulletins et Mémoires de la Société d'Anthropologie de Paris*, 17 (3-4): 167-176.

Schmitt, A. 2005. 'Une nouvelle méthode pour estimer l'âge au décès des adultes à partir de la surface sacro-pelvienne iliaque'. *Bulletins et Mémoires de la Société d'Anthropologie de Paris* 17: 89-101.

Stone, A.C. 2008. 'DNA Analysis of Archaeological Remains'. In M.A. Katzenberg, S.R. Saunders (eds), *Biological Anthropology of the Human Skeleton.* New Jersey: John Wiley & Sons, pp. 461-484.

Thomas, A. 2014. 'Bioarchaeology of the Middle Neolithic: Evidence for Archery Among Early European Farmers'. *American Journal of Physical Anthropology* 154: 279-290.

Turner II, C.G., Nichol, C.R. & Scott, G.R. 1991. 'Scoring Procedures for Key Morphological Traits of Permanent Dentition: the Arizona State University Dental Anthropology System'. In M.A. Kelley & C.S. Larsen (eds), *Advances in Dental Anthropology*. New York: Wiley-Liss, pp. 13-31.

White, T.D. & Folkens, P.A. 2005. *The Human Bone Manual*. New York: Elsevier Academic Press.

RADIOCARBON DATING

Pierre de Maret [1]

Dating a specific event or phase or establishing a sequence is still of particular importance in Africa, as the chronology of many regions is far from established.
Close reading, detailed analysis, and extensive study of the stratigraphy, as well as the identification of sealed archaeological contexts such as graves or refuse pits, remain the basis for all reasoning on dating, whether relative or absolute.

I. ABSOLUTE DATING

Choosing from among the ever-expanding range of absolute dating methods requires taking into account the time range under consideration, the feasibility of this kind of analyses, and of course the cost.

In practice, for research that concerns the last 50,000 years, radiocarbon (carbon 14) dating is most often used. As we know, this measures the amount of radioactive carbon 14 remaining in organic matter, from which the time since death is estimated. To ascertain the amount of residual ^{14}C, the radioactivity of a specific quantity of the sample is measured for a specific period. This is the most commonly used and cheapest method.

But to analyse very small or very old samples, a much finer method was developed: accelerator mass spectrometry (AMS). This technique directly counts the amount of ^{14}C atoms present in the sample (and not only those that degrade during the counting).

The AMS technique allows researchers to:

- date samples of only 1 mg of carbon (a small piece of charcoal measuring only a few millimetres, a bone fragment only a few centimetres long, a seed, a nut fragment),
- be more selective when choosing which samples to date and therefore, ideally, date the object itself (pottery, slag, skeleton) without damaging it, rather than associated charcoal or nuts,
- date samples faster (less than 24 hours of counting time),
- push the limits of the method beyond 50,000 years,
- reduce statistical error through greater precision (particularly interesting in the case of small and/or very ancient specimens).

But this is costly. AMS should therefore be used sparingly.

Generally, we must develop a dating strategy depending on the specific problem, available resources, and the quantity and quality of available samples (size, risk of contamination, uncertainty about the context, etc.).

II. ERRORS, UNCERTAINTIES, CONTAMINATION, AND OTHER PROBLEMS

A. Statistical uncertainty

As the measurement of the specific radioactivity of a given sample is not an absolute measurement but a statistical measure (since the amount of disintegration varies over time), the result always reflects this statistical imprecision. This expresses the probability in % that the result falls between two time limits on either side of the average. This is equally true of AMS dating. Conventionally, a date is expressed with +/- 1 σ imprecision (its standard deviation), which is to say that there is a 68% chance that the date is within the 'confidence interval' thus defined.

As this is not accurate enough – at 68%, there is just under a one-in-three chance that the date is not within the range of +/- 1σ – we need to work with 2 σ. By doubling the interval, there is a 95% chance that the date is within the range.

By convention, laboratory results are given in years BP (before present [1950]), with an error of 1 σ. The smaller the error, the smaller the σ value, the smaller the time interval will be and therefore the more accurate the estimated date will be. Some laboratories can obtain high-precision dates (by counting longer, or reducing as much as possible the background noise by also measuring the radioactivity of carbon 13, etc.).

B. Need for calibration

We also know that, contrary to what was initially assumed by the inventor of the radiocarbon method, the proportion of ^{14}C in the atmosphere has not remained constant. Laboratories today therefore usually provide a corrected result that takes into account these changes and the requirement for an interval of 2 σ.

Generally – although not always – non-calibrated dates are given in lower case (bp, bc, ad), whereas calibrated dates are capitalised (BP, BC, AD). In order to avoid con-

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fusion, it is preferable to add 'Cal' to calibrated dates. Calendar dates are therefore in bc and ad if they are not calibrated, and BC, Cal BC, AD, or Cal AD if they are. For distant prehistoric dates, it makes little sense to use calendar dates, so we mostly use BP or cal BP because the result always needs to be calibrated.

When comparing dates obtained more than ten years ago with results measured more recently, it is appropriate to calibrate the earlier dates using programs available on the web (www.radiocarbon.org; http://www.calpal-online.de/; https://c14.arch.ox.ac.uk/). The program and version used should be specified upon publication. In the southern hemisphere, dates should be a little aged, generally 30 to 50 years. Specific calibration curves are available.

These programs produce 'cloud diagrams' which demonstrate visually the interval corresponding to the date and probability variations within this range. The two horizontal lines that appear under the cloud diagram correspond to the confidence intervals 1 σ and 2 σ.

C. Consequences of calibration

As the calibration curve has significant oscillations (wiggle) during certain periods, calibration can have very different results. In some cases, the calibration will reduce the time range, and in others – where there are oscillations – it can extend the range of calendar dates. Sometimes, the probability distribution curve becomes so irregular that it cannot be expressed as an average with its confidence interval.

This is why dates between 2500 BP and 1900 BP, a crucial period for the start of metallurgy, cannot be separated, and are found in a range that goes from 800 cal BC to cal AD 100. Similarly, it is almost impossible to separate samples chronologically in the range of from about cal AD 1650 to cal AD 1950, which makes, for example, correlations between archaeological data and recent historical sources very risky. On the other hand, after 1950, 'thanks' to the atomic bomb tests, dating is easy, often to within a decade.

While these inaccuracies are inherent in the radiocarbon method, it has nevertheless steadily improved since its discovery over 60 years ago. Many problems and errors encountered result mainly from the choice of samples and the interpretation of the results by the archaeologist.

III. SELECTION OF SAMPLES TO DATE USING CARBON 14

Choosing among available samples depends on the size of the sample, the type of material, the risk of contamination, and its context.

A. Amount needed for a sample

This concerns the material used most frequently.

Usual method		**AMS dating**
- wood charcoal (preferably of large calibre)	10 g	1 mg to 20 mg is enough!
- carbonised bone	50 g	
- unburnt bone	300 g	
- seed	10 g	
- wood	20 g	
- shell	50 g	

Peat, soil loaded with organic matter, teeth, calcium concretions, pottery, slag, mortar, etc., can also be dated.

Larger specimens are always preferable.

B. Sample material

Any sample of organic material submitted for dating has always stopped living before being buried and becoming associated with other objects. The date obtained will precede the date of deposit. To keep the age difference as low as possible, the preference is therefore for sample materials with short lifespans. Seeds, nuts, grass, and bone are better than charcoal. For the latter, short-lived species (less than 100 years) are preferable to long-lived species (over 100 years), but for that, one must be able to determine the species of wood, and therefore have a fragment large enough that one part can be used for anthracological analysis while another is dated. In desert conditions, dead wood can survive for a long time and be used as fuel centuries later. Similarly, a beam from an older building can be re-used.

We must also remember that wood grows on the outside, and so the oldest parts are at the centre. The opposite is true of ivory.

C. Risks of contamination

Before taking samples	While taking samples	After taking samples
Ground water can either dissolve organic materials, or otherwise add more recent carbon. Bioturbations (termites, ants, burrowing animals) and soil movement – especially in sand – can mix charcoals of different ages.	Avoid ash (cigarettes, fires, especially late in the dry season at the time of controlled bush fires). Use a clean trowel, knife, pliers, and put in a pre-marked plastic bag. Avoid taking samples where various stratigraphic units meet if there is a risk of mixing samples of different ages.	Dry away from the sun (condensation) and avoid ashes or dust. Remove soil, roots and rootlets. Pack large samples in aluminium foil, then in a clearly labelled plastic bag. Keep a separate register of samples that can be used for dating with a system of labels, different if possible. Store in a dark and, if possible, cool place, to prevent the formation of condensation or green mould.

D. Sample context

When selecting samples to date, great attention should be paid to an understanding of the stratigraphic context (see also this volume Schwartz pp. 218-222 and Rasse pp.223-227).

A sample from a secured context (pit, tomb, under a rock slab, in baked clay) is always preferred to one from a simple combustion structure. Small fragments of charcoal scattered in a layer within an artificial stratigraphic level are the most likely to be problematic. Unfortunately, we often have no other choice!

The relationship between what is being dated (charcoal, seeds, bones, etc.) and the remains of human activity is rarely clear, since there is a degree of uncertainty in the association (Waterbolk 1971, p. 16, groups A-D; 1983). The ideal is when the archaeological relic itself provides the sample (bones from a skeleton in a grave, the wooden beam of a house, a wooden sculpture, charcoal from slag, etc.). In this case there is *full certainty* of association (A).

There is *high probability* (B) of association when there is a direct and functional relationship between the sample and the archaeological remains (e.g., seeds in a pot, coffin in a tomb). *Probability* of association (C) is when there is no demonstrable functional relationship but the quantity, concentration, and size of the fragments of organic matter are thought to indicate a relationship (e.g., area of combustion, concentration of bones). The degree of association is a *reasonable possibility* (D) with small fragments scattered at the level of occupancy or of a grave. On the other hand, if the fragments are small and scattered and do not come from a detectable archaeological structure, but are simply dispersed in an archaeological layer, the association between sample and dated archaeological material present in this level is likely, but the degree of certainty of association is the lowest.

Sometimes charcoal from an older archaeological level is mixed with clay later used for building, and thus finds itself embedded in the walls of a much more recent construction.

IV. INTERPRETING RESULTS

A. Basic principle:

An isolated date has no significance. At least three convergent dates are needed to date an archaeological phenomenon with any certainty.

Checking the consistency of the results

The best form of verification is a series of dates the order of which corresponds to the sequence of stratigraphic levels, the deepest unit being the oldest. Slight discrepancies, with age inversions, are negligible so long as the confidence intervals of 2 σ for the dates concerned overlap. If this is not the case, more explanation will be required: contamination, "old" sample at the time of abandonment, laboratory error, stratigraphic inversion, error in reading the stratigraphy?

Comparisons with dates obtained by other methods (TL, OSL, etc.) are also always useful.

B. Processing a significant number of dates

A range of dates calibrated to the same phase, period, culture, or tradition can be grouped into a table using a time scale as ordinate with proportional vertical lines to the margin of error.

A range of dates can also be grouped into a single cloud chart for easy visualisation of the probable temporal boundaries of an occupation or culture.

Finally, the shape of the probability curves obtained by adding the probability curves of a large number of calibrated dates should be interpreted with caution. The shape of curves resulting from this kind of calculation may indicate changes in human activities over time, e.g., population growth, but their form is also partly a reflection of the calibration curve itself.

REFERENCES

Waterbolk, H.T. 1971. 'Working with Radiocarbon Dates.' *Proceedings of the Prehistoric Society* XXXVII: 15-33.

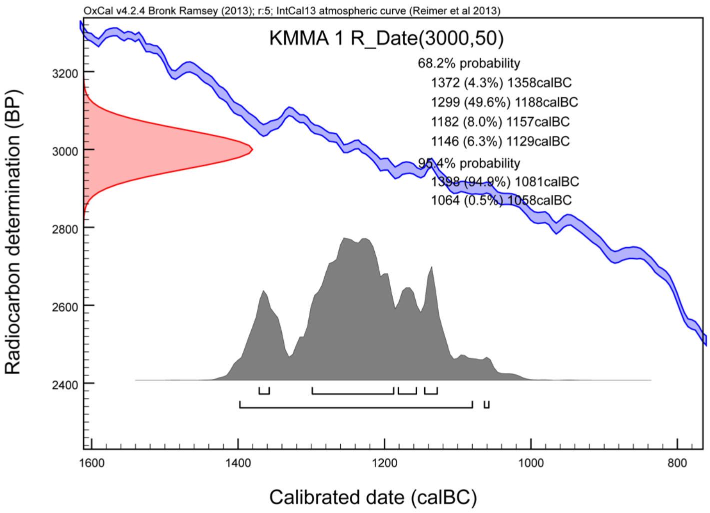
Waterbolk, H.T. 1983. 'Thirty years of radiocarbon dating: the retrospective view of a Groningen archaeologist.' *Pact 8* (*14C and archaeology: symposium held at Groningen, August 1981*): 17-27.

BY MEANS OF EXAMPLE: INTERPRETING C14 DATES

E. Cornelissen[1], P. de Maret[2] & D. Wright[3]

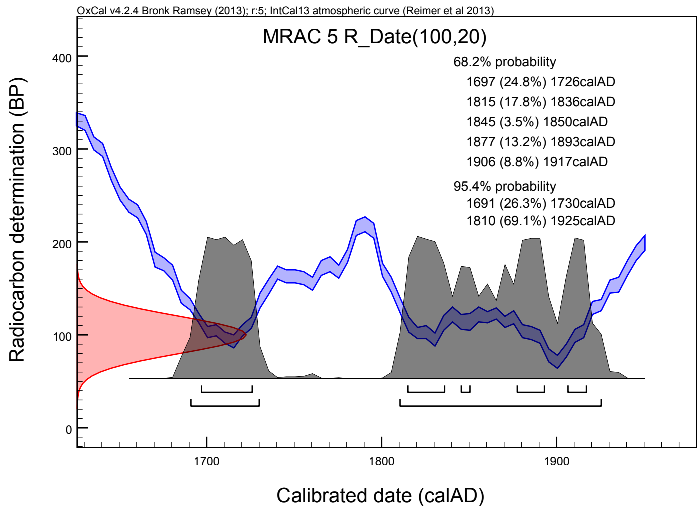
The calibration curve used here is available for free at https://c14.arch.ox.ac.uk/oxcal/OxCal.html. Registration for a username and password is required prior to using the service. Fill in the name, date and 1-σ interval of statistical uncertainty based on the results obtained from the laboratory where your sample was analysed. The view chosen below is the 'single plot'. The examples provided here are fictitious.

- At the 68.2% probability level there is almost



50% chance that the event dates from the 13th century to early 12th century BC. There is a very small chance (4.3%) that it is older and dates from the 14th century or that it dates to the 12th century (14.3%).[t]

- At the 95.4% probability level the date may fall anywhere between the beginning of the 14th and beginning of the 11th century BC, and 0.5% probability that the date is in the middle of the 11th century BC.
- Of course, there is a 4.6% chance (statistically) that the age falls outside the range of these dates.
- Under no circumstance can the result be taken to conclude that the event took place *from* the beginning of the 14th *until* the beginning of the 11th century BC or that the feature/artefact was used throughout the entirety of this timespan.



- At the 68.2% probability level there is an approximate 25% statistical probability that the item or event dates between 1696 and 1726 AD, or at the turn of the 17th-18th century. Similarly, there is a 43.4% probability that the event may date to much later periods in the 19th century and early 20th century.
- Increasing the probability level to 95.4% shows that there is a 26.3% probability that the date of the death of the organism associated with the sample occurred between 1690 and 1730 AD, but there is a concomitant higher probability of 69.1% that the date is situated anywhere between the early 19th century and the first quarter of the 20th century.
- Conclusive evidence may come from other sources of dating such as a coin or an item of which the production is clearly set at a given time.
- Under no circumstance can the result be taken to conclude that the event took place *from* the end of the 17th *until* the beginning of the 20th century AD or that the feature/artefact was used throughout the entirety of this timespan.
- In fact, this hypothetical date illustrates the major weakness of C14 dating whereby items cannot be dated after the advent of the Industrial Revolution when annual emissions of tonnes of carbon into the atmosphere began and before the event of exploding nuclear weapons (1944 AD). Therefore, the organism died sometime between 1700 AD and 1950 AD. There is now a post-bomb calibration curve established for more recent artefacts based on the implementation of the nuclear test ban treaty in 1963 and progressive decline of atmospheric concentrations of C14 to the present day 1950 AD calibration curve established for more recent artefacts, that allows stating that the organism did not die prior to 1950 AD (Hua and Barbetti 2004, Review of tropospheric bomb (super 14) C data for carbon cycle modelling and age calibration purposes, *Radiocarbon*, vol. 46, Nr. 3, 2004, pp. 1273-1298 also available at https://journals.uair.arizona.edu/index.php/radiocarbon/article/view/4182.)

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OTHER RADIOMETRIC METHODS OF DATING

David K. Wright[1]

INTRODUCTION

While radiocarbon dating justifiably remains the most common way to date archaeological sites in Africa, other methods have gained acceptance as providing accurate means of estimating the timing of past site occupations. Optically Stimulated Luminescence (OSL), in particular, has become a standard bearer for dating archaeological sites in a wide variety of depositional settings. However, like radiocarbon dating, these methods will not provide site chronologies without a certain amount of critical application. Archaeologists must approach site chronology carefully, and the following chapter provides a review of the possibilities and limits of other dating methods besides radiocarbon.

I. OPTICALLY STIMULATED LUMINESCENCE

Whereas radiocarbon dating is applied directly to carbon-bearing artifacts, OSL is normally performed on sediments that bury archaeological sites. Sedimentary minerals (normally, quartz and feldspars) possess trace amounts of radioactive elements such as uranium (U), thorium (Th) and potassium (^{40}K), which are constantly shedding electrons to achieve a stable (non-radioactive) state. In the absence of light, the electrons fill defects in the crystal lattice* of the minerals known as 'traps'. Once the mineral is exposed to sunlight, most of the electrons stored in the traps normally vacates within 10 seconds, leaving the mineral devoid of stored energy. Once the sediment is removed from light, the process resumes and traps begin to fill again (fig. 1). Additional sources of radiation accumulating in the minerals come from cosmic rays ('muon*s'), which constantly bombard the surface of the earth and from beta radiation* emitted from the surrounding sediments. Thus, OSL measures the last time sediments were exposed to sunlight by measuring the equivalent dose (D_e) of radiation present in a sample and dividing that by the reconstructed rate of radioactive dosing the sample was subjected to during burial (D_r).

The primary advantages of using luminescence dating over radiocarbon are that one does not need to have carbon to obtain an age estimate and the range of age estimation begins from <10 years from the collection date to >100,000 years, in many cases. In the African context, this extends far back into the Middle Stone Age in which there are many significant archaeological sites outside of volcanic areas that have almost no other means of obtaining a reliable estimation site age. Experimental research using potassium feldspars suggests that age estimates as far back as 1,000,000 years may be possible using OSL, but it will be some time before routine age estimations at this time scale are made.

The primary considerations for using OSL dating are as follows:

(1) It is absolutely critical to know whether the sediments being dated were fully solar reset prior to burial. Geomorphic conditions that are normally safe to assume this process has occurred include eolian (wind blown) environments and alluvial river terraces comprised primarily of fine sands. Less safe are alluvial fan environments and bedload* sediments from river terraces. Generally unacceptable depositional environments are colluvial or a mass wasting* hillslope process. If archaeological remains are somehow being dated from sediments that were not solar reset, the result will be a significant over-estimation of site age.

(2) Sites with exceptional bioturbation from roots or animals are poor candidates for OSL dating. OSL works on the theory that once a sediment is buried, it has more or less remained in its same position throughout the time it has been buried. If a termite carries a grain of sand from deeper in the profile up into an overlying stratum, then a grain that was solar reset further back in time has now entered the sample environment. Or, if a root pushes a sand grain from the top of a profile into the lower portion of the profile, younger contaminants can provide under-estimates of site age. Additionally, the 'dosing environment*' of a sample includes radiation contributions from other minerals emitting radiation in beta decay*, so as plants or animals bring new minerals into this ecosystem, the potential for errors increases.

(3) Related to the above point, it can be difficult to obtain a reliable age estimate for heavily weathered soils. Soil-bearing horizons occur when landform stabilization has resulted in the translocation of minerals from the upper portion of the solum* into the lower portion. As this weathering process occurs, the dos-

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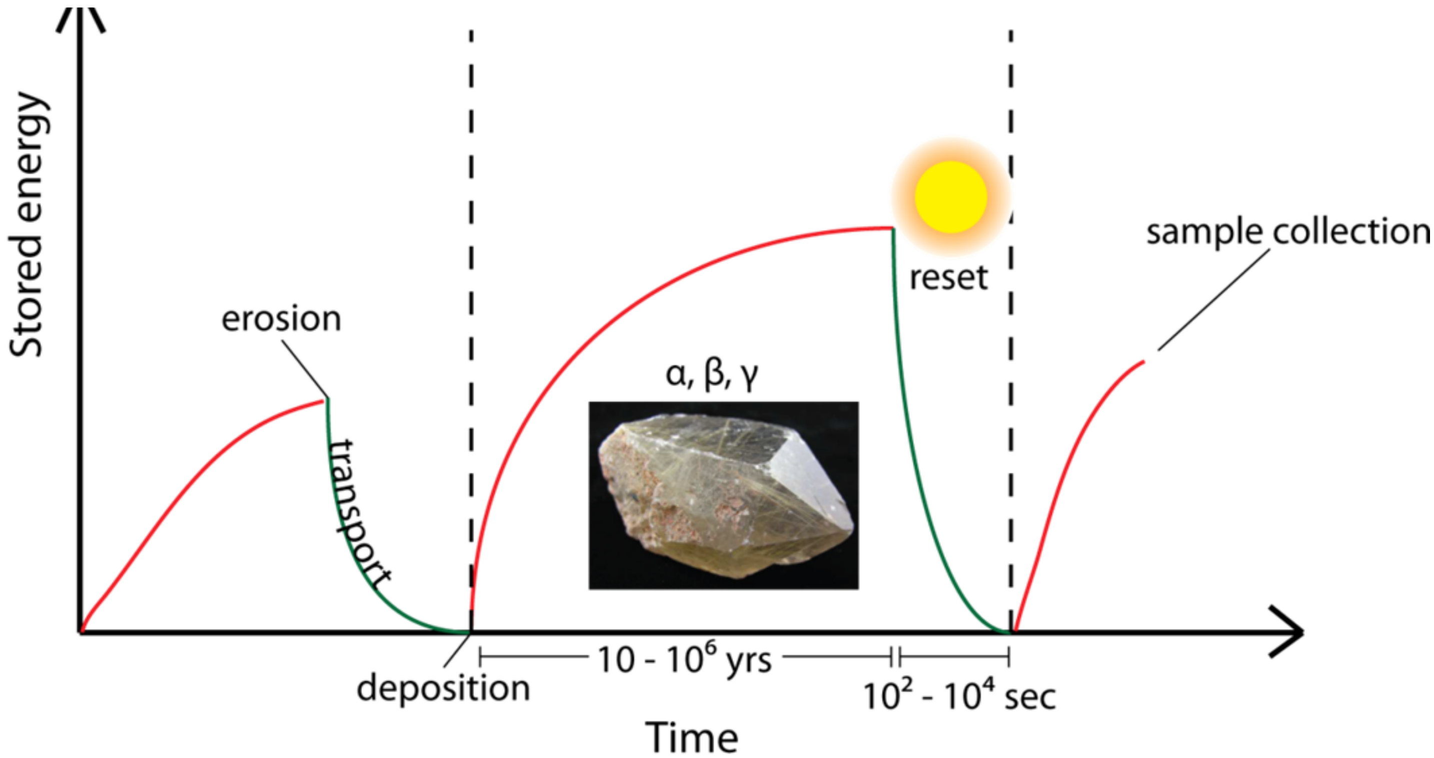

Fig. 1. Schematic view of the process of luminescence accumulation within sedimentary minerals.

ing environment is altered, particularly in well-developed soils. Authigenic* mineral formation occurs when groundwater percolates upwards and these minerals also alter the dosing environment. In saprolitic* environments where bedrock is breaking down from water perching, one needs to be particularly cautious whether an OSL sample is to be collected.

(4) Geochemistry of the sample environment is another factor that is important to consider, although often this knowledge does not come until long after the fieldwork has concluded. The minimum amount of quartz needed to obtain a reliable OSL age from a landform is about 10%. In volcanic ash environments, especially in the Rift Valley of Africa and environs, there are many areas where obtaining a sample is completely untenable. It is also well known amongst OSL analysts that many of the quartz-bearing minerals from the Rift Valley have a significant 'medium component' in which the electron traps are difficult to vacate in a laboratory setting. Archaeologists working in or near the Rift Valley need to plan on using at least one other method of dating a site besides OSL in order to make sure that accurate ages are obtained.

(5) Another major source of error introduced into OSL dating comes during the collection process. When samples are collected, they must not be exposed to light in any form. Samples collected in lateritic tropical soils, which are common in Africa, are troublesome because they are so cemented and tend to be difficult to pound a sediment collection tube into cleanly. If it is suspected that a sample has been exposed to sunlight while pounding the tube into the profile wall, it is far better to discard the sample and start over than spend US$1,000 on a sample that will give an erroneous result.

The five points provided above should serve as cautionary notes for archaeologists thinking about using OSL. In that regard, it is critical that personnel experienced in OSL collection and/or analysis are involved before fieldwork commences. Many OSL labs will not accept samples from non-experienced personnel.

When having samples analyzed, there are two broad categories of analysis now being performed by laboratories. The first method analyzes multiple grains of sand glued onto up to 48 aluminum disks. In recent years, this method has assumed the name 'small aliquot*' (SA) because there are usually <100 grains of sand, each measuring between 100-250 μm in diameter on each disk. This method is losing popularity as the single-grain (SG) method of analyzing individual grains of sand, one-by-one, is seen as providing the most reliable estimates of burial time. This is because by analyzing the luminescence properties of individual grains, analysts can detect whether or not there is a high degree of bioturbation moving grains or pedogenic alteration affecting the radiation dose over time. Additionally, it is thought that the analysis of individual grains accommodates potential changes in the sensitivity of the minerals to absorb radiation induced by the instruments themselves.

The primary disadvantage of the SG method is that the analytical time is significantly higher than when using SA, thus it is more expensive and harder to get samples processed in a timely manner. There have also been reports of under-estimation of ages compared to radiocarbon chronologies when using the SG method. It is important to consider these factors when choosing an analytical method appropriate for dating an archaeological site. As a general rule, if OSL is the only method used to date a site, and it is not in an eolian or well-sorted fluvial setting, SG is the safest method to choose. On the other hand, comparing one or two SA samples to the results from another dating method could potentially improve the efficiency of analysis over the duration of a project.

II. THERMOLUMINESCENCE (TL)

The physics behind TL dating is identical to OSL except that the measurement is taking place from the resetting of electron traps during heating, rather than light stimulation.

Normally, thick pieces of pottery or bricks are the materials dated using TL, however, it is critical that environmental samples be collected from the adjacent 20 cm of sediment matrix in order to determine the natural dosing environment. These can be exposed to light and a 100 g from N, S, E, W and underneath a TL sample will suffice.

III. ELECTRON SPIN RESONANCE (ESR)

Similar to luminescence dating methods, ESR measures the presence of free electrons that have separated from their magnetic field and become trapped in tooth enamel, speleothems* or other soluble carbonates. The age of a sample is determined through changes in the paramagnetic* centers of ^{238}U, ^{232}Th and ^{40}K isotopes using microwave absorption spectroscopy*. The changes detected in the magnetic field from the original state are assumed to be a proxy for increasing amounts of time since ESR began. Light has no effect on ESR, but if teeth come into contact with carbonate-rich water common in cave environments, uranium is at risk of dissolving, which frees the trapped electrons and the resonance process is restarted.

ESR has been applied to dating fossil teeth from caves in southern Africa and is normally cross-checked using uranium-series dating methods. There is a limited direct application to archaeological deposits outside of caves, but ESR can be used to date the formation of corals or carbonates that may be associated with archaeological artifacts.

IV. COSMOGENIC RADIONUCLIDE DATING

Dating using cosmogenic nuclides* (normally ^{10}Be, ^{26}Al, ^{36}Cl, ^{21}Ne) is similar to OSL in that it measures the accumulation of charged particles within the crystal lattice* of minerals. As cosmic rays hit the earth, they can induce chemical reactions both in atomic-sized particles in the atmosphere and within the atoms of rocks and minerals. The collision of subatomic particles can form new isotopes through loss or addition of neutrons and electrons. Because they are ubiquitous atoms in rocks and minerals, the most common cosmogenic nuclides* measured are those formed from $^{16}O>^{10}Be$ and $^{28}Si>^{26}Al$ spallation* or muon* capture events.

The theory of dating these recombinations operates on three central premises:

(1) The minerals being dated have been present at or near to the surface throughout the entire period of interest for dating. Because sediments retard the attenuation of cosmic rays, the relative distance that the sample is from the surface through time is important for modeling the amount of cosmogenic nuclides* that have been produced. So-called 'inherited' components that are residual from previous depositional settings can be tricky to mathematically model.

(2) The rate of cosmic ray flux can be modeled through time and spallation/muon* capture events occur constantly relative to the rate of cosmic ray flux. Radiocarbon (^{14}C) is also a cosmogenic nuclide and must be calibrated using the same datasets.

(3) Spallation* and muon* capture occur within the confines of the mineral and are not released outside of the sample and the mineral has not absorbed more or less than it has shed through this process.

Unlike OSL, surface exposure dating is useful on colluvial landscapes or for measuring surface artifact scatters on fluvial terraces. However, the analytical time and cost is high and meeting the first condition above often discourages potential users from attempting the method. Samples must be collected in a depth column and exact geographic position and surrounding topography must be recorded if the samples are going to be analyzed properly.

V. URANIUM-BASED DATING

Uranium-based dating comes in various forms, but the general purpose is to measure the decay of unstable uranium (U) isotopes into stable lead (Pb) isotopes. The decay of radioactive isotopes in the uranium series ($^{238}U>^{206}Pb$, $^{235}U>^{207}Pb$ and $^{232}Th>^{208}Pb$) occurs in half-lives of 4.5, 0.7 and 14 billion years, respectively, and measuring this stage of this process in which a sample occurs is called U-series dating. Uranium-thorium dating relies on detecting a specific phase of the $^{238}U>^{206}Pb$ decay series in which the parent ^{234}U and daughter ^{230}Th are analyzed with respect to the emission of an alpha particle emitted from the nucleus of the atom. Radiocarbon dates between 10,000 and 50,000 years ago are now calibrated using U-series ages from corals due to the high accuracy and precision of the method.

For archaeologists, the practical knowledge needed is that materials such as bone, cave travertine, terrestrial and marine carbonates can be dated with high precision. However, the primary assumption in the method is that there has been no isotopic exchange of minerals with the environment. This is a difficult assumption to make since uranium is highly soluble in water and easily reprecipitates.

The value of the method comes from the deep time perspective possible and high precision when the circumstances are right. Cave sites are important repositories of human evolution across southern Africa, and the dark conditions and lack of volcanic deposits leaves few alternatives for dating the sites. U-based dating has been increasingly used to date soil carbonates (which are abundant in the dry regions of Africa) by laser ablation as a means of constraining deposition of sediments on archaeological sites. Dating teeth and bone is far more problematic due to the easy exchange of uranium between the environment and decaying organism.

VI. POTASSIUM-ARGON (K-AR) AND ARGON-ARGON (AR-AR) DATING

K-Ar dating measures the decay of radioactive ^{40}K into inert ^{40}Ar, but has all but been replaced by $^{40}Ar/^{39}Ar$ dating, due to the latter's improved accuracy. Samples are irradiated in a nuclear reactor and the short half-lives of ^{39}Ar are analyzed as a proxy for the potassium content upon formation of the mineral. As such, these dating techniques are useful only for measuring the formation of volcanic rocks.

In Koobi Fora, Olduvai Gorge and the Hadar Valley of Ethiopia, volcanic ashes are common and using K-Ar/Ar-Ar dating has proven critical for narrowing down the timeframe of early human evolution. Error ranges can be <1% even in young volcanic deposits, but chances to compare Ar-Ar ages directly to radiocarbon ages are exceedingly rare due to the different preservation environments. Half-lives of $^{40}K>^{40}Ar$ are 1.3 billion years, so the application of the method is suited throughout the duration of human history in Africa, which is, of course, where the human story begins.

REFERENCES

Aitken, M.J. 2014 Science-Based Dating in Archaeology. Routledge.

Bahain, J.J., Laurent, M., Falguères, C., Voinchet, P., Farkh, S., & Tissoux, H. 2002 'Datation par résonnance paramagnétique électronique (RPE) des formations fluviatiles pléistocènes et des gisements archéologiques ou paléontologiques associés'. *Quaternaire* 13(2): 91-103.

Carvajal, E., Montes, L., & Almanza, O.A. 2011 'Quaternary dating by electron spin resonance (ESR) applied to human tooth enamel'. *Earth Sciences Research Journal* 15(2): 115-120.

Darvill, C.M. 2013 'Cosmogenic nuclide analysis.' In *Geomorphological Techniques*, Ch. 4. British Society for Geomorphology.

Gebrekirstos, A., Bräuning, A., Sass-Klassen, U., & Mbow, C. 2014 'Opportunities and applications of dendrochronology in Africa'. *Current Opinion in Environmental Sustainability* 6: 48-53.

Ivy-Ochs, S. & Kober, F. 2008. 'Surface exposure dating with cosmogenic nuclides'. Quaternary Science Journal 57(1-2): 179-209.

Joannes-Boyau, R. 2014 'Electron Spin Resonance (ESR) Dating in Archaeology'. In C. Smith (ed.). *Encyclopedia of Global Archaeology*. Springer, pp. 2352-2358.

Jourdan, F., Mark, D. F. & Verati, C. (eds) 2014 'Advances in $^{40}Ar/^{39}Ar$ Dating: from Archaeology to Planetary Sciences'. *Geological Society Special Publications* 378, http://dx.doi.org/10.1144/SP378.24

Malainey, M. E. 2010 *A Consumer's Guide to Archaeological Science. Analytical Techniques*. Springer.

Morgan, L.E., Renne, P.R., Kieffer, G., Piperno, M., Gallotti, R. & Raynal, J.-P. 2012. 'A chronological framework for a long and persistent archaeological record: Melka Kunture, Ethiopia'. *Journal of Human Evolu-*

tion 62: 104-115.

Rhodes, E.J. 2011 'Optically stimulated luminescence dating of sediments over the past 200,000 years'. *Annual Review of Earth and Planetary Sciences* 39: 461-488.

Tribolo, C., Mercier, N., & Valladas, H. 2005 'Chronologie des technofaciès Howieson's Poort et Still Bay (Middle Stone Age, Afrique du Sud): bilan et nouvelles données de la luminescence'. *Bulletin de la Société préhistorique française* 102(4): 855-866.

Vogel, N., Nomade, S., Negash, A. & Renne, P.R. 2006 'Forensic ^{40}Ar/^{39}Ar dating: a provenance study of Middle Stone Age obsidian artifacts from Ethiopia'. *Journal of Archaeological Science* 33: 1749-1765.

Yukihara, E.G. & McKeever, S.W. 2011 *Optically Stimulated Luminescence: Fundamentals and Applications*. John Wiley & Sons.

WEB RESOURCES

OSL/TL

University of Oxford, Luminescence Dating Laboratory at the Research Laboratory for Archaeology and the History of Art (http://www.arch.ox.ac.uk/luminescence.html)

United States Geological Survey, Crustal Geophysics and Geochemistry Science Center (http://crustal.usgs.gov/laboratories/luminescence_dating/what_is_tl.html)

University of Georgia, Luminescence Dating Laboratory (http://osl.uga.edu/index.php)

Technical University of Denmark (DTU), makers of the Risø TL/OSL reader (http://www.nutech.dtu.dk/english/Products-and-Services/Dosimetry/Radiation-Measurement-Instruments/TL_OSL_reader)

L'Université du Québec à Montréal, Département des sciences de la Terre et de l'Atmosphère, Laboratoire de luminescence (Lux) (http://lux.uqam.ca)

ESR

Geographisches Institut der Universität zu Köln (http://www.geographie.uni-koeln.de/elektronenspin-resonanz.338.de.html)

Université Paris Descartes, Imagerie de Résonance paramagnétique électronique (http://irpe.parisdescartes.fr/ressources/observables-applications-RPE.php)

Cosmogenic radionuclide dating

Purdue University, Department of Physics and Astronomy, PRIME Laboratory (http://www.physics.purdue.edu/primelab/rosetest/plresearch.php)

University of Washington, Quaternary Research Center, Cosmogenic Nuclide Laboratory (http://depts.washington.edu/cosmolab/)

Lecture by Ramón Arrowsmith, Professor of Geology at Arizona State University, 'Methods in Active Tectonics' delivered in the summer of 2013 at LIPI in Bandung, Indonesia, sponsored by LIPI, IT Bandung, and the GREAT program. (https://www.youtube.com/watch?v=FcPAlZWow9s)

L'Université Aix-Marseille, Centre de Recherche et d'Enseignement de Géosciences de l'Environnement (https://www.cerege.fr)

Uranium-based dating

British Geological Survey, NERC Isotope Geosciences Laboratory (http://www.bgs.ac.uk/nigl/quaternary.html)

Centro Nacional de Investigación sobre la Evolución Humana, Uranium-Series Laboratory (http://www.cenieh.es/en/laboratories/uranium-series)

Universität Wien, Department of Lithospheric Research (http://lithosphere.univie.ac.at/geocosmchron/geochron)

^{40}Ar/^{39}Ar dating:

Berkeley Geochronology Center (http://bgc.org/facilities/argon_lab.html)

Scottish Universities Environmental Research Centre, Argon Isotope Facility (http://www.gla.ac.uk/research/az/suerc/nercfacilities/argonisotopefacility/)

Australia National University, Argon Geochronology Facility (http://argon.anu.edu.au)

GLOSSARY

Aliquot: sample or portion of a larger whole.

Authigenic minerals: constituent minerals formed in a primary context (e.g., below the ground surface or in a rock) in response to geochemical reactions taking place in that context.

Bedload: the sediment that moves along the bottom of fluvial channels typically comprised of particles with diameters ≥250 μm. Bedload is contrasted from 'suspended load', which is typically comprised of fine silts and clays that move in fluvial channels via the upper portion of the water column.

Beta radiation: Electrons or positrons shed from the nucleus of radioactive isotopes, typically as a byproduct of having too many neutrons compared to protons.

Beta decay: the process of beta radiation emission.

Cosmogenic nuclides: isotopes formed from the collision of cosmic rays with the nucleus of atoms. Nuclides are formed via neutron spallation, capture of those neutrons by other adjacent atoms and capture of the muon isotopes (cosmic rays) themselves within the atoms comprising rock-forming minerals.

Dosing environment: the total amount of beta decay occurring around a sampled area. Some beta radiation will be absorbed by positively charged isotopes or trapped in the crystal lattice of surrounding mineral structures. Typically, the rate of beta decay is analyzed from bulk samples in order to determine how much ambient radiation a sample has been exposed to over time.

Lattice: the structural defects present in all naturally occurring minerals. These appear as cracks or holes under view of a microscope. The crystal lattice of minerals provides traps for beta particles, which get stuck in the traps. Once the traps are full, no more beta particles can be absorbed and the mineral is said to be 'saturated'.

Mass wasting: when soils, sediments and/or bedrock move downslope as a coherent unit as a result of failure of the underlying sediments to hold the overlying unit in place. Mass wasting often occurs in devegetated landscapes and where heavy amounts of precipitation saturate the ground surface, decreasing the tensile strength of clastic materials.

Muon: negatively charged particle that forms following collisions with atoms in earth's atmosphere. Muons travel to earth's surface close to the speed of light but decay as they ionize through the heavy atmosphere and penetrate the lithosphere.

Paramagnetic centers: the loss of radioactive particles from isotopes and subsequent trapping in the adjacent environment creates secondary sources of energy in the lattice of a mineral. These charged particles force changes in the magnetic fields of the parent isotopes causing their magnetic poles to shift to accommodate the outside force. The more free radical particles present in a given mineral, the more distortions in the paramagnetic centers will occur.

Saprolite: chemically weathered regolith (bedrock). During saprolite formation, the rock breaks down into sediment in situ.

Solum: portion of a sedimentary environment that has undergone soil formation processes. The solum does not include parent materials and 'C-horizon' sediments, which are often included as part of a soil classification.

Spallation: the process in which portions of a material are fragmented as a result of some kind of mechanical process. In the context of cosmogenic nuclides, this occurs when a fast-moving cosmic ray collides with an isotope either in earth's atmosphere or lithosphere.

Spectroscopy: the study of how physical matter absorbs or emits waves of electromagnetic radiation, including visible light.

Speleothems: soluble calcium carbonates that precipitate inside cave formations.

RELATIVE DATING METHODS

David K. Wright[1]

INTRODUCTION

Unlike radiometric dating methods, which measure radioactive decay or accumulation within samples, techniques that are calibrated from the present day using counting or comparisons to present day phenomena are classified as relative dating techniques. Seriation techniques* are also forms of relative dating, but are not discussed in detail here. For reasons explained below, the techniques have been employed sparingly on archaeological sites in Africa. As advances are made in applying these techniques and the need grows for new dating methods in Africa, Africanist archaeologists should be aware of these potential alternatives.

I. DENDROCHRONOLOGY

By counting the growth rings inside trees, dendrochonologists can offer a precise and accurate estimation of when a tree was cut down in the past. Typically, trees growing in the same region will receive roughly the same amount of rainfall and sunlight in a given season, which affects the relative thickness of the rings. Reference samples are collected through coring extant trees in a specific region. Those samples are compared with wood or charcoal recovered from archaeological sites to produce a key linking the present to the past. In many parts of the world, posts supporting structures are dated because they are amply thick to have a dendrochronology matching reference collections.

The disadvantage of using dendrochronology is that this method only dates the time when a tree was cut down. In the abundant semi-arid regions of Africa where wood can be preserved in the archaeological record, the most common form of subsistence was mobile pastoralism for much of the last 2,000 years. Using large trees for structural supports was not a common enough occurrence to build a dendrochronological database. High mobility does not lend itself to transporting heavy logs from place to place.

The longest dendrochronology in the world comes from oak (*Quercus robur*; *Q. petraea*) and pines (*Pinus sylvestris*) from central Europe spanning 12,640 years (Friedrich *et al*. 2004), but the African dendrochronologies do not have a near equivalent in time depth. Nevertheless, a nascent database is being constructed for the African pencil cedar (*Juniperus procera*) and *Acacia* sp. in Ethiopia extending the last ~100 years (Krepkowski *et al*. 2012). There are other regional chronologies on *Brachystegia* sp. in central Africa, Karkloof Yellowwood (*Podocarpus latifolius*) in southern Africa and limba trees (*Terminalia superba*) from tropical central and western Africa, to name a few. This research has yet to be applied in an archaeological context, but is useful for interpreting rainfall patterns over the historical period for which there are many missing records.

II. FISSION TRACK DATING

The decay of uranium (^{238}U) into lead involves the fission of the nucleus into two roughly equal sizes. In volcanic glass such as obsidian, the fission process leaves a scar (or 'track'). When the volcanic glass is heated, the fission tracks disappear with annealing*. Therefore, fission track dating measures the last time a glassy volcanic rock was heated by counting the scars left behind during the rather constant fission of ^{238}U. In order to date the annealing, the number of tracks are counted from the sample rock, the sample is then heated to anneal the tracks and then observed for an extended period of time to determine the rate of fission within the sample. Finally, the number of tracks present in the sample before heating is divided by the rate of fission to estimate the time of the previous heating event.

Assumptions made in fission track dating include: (1) the uranium content is significant (>0.1 ppm) and homogenous throughout a sample being analyzed, (2) there is no loss of tracks due to chemical weathering, and (3) other potential sources of fission tracks, most commonly ^{235}U, are minor contributors to the total number of tracks being counted.

Fission track dating in Africa is mostly performed on glassy tuff sediments from the volcanic regions of the Rift Valley to constrain occupation layers between volcanic eruptions. The inherent imprecision of the method (±10%) normally necessitates a cross check by more precise argon-based methods of dating volcanic rocks.

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III. OBSIDIAN HYDRATION DATING (OHD)

When a piece of volcanic glass is flaked into a tool, the freshly exposed surface of the rock begins to slowly absorb moisture from the atmosphere that creates a rind of water, coating the outside of the rock observable under a microscope or measurable by spectroscopy* or spectrometry. An obsidian artifact is notched using a diamond tipped saw and the growth rate of a new water rind is measured on the cut edge over a period of several months to a year, then compared to the rind present on the sample. Time since the artifact was flaked is estimated by dividing the length of the prehistoric rind by the time elapsed since the experiment began, multiplied by the length of the rind from the experimentally-flaked edge.

The primary problem with OHD is that the ambient temperature and humidity content must be known since the artifact was flaked because these factors affect water absorption in obsidian. The less that is known about these factors, the more imprecise the method. If an artifact has been buried for a long period of time, this is easier to estimate compared to those artifacts recovered in near-surface or surface contexts.

According to Ambrose (2012), the only obsidian hydration studies conducted in Africa to date took place in Kenya and Ethiopia by Joseph Michels and with limited success. More chemical fingerprinting studies are needed to develop a baseline dataset for hydration rates and effective temperature and moisture across the region.

IV. ARCHAEOMAGNETIC DATING

When rocks are heated into viscous states above 400°C, magnetic minerals become dislodged from their matrix. As they cool, magnetic particles in the rock align with the position of the North Pole. Magnetic north is not a fixed point and its movement has been tracked using archaeomagnetic dating with differing degrees of precision since the advent of the Pleistocene. The difference between 'true north' and magnetic north is called declination. Magnetic reversals occur approximately every 450,000 years in which earth's polarity reverses between the northern and southern axes. Between the reversal episodes, though, the North Pole wanders tens to hundreds of km per decade. Thus, the application of archaeomagnetic dating can be applied on hearths from recent periods to volcanic sediments with magnetic minerals.

When a sample is collected, special care must be made to record the exact sample location and extract the sample orientation from a level context with a precise accounting of the location of magnetic north and slope of the landform from which the sample is being collected. The sample is normally encased in plaster, resin or a special plastic cylinder and must not be jostled during transport to the lab. Multiple samples from a location need to be collected in order to homogenize local magnetic anomalies that may have affected the sample's magnetic orientation.

The primary disadvantage of archaeomagnetic dating occurs due to 'multiple intercepts', where the geomagnetic pole is aligned with the sample numerous times due to its non-stationary position. Typically, a consumer will receive a multitude of potentially applicable ages and so a relative idea of a sample's age must be known prior to sample submission. The geographical position of the African continent related to the North Pole is also problematic as the region lies south of a geomagnetic flux patch* that occurred during the Middle Holocene, which created large non-axial-dipolar variations of intensity that need to be calibrated.

Archaeomagnetic dating has primarily been applied to hominin fossil sites at broad time scales by analyzing geomagnetic reversals in magnetic volcanic rocks. These studies are normally combined with radiometric dating techniques like argon-argon and are intended to improve the precision of the geochronology, while the radiometric technique provides the accuracy. A study by Mitra *et al*. (2013) suggests that there is potential to apply archaeomagnetic studies toward building Holocene site chronologies in sub-Saharan Africa on burnt clays, but more knowledge is needed to determine geomagnetic fluctuations over the region.

REFERENCES

Ambrose, S.H. 2012. 'Obsidian Dating and Source Exploitation Studies in Africa'. In I. Liritzis and C.M. Stevenson (eds). *Obsidian and Ancient Manufactured Glasses*. University of New Mexico Press, pp. 56-72.

Bayélé-Goma, R. 2011 *Interdatation par la dendrochronologie applicable en milieu tropical: Procédure type*. Editions Publibook.

Djindjian, F. 2011 *Manuel d'archéologie: méthodes, objets et concepts*. Armand Colin.

Friedrich, M., Remmele, S., Kromer, B., Hofmann, J., Spurk, M., Kaiser, K.F., Orcel, C., & Küppers, M. 2004. 'The 12,460-year Hohenheim oak and pine tree-ring chronology from central Europe – a unique annual record for radiocarbon calibration and paleoenvironment reconstructions'. *Radiocarbon* 46(3): 1111-1122.

Hannaford, M.J., Bigg, G.R., Jones, J.M., Phimister, I., & Staub, M. 2014. 'Climate variability and societal dynamics in pre-colonial southern African history (AD 900-1840): A synthesis and critique'. *Environment and History* 20(3): 411-445.

Krepkowski, J., Bräuning, A., & Gebrekirstos, A. 2012. 'Growth dynamics and potential for cross-dating and multi-century climate reconstruction of *Podocarpus falcatus* in Ethiopia'. *Dendrochronologia* 30(4): 257-265.

Liritzis, I., & Laskaris, N. 2011. 'Fifty years of obsidian hydration dating in archaeology'. *Journal of Non-Crystalline Solids* 357(10): 2011-2023.

Mitra, R., Tauxe, L., & Keech McIntosh, S. 2013. 'Two thousand years of archeointensity from West Africa'. *Earth and Planetary Science Letters* 364: 123-133.

Wagner, G. & van den Haute, P. 2012. *Fission-Track Dating (Solid Earth Sciences Library)*. Springer.

WEB RESOURCES

Tree ring dating

Department of Geography, University of Tennessee, Knoxville (http://web.utk.edu/~grissino/principles.htm)

University of Montréal, Groupe de Recherche en Dendrochronologie Historique (GRDH), (http://www.grdh-dendro.com/index.html)

Fission track dating

University of Ghent, Vakgroep Geologie en Bodemkunde, Geochronology Group, Fission Track Dating (http://www.minpet.ugent.be/fission.htm)

Personal webpage of Tristan Ferroir, Professor of CPGE BCPST – Lycée Janson de Sailly (http://tristan.ferroir.fr/index.php/2008/10/13/la-datation-par-traces-de-fission-en-geologie/)

Obsidian hydration dating

University of Arizona, Department of Geosciences (http://www.geo.arizona.edu/palynology/geos462/11datingmeth.html)

Bieling & Psota Archaeological Consultants (http://www.sonic.net/~dbieling/obsidian_hydration.html)

Archaeomagnetic dating

University of Bradford, Division of Archaeological, Geographical and Environmental Sciences (http://www.brad.ac.uk/archaeomagnetism/archaeomagnetic-dating/)

English Heritage, Archaeomagnetic Dating Guidelines, online pdf (http://www.english-heritage.org.uk/publications/archaeomagnetic-dating-guidelines)

La Trobe University, The Australian Archaeomagnetism Laboratory (http://www.archaeomagnetism.com)

University of California at San Diego, GEOMAGIA50 database of archaeomagnetic data (http://geomagia.ucsd.edu)

Institut Français de l'Éducation (http://acces.ens-lyon.fr/acces/terre/limites/Temps/datation-isotopique/enseigner/paleomagnetisme)

L'Université Laval, Département de Géologie (http://www2.ggl.ulaval.ca/personnel/bourque/s1/magnetisme.terr.html)

GLOSSARY

Annealing: heating a material above a threshold where it remains structurally intact. When the material cools, the molecular constituents are realigned. In fission track dating, the annealing process results in the erasure of fission tracks. As it relates to archaeomagnetism, annealing results in the magnetic particles realigning to face the geomagnetic North Pole.

Geomagnetic flux patch: an area in the magnetosphere with intense magnetic field activity. The earth's magnetic field is generated from electrical currents that travel through iron particles that predominate the outer core and is not distributed evenly through the magnetosphere, and varies in intensity and spatial extent through time.

Seriation techniques: Obtaining a chronology by using culturally-specific and temporally diagnostic artifacts.

Spectroscopy: the study of how physical matter absorbs or emits waves of electromagnetic radiation, including visible light.

Method	Age range (years BP)	Precision (1-σ)	What can you date?
Radiocarbon (^{14}C)	250 - 50,000	<1-2%	things that used to be alive (bone, wood, seeds, shell, etc.)
Cosmogenic nuclide	2000 - 10,000,000	1% (rocks) - >10% (sediment)	exposed ground surfaces
Dendrochronology	rarely conducted in Africa	0% (when done right)	trees
K-Ar/Ar-Ar	2000 - 4,600,000,000	1-2%	volcanic rocks
U-series	50,000 - 500,000	1-10%	travertines (limestone caves), bone, shell, carbonates
Fission track	2000 - 1,000,000+	10%	young samples = glass or ceramics; old samples = volcanic glass (obsidian)
Thermoluminescence (TL)	100 - 50,000	5-10%	ceramics or heated sedimentary stones (flint, quartz)
Optically Stimulated Luminescence (OSL)	10 - 150,000	3-7%	sedimentary rocks that have been buried (not exposed to light or extreme heat)
Electron Spin Resonance (ESR)	0 - 150,000	10-20%	teeth in thermally stable environments (caves)
Obsidian hydration	0 - 120,000	10%	the time of manufacture of obsidian artifacts
Archaeomagnetic dating (a-mag)	0 - 2,000,000+	it depends on number of intercepts	magnetic minerals that have been heated (hearths and volcanic deposits are most commonly dated)

Common methods of radiometric and other dating of archaeological sites, timespans covered, precision of the method and materials able to be dated.

Chapter 6

From present to past

INTRODUCTION

Olivier P. Gosselain[1]

This chapter focusses on historical approaches that start from the present rather than the past. The reversal may seem incongruous in a field manual in archeology, but it certainly has its place here. After all, the present is never more than the past in the making. More fundamentally, this past which has forged our 'present' continues to live, in the form of survivals, of more or less preserved remains, or even of 'phantoms' that come back to haunt the living (Gosselain & Smolderen 2016). These disparate elements can enrich our understanding of the past in at least two ways: (1) as an historical document, which should be interpreted with the same rigour as archaeological remains; and (2) as analogical referents, which help us to refine archaeological reasoning (**Lyons; Mayor**).

If the African continent is richer in written sources than is sometimes believed, these documents are unevenly distributed and almost exclusively concern the second millennium AD. To access the African past, we must leave the well-marked frameworks of the historical method, using every means available in blending disciplines, exploiting a wide range of sources, and developing or importing new approaches. It is in Africa, for example, that oral traditions have gained scientific legitimacy (Vansina 1962; Schoenbrun). It is in Africa that a fruitful dialogue has developed between linguists and archaeologists around the Bantu question (**Bostoen**). And it is particularly in Africa that important research programs combining archeology, ethnography and history have emerged, whether under the banner of 'ethnoarchaeology' (**Lyons; Mayor**) or of the 'direct historical approach' (**Stahl; Mezop**).

This intellectual ferment, which marked the second half of the 20th century and continues today with the entry of genetics on the scene (**MacEachern**), is based both on an exploitation of data collected from living people and the correlation of these data with archaeological information – which is the principal category of information *derived* from ancient contexts. A fairly comprehensive overview of the types of data to be exploited for this purpose can be found in this chapter: traditions and oral histories (Schoenbrun); languages and specialized lexicons (**Bostoen; Riquier**); the genome (MacEachern); techniques of production – especially pottery – (**Gosselain; Mayor; Mezop**); architecture (**Brunfaut & Pinet; Stahl**); and art (**Polet**). We should ideally add music and the study of musical instruments, social structure and rituals, and domestic plants and animals, all of which also constitute entry points into the past (e.g. Charry 2000; Masquelier 2001; Seignobos 1980; Tamari 1991).

Despite the diversity of the disciplines and subjects covered, the different contributions overlap in many respects. All particularly stress the importance of a rigorous methodology in the collection and description of the data, as in their interpretation and their juxtaposition to archaeological facts. This methodological rigour includes several imperatives: to avoid the dangers involved in using concepts like 'ethnicity' or 'autochthonous', which too often prevent us from appreciating the porous, dynamic and sometimes improvised character of borders and social relations (Polet; Schoenbrun; Stahl); to examine the degree of similarity between observed facts – as is underlined by Lyons, Polet and Stahl, a formal resemblance does not in any way imply a functional or semiotic similarity; and to favour tools that have proven themselves and are built on solid foundations, even if they are old or have been developed in very different contexts, over *ad hoc* bricolage (**Bostoen; Brunfaut & Pinet; Gosselain; Mezop; Polet; Ricquier; Stahl**). Concerning linkages with the archaeological data, readers should complete this set of different contributions with the essential article by Jan Vansina (1985): 'Historians, are archaeologists your siblings?'

Another commonality between the different contributions to this chapter is the use of a comparative approach. This not only enlarges our archaeological imagination and allows us to better contextualize the facts under study (**Lyons, Mayor**; see also Lane 2005); it also allows us to formulate historical hypotheses that can be compared with those of archaeologists, or that can lead to new archaeological research (**Bostoen; Gosselain; MacEachern, Mayor; Mezop; Schoenbrun; Stahl**). In this regard, we note the almost universal use of distribution maps, which returns us to a common archeological practice. These maps are fundamental tools in interpreting data and formulating historical hypotheses. However, this first requires consideration of their scales, and of scales of comparison more generally (**Gosselain;**

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Mayor), of the information to be recorded, and of the significance of the spatial distributions that are generated (**Bostoen; Gosselain; Mayor; Polet; Ricquier; Schoenbrun**). The analysis of these spatial distributions may often require a second approach to comparison, through research on their relations to social, environmental or historical phenomena.

To conclude this brief rendering of the intersections between ethnography and archeology in exploring the African past, we need to remember the advice that was frequently repeated by our late colleague, the linguist Baudouin Janssens: everyone should start working independently and with critical rigour on their own data, and the confrontation with conclusions derived from other disciplines should be done only after that. This avoids circular reasoning, and the mutual validation of data that are not well-substantiated. This does not diminish the need to keep abreast of advances in other, partner disciplines, either in their methods or their results. On the contrary, such knowledge is essential not only to undertake a fruitful interdisciplinary dialogue, but also to preserve one's critical judgement for possible disjunctures, as **Scott MacEachern** reminds us in the case of genetic analysis.

References

Charry, E. 2000. *Mande Music. Traditional and modern music of the Maninka and Mandinka of Western Africa.* Chicago: University of Chicago Press.

Gosselain, O.P. & Smolderen, L. 2016. 'Les fantômes du Dendi. Lorsque les restes d'une ancienne filière textile surgissent au Nord Bénin'. *Techniques & Culture* 65.

Lane, P. 2005. 'Barbarous tribes and unrewarding gyrations? The changing role of ethnographic imagination in African archaeology'. In A. Stahl (ed.), *African Archaeology. A Critical Introduction*, pp. 24-54. London: Blackwell.

Masquelier, A. 2001. *Prayer has spoiled everything. Possession, power, and identity in an Islamic town of Niger*. London: Duke University Press.

Seignobos, C. 1908. 'Des fortifications végétales dans la zone soudano-sahélienne (Tchad et Nord Cameroun)'. *Cahiers ORSTOM* (Series 'Sciences humaines) 17(4): 191-222.

Tamari, T. 1991. The development of caste systems in West Africa. *Journal of African History* 32: 221-250.

Vansina, J. 1962. *De la tradition orale. Essai de méthode historique*. Tervuren: Royal Museum for Central Africa.

Vansina, J. 1985. 'Historians, are archaeologists your siblings?' *History in Africa* 22: 369-408.

THE DIRECT HISTORICAL APPROACH

Ann B. Stahl[1]

The term "direct historical approach" was coined by early 20th-century 'ethnohistorians' interested in the recent pasts of Native Americans. Prior to that time, archaeology in North America had focussed preferentially on ancient mound sites thought to be too complex to be constructed by the 'simple' indigenous societies of eastern North America. This perception ignored the high mortality, population loss and resettlement that these indigenous groups had suffered through settler colonization. The small Native American populations that persisted in regions like the northeastern United States were therefore seen as disconnected from the sites that interested archaeologists.

In the early decades of the 20th century, a small cadre of scholars began to work in regions where, despite settler colonization, Native Americans held on to some of their ancestral lands, for example the Iroquois of New York or Pueblo people of the American Southwest. These scholars became interested in the histories of these groups. Because at that time studying 'history' was thought to depend on written sources, scholars referred to studies of non-literate Native American societies as 'ethno-history.' They used European documents to study the history of these indigenous people, but also relied on ethnography and archaeology. Notably the term ethnohistory was rejected by scholars who worked in Africa. They argued that no special term was needed to refer to the study of Africa's precolonial past, despite the importance of oral traditions and archaeology to that endeavour (Vansina 1962).

Faced with the problem of drawing connections among sources deemed unconventional by historians (e.g., archaeological and oral historical evidence), early North American ethnohistorians sought a method to ensure the likelihood that these sources were reliably connected to a known group of people. The 'direct historical method' was developed as a way to achieve this. In the American Southwest where Native American peoples lived in pueblo-style settlements that resembled precolonial architecture, the direct historical approach was based upon assumptions of continuity between past and present (Parsons 1940). It was thought that, once a connection could be demonstrated between a group of people and an archaeological site, observation of ongoing life (e.g., through ethnographic research) could be used to reconstruct past lifeways. They used this a means to ensure that analogies – insights based on observation of present-day practice – could be reliably used to interpret the past.

The assumptions of this early 'direct historical method' were spelled out by William Fenton who worked on sites associated with Iroquoian people in New York. Fenton formulated three premises of what he called 'upstreaming': that 1) broad cultural patterns tend to be 'stable over long periods of time;' 2) study should precede from a focus on the most recent sources ('because they contain familiar things') to earlier sources; and 3) a focus should be placed on 'those sources in which the descriptions of society ring true at both ends of the time scale' (Fenton 1952:335). The problem with this formulation is that it assumed what should have been asked: was there, in fact, continuity of practice and attributes through time? At the time, these scholars saw change as something that 'eroded' culture and made it less 'authentic.' This was a period when it was assumed that Native American societies were in the process of disappearing and that indigenous peoples would ultimately be assimilated into dominant society. Change was seen as a process of 'acculturation' that would ultimately lead to the demise of Native American cultures. These flawed assumptions of the direct historical method ignored the fact that Native American peoples had long been entangled in historical processes, and failed to take account of the diverse ways in which they responded to the shifting global entanglements within which they had operated for centuries prior to the recording of ethnographic accounts in the 20th century.

A notable exception to this assumption of continuity in early applications of the direct historical method centred on the American Plains regions where the indigenous peoples were historically known as nomadic buffalo hunters. Archaeologists like Strong (1933) and Wedel (1938) used archaeological evidence to demonstrate that the lifeways of Plains peoples had been transformed by the introduction through European contact of the horse. Prior to accessing horses, Plains peoples had been farmers who augmented their diets through hunting, their settlements

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confined to the fertile margins of the Plains region. Adoption of the horse enabled Native Americans of the Plains region to follow migrating buffalo herds, a practice associated with the adoption of alternative forms of movable dwellings ('teepees'). Their work demonstrated the value of the direct historical method in documenting *change* as well as continuity.

This work had important implications for the way in which we approach analogical reasoning. Analogy is a foundational form of logic in which we assume that if things are alike in certain respects that they must be alike in others as well. Applied in this way, analogy *assumes* similarity. As an example, if we find a stone tool shaped like a knife, we might assume that the tool was used for cutting as knives are today. But if, as in the Plains example described above, we adopt a *comparative approach* to analogy, we *assess* rather than assume similarity (Wylie 1985). Archaeologists like Strong and Wedel documented sites that differed from the expectations of historic Plains lifestyles, yet showed through material culture how they were nonetheless linked to Plains peoples. Returning to the knife example, similarity in form provides a basis for comparing other attributes. For example, if a tool was used a knife, it should show a thin edge with forms of wear consistent with slicing or cutting. If it does not – if the edge of the tool is steep and the forms of wear consistent with some other activity, for example scraping – the analogical inference of the tool as a knife is not verified. This could lead to an alternative analogue, for example the interpretation of the tool as a scraper, in which case we might be successful in identifying a glossy build-up that is sometimes characteristic of processing animal skins.

Putting these two approaches together – the direct historical method and a comparative approach to analogy – offers a powerful means to explore the dynamism of cultural practice in relation to historical processes. It enables us to explore how people responded to the challenges and opportunities of recent centuries, for example as Africans participated in the forging of Atlantic networks or responded to climatic and environmental change. This dual approach helps us to appreciate how people built on prior practice as they responded to novel circumstances – in short, to appreciate how they improvised. Drawing on multiple lines of evidence – archaeological, documentary and oral – further strengthens this approach, particularly when each is approached comparatively and used to assess the strengths and weaknesses of the other.

A comparative approach to the direct historical method has been used to good effect in a number of West African case studies. For example, work in the Banda area of west central Ghana has documented the continuity but also changes that characterized daily life with the region's shifting global entanglements. These ranged from its involvement in medieval Sudanic networks that connected West Africa to the Mediterranean world to the Atlantic networks of recent centuries and the brief period of formal British colonial occupation. As described more fully in Stahl (2001:19-40), the key to this approach was to begin analysis with a focus on recent sites and practices – a contemporary baseline – and comparatively assess a range of sources to chart commonalities and differences with earlier sites and practices.

As an example, later 20th-century Banda villages were characterized by earthen-walled houses arranged around open courtyards where domestic activities like cooking are focused. The coursed earth or tauf-walled houses with peaked, thatched roofs are durable with appropriate maintenance. Many have stood for decades. Yet most Banda villages are associated with adjacent archaeological sites abandoned early in the British colonial period (early 1900s) when British colonial officials used various sorts of persuasion (including razing houses) to encourage villagers to rebuild according to a British 'village planning' scheme. These schemes were implemented – more or less successfully – across British colonies and, while details varied, common elements included a reconfiguration of space through measures like orienting houses on a grid pattern and realigning practices encompassed under a British conceptualization of 'sanitation.' This included establishing special purpose cemeteries on village margins, refuse tips and so on. With respect to the Banda area, this also encompassed British ideas of a 'model compound' based on house forms with which British colonial figures were familiar in the southern Gold Coast Colony (e.g., among the Asante). This raised questions regarding past practice. To what extent were the British successful in imposing their village planning schemes? What did Banda area houses and villages look like prior to village relocation? What was the spatial configuration of activities in the centuries prior to British colonial occupation? Abandoned sites directly and historically linked to later 20th-century villages held promise to address these questions.

Excavations at successively earlier sites have revealed important insights into Banda settlement practice. Beginning with investigation of sites abandoned early in the colonial period, it became clear that the villages described in early colonial documents by the first British officials to visit the area were temporary villages established late in the 19th century when Banda villagers had returned to the area following a period of warfare and dislocation. Those houses were small, free-standing wattle-and-daub structures, buildings that could be raised quickly at a time when people were coping with conditions of uncertainty. Yet an area of the site occupied earlier in the 19th century – prior to the site's abandonment during the mid-century upheavals – was characterized by very different architecture and spatial arrangements. Here the houses were durable tauf constructions arranged in compound formations – similar to those of the later 'planned' village, though without evidence of the grid pattern of streets characteristic of 20th-century villages. In short, the late 19th-century housing that the British took to be characteristic of Banda 'traditional practice' ('flimsy' wattle-and-daub construction) was based on a moment in time when Banda villagers had responded with expediency to the conditions in which they found themselves. The architectural and spatial practices characteristic of the 'planned' colonial villages drew in fact on an earlier repertoire manifest in the early 19th-century village, suggesting a deeper flexibility and durability of practice than can be gleaned from documentary sources. As discussed more fully elsewhere (Stahl 2001:148-214), a comparative approach to practices of craft production, subsistence and exchange based on multiple sources (documentary, oral and archaeological) carefully seriated in time has yielded valuable insight into aspects of both continuity and change in the lifestyles of Banda peoples over recent centuries. Key to this approach is using 20th-century or contemporary insights (e.g., from ethnoarchaeology) as a *baseline for comparison* rather than as practices or patterns to be naively projected into the past.

Ending on a cautionary note, it is important in pursuing a direct historical method to be well aware of the flexibility and historical malleability of ethnicity. The ethnic entities of today are the products of complex historical processes – outcomes that should not naively be projected into the past. We know for example that processes set in motion by colonial officials – like schooling and the expansion of literacy – have shaped the contours of contemporary ethnicity (Hawkins 2002). We know that African societies were flexible in their membership, often embracing compositional strategies (Guyer & Belinga 1995) in which they drew strength by incorporating people who held diverse knowledges. So too were many societies open to adopting new strategies and practices in improvisational fashion, whether with respect to ritual, foodways or other aspects of daily life. As such, we need to be careful to avoid ethnic essentialism – the tendency to assume that the practices and attributes of a given group of people are fixed. Archaeology and the direct historical method have much to contribute to our understanding of the dynamism of African societies, so long as we deploy these approaches comparatively and in ways that admit of both change and continuity.

REFERENCES

Fenton, W.N. 1952. 'The Training of Historical Ethnologists in America'. *American Anthropologist* 54: 328-339.

Guyer, J.I. & Belinga, S.M.E. 1995. 'Wealth in People as Wealth in Knowledge: Accumulation and Composition in Equatorial Africa'. *Journal of African History* 36: 91-120.

Hawkins, S. 2002. *Writing and Colonialism in Northern Ghana: The Encounter between the LoDagaa and the 'World of Paper.'* Toronto: University of Toronto Press.

Parsons, E.C. 1940. 'Relations between Ethnology and Archaeology in the Southwest'. *American Antiquity* 5: 214-220.

Stahl, A.B. 2001. *Making History in Banda. Anthropological Visions of Africa's Past.* Cambridge: Cambridge University Press.

Vansina, J. 1962. 'Ethnohistory in Africa'. *Ethnohistory* 9: 126-136.

Wylie, A. 1985. 'The Reaction against Analogy'. In M.B. Schiffer (ed.), *Advances in Archaeological Method and Theory,* vol. 8. New York: Academic Press, pp. 63-111.

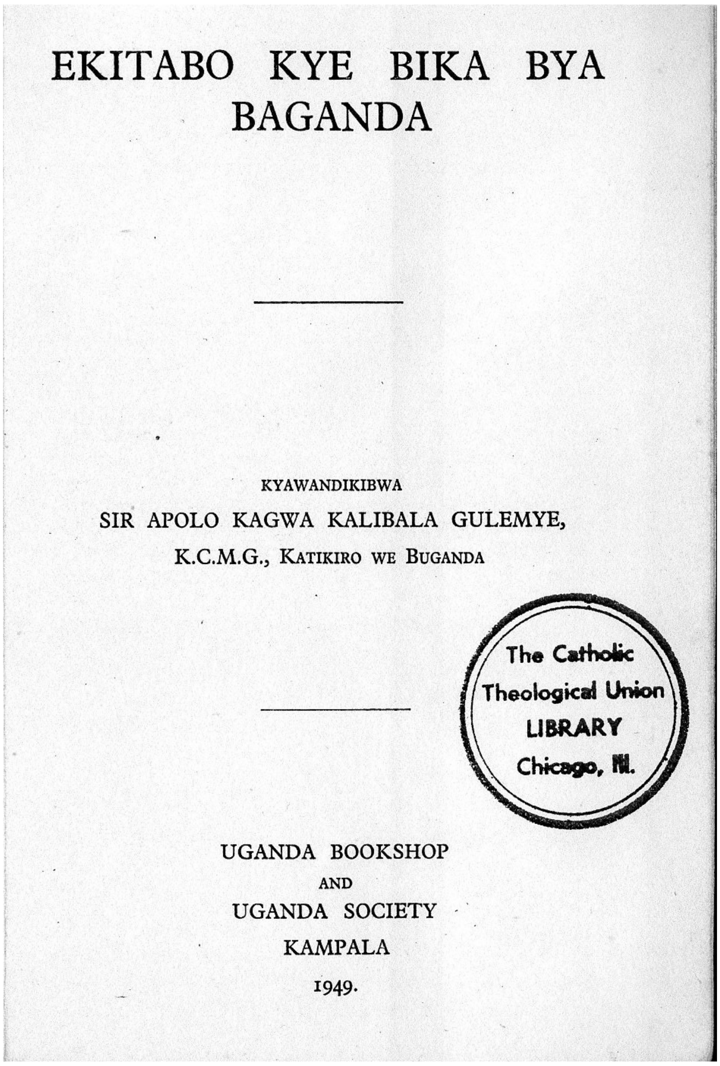
ORAL TRADITION

David Schoenbrun[1]

Oral traditions are 'verbal messages which are reported statements from the past beyond the present generation' (Vansina 1985). Oral histories differ; their verbal messages are statements about the present generation. Oral traditions include migration itineraries, military conflicts, famines, and claims about the origins and fates of groups. Oral traditions include names of places, people, animals, plants, and objects often related to claims about which groups were first in a place or a region. In order to analyze and interpret the historical riches in oral traditions, one begins by understanding what shapes the transmission of its messages (Ogot 2001). Oral traditions were performances before they became written accounts (**fig. 1**). They contain evidence about both the construction of the past and the past itself. It is correct to think of them as historical and archaeologists may benefit from analyzing and interpreting them or including in their teams a scholar who can do so. But their messages often have many meanings.

One begins by finding out how people who claim a connection to the area in which one is working think about the past. What genres of talk about the past exist or existed? What distinguishes them? Who may specialize in their performance? Where and when are they performed? These questions invariably lead the researcher to local experts on the past. One must then look beyond such experts and the established centers for their knowledge – schools, missions, shrines, courts, palaces, and so forth – in order to find other versions of oral tradition on the particular topic(s) of interest. For example, if a researcher seeks performances of oral traditions in places like shrines rather than in places like royal, noble, or chiefly courts, they may find performances on the same topics but told differently or emphasizing different ideas (Kodesh 2010). Balancing good manners and respect with persistence, a researcher must find other locations and opportunities for the production of oral tradition than those they encounter first.

The phrase 'oral traditions' can be misleading because they are often strongly influenced by material that performers have learned from books or other media. Attending and documenting the performance of oral traditions today must include locating written versions. They are commonly found in the accounts of foreign travelers in the region, mission archives and publications (which often include material penned by Africans in their vernacular), and colonial archives. Scholars working in the 1950s and 1960s to recover Africa's earlier history embraced research in oral traditions and much of their work may have been deposited in national archives, university libraries, or remain in their possession. Tracking the influences of performance and writing on oral traditions is an example of understanding what shapes the transmission of the messages they convey. But the influences of writing on the contents of performed oral


EKITABO KYE BIKA BYA BAGANDA

KYAWANDIKIBWA

SIR APOLO KAGWA KALIBALA GULEMYE,

K.C.M.G., KATIKIRO WE BUGANDA

UGANDA BOOKSHOP

AND

UGANDA SOCIETY

KAMPALA

1949.

Fig. 1. Title page of the most commonly cited history of the Ganda clans, including the Lungfish clan (1st Edition, 1912). The Title's English translation is *Book of the Clans of Buganda*'.

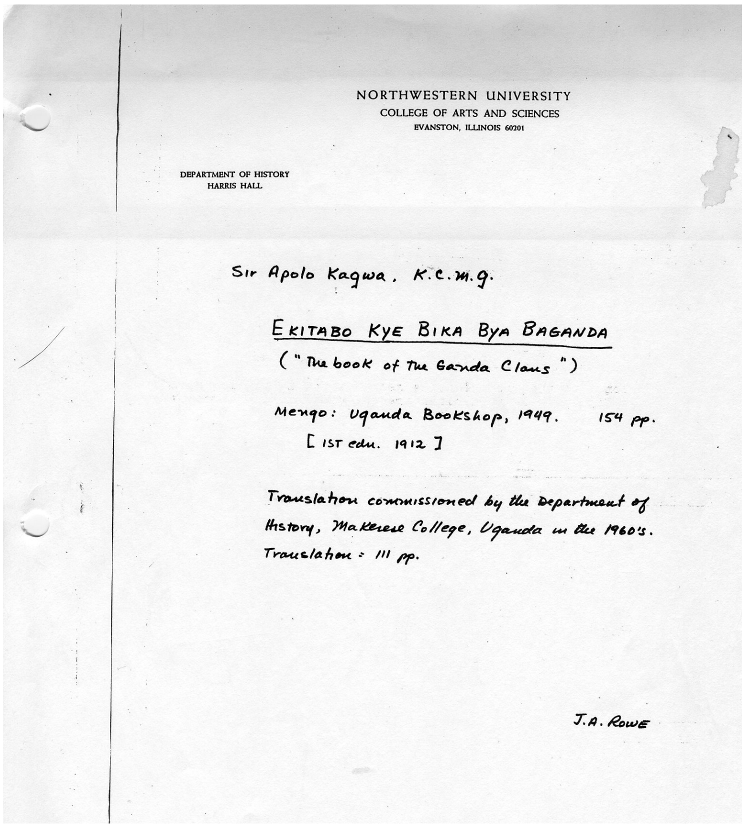
1 Weinberg College of Arts and Sciences, History Department, Northwestern University, USA.

traditions do not extinguish their value as evidence of past events and past political realities.

To analyze and interpret the historical content of oral traditions, the researcher moves between performances of oral traditions and documentary accounts of them. The goal is to find or prompt different versions to study comparatively (see Stahl, this volume, pp. 250-252). One then fits their contents into the past contexts of use that shaped them by drawing on the findings of other historical sources – such as environmental studies, historical linguistics, and archaeology. These sources contain datable information to which topics in the oral tradition refer and they provide broader context for past performances of oral tradition. Clan traditions are widely found in Africa and they may be treated in this way. A clan history is very often a history of a network told through a metaphor of descent that manages contests over the contributions of different nodes in the network by placing them at particular points in an unfolding story. The older or earlier figures in the traditions with which later groups enjoy a tie of affinity or marriage ennoble each other. Clan traditions – indeed, all oral traditions – unfold in a dynamic tension between teller(s) and audience. It is therefore dangerous to take literally the rhetoric of descent that shapes them. The trails of generations they trace across the land over time by a series of migrations are better seen as networks of political affiliation and social opportunity, creating and joining smaller, dispersed communities (Shetler 2007). Where royal and clan traditions coexist, the latter tend to be calibrated by the shifting power of the royal centre (Schoenbrun 2013), something often revealed in the different versions of events one finds in the two genres. If you study performances at a royal capital or a chief's compound and then study them at a shrine or a place claimed by a particular clan network as an early home, the contents and shape of a clan's oral tradition changes, departing in rich ways from royal traditions (Cohen 1989; Kodesh 2010).

One must pay careful attention to the settings in which oral traditions are performed. This can be very difficult, if not impossible, to achieve from books alone. In Uganda, clan histories are very common. They tell about distant pasts but they have lives rooted firmly in 20th century political realities. Indeed, the messages one retrieves from oral traditions, when properly analyzed and interpreted, are nothing less than traces of earlier political realities. The politics of imperial conquest, mission activity, and the establishment of colonial rule all unfolded in this part of Africa after the 1860s and were concentrated most intensely in the two decades from 1885 to 1905. During this time the political fortunes of clans, kingdoms, and wealthy houses in the region took divergent paths with respect to each other, resisting or manipulating external interests. It was the time during which clan and dynastic traditions took their earliest written forms – in vernacular languages and sometimes translated (**fig. 2**). Of course, clan traditions were deployed throughout the colonial period– most energetically around issues of land tenure and the creation of markets in private landed property from 1900 to the 1920s. And, the political winds of post-colonial Uganda have continued to blow through clan traditions up to the present, especially around issues of sovereignty and party politics. Whether written, oral, or both, clan traditions are alive.

Whatever past one hunts down with oral traditions, one begins by grasping the ways in which culturally specific but shifting concepts of time, space, and truth operate in them. Space is defined geographically, as a region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DEPARTMENT OF HISTORY
HARRIS HALL

Sir Apolo Kagwa, K.C.M.G.

EKITABO KYE BIKA BYA BAGANDA
("The book of the Ganda Clans")

Mengo: Uganda Bookshop, 1949. 154 pp.
[1st edn. 1912]

Translation commissioned by the Department of History, Makerere College, Uganda in the 1960's.
Translation: 111 pp.

J.A. Rowe

Fig. 2. Title page of one of two unpublished English translations of Kagwa's history of the Ganda clans.

composed of nodes of authority, and relationally, as a set of links between those nodes. Descent logic marks the unfolding of time by assigning generations a basic referential kinship standing. Huge amounts of information are often compressed into the earliest and the most recent generations and the brothers and sisters alive in each. The longer ago – or the earlier in the line of descent linking different generations – an event occurred or a persona existed, the greater the weight of truth behind it. But alternative versions use the same logic to dispute one another, by shifting the order of generations or by inserting new ones in the sequence or by leaving some out of the mix, or all three. Clan histories, then, tell about the shifting political affiliations of many differently sized groups, so it is unsurprising and valuable to find in them displays of dispute, conflict, and fission. Again, one cannot make head or tail of such characteristics apart from the performance setting in which they are actually made.

Archaeologists benefit from oral traditions plausibly connected to a region of survey or a set of sites in a region, in two important ways. First, they often contain names, titles, or sayings with metaphorical content that also appears on material culture. Versions of the Lungfish clan's history agree that one Mubiru Gabunga traveled along Lake Victoria's northern littoral and some of its island archipelagos, from east to west. He established a network of smiths, canoe-builders, fishing groups, and spirit mediums. When his generation's travels were completed, he settled at a safe harbour on the lakeshore, with the assistance of a couple of other clan networks in the region. There he handed over leadership of the clan, by placing a copper bracelet on the wrist of a 'son' called Ssematimba (father of the pythons) who then moved to another harbor and stayed there (Kagwa 1912). In 1929 a pressgang of African prisoners clearing land for the expansion of the colonial prison in which they were incarcerated uncovered a buried set of terracotta figures dated to between the 10th and 12th centuries. One figure is a head with a coiled neck-ring, an icon of a python's constricting method of crushing its prey (a local metaphor for the human experience of being possessed by a spirit). The other figures in the assemblage are headless, but they wear bangles on their wrists. Lungfish clan histories claim that once their network had been defined spatially and relationally – during the generation of Mubiru Gabunga and his 'brothers' – the next period in its history involved establishing authority over territorial spirits represented by the figure of the python. When set alongside the iconography of the *terracottas* from Luzira Prison, the stakes of traditions and the messages in the assemblage enter a dynamic conversation about a new scale of politics (Schoenbrun 2016).

Second, in recounting the itinerary of travels undertaken by founding generations of a clan, traditions craft a map that is both geographical and relational. The map defines a region of activity for the clan by linking nodes in it. Nodes are stopping places. Links are movements between them. The shapes of these regions may help make sense of facies in a pottery tradition, or the temporal overlap of two different pottery traditions, one fading away and the other coming to life, in the same region. The traditions often specify why the nodes and links mattered to people, pointing to what brought pottery traditions to life or led to their disappearance. Lungfish clan histories do not agree on every stop in this itinerary, but the stops on which they agree all lay very near the shores of Lake Victoria, or on one of the islands that dot the northern part of the Lake. The itineraries also agree that Lungfish clan founders and their followers very often moved by canoe. Of the several 'brothers' said to have founded the clan, one of them is always recalled as a smith. Fishing in Lake Victoria was an important economic activity that differed from fishing in rivers or smaller lakes. It required specialized knowledge of fish ecology in a huge and diverse lake, technical skill in making and setting large nets, and great skill in navigation and understanding weather patterns.

Nuances in Lungfish clan traditions come to light by paying attention to their performative settings, studying the bits of historical information contained in itineraries, the significance of which people may no longer know. These elements teach the archaeologist about what mattered to people of long ago. The archaeologist then sheds new light on ancient settings for performances of oral traditions, by unearthing materials such as large pots used for brewing the beer that accompanies performances. They may discover that the depositional contexts of an entire kind of pot reveal its exclusive use in making offerings at shrines. And they may analyze and interpret assemblages of objects – such as the Luzira Group – implicated in spirit possession, a common performative setting for oral traditions in many parts of Africa.

REFERENCES

Cohen, D.W. 1989. 'The Undefining of Oral Tradition'. *Ethnohistory* 36 (1): 9-18.

Kagwa, A. 1912. *Ekitabo kye Bika bya Baganda*. Kampala: Uganda Bookshop.

Kodesh, N. 2010. *Beyond the Royal Gaze: Clanship and Public Healing in Buganda*. Charlottesville: University of Virginia Press.

Ogot, B. A. 2001. 'Luo History and Identity'. In L. White, S.F. Miescher & D.W. Cohen (eds). *African Words, African Voices: Critical Practices in Oral History*. Bloomington: Indiana University Press, pp. 32-50.

Schoenbrun, D. 2013. 'A Mask of Calm: Emotion and Founding the Kingdom of Bunyoro in the Sixteenth Century'. *Comparative Studies in Society and History* 55 (3): 634-664.

Schoenbrun, D. 2016. 'Pythons Worked: Constellating Communities of Practice with Conceptual Metaphor in Northern Lake Victoria, ca. 800-1200 CE'. In A. Roddick & A. Stahl (eds). *Knowledge in Motion: Constellations of Learning Across Time and Place*. Tucson: University of Arizona Press, pp. 216-246.

Shetler, J.B. 2007. *Imagining Serengeti: A History of Landscape Memory in Tanzania from Earliest Times to the Present*. Athens, OH: Ohio University Press.

Vansina, J. 1985. *Oral Traditions as History*. Madison: University of Wisconsin Press.

HISTORICAL LINGUISTICS

Koen Bostoen[1]

Linguists and archaeologists offer complementary viewpoints on human behaviour and culture in past African communities. While historical-comparative linguistics commonly deals with the immaterial traces of the past in Africa's present-day languages, archaeology unearths the material vestiges of ancient cultures. Even if both sciences share similar core concepts, their methods, data and interpretive frameworks are profoundly different. Explaining some basic principles of historical-comparative linguistics as applied to the Bantu languages and debunking some common misconceptions are the central aims of this contribution. Due to space constraints, no detailed bibliographic references are provided throughout the text (see my earlier publications for extensive bibliographies).[2] Some essential readings for non-specialists are listed at the end of this chapter.

I. DIACHRONIC LINGUISTICS ON THE BASIS OF SYNCHRONIC DATA

Ideally speaking, historical linguistics is the study of distinct historical stages in the evolution of one single language or language family. This is the case in Romance, for instance, where the development of Latin into its multiple daughter languages can be empirically reconstructed. In Africa, examining language variation through time on the basis of diachronic language data is hardly ever possible, due to the lack of written documents.

The case of Kikongo, whose historical record starts in the early 17th century, is exceptional, and even not equalled by Kiswahili whose oldest surviving texts do not date further back than the mid-18th century. For most other Central African languages, written documents become at best available from the late 19th century onwards. Even today, there are still many undocumented languages, several of which are on the verge of extinction. Historical linguistics in Africa thus usually consists in the comparative study of historically-related languages. This up-stream approach, also known as 'historical-comparative linguistics', starts from extant languages and tries to reconstruct their evolution from ancestral stages through the study of current-day variation. Such inter-language variation can be phonological, morphological, syntactic, semantic or lexical.

In the case of Bantu, the hypothetical common ancestor language reconstructed on the basis of similarities observed between languages known mainly from the 19th century onwards is commonly called Proto-Bantu. This proto-language is assumed to be the best possible reflection of the ancestor language that was supposedly spoken some 4,000 to 5,000 years ago in the area from where Bantu languages started to spread through Central Africa and beyond. Bantu linguists agree to situate this homeland in the so-called Grassfields region of Cameroon, not far from the country's border with Nigeria. This zone displays the highest linguistic diversity (which means that parent languages had sufficient time to diverge locally) and is close to the area where the Benue-Congo relatives of Bantu languages are spoken.

II. REFERENTIAL VS. HISTORICAL OR GENEALOGICAL CLASSIFICATIONS

The best-known Bantu classification is no doubt Malcolm Guthrie's. In 1948, Guthrie subdivided the Bantu languages in 16 different zones labelled A, B, C, D, E, F, G, H, K, L, M, N, P, R, S and T, which he reduced to 15 in 1971 by merging the last two to one zone. Each zone is further subdivided into language groups, indicated by a decimal number, in which individual languages are indicated by a unit. Lowercase letters following certain units refer to dialects of a same language, e.g. Ciluba (L31a) and Lulua (L31b). In contrast to what is often believed, Guthrie's classification is strictly referential and was never meant to be historical: Guthrie did not rely on the 'Comparative Method' (which is the core approach of historical-comparative linguistics) or 'shared innovations', its basic principle for historical subgrouping. Shared innovations are lexical, phonological or grammatical changes that took place only once in some ancestor language from which its daughter languages inherited it and which are therefore indicative of the closer

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2 http://research.flw.ugent.be/en/koen.bostoen

relatedness between languages. By attributing a unique alpha-numeric code to each language, Guthrie wanted to facilitate comparison between the several hundred Bantu languages known at the time.

Despite its limited historical or genealogical value, Guthrie's classification remains a useful reference tool. Each one of the nearly 900 documented Bantu language varieties can be approximately situated in space thanks to its unique code. That is exactly why Jouni Maho updated Guthrie's list by adding new languages, but remained as faithful as possible to the original approach. Other scholars did propose rearrangements on historical grounds. Only one of these gained relatively wide acceptance amongst Bantu linguists, i.e. zone J proposed by the former linguistics department of the Royal Museum for Central Africa in Tervuren.

Bantu as a language family has been established ever since Bleek (1851). Its homeland is the region where the 'Narrow Bantu' languages, i.e. those conventionally classified as Bantu by Guthrie, meet the 'Wide Bantu' languages, i.e. their closest Benue-Congo relatives aka 'Bantoid'. The small 'Mbam-Bubi' subgroup, consisting of several languages of the Mbam region of central Cameroon and Bubi spoken on Bioko Island, is the genealogical junction between Narrow and Wide Bantu. The (Narrow) Bantu family further branches into five major subgroups: 'North-Western', 'Central-Western' (aka 'North Zaire' or 'Congo'), 'West-Western' (aka 'West-Coastal'), 'South-Western' and 'Eastern'. We mainly owe this robust understanding of Bantu genealogy to quantitative analyses of so-called 'basic vocabulary', such as lexicostatistics and phylogenetics. Qualitative approaches based on phonological and/or grammatical features fit less with the tree model of language divergence, and emphasize that convergence due to language contact also had a significant impact on the speciation of Bantu languages.

III. LANGUAGE AS AN HISTORICAL SOURCE

Our knowledge of the environmental, social, cultural, and historical phenomena underlying language change is often very limited in Africa. Its languages most often need to 'speak for themselves'. The study of language has in itself become an important method of reconstructing history to which not only linguists, but also historians and archaeologists dedicate themselves. Founded on the basic premise that vocabulary shared between speech communities[3] is a reflection of shared history, the study of widespread cultural vocabulary usually provides interesting insights on the lifestyle of past societies. This sub-discipline is also known as the 'words-and-things method' (see Ricquier, this volume, pp. 261-263) or linguistic palaeontology. To archaeologists, language data are particularly useful as a source of indirect historical evidence for those aspects of human culture which are either immaterial or whose material traces do not conserve well. Similar words with similar meanings shared by numerous languages can be inherited from a common ancestor language and spread through the dispersal of its daughter languages. They can also have been adopted through contact and spread across languages as loanwords.

To distinguish between inherited and borrowed vocabulary, linguists depend on the principle of regular sound correspondences. These are phonological similarities between languages, which cannot be the outcome of historical accident, because they are recurrent, systematic and without unexplainable exceptions. While synchronically widespread inherited terms can be reconstructed into a putative proto-language via these regular sound changes, loanwords cannot. Several Great Lakes Bantu languages, for instance, have a lexical doublet to refer to calabashes and glass bottles. These are two words that are historically related, but one of them was acquired through regular intergenerational transmission from an ancestor language, while the other was obtained from vehicular Swahili through contact-induced diffusion. The inherited word for calabash is phonologically much more heterogeneous, e.g. Sukuma *cuβa*, Nyamwezi *nsòhá*, Ganda *ènsúwà*, Shi *nshùhá*. These words were subject to the regular sound changes that their language underwent since Proto-Bantu for which **-cʊ́pà* 'calabash' has been reconstructed. Such is not the case for the term for glass bottle, which they recently borrowed from Swahili resulting in much more similar loanwords: Sukuma *cupá*, Nyamwezi *cupa*, Ganda *ccúpà*, Shi *ìcúpà*. In Swahili itself, the word *chupa* refers to both calabashes and glass bottles. When the latter type of containers were introduced along the East African coast, Swahili speakers called them after their traditional containers using the word for calabash which they inherited from Proto-Ban-

3 A speech community is defined here as a group of people who consider themselves to speak a same language.

tu. Swahili speaking long-distance traders subsequently introduced this new specimen of material culture and its Swahili word in several East-African communities, many of them already having a regularly inherited Bantu word for 'calabash'.

Unlike archaeologists, linguists do not have a standard and universally accepted method for the absolute dating of language change. In the absence of diachronic language data and without the tentative association of language data to archaeological data, linguists need to limit themselves to relative dating. To do so, they rely on a number of principles for which they are indebted to archaeology: stratigraphy, geographic distribution and seriation.

Linguists refer to the concept of stratigraphy to disentangle the successive strata in the formation of a language. The grammar and lexicon of a language are transmitted through time and transformed due to the loss of old elements and the incorporation of new elements. They accumulate formative layers, which are never neatly superposed. Unlike archaeological strata, language layers are not subject to the law of superposition. There is permanent stratigraphic contamination, so to speak. It is the task of the historical linguist to order the present-day data into successive strata. The words for 'calabash' and 'glass bottle' in the example above clearly belong to two distinct strata of language history.

Linguistic geography or geolinguistics can help with the relative dating of language layers. This method deals with the geographic distribution of linguistic features. It is used for mapping loanword diffusion routes and for determining their direction of borrowing and also as a relative chronology device. 'Linguistic isoglosses' are the equivalent of stylistic horizons in archaeology. They mark the geographic distribution of a given linguistic feature shared by a number of languages. For example, cognate words for Kimbundu **njila (**'bird') are only found in a geographically restricted cluster of Bantu languages spoken in the southwestern part of the domain, while cognates for Kikongo **nuni** 'bird' are found throughout the Bantu domain. Such spatial distribution is interpreted as a function of time: the Kikongo word is a shared retention going back to Proto-Bantu while the Kimbundu word is a more recent shared innovation. The relative chronological interpretation of isoglosses is done according to certain areal norms which are not strict rules, but rather hermeneutic principles, e.g. the oldest form is the most scattered one, which is preferably attested in the more outlying areas, while the younger form occurs in a group of adjacent languages, which may be large, but not as scattered as the older form. A judicious historical interpretation of isoglosses requires a basic insight into the internal classification of a language family. The relative time depth does not depend so much on the number of languages in which a feature occurs, but rather on its distribution over distinct historical subgroups. Hence, a term that is rare but scattered amongst the north-western and western Bantu languages is considered older than a synonym that is densely spread among eastern Bantu languages only.

A final basic archaeological concept also found in historical linguistics is seriation. Linguists usually rely on it for the sequential ordering of sound changes. Each language is subject to sound changes, which can be called regular to the extent that they affect all words sharing a given phonological environment. The chronological sequencing of sound changes is primarily used for the historical classification of languages through the principle of shared innovations. If closely related languages share a historical change (whether lexical, phonological or grammatical), there is a good chance that this innovation only happened once, i.e. in their most common recent ancestor – although independent convergent change can never be entirely excluded. Once one has an idea of the internal classification of a language group and the relative chronology of sound changes, seriation is also a helpful dating device for loanwords. The earlier foreign words are borrowed, the more sound changes they have in common with regularly inherited words and the better they are phonologically integrated, making it difficult to identify them as borrowed vocabulary.

CONCLUSIONS

The interaction between African archaeology and linguistics has been severely criticized in the past, among other things due to a lack of critical evaluation of underlying concepts and methods. Although this appreciation is certainly not undeserved, this should not refrain us from interdisciplinary collaboration. No discipline is capable of solving on its own the many complex riddles of African history. Sound archaeological-linguistic teamwork requires in the first place a good understanding of each other's concepts, methods and evidence, to which I have tried to contribute in this chapter. A second fundamental issue is the importance of direct collaboration between scholars of different disciplines who perfectly command their own body of evidence and are able to make a judicious assessment of its historical significance instead of leaving this task to scholars who only master one method or none at all. Finally, it is crucial that archaeologists and linguists mutually benefit from their specific advantages, e.g. absolute dating in the case of archaeology or the possibility to reconstruct vocabulary referring to immaterial or poorly preserved material aspects of human life in the case of historical linguistics.

REFERENCES

Bastin, Y. & Piron, P. 1999. 'Classifications lexicostatistiques: bantou, bantou et bantoïde. De l'intérêt des "groupes flottants"'. In J.M. Hombert & L.M. Hyman (eds.), *Bantu historical linguistics: theoretical and empirical perspectives*. Stanford: CSLI Publications, pp. 149-164.

Bastin, Y., Coupez, A. & Mann, M. 1999. *Continuity and Divergence in the Bantu Languages : Perspectives from a Lexicostatistic Study.* Tervuren: RMCA (series « Annales de Sciences humaines, série in-8°», no. 162).

Bleek, W. 1851. *De nominum generibus linguarum Africae Australia*. Bonnae: Formis Caroli Georgii.

Blench, R. 2006. *Archaeology, Language and the African Past.* Lanham: Altamira Press.

Bostoen, K., Clist, B., Doumenge, C., Grollemund, R., Hombert, J.-M., Koni Muluwa, J. & Maley, J. 2015. 'Middle to Late Holocene Paleoclimatic Change and the Early Bantu Expansion in the Rain Forests of West Central-Africa'. *Current Anthropology* 56: 354-384.

Dimmendaal, G. 2011. *Historical Linguistics and the Comparative Study of African Languages*. Amsterdam/Philadelphia: John Benjamins.

Grollemund, R., S. Branford, K. Bostoen, A. Meade, C. Venditti and M. Pagel. 2015. 'Bantu expansion shows that habitat alters the route and pace of human dispersals'. *Proceedings of the National Academy of Sciences of the United States of America*. http://dx.doi.org/10.1073/pnas.1503793112

Heine, B. & Nurse, D. (eds). 2000. *African languages: an introduction*. Cambridge/New York: Cambridge University Press.

Heine, B. and Nurse, D. (eds). 2004. *Les Langues africaines*. Paris: Karthala.

Hombert, J.-M. & Hyman, L.M. (eds.). 1999. *Bantu Historical Linguistics: Theoretical and empirical perspectives*. Stanford, CA: CSLI.

Maho, J.F. 2009. NUGL Online: The online version of the New Updated Guthrie List, a referential classification of the Bantu languages (4 June 2009). Online file: http://goto.glocalnet.net/mahopapers/nuglonline.pdf

Nurse, D. & Philippson, G. (eds). 2003. *The Bantu languages.* ('Routledge language family series', no. 4). London/New York: Routledge.

Nurse, D. and G. Philippson. 2003. Towards a historical classification of the Bantu languages'. In D. Nurse & G. Philippson (eds.), *The Bantu Languages*. London/New York: Routledge, pp. 164-181.

Schadeberg, T.C. 2003. 'Historical linguistics'. In D. Nurse & G. Philippson (eds.), *The Bantu Languages*. London/New York: Routledge, pp. 143-163.

Vansina, J. 1995. 'New Linguistic Evidence and the Bantu Expansion'. *Journal of African History* 36: 173-195.

THE 'WORDS AND THINGS' METHOD

Birgit Ricquier[1]

Suppose you want to put archaeological potsherds in functional context: what did people prepare in these pots, and how? Laboratory analyses may reveal whether they were used for boiling foodstuffs or conservation purposes. However, due to climatic conditions and soil acidity in tropical Africa, the chance of finding diagnostic organic residues is extremely remote. Food processing also implies a series of stages that hardly leaves any traces in the archaeological record, many kitchen utensils being made of organic, hence perishable, materials. In sum, the direct evidence delivered by archaeology and related studies (see chapter 5) cannot answer all historical questions. Indirect evidence in the form of words may provide a solution (see Bostoen, this volume, pp. 257-260). The comparative linguistic study of contemporary words for plants, animals, tools and technologies offers insights into their past. The name for this type of historical-linguistic research – 'Words and Things' – underlines its relevance for the history of material culture. Nevertheless, it may also be used for the history of ideas or cultural concepts, like socio-political structures and religion.[2]

The following paragraphs offer a step-by-step guide for the 'Words and Things' method, illustrated with examples from food history. The first step is data gathering. When a large number of language varieties is concerned, retrieving words from dictionaries and glossaries may suffice. However, specialized vocabulary is often missing, making fieldwork necessary. When a smaller linguistic subgroup is studied, it is advisable to make field recordings in order to cover dialectal differences, since these may be historically significant. To apply 'Word and Things' in the field is to combine ethnographic observation and linguistic inquiry. In case of material culture, it is important to document the entire *chaîne opératoire* (see Gosselain, this volume, pp. 292-295). The ethnographic observation allows both for a better understanding of a word's meaning and the recording of specialized vocabulary. **Table 1** offers the example of cassava preparations (Ricquier 2013) with words in five language varieties of the Kongo group for which little literature is available.

When collecting vocabulary, linguistic elements such

Table 1. The *chaîne opératoire* of making cassava porridge in five Kongo varieties.

	Vili	Yombe	Kunyi	Kamba	Sundi
cassava (generic)	mayák(a) (or meyáka)	mayáka	mayák(a)	mayáka	mayáka
to soak/to ret	-íín(ik)-	-íín-	-íín-	-yinik-	-inik-
place where the tubers are soaked	-	kísíma	kicínga	bandá	bandá
to peel the tuber	-túúnd-	-túúnd-	-yúbul-	-tund-	-kátul-
to wash the tuber	-súkul-	-súkul-	-	-súkul-	-súkul-
soaked tuber	liyáka libóómb	-	diyáka di máámba	kikóóngo (kíá máámba)/ mukédi	cikédi
to dry in the sun	-ánik-	-ánik-	-anik-	-yánik- / (-yúúmís-)	-yánik-
drying shelf	cyângə	kíyaanga	-	kitálaka	citálaka
dried cassava	cíkoongo	kíkoongo	kikóngó	kikóóngo (kíá yuma)	fúfu
to pound	-tuut-	-tuut-	-tók-	-tuut-	-tuut-
mortar	cyúfu	kívu	kídu	kidú	cítuutulú
pestle	ńti cyúfu	múfu	muswá	mutí / mwáání múúsú	mutí
to sift	-	-yéngis-	-yengis-	-yengos-	yengizá
sieve	-	kíyéngis(a)	kíyengelé	kíyengosó	cíyengoló
flour	fúf(u)	fúfu	kitó	fufu	fúfu
to stir flour in hot water	-vóót-	-vóot-	-hóót-	-hot-	-ot-
stirring stick	ńti fúfu	nti	lukú	múukú	mwiikú
pot	nzúúngu	nzúúngu	kísa	nzúúngu	ndzúúngu
porridge	fúf(u)	fúfu	kitó	fufu	fúfu

1 Heritage studiess, Royal Museum for Central Africa, Belgium.

2 A discussion of the history of the method and its applications to the precolonial history of sub-Saharan Africa can be found in Bostoen (2005:8-18). Ricquier & Bostoen (2010) offer an overview of results obtained by means of the Words and Things method with respect to the food history of Bantu speech communities. Lexical reconstructions have been made for several African language groups. The online database by Bastin *et al.* (2002) assembles most lexical reconstructions that have been proposed for Bantu languages.

as noun classes and tone must be taken into account. Another precaution is to have a questionnaire at hand since ethnographic observations may not cover all known practices.

The Words and Things approach usually starts with 'onomasiology', namely the study of words expressing a given concept. These words are paired to their possible 'cognates', words that are similar in form and meaning and thus probably share a common history. Each set of cognates is subjected to a formal analysis. Inherited words have undergone sound changes specific to the respective languages and the outcome displays regular sound correspondences with the cognates in related languages. The examples in **Table 2** display regular sound and tone correspondences.

	Ewondo (Northwest Bantu, A72)	Venda (East Bantu, S21)	BLR
Example	*dúg* 'to row'	-*bvúwa* 'to beat up porridge'	*-dúg-
Compare with	*dum* 'to thunder' *túg* 'to subject (a slave)'	-*bvụma* 'to thunder' -*fúwa* 'to keep livestock; to keep and handle people expertly, as patron, protector'	*-dùm- *-túg-

table 2. Sound correspendence (Reflexes from Tsala (s.d.: 127, 128, 631) and Van Warmelo (1989: 18, 19, 60), reconstructions from Bastin *et al.* (2002), detailed discussion of the example in Ricquier (2013).)

Loanwords typically display irregular sound correspondences, especially when complex sound changes should have been in play. Sometimes, however, sound changes are minimal and cannot be used to identify loans. East-Bantu nouns with the form *unga* meaning 'flour' are a good example, since they could be inherited from Proto-East Bantu or borrowed from Swahili (see discussion in Ricquier 2013). Loans can also be distinguished from inherited vocabulary by their geographical distribution. When forms occur in a continuous region, it is likely that the distribution is the result of borrowing, especially when crosscutting linguistic boundaries. In contrast, a distribution in the form of distant dots on the map, with cognates in different linguistic subgroups, suggests common inheritance. The immediate common ancestor of the languages involved then indicates the word's age. The Ewondo and Venda examples illustrated above belong to a series that has cognates in all major Bantu subgroups. The immediate common ancestor consequently is Proto-Bantu. This step implies the insertion of the linguistic data into the genetic classification of the languages involved.

Next, inherited forms are subjected to a 'semasiological' analysis, meaning the study of a word's semantic history. Often, the cognates belong to different semantic fields. Ewondo *dúg*, for example, is part of the semantic field of navigation, whereas its Venda cognate refers to a cooking technique. The latter is a metaphorical extension of the first semantic value: both actions involve the circular movement of a wooden instrument in water. Geography is again in play here. When a given meaning occurs in different linguistic subgroups, whereas another is limited to a smaller language group, the first is more likely to reflect the original semantic value. As for the example offered, the meanings 'to row with a paddle' occur in all Bantu subgroups, whereas 'to stir porridge' is an East-Bantu innovation.

Sometimes, a word is not inherited or borrowed, but created. Neologisms frequently stem from derivation: for example, in Xeso (West Bantu, C52), *mòpùlúngù* 'stirring stick' derives from the verb *-pùlùng-*'to stir porridge' (Ricquier fieldnotes 2010). Other types of neologisms include composition, word blending, eponymy (derivation from the name of a place or region), and the imitation of sounds, or onomatopoeia.

As soon as the etymology of the words for a given concept has been unraveled, the history of these words may be turned into a history of things or ideas. Inherited words refer to realities that were familiar to the ancestors. When an inherited word underwent a semantic shift, or when a new word was created, this may point to the introduction or invention of a new reality. Loanwords, finally, are indicators of novelties adopted from other communities. For example, no word for 'stirring porridge' can be traced back to Proto-Bantu, but a reconstruction could be made for two subgroups – East and Southwest Bantu (see Ricquier & Bostoen 2011; Ricquier 2013). This indicates that the cooking technique was new to the first speech communities of the mentioned subgroups.

The final step is to integrate the historical interpretation of comparative linguistic analysis into a known historical context. For the example discussed here, the new insights regarding culinary history need to be linked to the available knowledge about the relevant historical speech communities as well as plant history. Thanks to historical-linguistic research, we know that the first East and Southwest Bantu speech communities lived in savannah areas where they adopted cereal cultivation. The new cooking technique must have been intended for the preparation of this new starch ingredient (see Ricquier & Bostoen 2011; Ricquier 2013).

Several obstacles need of course to be acknowledged. As the 'Words and Things' method develops in the present, we only have access to the origins of *existing* words and practices. What is lost can no longer be recovered by linguistic means. Second, languages do not always have specialized terms for specific extra-linguistic realities, making it impossible to study their history by means of comparative linguistics (see Bostoen 2009 on 'semantic vagueness'). For instance, in many Bantu languages grindstones are simply named 'stone for grinding' or 'stone for [a certain foodstuff]', nouns too vague to be relevant for food history. Next, a word's history may reveal the time at which a certain practice or tool came into fashion but still conceal its origins. Loanwords indicate the source of inspiration, but when an inherited word underwent a semantic shift or when people use neologisms, no link can be established with other communities. Finally, the interpretation of the results obtained by the 'Words and Things' method largely depends on the classification of the languages involved. Choosing between different classifications often implies choosing between common inheritance or language contact.

Despite these drawbacks, the 'Words and Things' approach can offer valuable insights into matters for which archaeological data cannot be consulted. Moreover, historical-linguistic conclusions have proven to be a trigger of further archaeological and archaeobotanical debate, as in the case of bananas and cereals (see chapter 5) (see the summary in Ricquier & Bostoen 2010).

REFERENCES

Bastin, Y., Coupez, A., Mumba, E. & T. Schadeberg. 2002. *Bantu Lexical Reconstructions 3*. http://www.metafro.be/blr. (Last consultation: 17/09/2015).

Bostoen, K. 2005. *Des mots et des pots en bantou*. Frankfurt am Main: Peter Lang.

Bostoen, K. 2009. 'Semantic Vagueness and Cross-Linguistic Lexical Fragmentation in Bantu: Impeding Factors for Linguistic Palaeontology.' *Sprache und Geschichte in Afrika* 20: 51-64.

Ricquier, B. 2013. *Porridge Deconstructed: A Comparative Linguistic Approach to the History of Staple Starch Food Preparations in Bantuphone Africa*. Unpublished PhD, Université Libre de Bruxelles.

Ricquier, B. & Bostoen, K. 2010. 'Retrieving Food History through Linguistics: Culinary Traditions in Early Bantuphone Communities.' In R. Hosking (ed.). *Food and Language. Proceedings of the Oxford Symposium on Food and Cookery 2009*. Totnes: Prospect Books, pp. 258-269.

Ricquier, B. & Bostoen, K. 2011 'Stirring Up the Porridge: How Early Bantu Speakers Prepared Their Cereals.' In A.G. Fahmy, S. Kahlheber & A.C. D'Andrea (eds). 2011. *Windows on the African Past. Current approaches to African archaeobotany. Proceedings of the 6th International Workshop on African Archaeobotany, Cairo*. Frankfurt am Main: Africa Magna Verlag. pp. 209-224.

Tsala, T. s.d. *Dictionnaire ewondo-français*. Lyon: Imprimerie Emmanuel Vitte.

van Warmelo, N.J. 1989. *Venda Dictionary. Tshivenda-English.* Pretoria: J.L. van Schalk.

ARTWORKS

Jean Polet[1]

INTRODUCTION

'Artworks' generally stand as representations of thinking, symbols, or beliefs – all realms that cannot be contained within the narrow confines of the 'ethnic group'. Snatched from Africa as 'curios', then as evidence of the 'primitive savagery of Africans', artworks were 'mute' and the meanings attributed to them arose concomitantly with the development of a colonial order aimed at dominating societies perceived as organized into 'tribes', or ethnic groups. This is why such objects retrospectively 'acquired' an origin, an identity, a role and a way of functioning that were strictly limited to ethnic background. Art was thus envisaged as a *sui generis* product of the ethnic group, where artists – always anonymous – worked essentially in the context of culturally predetermined styles, although perhaps in an unconscious way. This vision resulted in a simple, but false, classification: to each tribe a type of work, and within each art thus 'tribalized', some rare masterpieces 'including all the elements of the style' as well as a multitude of so-called lesser works (Fagg 1965).

Today, this obsolete vision endures in the art market and its prolific literature. Following the works of historians, it must however be replaced by a concept that integrates history, social practices – including playful aspects (Boutin 2007-2009) as masks are not only 'charged', dangerous objects –, ideology (or religion), politics, trade, and the recognition of artists as well as their relations with clients in the development of styles.

I. RECORDING ARTWORKS IN GLOBAL HISTORY

Whether they are made of wood, metal or terracotta, African artworks require the same methods as those applied to the arts of the Renaissance, medieval period, etc. Readers are notably referred to the works of Olbrechts (1959) and other art historians who followed his approach (for example, Perrois 1966; Wingert 1972). A major prerequisite is to free artworks from ethnic classificatory grids, and to integrate them into broad spatial and historical perspectives. Three contrasting examples – in terms of research questions and aims – will illustrate the potentials of such an approach.

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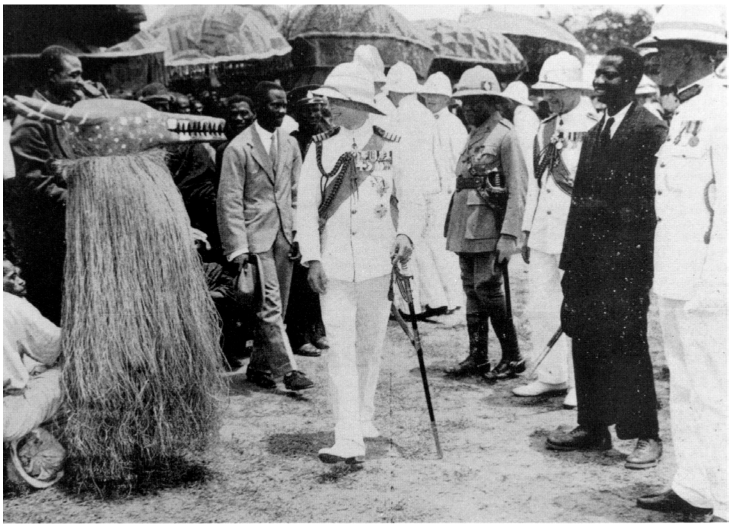


Fig. 1. Prince of Wales visits Gold Coast (Guggisberger 1925).

A. Witnesses of Mande history: helmet masks with zoomorphic jaws

These helmet masks are worn horizontally on top of the head (no wooden part covers the face) and have a long muzzle or jutting mouth, as well as bumps or horns behind the head[2]. They were collected, or seen and described, from the late 19th century to the late 20th century. This particular form is widespread in societies of the west Atlantic savannah as well as Nigeria, but also in central Ivory Coast d'Ivoire and south-west Ghana (Guggisberg 1925; **fig. 1**). While the overall morphology remains the same, slight changes in the size of particular parts, or the addition of feathers or painted or engraved decorations are observed from one region or population to the next. In museums, these masks are attributed to dozens of ethnic groups.

The new approach of art historians (McNaughton 1974, 1987, 1991, 1992; Pinault-Paradis 2001) consisted first in a careful mapping of the masks' spatial distribution, which forced them to eliminate any mask with an imprecise origin (**fig. 2**). The analysis of the Nigerian grouping is ongoing and will not be addressed here. However, that of the western grouping has provided spectacular results when combined with a rereading of old texts and several field surveys.

2 You can see one of the these helmet masks on the following link: http://collections.quaibranly.fr/#c6f8b391-52ab-4a6d-befe-1de6e98ae649

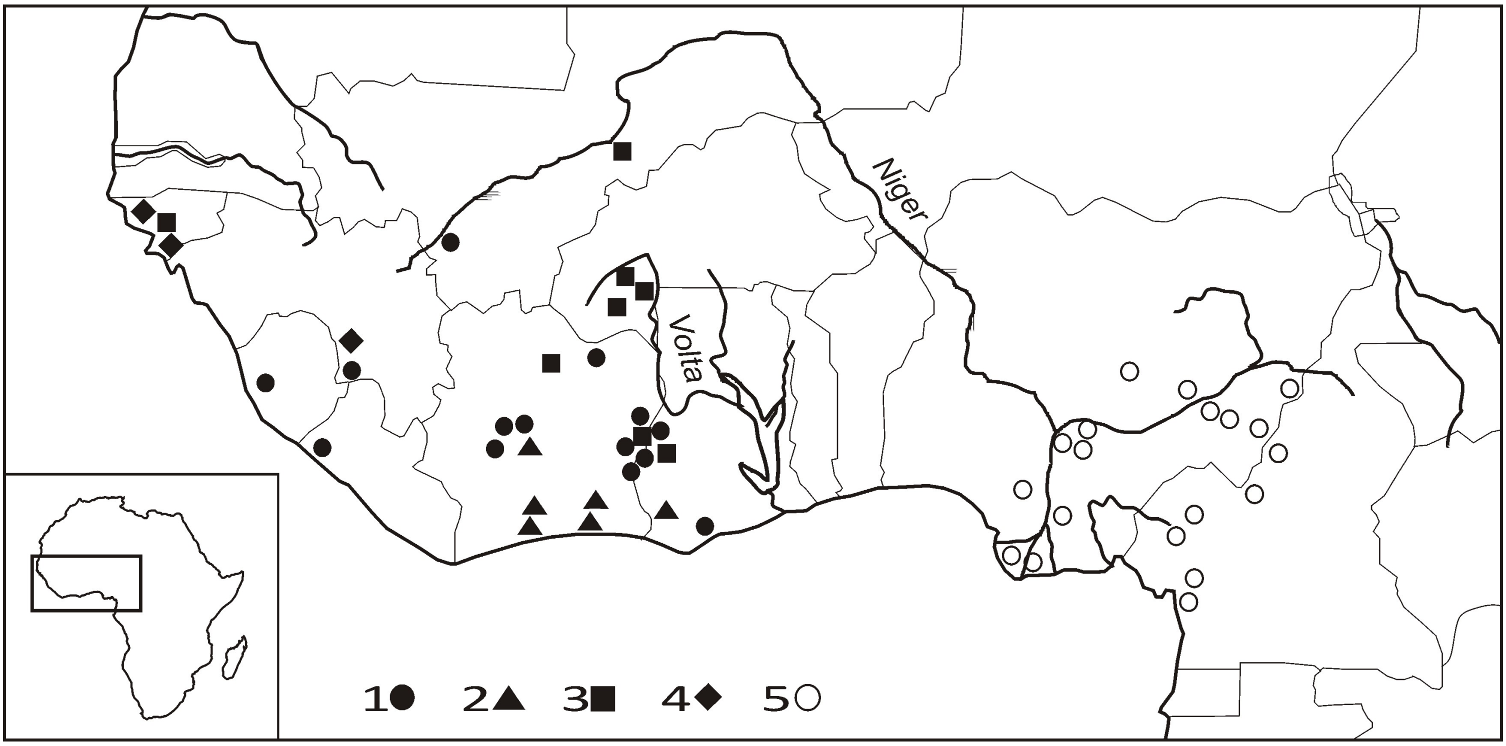


Fig. 2. Spatial distribution of horizontal masks. Linguistic groups 1. Mande, 2. Kwa, 3. Gur, 4. West Atlantic and 5. Benue area. (From a map in Pinault-Paradis 2001.)

To summarize:

- this mask and the men who control it are linked to associations such as the *Komo* and *Do*, and to the Mandé diaspora;
- the mask is always associated with iron working and a group close to political power;
- there is no brutal clash between Islam and an older religion: the degree of porosity and possible association between both religious practices are important;
- the language of the mask in action is bamanakan, whether in Baule country (central Côte d'Ivoire) or on the western coast of Ghana.

Analyses thus demonstrate that the occurrence of such a mask (a term that encompasses form, music, dance and the social group in charge of the mask and its display) stems from the expansion, political influence and commercial networks of the ancient Kingdom of Mali.

B. At the crossroad of several cultural boundaries: plant masks in north-western Burkina Faso, Christianity and Islam

The very precise location, along the southern edge of the Sahara, of colourful geometric decorations on masks, textiles, leather (Frank 1987), etc., could be the consequence of contacts with the iconography of Islam, which usually forbids human and animal representations. A first thing to note is that the ethnic affiliation of the people using these masks – which usually determines their attribution in collections – bears no relationship to the iconography of the artworks.

The particular example of plant masks from Burkina Faso and their encounter with Christianity and Islam allows us to go a step further. Originating probably from the Mandé, and settling before the 15th century in what is today the north-western part of Burkina Faso, the San (or Samo), a society long without masks, adopted the *su* cult of their Nuna neighbours in the 18th century and, subsequently, the type of masks used in the cult (Ky 1994). Henceforth the iconography of these masks sometimes includes visual symbols of the religions – Christianity and Islam – with which their users coexist. For protection? To coexist in peace? Or to signal a desire for syncretism? The most recent form of this 'meeting' is a church whose architecture includes the form of the mask (**Fig.** .)!

C. Art and first globalization: creativity inspired by the distant Other

Just as Western societies 'imported' African sculptures very early (in the mid-15th century in Brussels), African societies from the Atlantic coast discovered the religious and secular iconography of Western societies. The Chris-

Fig. 3. Plank masks, Burkina Faso. 1. The gouabognin mask. 2. The missiribagnin (mosk mask). 3. Church of Boni. (Photos © J. Ky.)

tian art associated with the first Christianization of the Kongo area is a famous example, as well as the Luso-African ivory sculpture of Sierra Leone, which resulted from a Western demand. But the transfer and adoption of forms that affected folk art are much more difficult to highlight. A major difficulty is the lack of specific information about these artworks, always considered as ethnic productions, whatever the time at which they were created. Yet this time factor is crucial, as illustrated by the example of funeral figurines from southern Ghana and south-eastern Côte d'Ivoire.

In this case, a confrontation of three categories of sources helped highlight a popular creativity driven by contacts between Europe and Africa from the 16th century to the 20th century (**fig. 4**):

- historical sources (travellers' accounts; Barbot 1992, de Marees 1987): from 1601 onward, several descriptions of coastal societies evoke sets of terracotta figurines, painted and richly dressed, near forts;
- 'artistic' and ethnographic sources: several hundred figurines were collected in south-western Ghana and south-eastern Côte d'Ivoire and accumulated in museums and collections. Their generic attribution is 'akan' or 'ashanti', but they are also named after the people of the region from which they come. At the start of the 20th century, they were clearly related to a funerary ritual dissociated from the burial context;
- archaeological sources: the abundance of European objects always associated with them in the 11 excavated sites proves that they are post-15th century.

Methodologically, it is of utmost importance to restrict the analysis to figurines precisely located during excavations (**fig. 5**), surveying (**fig. 6**) or plundering. This drastically reduces the corpus, but allows work on real data. The mapping of the funeral figurines (**fig. 7**) ultimately situates them in a very limited zone of the 'akan area': to the south of the Ashanti Kingdom's territorial control, along the coast, as well as in south-eastern Côte d'Ivoire, a region beyond the control of the Ashanti Kingdom.

Next, a broad mapping of second millennium West African statuary shows that between the abundant production of the societies of the Niger basin and its tributaries and the area where the figurines evoked above are found, there is nothing: not even a trace of terracotta sculpture. These southern small terracotta objects with very finely worked face and hairstyle but crude body (once covered in cloth) appear thus as an isolated occurrence. A long-term analysis of historical sources allowed mapping of the logic and the traces of this first globalization (**figs. 8 and 9**). Indeed, the places where the figurines were discovered are always associated with gold extraction sites and the possible routes along which gold was delivered to forts and smuggling ports along the coast.

Finally, to make sense of the figurine-gold trade association, archaeological and art history methods and tools have to give way to classical historical tools for studying the visual display of Christianity in Portugal in the 16th century, modes of evangelization, religious beliefs and practices of the ancient African societies on the coast, as well as the new social constructions that a permanent Portuguese presence generated.

It thus appears that this form of plastic creation is in no way borrowed from a Western model; neither is it a hybrid, since no prior trace of funeral sculpture has been found in these regions despite the existence of wood sculpture. It is a creation, spawned by the meeting and subsequent peaceful coexistence, until the mid-17th century, of two religious systems, Christianity and 'animism', whose primary role was to reassure their followers by finding and providing the means of avoiding the pitfalls of a very uncertain future. This generated a multiplication of protective saints among the Portuguese (chapels proliferated exponentially in Iberia) and the development, within coastal African societies, of geomantic practices integrating Christian elements around the spirits of the dead (Polet 2001; L'Haridon & Polet 2005). The highly festive rituals (parading statues of saints, dances, music, chorus singing) of Counter-Reformation Catholicism, the induction of honoured followers into the caretaking and ritual dedicated to statues imported from Portugal (Saint Anthony and Saint George), associated with the mystery of the resurrection, doubtlessly facilitated the emergence of a ceremony linking funeral statuary to parades inspired by public Catholic ceremonies.

II. THE DANGERS OF INTERPRETATION

Applying these new approaches to objects categorized as 'artworks' may provide crucial information about other realms than those directly connected to their primary role in society. Yet rigour forces us to keep in mind that a form can spread and become a vehicle for a different 'ideology' than that with which it was initially associated,[3] – and that an ideology can exist without material support,[4] or 'lose' it.

Regarding artworks recovered from archaeological sites, is it possible to go beyond characterization and truly grasp their role within a site or the society that produced them? No! The most straightforward critic of the false

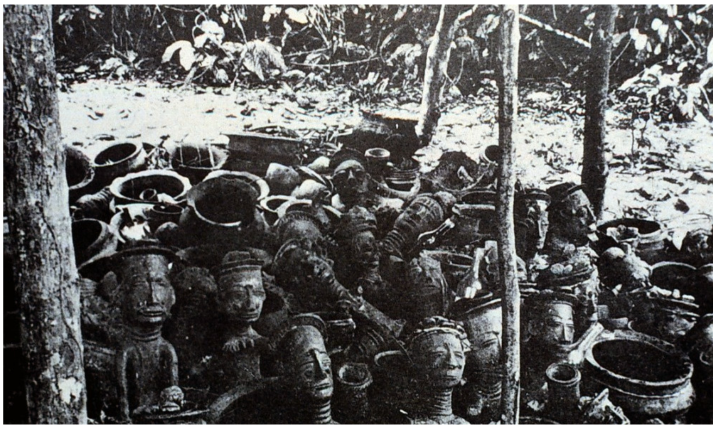


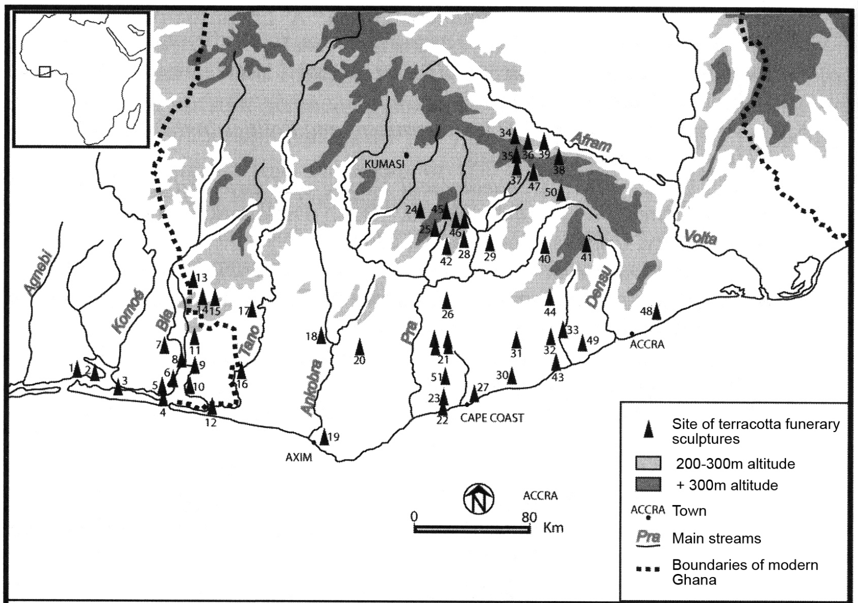
Fig. 4. Old postcard illustrating a *mmaso* from the South-East of Ivory Coast, published by Robert Soppelsa (https://africa.uima.uiowa.edu/topic-essays/show/28?start=8).

Fig. 5. Excavation of an old funeray altar (*mmaso*) at Ngaloa (Ivory Coast). (Photo © J. Polet.)

Fig. 6. Old funerary altar (*mmaso) in the region of* Krinjabo (Ivory Coast). (Photo © J. Polet.)

3 The case of the swastika, the gammadion cross native to India, is a poignant illustration.

4 Certain old forms of Protestantism, for example.



1 Eloka, 2 Moosou, 3 Bonoua, 4 Mafia, 5 Ngaloa, 6 Siman, 7 Kouakro, 8 Asuba, 9 Krinjabo, 10 Aby, 11 Ayame, 12 Falambo, 13 Dissuenao, 14 Yoyo, 15 Enchi, 16 Jema, 17 Abokya/Achimfu, 18 Nkwanta, 19 Axim, 20 Kafudidi, 21 Twido-Heman, 22 Elmina, 23 Efutu, 24 Fomena, 25 Kusa, 26 Assin-Nyamkumasi, 27 Mouri, 28 Ahinsan, 29 Akokoaso, 30 Mankessim/Enyam Main, 31 Befikrom, 32 Agona-Swedru, 33 Duakwa, 34 Abene, 35 Nkami, 36 Aduamoa, 37 Assumengya, 38 Asakrakra, 39 Kwahu-Tafo, 40 Asin-Akropong, 41 Dawu, 42 Adansemanso, 43 Adjumako, 44 Akroso, 45 Anyinam, 46 Esiase, 47 Mpraeso, 48 Agona-Asafo, 50 Twindorasi, 51 Dwokwa

Fig. 7. Distribution of sites with funerary terracottas in the Gold Coast. (Map © N. L'haridon & J. Polet.)

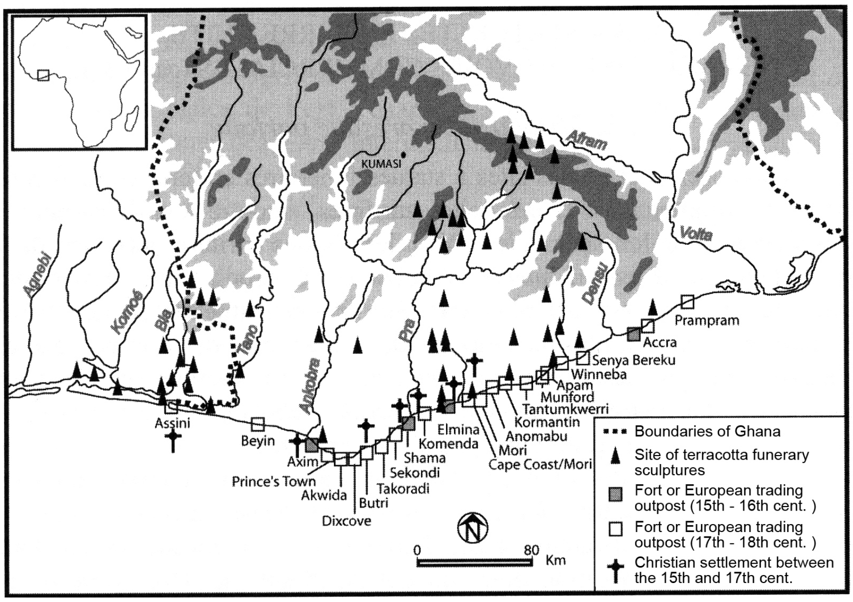


Fig. 8. Distribution of sites with funerary terracottas and European forts. (Map © N. L'haridon & J. Polet.)

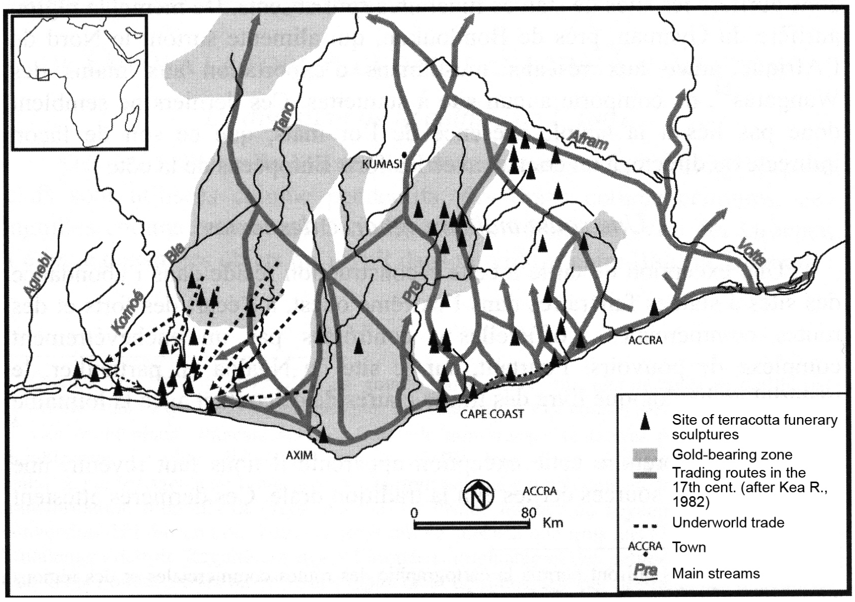


Fig. 9. Distibution of sites with funerary terracottas, trade roads and main gold extraction zones. (Map © N. L'haridon & J. Polet.)

logic underlying the inference of function from form has been made by Leroi-Gourhan in *Les Religions de la Préhistoire* (1964: 2):

> 'Suppose an intelligent being incapable of communicating with us studied European piety by visiting churches. In them he would see lambs, a donkey and an ox, many people tortured, whipped, wounded, dying, lying on tombs; what image of Christian piety would endure? How would he pass from the deceptive superficiality of representation to the mystical depth of concepts?'

An interdisciplinary approach to objects broadens horizons and can certainly reduce ignorance, but – and this is one of its limits – ruminating over fragmented data can hardly lead to absolute certainty.

REFERENCES

Barbot, J. 1992. *On Guinea. The Writings of Jean Barbot on West Africa*, *1678-1712.* London: The Hakluyt Society, 2 vol., 585 p.

Boutin, P. 2007-2009. 'Les masques "Krou" de Côte-d'Ivoire : de nouvelles sources d'information'. *Afrique: Archéologie & Arts* 5: 7-26.

de Marees, P. 1987. *Description and Historical Account of the Gold Kingdom of Guinea (1602).* Oxford: British Academy/Oxford University Press, 272 p.

Fagg, W. 1964. *Afrique, 100 tribus, 100 chefs-d'œuvre.* (Musée des arts décoratifs, Palais du Louvre, Pavillon de Marsan, 28 octobre-30 novembre 1964.) Paris: Musée des Arts décoratifs, 66 p. + 100 pl.

Frank, B.E. 1987. 'Open Borders: Style and Ethnic Identity'. *African Arts* 20 (4): 48-55, 90.

Guggisberg, F.G. (ed.). 1925. *Visit of His Royal Highness The Prince of Wales to the Gold Coast Colony.* U.S. Government Printing Office, 242 p.

Ky, J.C., 1994. 'Des Masques en pays san (Burkina Faso) : recherche des origines à travers l'histoire, le culte et l'art'. Thesis, Université de Paris I Panthéon-Sorbonne, 521 p.

L'Haridon, N. & Polet, J. 2005. 'Les statuettes funéraires en terre cuite de la Côte de l'Or témoignent-elles d'une première christianisation ?' *Journal de la Société des Africanistes* 75 (2): 64-85.

Leroi-Gourhan, A. 1964. *Les Religions de la Préhistoire (Paléolithique)*. Paris: Presses universitaires de France (series 'Mythes et Religions', no. 51), 156 p.

McNaughton, P. 1974. '*Islam and Tribal Art in West Africa* by Rene A. Bravman'. *African Arts* 8 (1): 72-74.

McNaughton, P. 1987. 'African Borderland Sculpture'. *African Arts* 20 (4): 76-77, 91-92.

McNaughton, P. 1991. 'Is there History in Horizontal Masks? A preliminary response to the dilemma of form'. *African Arts* 24 (2): 40-53, 88-90.

McNaughton, P. 1992. 'From Mande Komo to Jukun Akuma: Approaching the Difficult Question of History'. *African Arts* 25 (2): 76-85, 99-100.

Olbrechts, F.M. 1959. *Les Arts plastiques du Congo belge*. Brussels: Éditions Érasme, pp. 29-35.

Perrois, L. 1966. 'Note sur une méthode d'analyse ethnomorphologique des arts africains'. *Cahiers d'Études africaines* 6 (21): 69-85.

Pinault-Paradis, E. 2001. 'De la forme à l'histoire. Les masques heaumes horizontaux à l'ouest des Volta : étude comparative, plastique et sémantique'. Doctoral thesis, Université Paris 1 Panthéon-Sorbonne, 3 vol., 614 p.

Polet, J. 2001. 'Rendre aux peuples d'Afrique, par l'Histoire des arts, leur place dans l'Histoire'. *Cahiers d'Histoire* 82: 9-19.

Wingert, P.S. 1972. 'Style Determinants in African Sculpture'. *African Arts* 5 (3): 37-43.

Further reading

Laude, J. 1959. 'En Afrique noire : arts plastiques et histoire'. *Annales. Économies, Sociétés, Civilisations* 14e année (4): 640-661.

Mark, P. 1998. 'Est-ce que l'art africain existe ?'. *Revue française d'Histoire d'Outre-mer* 85 (318): 3-19.

Mark, P. 2007. 'Towards a Reassessment of the Dating and the Geographical Origins of the Luso-African Ivories, Fifteenth to Seventeenth Centuries'. *History in Africa* 34: 189-211.

Ravenhill, Ph. L. 1996. 'Africa: Art and Æsthetics'. In J. Turner (ed.), *The Dictionary of Art*. London: MacMillan, vol. 1, pp. 230-233.

Ravenhill, Ph. L., Mudimbe, V.Y., Drewal, H.J. & Littlefield Kasfir, S. 1992. 'More on "African Art and Authenticity"'. *African Arts* 25 (4): 18, 20, 22, 24, 26-28, 30, 100-103, 107-108.

Vansina, J. 1984. *Art History in Africa: An Introduction to Method*. London: Longman, 233 p.

ETHNOARCHAEOLOGY

Diane Lyons[1]

INTRODUCTION

Ethnoarchaeology investigates the relationship between contemporary people and their material culture in ways that can help archaeologists interpret the archaeological record. Without a systematic, empirically based and cross-cultural understanding of how contemporary people use spatial and material culture, we have little chance of developing, let alone testing, archaeological theory and interpretations of how people did so in the past. Ethnoarchaeological studies cover an enormous range of topics and this approach can be used with any archaeological theory. Experimental studies are included as ethnoarchaeological research only when they are conducted in an ethnographic context and are not restricted to laboratory-based research.

I. ANALOGICAL REASONING

A major contribution (but not the only purpose) of ethnoarchaeological research is to develop analogies (David & Kramer 2001). Analogies are interpretations based on observable practices that produce or are associated with material practices in contemporary societies (***the ethnographic source***) that are compared with and used to interpret material evidence produced by non-observable practices that are found in the archaeological record (***the archaeological subject***) (**Table 1**). Good ethnoarchaeological practice never assumes that the past is identical to the present because it is not. The purpose of ethnoarchaeological research is to compare the ethnographic source with the archaeological subject to determine how and why they are similar <u>and</u> different; we do not impose the present onto the past. This comparative process of moving back and forth between source and subject is important in developing good research questions and in producing strong archaeological interpretations about the past.

Ethnographic analogy is based in inductive reasoning and there is always the chance that it can be wrong. Nevertheless, Alison Wylie (1985) shows that analogy is important to most sciences and that without ethnographic analogy archaeologists can say very little about the human past beyond its description. Despite concerns, Wylie (1985: 107) states that ethnoarchaeology is one of the most important tools in the archaeologist's repertoire because it is the only way that we can observe and query people directly about their material practices and from these observations develop material expectations that can be tested against the archaeological record.

There are two types of ethnographic analogy: the direct historical approach and general analogy. The direct historical approach is discussed by Ann Stahl (p. XX). This approach assumes an historical continuity between source and subject. Nevertheless, historical connections between contemporary and past people must be demonstrated and not assumed, and the source and subject must be compared for similarities and differences. General analogies are made between unrelated source and subject populations, but the compared groups must share several common boundary conditions such as similar ecological settings, subsistence practices, and social organization. Both types of analogy are strengthened by using multiple lines of evidence that develop the number of relevant connections between the source and subject, and which help to explain why present and past contexts are similar and different. Differences can also be relevant to an analogy. New types of products may be introduced into a region through trade or contact, and be incorporated into a culture's existing system of values and practices. For example, plastic beer brewing containers may replace pottery vessels in a contemporary bride's dowry. The introduction of plastics has economic consequences for potters, but the plastic brewing vessel may be valued similarly to former pottery ones as appropriate for dowry and it is used similarly to its pottery counterpart in household feasting events. The plastic vessel is incorporated into existing systems of value and reproduces certain cultural practices despite being an industrially made product. Nevertheless, new products do contribute to culture change. For example, plastic vessels can have greater social value than ceramic ones in a bride's dowry if the adopting society perceives industrial products as constituting a 'modern' household. This perception can drive material change in other categories of household goods.

It is essential that the historic context of the ethnographic source for direct historical or general analogies is

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determined as fully as the available data allows. Historic context includes (but is not restricted to) the critical evaluation and use of historic records, oral histories and oral traditions, records of environmental and cultural change, changes to political, social and economic organization, and the impact of colonialism, market globalization or other relevant events that have introduced, modified or maintained contemporary practices. Determining historic context ensures that the ethnographic observation of any particular material practice is understood in contemporary practice before it is compared with the archaeological subject.

The quality of ethnoarchaeological research should also be evaluated by the length of time that the researcher spent in the field, how data were collected in terms of the use of interpreters, field methodology, sample size and participant composition by age, gender, status, level of knowledge etc., and the theoretical perspective of the study. This information must be provided in research reports and publications.

II. FIELD METHODS

Ethnoarchaeological field methods are drawn from ethnography, archaeology and other social and physical sciences in order to investigate a given subject from a multi-disciplinary approach and to assemble multiple lines of evidence to provide substantive conclusions. The primary method in ethnoarchaeology is interview and observation. But first it is essential that the collection of ethnographic information is guided by ethical practice.

A. Ethics in field research

As for archaeologists, ethnoarchaeological research projects may require federal, regional and local government permits that must be obtained before conducting research. Ethical practice means that researchers treat the communities and people who participate in their project with respect. Research should never expose participants to political, physical, social or economic harm and these factors should be considered when developing the research programme. Prior to interviews, participants should be made aware of the purpose of the project and what they will be asked to do so that they can make an informed decision about their participation. Researchers must tell people the purpose of the project, the identity of the principal investigator and other project members, and how photographs and information are going to be used and reported (e.g., academic journals, websites on the internet). Participation is always voluntary and people must be informed that they can refuse all participation in a project without any consequences or they may refuse to answer specific questions or to have their photo taken during interviews. Participant anonymity should be offered and ensured by using pseudonyms, a numbered code for each participant, or by reporting data in aggregate form (e.g., twenty-five individuals responded 'yes' to interview questions 1, 2 and 3). Many archaeological and anthropological associations have ethical guidelines that are posted on their websites.

B. Collecting data

Ethnoarchaeologists use a combination of structured and unstructured interviews in most aspects of data collection. Structured interviews are comprised of questions determined by the researcher in advance of the interview and produce comparable data from multiple interviews. Unstructured interviews are still 'structured' by the researcher's preparedness. For example, in a study of pottery-making a researcher anticipates asking all participants the same questions about specific practices in each stage of pottery-production. However, the interview remains fluid (or unstructured) in the sense that questions will develop in the course of individual interviews because different people have different levels of knowledge, experience, willingness to participate in the study, etc. This information is important to understanding variability in material practices and it can contribute new insights to pursue in the course of a field project.

Random samples are useful for some types of research, but non-random sampling is more common in ethnoarchaeology because we rely on people's willingness to participate or we are dealing with small samples. For instance, a study of blacksmiths creates a sub-group of the population for interview that may be very small. The researcher may further select smiths of different ages and skill levels for their research. This selection is then subject to people's willingness to participate. The strategy is appropriate to meeting research goals but the sample is not random. What is important is that the sampling design suits the goals and ethics of research.

Successful interviews will happen when the researcher is prepared and shows genuine interest in the participant's responses. Although you may ask a large group of people

Fig. 1. Ethnoarchaeology in practice. (Photo of author © J. Casey.)

Fig. 2. Ethnoarchaeological research takes time. Make appointments with people in advance of interviews to ensure that they are willing to participate and understand the time commitment involved. (Photo © D. Lyons.)

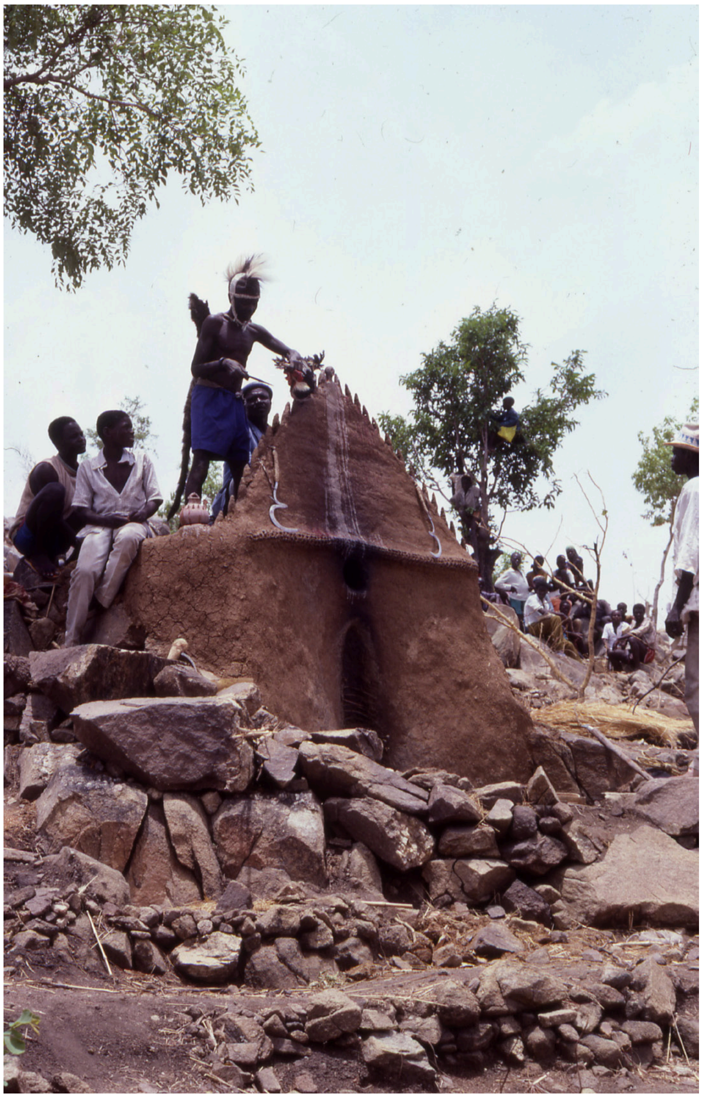

Fig. 3. Ethnoarchaeology of iron working is an example of long-term and extensive ethnoarchaeological research in sub-Saharan Africa. This research provides cross-cultural information of social, economic, technological and symbolic information on iron smelting practices. This body of ethnoarchaeological research contributes significantly to understanding African metallurgy and technological accomplishments, political economy, belief systems and the history of complex societies across sub-Saharan Africa. (Photo © D. Lyons.)

the same questions, it is useful to interview people individually. Some people have rich information that they are less willing to discuss in a group because of their interpersonal relationships. For example, people may agree with a senior person's answer in a group interview but provide different responses in an independent interview. Nevertheless, there are times when group interviews are revealing or necessary. Elders may remember more (or correct one another) in a group discussion, or a husband may prefer to be present when female members of a family are being interviewed.

Recording methods can include (often simultaneously) note taking, audio/video recording, photography, mapping houses, measuring artefacts and other forms of data collection (**fig. 1**). Multi-tasking in interviews is normal but distracting. Memories of events are unreliable so good note-taking is essential and it is advisable to write up the final notes of interviews at the end of the day to avoid the problem of deciphering your personal hieroglyphics weeks later. Ethnoarchaeological field research takes patience and time. Weekend fieldwork or a two-week study working in a culture or place with which the researcher is unfamiliar will produce data, but the reliability of the interpretation of that data and the variability that comes from long-term studies are seriously compromised. Long-term projects over sev-

Fig. 4. Globalizing markets in northern Ethiopia provide opportunities to test and expand interpretations of globalizing processes used in archaeological research.(Photo © D. Lyons.)

eral research seasons develop the researcher's personal knowledge and experience with material culture and its use in different contexts. Even in short studies (a single season), repeat visits with participants build trust and relationships. Expect to be treated with suspicion (usually kindly) as an outsider in the community. It takes time for people to decide what they will or will not divulge to an outsider, and do not be surprised if people change their initial answers after a few visits! Do not be naïve. People may deceive you consciously or unconsciously for their own reasons. The reliability of information comes with an increasing sample of interviews and observations that provide consistent information including on the range of variability of particular practices.

There are many ethnographic field manuals available on interview and field methods (e.g. Bernard 2011). It is optimal to interview people in their own language, but this is not always possible in situations where there are multiple languages or dialects spoken in a research area or when interviews address sensitive information that require the intonations of respect that only a native language-speaker can provide. It is the responsibility of the researcher to work closely with interpreters to make sure that they understand the goals of the project, the questions being asked, why questions are asked in a certain way, and ethical protocols.

Observation is an important aspect of ethnoarchaeological fieldwork and usually involves an interview component (**fig. 2**). Observation of a process (e.g., processing crops, preparing food, making pots) also involves the use of other recording methods including imagery. A good digital camera is essential and images can be as important to documenting research as interview notes. Clear images of practices are required for publication. Make sure that participants are comfortable being photographed and understand that images can appear in journals or on websites. If people request anonymity do not photograph their faces (or keep faces in shadow). People are often delighted to view images in the playback mode and then they know what images you have taken. Providing people with copies of a few of the best photographs is usually appreciated. Photographs of artefacts and processes can be used in subsequent interviews as memory devices and resources to further discussion. In some contexts you may have the opportunity to participate directly in the process being investigated. There is nothing that compares to direct experience.

Compensation or a gift to informants should be determined in advance and according to local values. Being too generous in poor regions can upset relationships for local researchers who do not have access to the same funding. If there is a local gift that people bring as guests to someone's home, then this may provide a good compromise (e.g. coffee, sugar, salt, fruit). In cases where people work with your project for an amount of time that takes them from their own work, they should be compensated according to the local wage.

C. Analyzing data

Types of analyses will depend on the type of data collected and many of these analyses are similar to those used to study archaeological materials, (e.g., petrographic analysis of pottery, use-wear of stone tools). Ethnographic data can be organized into databases (e.g. Microsoft Office Access) or software programs that are specific to organizing ethnographic text (e.g. NVivo). A simple and inexpensive method is to organize data on a spreadsheet program such as Windows Microsoft Office Excel. This will allow for simple tabulations and comparisons but it may require several spreadsheets to organize different sets of data.

In terms of content, the minimum level of information that all surveys need to capture is as follows **(table 1)**

COMPARATIVE APPROACH: BUILDING STRONG ANALOGIES

ETHNOGRAPHIC SOURCE

- *historically situate ethnoarchaeological data from interview/observation:*
    - o critically evaluate data in comparison with oral histories of practice(s) under study
    - o critically evaluate data in comparison with historic documents of practice(s) under study
- *determine how the practice(s) under study is expressed materially and spatially*
    - o determine variability in both the practice and its material expressions
- *examine multiple lines of evidence*
    - o identify related practices to the practice being investigated
    - o determine how these related practices are expressed materially and spatially (e.g., for example: a study of pottery making is related to other social and economic factors: how is the potter's economic status expressed in their domestic compound relative to other people's compounds, how is pottery used in culinary practices, where are different types of pots located in households, etc.)

ARCHAEOLOGICAL SUBJECT

- *compare the source with the archaeological subject*
    - o determine similarities and differences between source and subject
- *determine how similarities and differences are connected in relevant ways*
    - o e.g., *how are similarities relevant* (e.g., do the material expressions of the practice(s) under study share the same spatial context, function, symbolic role or context of production such as the presence of special workshops, shared *chaînes opératoires*)
    - o Compare multiple lines of evidence investigated in the context of the ethnographic source to strengthen relevant connections between the source and subject.
    - o e.g., *how are differences between source and subject relevant* (e.g. are changes in pottery raw materials related to other environmental, social, economic or ideological changes evident from other archaeological data)
    - o Are the similarities and differences *not* connected in relevant ways e.g., the source is not an appropriate analogy to infer past practices.

Compare source and subject to determine relevant connections between them. The stronger the relevant connections the stronger the ethnographic source is in inferring these practices in the archaeological record.

Table 1. How to construct strong archaeological inference. (© D. Lyons.)

OTHER CONTRIBUTIONS

In addition to analogies, ethnoarchaeological research contributes to the development of African history, particularly those of everyday people (**fig. 3**). Ethnoarchaeological research is important to heritage conservation because it documents both tangible and intangible forms of cultural knowledge including how African people perceive and constitute their social relationships in material culture, spaces and landscapes. This information is of broad interest to social scientists (including archaeologists) in understanding human variability, cultural resilience and how people consider and incorporate material and technological change at local and global levels in contemporary societies (**fig. 4**).

REFERENCES

Bernard, H. R. 2011. *Research Methods in Anthropology*, fifth edition. Plymouth, UK: AltaMira.

David, N. & Kramer, C. 2001. *Ethnoarchaeology in Action*. Cambridge: Cambridge University Press.

Wylie, A. 1985. 'The reaction against analogy'. *Advances in Archaeological Method and Theory* 8: 63-111.

POTTERY AND ORAL HISTORY IN THE FARO (NORTHERN CAMEROON))

Alice Mezop Temgoua-Noumissing[1]

INTRODUCTION

As we know, the past and the present are closely linked. Archaeologists are therefore well advised to look to the present in their attempt to bring the past to life.

In this contribution, I intend to examine an aspect of this relationship between present and past. To do so, I will compare various hypotheses concerning the chrono-cultural sequence of a region in Central Africa from the 11th century to today, through a history based on current pottery traditions and on oral tradition. In doing so, I will demonstrate the potential of a historical and comparative approach in the interpretation of archaeological remains.

I. ETHNOGRAPHIC ANALYSES AND ARCHAEOLOGICAL INTERPRETATION: METHODOLOGICAL PRINCIPLES AND PRACTICAL ASPECTS

The Faro region, named for the river that runs through it and situated in the north of Cameroon, seems to demonstrate historical and cultural continuity in a number of fields (architecture, pottery, languages, agriculture, animal husbandry, kinship systems, ceremonial calendar, and religious beliefs) which makes it possible to establish links between archaeological contexts and modern populations (Mezop Temgoua 2011). To study this, I have applied a method inspired by the principles of the direct historical method (see Stahl 1993, 2005, Wylie 1988). Specifically, three different approaches were used. The first is ethno-historical[2] and focusses on establishing an initial model of settlement for the area, and the location of ancient sites known to oral tradition. The second focusses on the study of a collection of current pottery from the region documented in 1995. This involves choosing descriptive variables, analysing their distribution and variability, and highlighting recurring traits that emerge from studying links among ceramics in the region today. In other words, it involves identifying regional traditions, their spatial distribution, and the social context of their production and consumption. The third approach has been to study the material culture found at archaeological sites, the context in which it was deposited, and associated radiocarbon dates. The results from these different approaches are then compared. Linguistic data will often play a role, given their great capacity for providing insights on the past (see this volume, Bostoen, pp 257-260 and Ricquier, pp 261-263).

II. POTTERY AND ORAL HISTORY IN THE FARO REGION AND THEIR ARCHAEOLOGICAL IMPLICATIONS

Trends in the archaeological remains of the Faro region from the 11th century AD onwards allow us to make observations concerning its settlement history. Some of these hypotheses are juxtaposed with information provided by current pottery and oral traditions on the history of the Faro.

A. The archaeological sequence in the Faro

Three distinct phases of occupation are recognized in the Faro valley (Mezop Temgoua 2011): during approximately the 11th century AD (1050-1270 cal AD) (phase 1), agro-pastoralist-fishermen lived along the course of the Faro River, in Lamordé and Farkoumo and/or around current towns, in villages characterized by the presence of potsherd pavements. They produced pottery of the TD1-tradition (pottery traditions are categorised using 'TD') of which the decoration predominantly consists of impressions made by plaited flat fibre roulette (FSR) and twisted cord (TGR) (**fig. 1**). They used ochre in burial preparations for their deceased .

From the early 15th century AD (1400-1480 AD) (phase 2), the villages remained situated near waterways, but a unique pottery, associated with pipes and spindle whorls, appeared: the TD2 tradition, characterised by the use of *Blepharis* sp. cobs for making impressions, and polished slipware (**fig. 1**). This tradition seems to supplant TD1 production in Farkoumo and Lamordé. These innovations might point to instability linked to north-western influences.

Tradition TD3 (**fig. 1**) existed between 1650 and the beginning of the 20th century (phase 3), a period which saw the arrival of the Foulbé and the beginnings of European colonisation. Its ornamental register included FSR and TGR roulette impressions, as well as *Blepharis* sp. cob impressions. The TD3 tradition is common in material from upper excavations levels (Pantou, FA5/2, FA5/12, Tchamba) and found on the surface in abandoned villages (in Bogdou 1, Katchala Voma, Yelba) in the foot-

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2 This consists of studying a population using oral documents.

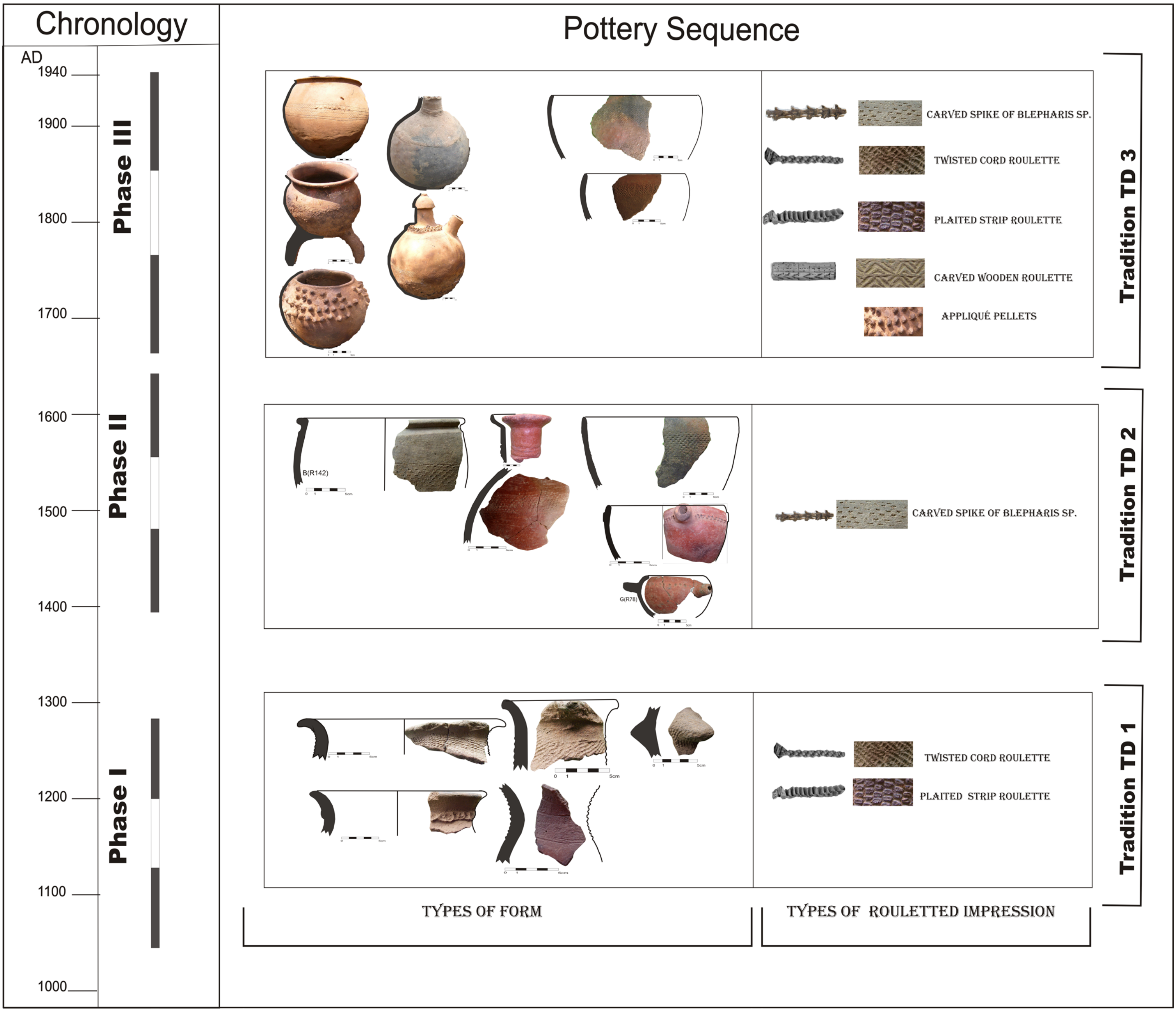

Fig. 1. Sequence of pottery traditions in the Faro between the 11th century and today. (Drawings by Alice Mezop Temgoua.)

hills between the left bank of the Deo and the Alantika Mountains, in association with significant metallurgic remains (*tuyères* , bricks, and slag). This tradition is still alive today among those who live in the mountains, and is known as 'montagnard decoration'. The fact that TD3 decoration combines the features typical of the first two production traditions (Bogdou 1 FA5/2, FA5/12, Pantou, Tchamba) suggests that the groups at the origin of these traditions lived side by side. The TD3 tradition has two major innovations: the use of appliqué buttons, and pots of specific forms (site of Pantou, Bimlerou village) (these pottery styles are very common in eastern Nigeria, which reinforces the idea of ancient links between the Faro and this region), as well as the generalisation of TGR-impressions (Woulba village). The presence of this TD3 pottery tradition in ancient mountain sites located both west and east of the Faro River reflects a relationship between the producers in the two regions (**fig. 3**). They were geographically close in the recent past, probably along the banks of the Faro, where the oldest traces of 'montagnard decoration' are found. This suggests movements from the plains to the mountains, which in fact reinforces the importance of archaeological remains in the mountains and their rarity in the plains during this period.

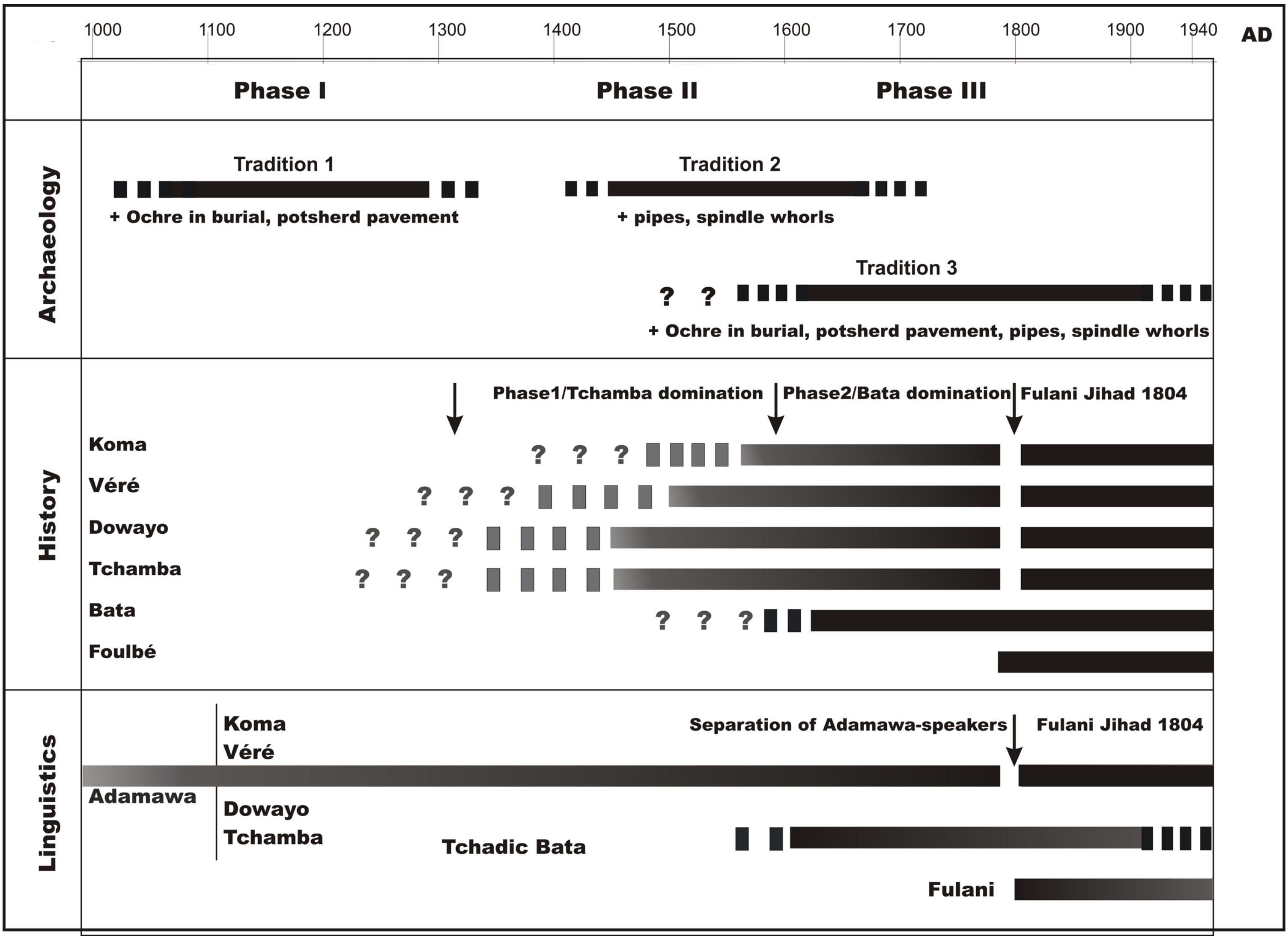

Fig. 2. Comparison of data on the history of Faro from archaeology, ethnohistory, and linguistics. (Drawings by Alice Mezop Temgoua.)

B. Discussion and conclusions

By combining all available data, we see that there are three historical phases. For phase 1, archaeology situates early settlement between the 11th and 13th centuries AD. According to oral tradition, this period would end towards the 16th and 17th centuries (**fig. 2**). According to oral sources, Farkoumo and Lamordé were inhabited by the Tchamba and Nyem Nyem (including the Koma, the Dowayo, the Vere, the Dii, and the Fali). This ancient cohabitation of Tchamba and Nyem Nyem is confirmed today by the continuity in the localisation of villages inhabited by these groups and by the many cultural traits they share. We might have hoped to distinguish them by the pottery from these sites, but the ceramic remains are not very informative on this topic. This might be explained by the long cohabitation of these groups or by the fact that the decoration of pots was ethnically not very significant. Beyond these paradoxes, both archaeology and oral history support the idea that the inhabitants of the older villages were largely ancestral to the current population (continuity of TGR and FRS decorations, funeral traditions using ochre, potsherd pavements, etc.) (**fig. 2**). The geographical location of the Adamawa-speaking groups in the Faro area and chronological estimates[3] also support this hypothesis (**fig. 3**).

Regarding Phase 2, archaeology and oral data both indicate profound changes linked to north-western influences during this period (**fig. 2**). In the 17th century, the Bata from the plains of the north-west Benue took over indigenous villages on the banks of the Faro. It is tempting to equate Phase 2 sites in Farkoumo and Lamordé with the establishment of a new population. This is all the more tempting as it corresponds to occupation levels marked by the sudden emergence of an unknown pottery

3 Adamawa speakers have occupied the region for at least 4,000 years.

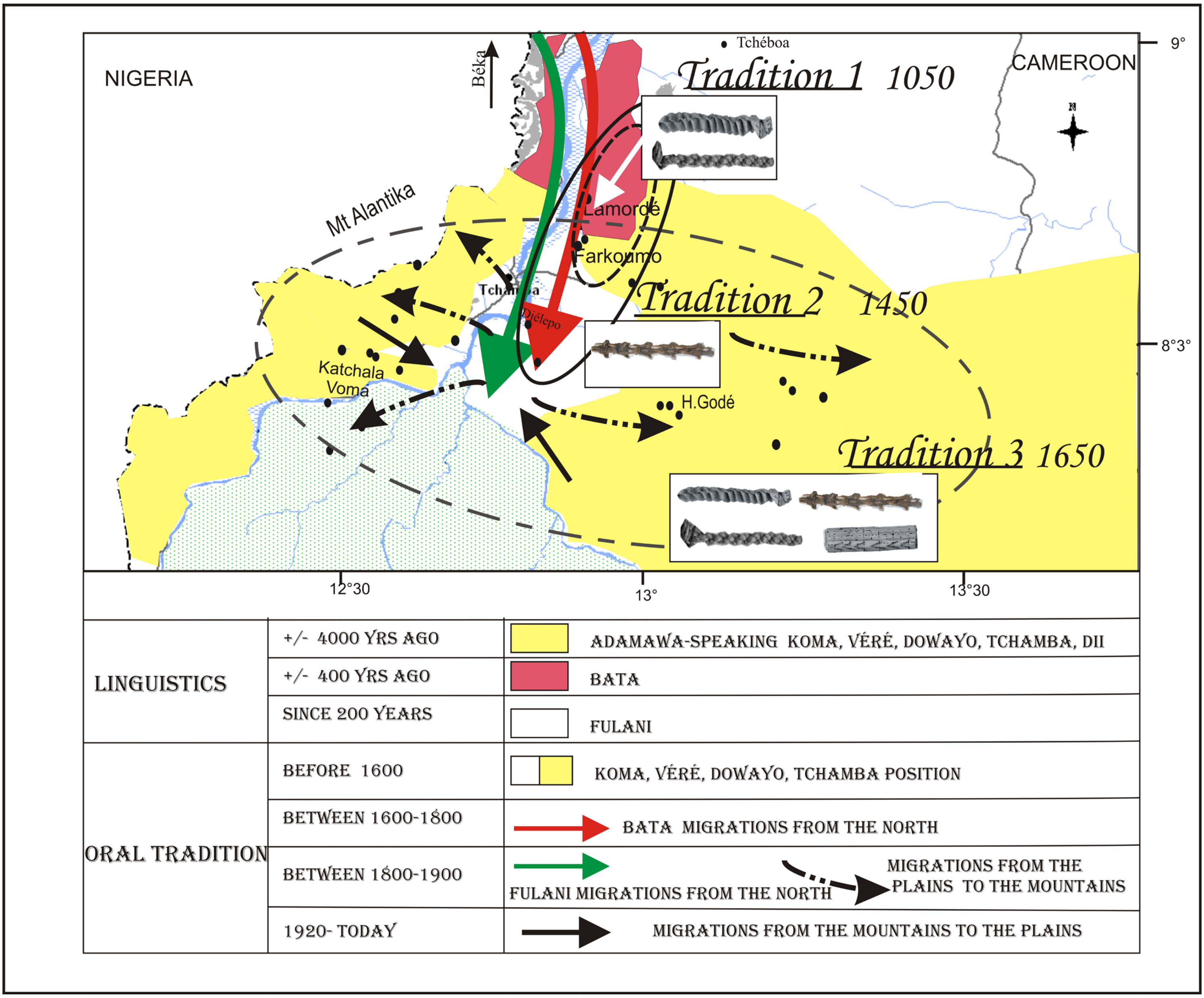

Fig. 3. Correlation of linguistic data and hypotheses derived from archaeology and oral history in the last millennium. (Drawings by Alice Mezop Temgoua 2011: fig.7.1, modified.)

decorated with *Blepharis* sp. cob (TD2), and of pipes and spindle whorls (**fig. 2 and 3**). The severe drought which struck the south of Lake Chad between the 15th and 16th centuries AD may have pushed the population to settle the region further to the south. While oral histories identify the newcomers as Bata, there is no clear archaeological evidence of Bata occupation. Gbwata-speakers are related linguistically to populations from the Mandara area, but *Blepharis* sp. cob impression decoration has never been documented in that region. On the other hand, it is currently impossible to identify material features that would distinguish Bata from other populations in the region. Note also that ethnohistory sets the arrival of Bata in the 17th century AD, while archaeology tends to place the TD2 tradition well before that, somewhere between the 15th and 17th centuries AD (**fig. 2**). This minor difference may be the result of the different dating methods. With the exception of these two points, there is general agreement between the archaeological information and that offered by ethnohistory and linguistics (**fig. 2**). Indeed, the area of distribution of TD2 sites tends to be the same as that of villages inhabited previously and today by Bata and the distribution of the Chadic Bata language in the Faro (**fig. 3**). The producers of TD2 might therefore be the ancestors of Gbwata speakers, whose language would come from lands north of the Benue.

For Phase 3, the idea of a generalized occupation of the highlands by producers of the TD3 tradition is echoed in ethnohistory (**fig. 3**). The mass installation of the Fulbé at the beginning of the 19th century is the most likely cause of the primary rupture in the history of the Faro region, but this does not seem to have had a direct influence on the pottery traditions of this period. So the development of appliqué buttons and of vessels of specific forms during this period might testify to a change in religious practices in the Faro, related to influences coming from the plains of Nigeria to the northwest, home to the largest development of ritual potteries in the region. A link might be established between the spread of twisted cord roulette impressions in the Atlantika area and the migrations of Véré artisans that are considered as the inventors of the present-day pottery style on the western side. The historical argument according to which the pottery production remained in the hands of local populations makes this hypothesis highly likely.

The objective of this case study has been to test the potential of analysis that combines oral sources, ethnographic pottery analysis, and archaeological remains in the analysis of the history of populations One must observe, in this specific case, the great value of basing the reconstruction of the past on a comparative approach. The juxtaposition of different data sources shows that, in most cases, the results of ethnohistory and the study of the current pottery can explain those of archaeology and vice-versa. It can therefore greatly enhance the possibilities for reconstructing the past. The combined study of archaeological and ethnographic data has led to the establishment of a chrono-cultural sequence for the Faro over the last millennium. It has allowed me to demonstrate the potential of historical information contained in this category of artefacts. The other contribution concerns the question of identities. This research clearly illustrates the complexity of relationships between material culture and identities, and the caution needed when projecting current identities on the past, especially into the distant past.

In Africa, where such a crucial question as the history of human settlement is often approached using only oral traditions and a few recent texts, this type of procedure seems indispensable.

Finally, I note that one of the difficulties of a multidisciplinary approach is that it requires a deeper understanding of the processes specific to each discipline, and that these must be pushed as far as possible without falling in the trap of an easy interdisciplinarity, which often leads to circular reasoning. At the same time, it is important to be aware that when conducting research, the results obtained from one discipline can influence the strategies developed in another.

REFERENCES

Lane, P. 2005. 'Barbarous tribes and unrewarding gyrations? The changing role of ethnographic imagination in African archaeology'. In A.B. Stahl (ed.), *African archaeology*. Oxford: Blackwell Publishing (series 'Blackwell Studies in Global Archaeology'), pp. 24-54.

Mezop Temgoua, A. 2011. 'Archéologie, traditions orales et ethnographie au Nord du Cameroun : histoire du peuplement de la région du Faro durant le dernier millénaire'. Doctoral thesis, Université libre de Bruxelles.

Reid, A. & Lane, P. 2004. 'African Historical Archaeologies: An introductory consideration of scope and potential'. In Reid, A. & Lane, P. (eds), *African Historical Archaeologies*. New York: Kluwer Academic/Plenum Publishers, pp. 1-32.

Stahl, A.B. 1993. 'Concepts of time and approaches to analogical reasoning in historical perspective'. *American Antiquity* 58 (2): 235-260.

Stahl, A. 2005. 'Introduction: Changing perspectives in Africa's past'. In A.B. Stahl (ed.), *African archaeology*. Oxford: Blackwell Publishing (series 'Blackwell Studies in Global Archaeology'), pp. 1-23.

Wylie, A. 1988. '"Simple" analogy and the role of relevance assumptions: Implications of archaeological practice'. *International Studies in the Philosophy of Science* 2 (2): 134-150.

ARCHITECTURE

Victor Brunfaut & Jean-François Pinet[1]

We will attempt to provide a summary of the conceptual and methodological bases for approaching African urban architecture and urbanism from a historical perspective. We will pay particular attention to the material dimension of architecture that can be seen, touched and measured today: existing built structures. We will consider this material as the evidence of a long-term historical process.

I. GENERAL FRAMEWORK

> '*[Architecture] means the moulding and altering to human needs of the very face of the earth itself…*'
> William Morris, 1881

A. Architecture is a complex cultural fact

Architecture is a complex cultural fact, the result of the activity of multiple actors, including the builder, the carpenter, the mason and (particularly in Africa) the inhabitant: it is a collective creation governed by a series of norms that codify its forms. These norms are passed from generation to generation.

B. Architecture is an object

A construction, whether it is a house, mosque or granary, is completely anchored in time and space (**fig. 1**). It is the expression of its time and of the society that created it. It is as impregnated with 'traditions' as any other man-made object. This 'bundle of traditions' includes architectural forms, building styles and techniques as well as references to elements beyond the sphere of building construction. For example, house decoration can evoke patterns found on fabric or pottery (see, among others, Huffman, this volume, pp. 180-186). Since built forms are the framework of human social life, they can become actual mental prisons: they become *structures* that are both supports and obstacles. Present-day architecture often reproduces that of the past, and perpetuates it.

C. Architecture is a language

Architectural space as well as the space within which the city, village or territory is located are charged with meaning: like a language, the spaces speak to us. Their meanings are organised in layers that sometimes are superimposed upon, or contradict one another: this is the case, for example, with buildings that maintain an architectural form linked to a specific building technique when the latter has been replaced by another, more modern one.

Beyond the primary purposes of protection and shelter, architecture translates into built forms the aspirations of individuals and those of the society in general: lifestyles and forms of housing are expressions of these aspirations (for example, of the inhabitant's desire to 'belong' to a certain social class or group or to a certain 'modernity', and so on.). In other words, architecture also expresses its creator's status or that of their sponsor: it 'speaks' of power, of social position, of belonging to a 'group'…

D. Architecture is an instrument of power

Architecture, and built structures in general, are in this sense particularly sensitive to acculturation; they also constitute one of its vectors, through the impact they exert on lifestyles. These phenomena are fed by the transfer of ways of doing things, of 'models', from one social group to another – whether by simple commercial contact or by military or political domination. In Africa, colonisation was a particularly massive and destabilising 'transfer'. This historical process, through which architecture was used as an instrument of domination and power-projection in a 'territory' considered untouched, was also marked, for the agents of colonialism, by a process of discovering the 'colonised'. Like many other social realities, the architecture previously produced by the 'colonised' was very diverse and long described as 'immutable', primitive, timeless, outside of history. Today, African architecture and the African city are beginning to be considered objects of study in their own right. They are acquiring a history.

II. ELEMENTS OF METHOD: ARCHITECTURE AS PRODUCT OF HISTORY

Beyond the analysis of relevant literature on which all research is based (in our case, it covers historical, geographical, social and political aspects of the spaces that interest us), we will pay particular attention to analysing built structures from a historical perspective: how does a

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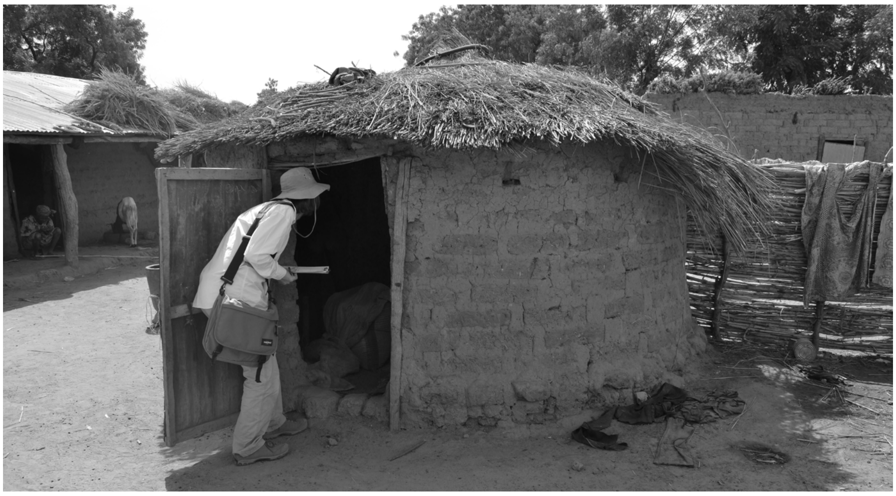
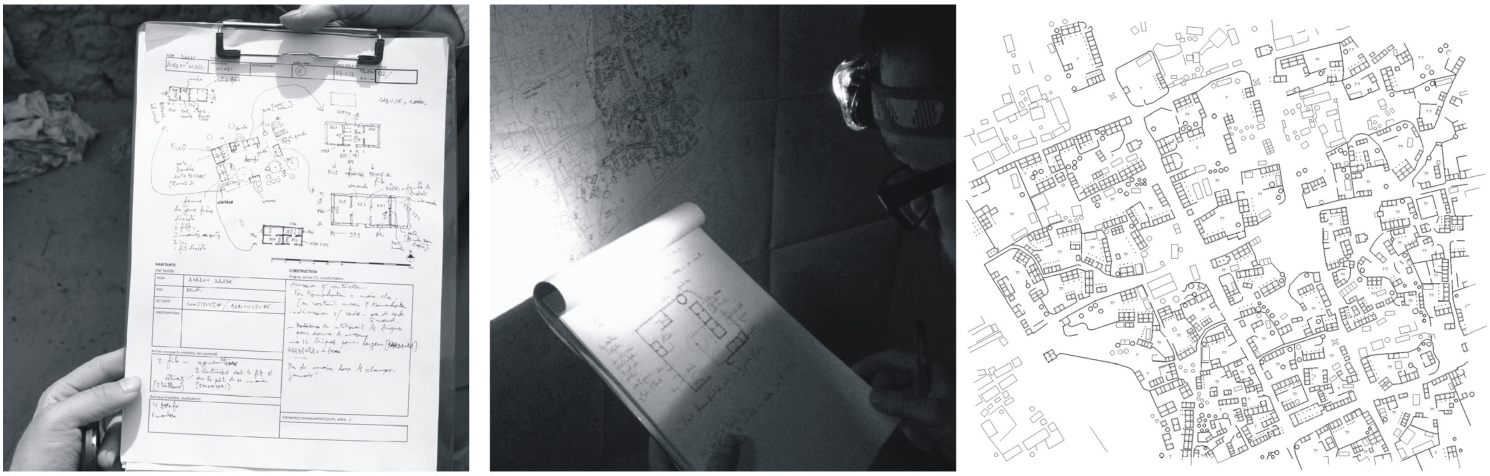


Fig. 1. ‘*Kouroukoutou*’ circular house at Birni Lafia, northern Benin. (Photo © J.-F. Pinet.)



Survey form used at Birni Lafi

The survey copied on a general map in the evening, originally drawn with the aid of Google Earth view

Excerpt of final map resulting from the survey at Birni Lafia

Fig. 2. Survey stages at Birni Lafia in 2013. (Photo © J.-F. Pinet et V. Brunfaut, plan © J.-F. Pinet.)

structure as it is currently observed in a given region provide clues to understanding the region’s history and the contexts of its settlement? We will rely on a method analogous to that of reading. Like other categories of material culture, architecture can be considered as a language. It is composed of elements whose arrangement or combination is governed by rules, by a grammar: for example, how houses are grouped, or how the area in front of the entrance is used to prepare food…To this extent, studying the built structures of a village and the architecture of its houses improves our understanding of the history of the village and of its inhabitants .

A. Architecture is a spatial fact

Keep in mind the quotation of William Morris that opened this chapter: architecture is not just the built structure but all the transformations to which humans subject their environment in order to adapt it to their needs (this is why we speak of ‘anthropogenic’ land or territory, transformed by humans). If our object of study will in most cases be the space of the town or the village – the ultimate anthropogenic terrain – we must always keep in mind that the village is linked to the fields and surrounding areas: they form a whole. From a historical perspective, anthropogenic territory over time becomes ‘the environment’ itself to which Morris refers; that is, the place of future transformations: the town or village becomes the ‘nature’ that humans transform. The town or village grows on itself, by building on what is already there; thus we can read in the urban fabric the persistence of structuring elements (a road, a built element of which the form persists) that shapes it.

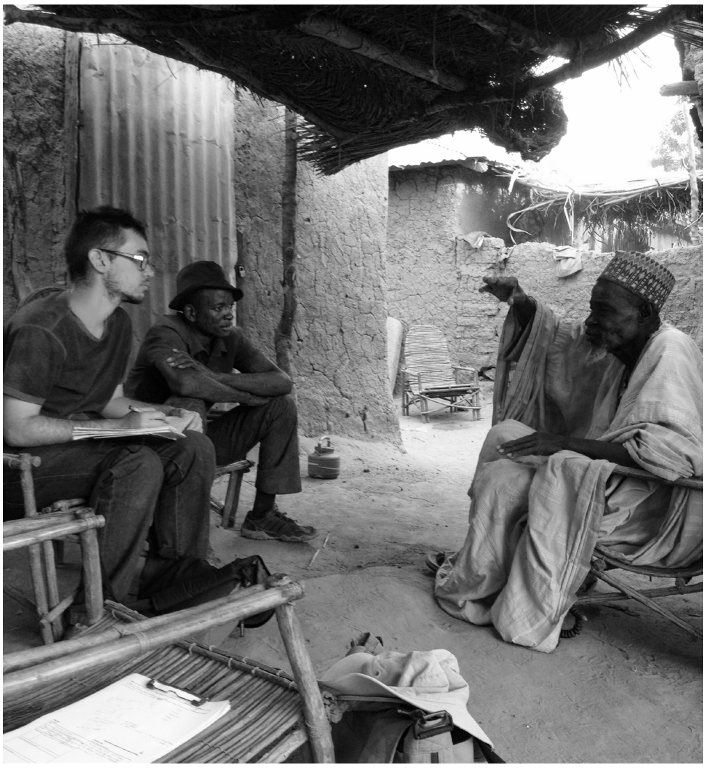


Fig. 3. Interview with the imam of Birni Lafia, Suley Guero (94 years old). (Photo © V. Brunfaut.)

B. Reading urban facts

Reading the built environment (that is, anything 'built or constructed' by humans: houses, granaries, walls, etc.) may be performed according to two approaches, synchronic and diachronic. The first addresses the description of the contemporary built structure at the moment when it is described; the second considers the temporal dimension of the feature, across time. These two approaches are complementary and require specific tools and methods that can be adapted to specific realities in the field.

1. Synchronic analysis and its tools

Synchronic analysis involves describing the built ensemble in its current state. In a synthetic manner, this can be described as being composed of regular or 'common' elements (houses, compounds, etc.) and particular or specific ones (e.g. buildings having a public, symbolic or religious function). All these elements are arranged according to a system of open spaces: streets, avenues, squares, etc.[2] In general, the analytical scale is the neighbourhood, or that residential part of the town where housing or habitation predominates.

a) First tool: architectural survey

The architect's main tool for describing built structures is the urban plan, which can be based on available documents such as aerial photographs, National Geographic Institute maps, land registers, and so on. (fig. 2). Today, aerial views with a precision that allows for the observation of a village's built structures are freely accessible on the Internet. Analytical ambitions must be adapted to (human and material) means, available time, and of course to the possibilities of accessing buildings (access to habitation in particular requires tact and careful attention: one must introduce oneself and explain one's goal without ever being overbearing). The survey aims at representing what is built: walls, poles, roofing, etc. It is carried out by drawing – plans, cross-sections, construction details – and measuring (even using makeshift units such as one's own body, stride or arm span to measure, say, a house; this is sometimes less invasive and faster than alternative methods). The survey will later be transcribed to represent the structures themselves and/or the principles guiding their composition:

- construction materials and techniques;
- principles of composition: basic dimensional units, housing/habitation typologies, room layouts, etc.;
- classification of structures by typological series.

b) Second tool: 'habitation survey'

The habitation survey complements the survey of architectural elements with regard to the use of spaces, in an attempt to represent furniture, utensils, and so on. It especially allows for an understanding of how people live in the space, the relationship between constructed spaces and family structures, and the use of objects.

c) Third tool: oral history

The survey will be usefully complemented by oral history (told by the people themselves) about the inhabitants and events, or what interests us more directly: the history of the house (fig. 3). Often tied to family history and personal trajectories, it teaches us a lot about migrations and reasons for settlement. Oral history also provides access to an essential element for understanding the dynamics of territorial transformation: the transmission of construction knowledge. This is a question of identifying the means and carriers (the builders) of knowledge, but above all the continuities and ruptures in this transmission (the impact of colonisation, for example). Here, architecture as a material object quite clearly supports a dialogue that covers a much larger field.

2 See http://unesdoc.unesco.org/images/0006/000623/062310fb.pdf

SURVEYED HOUSE MARIAM WINDI (MAISON *KULLÉ*)

0. *kata*, an entry system ensuring the privacy of the members of the compound. This is where the head of the family receives guests. Historically, the kata was built in the houses of chiefs, warriors and the wealthy. Today, it is also used for religious reasons;
1. *werenda*, Meïdawa's former room, now a 'shop';
2. *cheroga*, room of Assia + children;
3. *cheroga*, room of Imaïma + children;
4. *cheroga*, room rented to 'foreigners'. Open to men or women, but up to now rented by women only: Biba, a nurse from Karimama, and Kalidou, a merchant from Niger. Both already knew the family. It is common for alfas to rent rooms to 'foreigners', who work (including in the fields) in exchange for their lodging. Children of 'foreigners' help with domestic chores;
5 *cheroga*, abandoned room. Imaïma had been living here;
6. *werenda*, a pigeon house in 2013, a rabbit hutch in 2014;
7. *granary*, 'collapsed' in 2014.

Fig. 4. Example of habitation surveyed at Birni Lafia. The right-hand text includes vernacular terms used by inhabitants to name their houses. (Drawing © J.-F. Pinet.)

d) Name the elements!

A fundamental dimension of survey as discussed here is the terminology that inhabitants use for elements of construction and/or places (fig. 4). Vernacular terms often indicate the relative importance of an element, or its connexion with a specific semantic field, which leads to a better understanding of its origin or forgotten usage -(see this volume, Bostoen, pp. 257-260 and Ricquier, pp. 261-263). If the interviews are conducted via an interpreter, their role is vital.

e) Chance

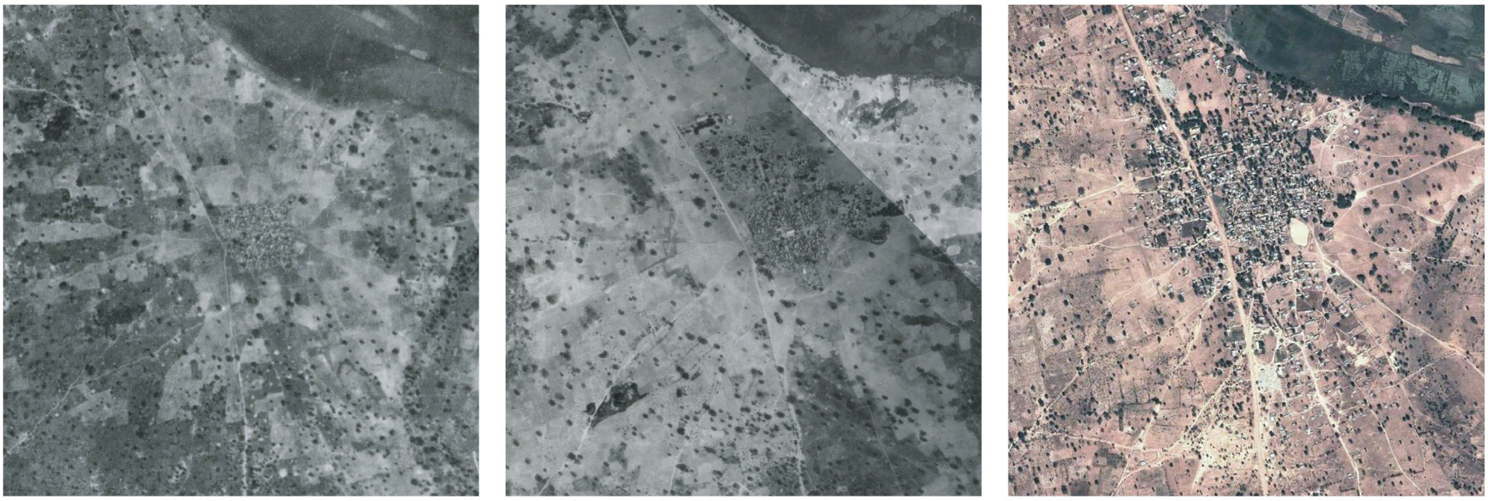
Beyond the necessary collection of information, *in situ* surveys allow the researcher to 'get into' the field: a lot of information is obtained by chance, or indirectly, while drinking tea, chatting with children curious about what we are drawing, or accepting an invitation to a wedding. This intensive fieldwork is just as important as the survey work itself. Both are based on confidence established according to certain rules of respect: asking permission to enter places or to take photographs (as a general rule, drawing is far preferable to photography, which is often perceived as intrusive).

2. Diachronic analysis and its tools

Diachronic ('across time') analysis is used to describe the process of growth, rupture and continuity of the built space. Pertaining generally to urban contexts, its main tools are geographical maps and historical aerial photographs (fig. 5).

Tools: historical maps

Diachronic reading must be done at different scales: that of a building, a village or a broader area. In general, this work is performed on a larger scale than for synchronic



Birni Lafia around 1960, IGN, silver print (ND 31 IV NC 31 XXII, shot 58)

Birni Lafia around 1975, IGN, silver print (DAH 3 P 125, shots 233 and 248).

Birni Lafia around 2013, satellite image © 2013 CNES/Astrium, map data © 2013 Google).

Fig. 5. Evolution of Birni Lafia, northern Benin. (Photos © IGN / Google.)

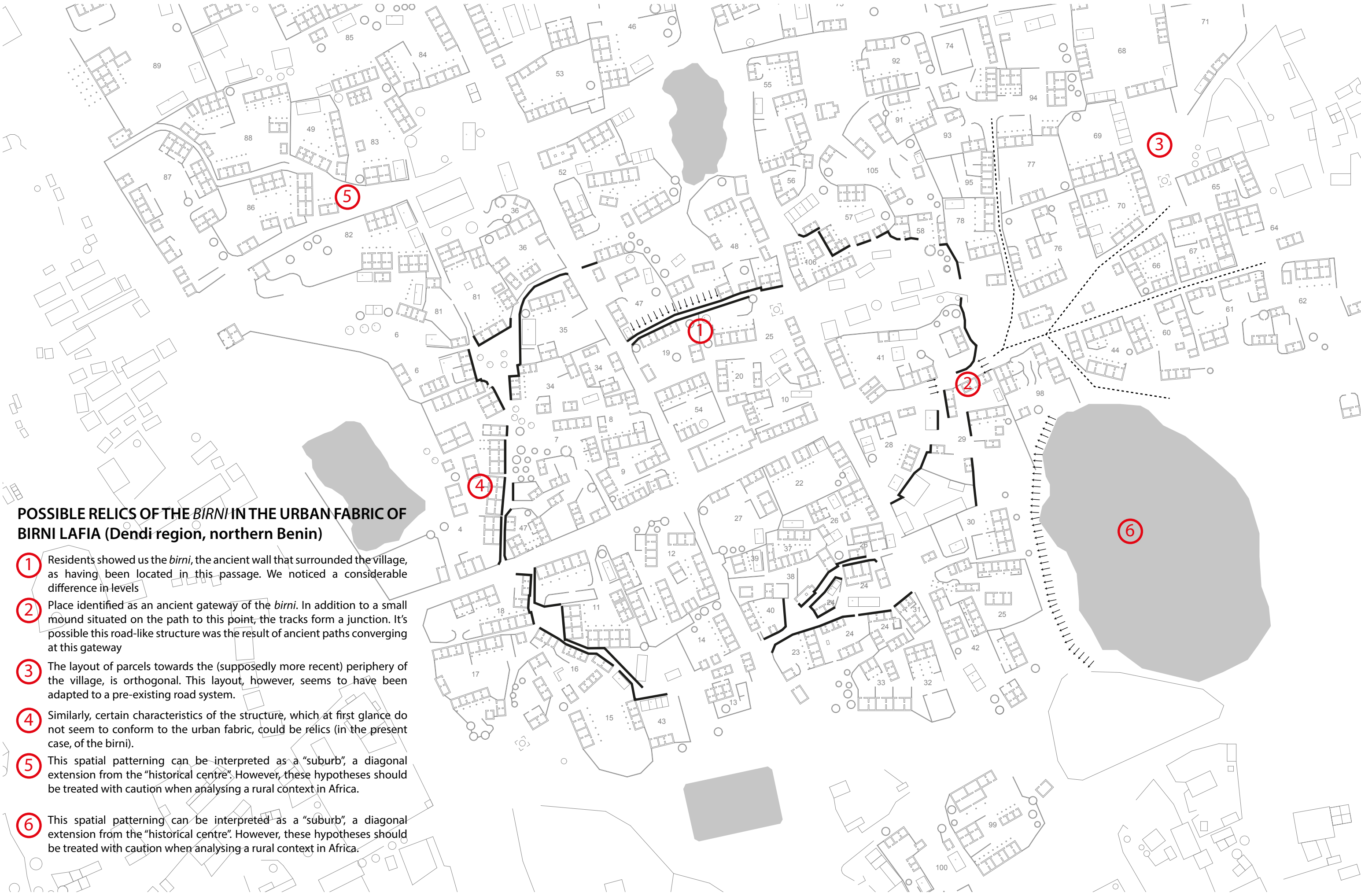


Fig. 6. Analysis of certain elements of the urban fabric of Birni Lafia, which may indicate traces of a *birni* (surrounding wall). (Drawing © J.-F. Pinet.)

reading, depending on available maps. Starting with a scaling of the documents, the method consists of comparing maps of different eras. The simplest way is to perform a 'deconstruction' of what is visible today, going back in time, by type of element (built structure, road network, land plotting, vegetation, etc.). The reading is morphological in nature: one tries to classify elements by their shape, size, etc. Diachronic reading reveals structuring elements (fig. 6) that endure over time, and the patterns of growth of the town or village (by urban agglomeration, densification, etc.).

CONCLUSION

In conclusion, it is important to distinguish in the elements of method presented above a primary 'documentary' dimension, and a secondary 'interpretive' dimension. We would like to stress here the necessity, in the case of Africa, of developing the first, without aspiring to interpretation: a work of documentation, an inventory of built realities, remains indispensable to a thorough comparative approach and an analysis of the processes of transfer (technical or cultural in the broadest sense) in space and time. One of the strengths of this research design is that it makes such comparisons possible.

REFERENCES

Borie, A. & Denieul, F. 1984. *Méthode d'analyse morphologique des tissus urbains traditionnels*. Paris: Unesco. http://unesdoc.unesco.org/images/0006/000623/062310fb.pdf (consulted on 05/05/16).

Castex, J., Cohen, J.-L., Depaule, J.-Ch. & Le Couédic, D. 1995. *Histoire urbaine, anthropologie de l'espace*. Paris: CNRS Éditions, 135 p.

Rudofsky, B. 1964. *Architecture without Architects: A Short Introduction to Non-pedigreed Architecture*. Albuquerque: University of New Mexico Press, 128 p.

Bourdier, J.-P. & Minh-Ha, T.T. 2005. *Habiter un monde : architectures de l'Afrique de l'Ouest.* Paris: Éditions Alternatives (series 'Anarchitectures'), 191 p.

Seignobos, C. & Jamin, F. 2003. *La Case obus, histoire et reconstitution*. Marseille: Éditions Parenthèses, 210 p.

CERAMIC TECHNOLOGY BETWEEN PAST AND PRESENT: A STUDY OF MALIAN TRADITIONS

Anne Mayor[1]

INTRODUCTION

Ceramic studies in archaeology have long focussed only on the stylistic classification of artefacts, through space and in time, based on morphological and decorative criteria. Few researchers were interested in the technical and functional aspects. It is now accepted that a set of stylistic traits does not necessarily coincide with a certain population. Many studies have demonstrated that technical aspects, on the other hand, are closely correlated to the identity of the producer group, as they often result from an early apprenticeship within the ethno-linguistic group. The transmission of technical knowledge can also follow other social configurations, such as clan, socio-professional class, or gender. Technical elements therefore provide essential information, even if they seem difficult to access. Furthermore, all pottery is produced in a particular context and is made to be used. The artisan will therefore make technical choices that take into account environmental and cultural constraints, as well as intended use. Studying the technical variability of ceramic assemblages thus aims at understanding the artisans' technical choices and their meanings. The technological analysis of archaeological ceramics involves a reconstruction of the different manufacturing steps following a *chaîne opératoire* framework (see Gosselain, this volume, pp. 292-295). The main stages are clay processing, shaping, finishing, and firing.

In archaeology, the interpretation of ceramics usually refers to – explicitly or not – a series of knowledge built by different approaches. Ethnoarchaeology (see Lyons, this volume, pp. 270-274) provides explicit references that are useful for interpreting the past by studying systematically, in the present, the links between ceramics and their various meanings, as well as the mechanisms behind observed regularities. Technological analyses therefore often rely on ethnoarchaeology (**fig. 1**), and other approaches such as experimental archaeology or archaeometry. These methods are varied and borrow elements from cultural anthropology as well as analytical tools from the natural sciences (see Livingstone Smith and de Francquen, this volume, pp. 173-179).

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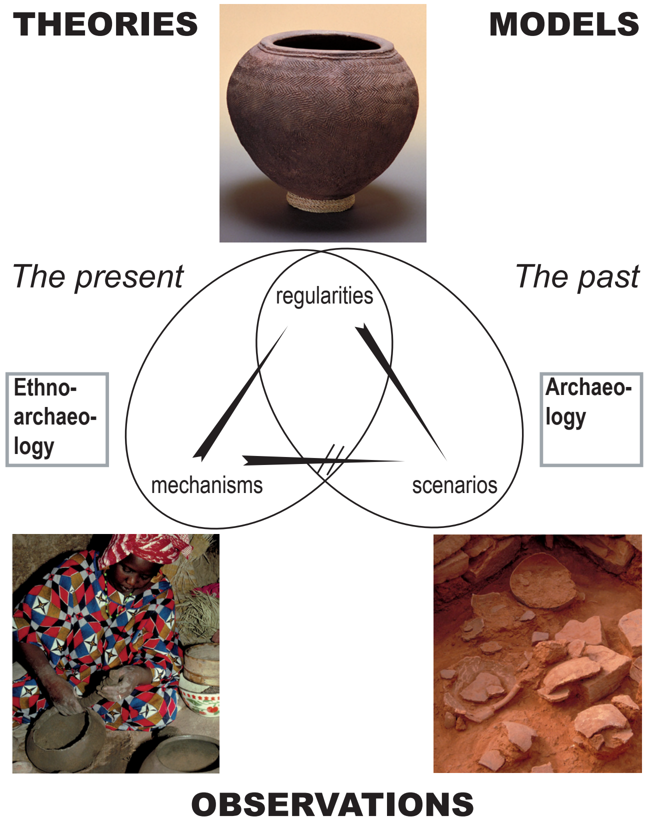

Fig. 1. The ethnoarcheological approach, applied to the study of ceramics (Mayor 2011: fig. 1).

I. AN ETHNOARCHAEOLOGICAL STUDY OF THE CERAMIC TRADITIONS OF MALI

As a case study, we will examine ethnoarchaeological research conducted by a team from the University of Geneva and devoted to Malian ceramic traditions. It contributed to a renewal of our understanding of the history of technical systems and populations in the Niger Bend.

Following a theoretical analysis that acknowledged the impasse faced by archaeologists when interpreting ancient artefacts, due to a lack of understanding of ethnographic realities, the MAESAO team from the University of Geneva, led by Alain Gallay and Eric Huysecom, launched a broad ethnoarchaeological project in Mali to understand the relationships between ceramic traditions and ethnic groups (Gallay *et al*. 1998). We will summarize what was learned through this research, which was carried out from 1988 to 2011, in order to explain how to obtain data that can renew our understanding of the past.

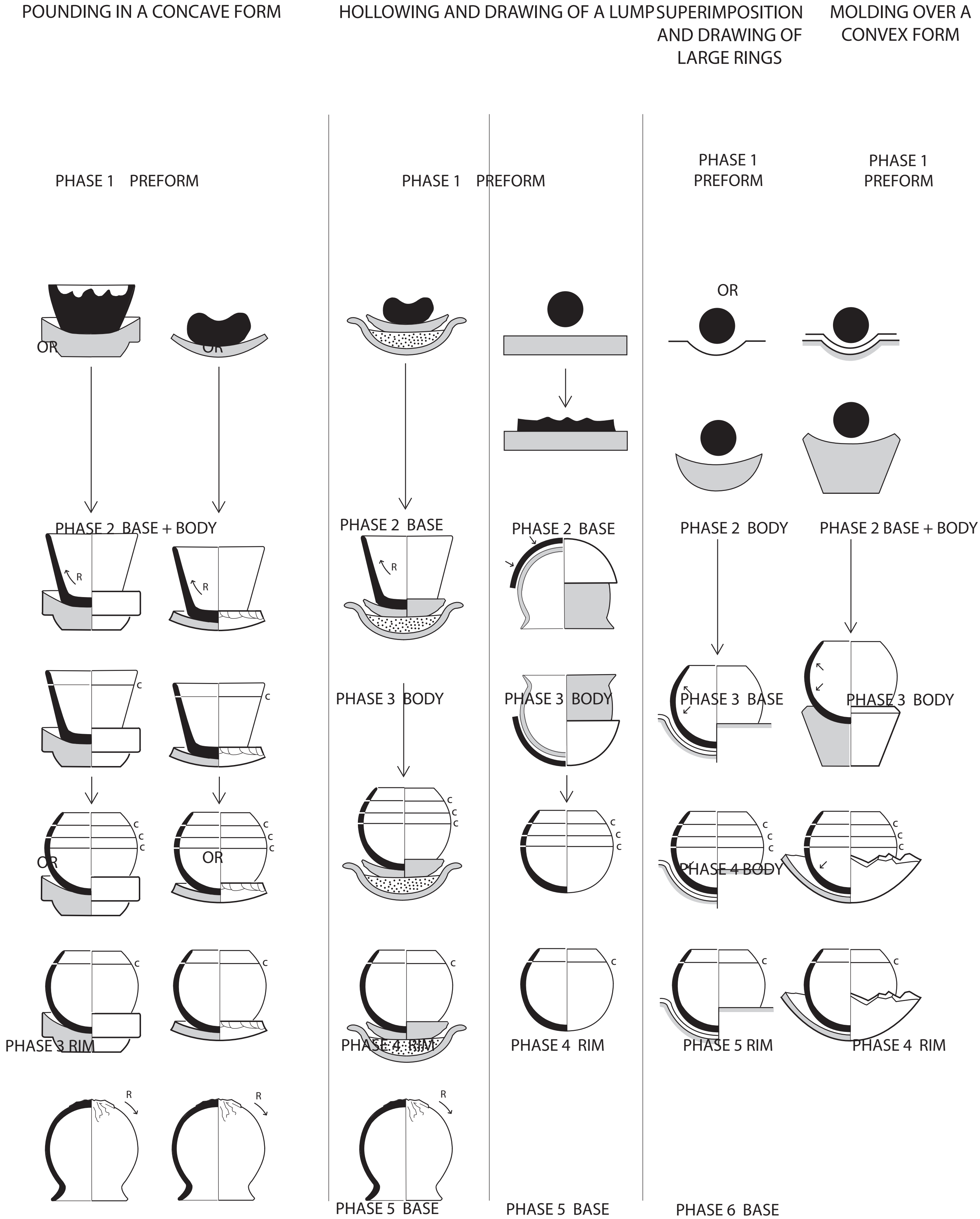

Fig. 2. Schematic 'chaines opératoires' for the four main shaping techniques practiced in the Niger Bend (Mayor 2011: fig. 3).

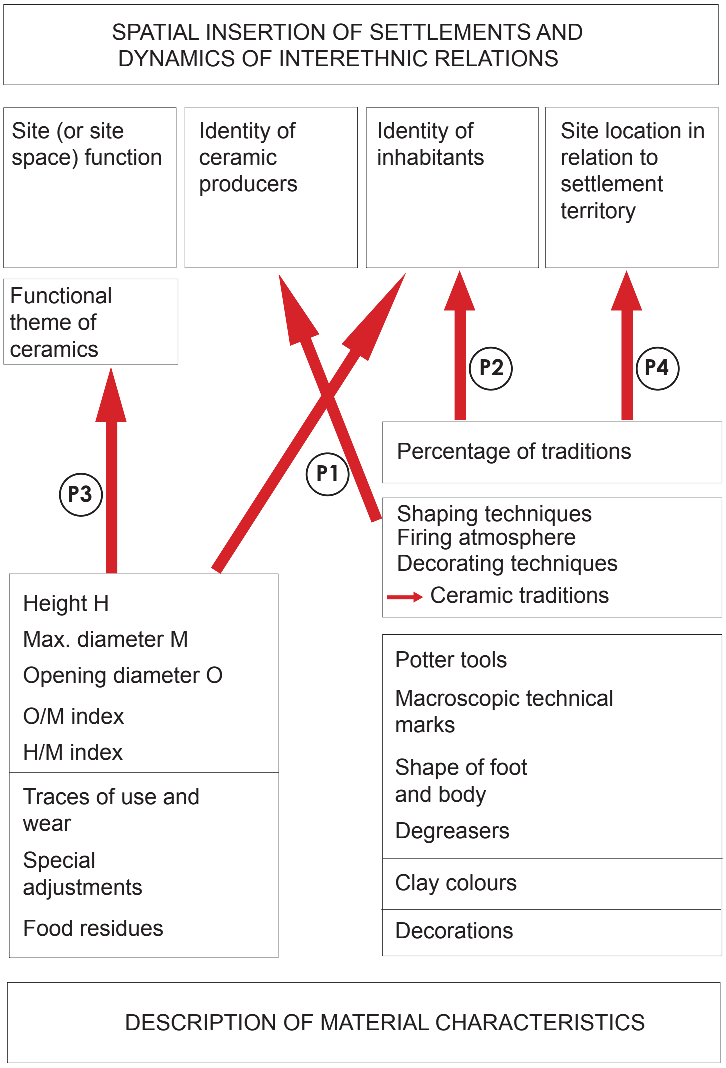

Fig. 3a. Diagram showing the links between selected relevant descriptive features and interpretations in terms of the spatial integration of settlements and the dynamics of inter-ethnic relations (Mayor 2011: fig. 59.)

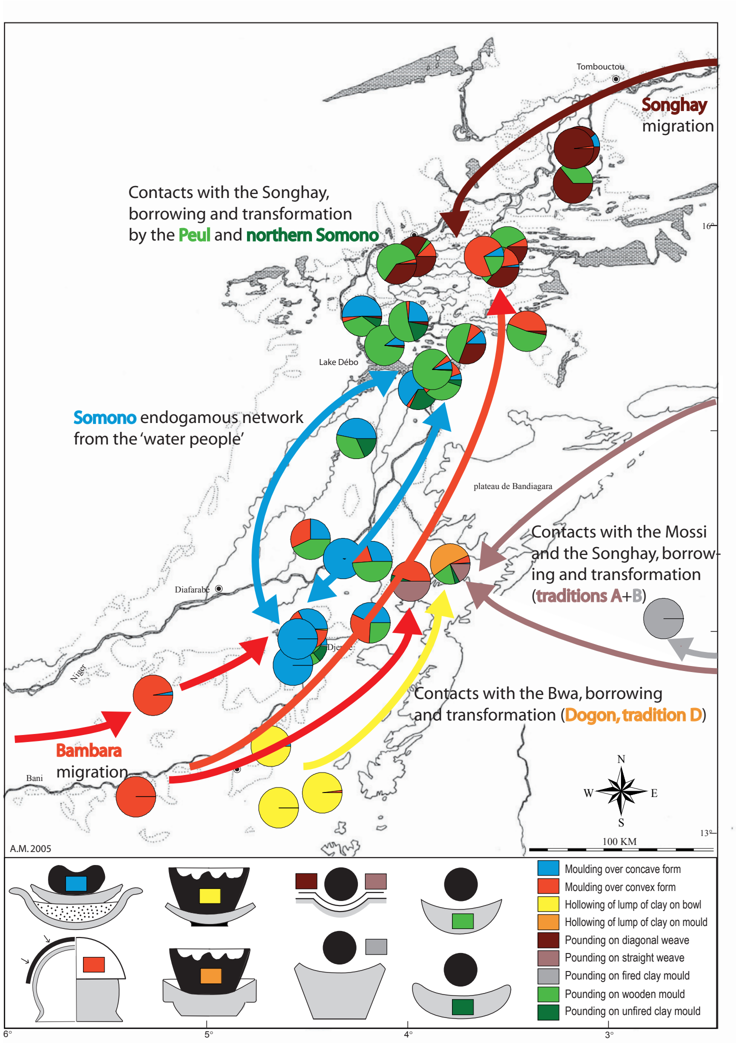

Fig. 4. Current distribution of shaping techniques and historical movements of populations responsible for their development (Mayor 2011: pl. 5 modified.)

Production of ceramics	
P1	Certain ceramic traditions are characterised by a manner of working and aesthetic properties that reflect the ethnolinguistic identity of producers
Consumption of ceramics	
P2	Recipients in a dwelling unit reflect the identity of the inhabitants
P3	Dimensions of recipients reflect their function
Spread of ceramics	
P4	The spatial distribution of a ceramic tradition reflects the structure of the producer group's population

Fig. 3b. Examples of regularities linking material facts with interpretation, and structuring the research.

Such a goal demands that specific methodological requirements be observed during field surveys:

- **An extensive strategy:** in order to understand the ceramic traditions of a region a wide geographical area must be covered, and enquiries must be made in many villages, with potters and customers from diverse socio-cultural backgrounds. The idea is to approach the complexity of reality and to get an accurate picture of technical boundaries.

- **A restricted objective:** with limited time and resources, a consequence of the previous requirement is that one must restrict oneself to the study of ceramics and of the elements that contribute to their understanding. This requires discipline, in order to put aside other exciting topics encountered in the field.

- **Numerous data:** Obtaining statistically relevant information requires that enquiries be both sufficiently numerous and systematized. Each location must be geo-located (see Ozainne, this volume, pp. 157-162), and researchers should work with standardized forms (village, compound, potter, pottery, market), completed by semi-structured interviews and observations, recorded in notes, photographs and/or videos. Ceramic production can be documented by interviewing potters, studying tools, making detailed recording of various operational systems (**fig. 2**), observing of different ceramic types, as well as through the observation of firing processes. This may be supplemented by a sampling of raw materials and finished products for laboratory analysis. Product distribution can be studied by surveying customers in markets and by comparing those observations to the data obtained from potters' and consumers' interviews. It can also be addressed by investigating (and drawing) pottery used in compounds.

- Formulating the associations observed between material facts and their meanings in the form of rules: in order to ensure that the results of ethnographic studies be easily exploited in the interpretation of archaeological remains, it is useful to adopt clear formulations in the form of proposals or 'regularities'. Also, to recognize shaping techniques used in the past, it is important to identify specific macro-traces left by present-day techniques, as did E. Huysecom (1994).

II. THE ESTABLISHMENT OF A MODEL OF INTERPRETATION OF THE PAST

After documenting and analysing current ceramic traditions, the final step is to assess the historical depth of these ceramic traditions and see if there are objective links between the archaeological past and the present. Here is, for example, how we proceeded in the Niger Bend.

Following the qualitative study of ethnographic data and the first implementation of archaeological testing on locations with a varying degree of temporal and spatial association, (e.g., Huysecom 1996), it was necessary to re-examine the archaeology of the Niger Bend in the light of information about current ceramic traditions. The idea was to develop a new understanding of the history of technology and populations (Mayor, 2011; Mayor et al. 2005). This involved the adoption of three complementary approaches (see Stahl, this volume, pp.250-252).

A. The ethnoarchaeological approach

Based on field data, we conducted a quantitative study of the current variability of ceramic traditions of the Inner Niger Delta and its surroundings, by mapping the ethnic groups and the spatial distribution of elements related to shaping and decoration techniques. This allowed us to select a number of criteria identified as culturally relevant: shaping and decorating techniques to identify producer groups; dimensions of containers to deduce function; percentage of traditions within the inhabited units to deduce the identity of the inhabitants (**fig. 3 a & b**). It is important to select the descriptive criteria carefully, according to the purpose of the study, because it is not possible to study everything. In our case, it turned out that the morphology of the vessel rims, a very popular criterion among archaeologists, had very little relevance in cultural terms.

B. The ethnohistorical approach

To address historical depth, we conducted a study of spoken and written sources to identify the dynamics underlying the settlement of various ethnic groups, their interactions and their transformations. We know that ethnic entities are not static and underwent recomposition over time. It is therefore important to collect traditions concerning myths of origin and migratory routes, conflicts or past alliances with neighboring groups, and/or changes in language, name, economic specialty, or religion. The terminology of current ethnic entities should be handled critically and cautiously when looking back in time.

C. The archaeological approach

We analyzed the archaeological documentation available for sites in the Niger Bend, focusing on chronological data, techno-economic characteristics, ceramics, and those settlement hypotheses proposed by researchers. A focus on central Mali meant that it was not possible to understand the significance of the spatial and temporal

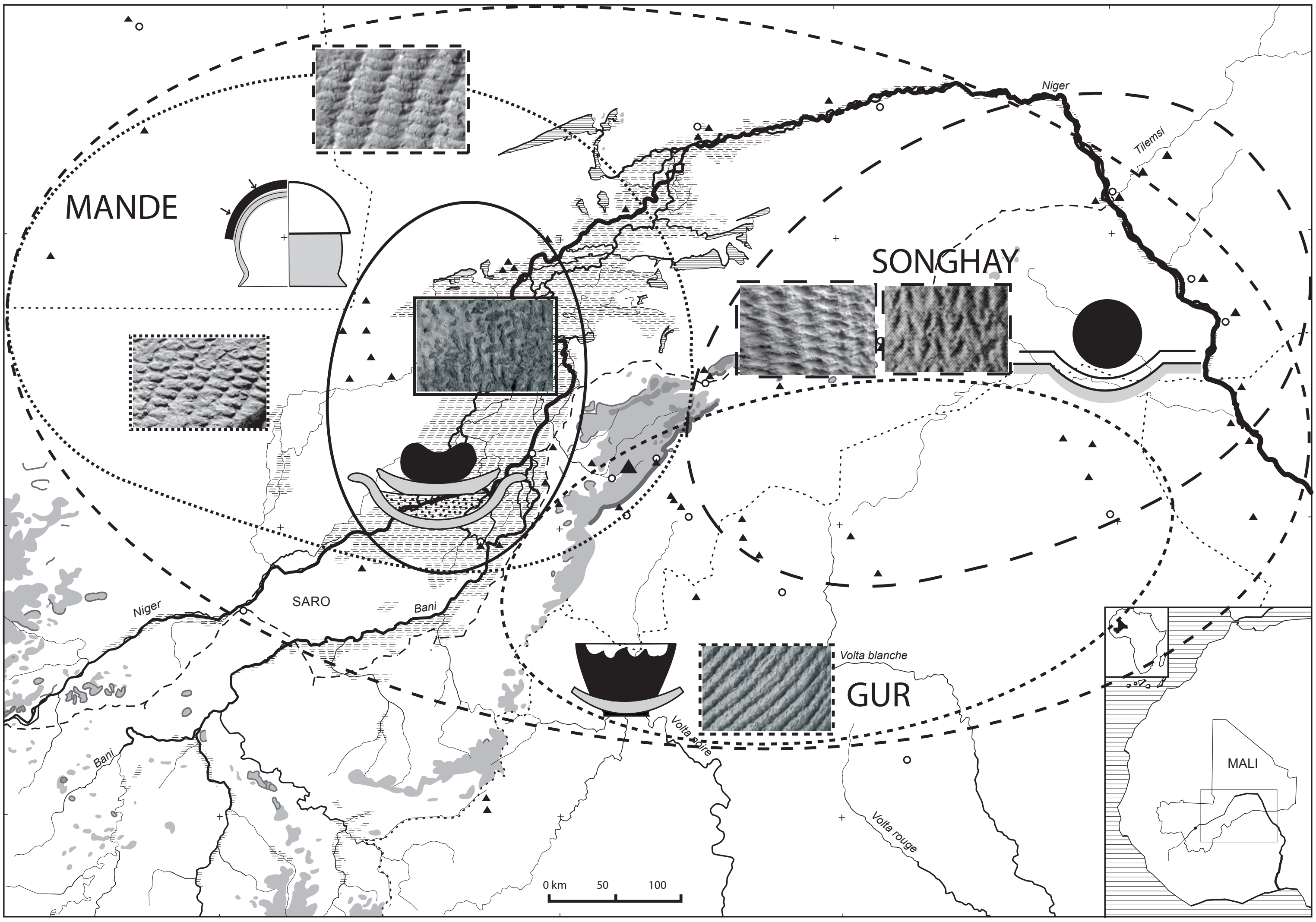

Fig. 5. Summary of relations between ceramic traditions and linguistic groups in the Niger Bend before the 15th century (Mayor 2011: fig. 88.)

distribution of selected descriptive criteria. We therefore expanded the spatial scale, which allowed us to examine contrasting areas. The careful choice of a spatial and temporal scale, neither too big nor too small, is important if we are to make sense of the data.

By comparing the synchronic and diachronic data on social dynamics and ceramic attributes, we developed a model of evolution of ceramic traditions in two phases: before and after the period between the 13th and 15th centuries AD, which is characterized by a significant historical and archaeological break in West Africa. For the period after this break, it is possible to correlate the historical migrations of some current populations with the distribution of present-day shaping techniques. For example, the Songhay went up the Niger river from the Gao area to Lake Debo at the height of their empire in the 16th century, and the installation of new populations in the northern Inland Niger Delta explains the use of the technique of pounding on a diagonal mat in the delta north of Lake Debo (**fig. 4**). Before the 13th to 15th centuries, the large historical depth no longer allows us to speak in terms of current ethnic groups, but it is still possible to propose an overall correlation between certain pottery techniques and ethnolingistic affiliations on the basis of their geographical distribution and historical evolution. For example, in the Niger Bend, the 'drawing of a lump' technique and rolled impressions with braided strop roulette can be associated with the Gur language family, while the molding technique on a concave mould and impressions with braided cord roulette are related to fishing groups within the Mande family from the Inland Niger Delta (**fig. 5**).

Geographically, the Dogon country is located at the intersection of Songhay, Gur and Mande cultural spheres, each characterised by different pottery techniques. Remains from new archaeological excavations undertaken in the region using our model served to test this. In light of ethnoarchaeological patterns, the body of archaeological ceramics revealed exchanges between cultural spheres, local technical innovations, and hybridizations between traditions, which could not be analysed without references to the present. These new data thus confirmed the model, while refining its resolution for the period prior to the 13th and 15th centuries AD. The approach has therefore enabled us to interpret the Dogon country as a socio-economic hub influenced by the contributions from diverse populations in the first millennium AD, hence placing into question the previously established 'Toloy–Tellem–Dogon' chrono-cultural sequence (Mayor, 2011; Mayor *et al.* 2014).

CONCLUSION

The case study presented here shows that a rigorous approach anchored in the present can be effective for interpreting regional proto-historic sites and generating new understandings of the past. With a significant investment of time in gathering information, and rigour in the analysis and establishment of regularities, this approach to the cultural history of technology and peoples is likely to be replicated in other geographical contexts where ceramic technical knowledge still exists.

REFERENCES

Gallay, A., Huysecom, E. & Mayor, A. 1998. 'Peuples et céramiques du delta intérieur du Niger (Mali): un bilan de cinq années de missions 1988-1993'. In *Terra Archaeologica: monographies de la Fondation Suisse-Liechtenstein pour les recherches archéologiques à l'étranger, no. 3*. Mainz: P. von Zabern, 130 p.

Huysecom, E. 1994. 'Identification technique des céramiques africaines'. In D. Binder & J. Courtin (eds), *Terre cuite et société: la céramique, document technique, économique, culturel. Actes des XIV[e] rencontres internationales d'archéologie et d'histoire d'Antibes, 21-23 octobre 1993*. Juan-les-Pins: APDCA, pp. 31-44.

Huysecom, E. 1996. 'Iron Age terracotta pestles in the Sahel area: an ethnoarchaeological approach'. In L. Krzyzaniak, K. Kroeper & M. Kobusiewicz (eds.), *Interregional contacts in the Later Prehistory of Northeastern Africa.* (*Studies in African archaeology* no. 5). Poznan: Archaeological Museum, pp. 419-458.

Mayor, A. 2011. *Traditions céramiques dans la boucle du Niger: ethnoarchéologie et histoire du peuplement au temps des empires précoloniaux*. (*Journal of African Archaeology Monograph Series* no. 7). Frankfurt am Main: Africa Magna Verlag, 292 p.

Mayor, A., Huysecom, E., Gallay, A., Rasse, M. & Ballouche, A. 2005. 'Population dynamics and paleoclimate over the past 3000 years in the Dogon Country, Mali'. *Journal of anthropological archaeology* 24: 25-61.

Mayor, A., Huysecom, E., Ozainne, S. & Magnavita, S. 2014. 'Early social complexity in the Dogon Country (Mali) as evidenced by a new chronology of funerary practices'. *Journal of Anthropological Archaeology* 34: 17-41.

COMPARATIVE TECHNOLOGY

Olivier P. Gosselain[1]

As with objects, myths or lexicons, technical processes are cultural manifestations in their own right, capable of informing us about the social dynamics, worldviews and history of those who carry them out (Balfet 1991; Bartholeyns *et al.* 2010; Gosselain 2011; Lemonnier 1992). Here, I will focus on their exploitation as historical documents.

The historical approach to technical processes implies two stages of **comparison**. The first stage involves a comparison of the technical processes themselves, in order to identify similarities and differences. The second stage involves a mapping of the common and distinctive features, and a comparison of the resulting spatial distributions in order to identify their characteristics (the effects of aggregation or disintegration, borders, or interpenetrations, for example). Since the spatial distributions always stem from a series of relationships – between people themselves, and between people and their environments – it then remains to identify the social, historical and geographical factors that explain the configurations in question.

This approach has deep roots. In particular, it was developed by one of the founders of the cultural technology school in France, André-Georges Haudricourt (1955). Often associated with 'diffusionism', whose excesses and abuses have been rightly denounced since the first half of the 20th century, comparative technology studies still suffer from a negative image and remain under-exploited. The main weaknesses of this approach are a lack of method in the collection and ordering of technical facts, and a frequent lack of contextualization of the data. It is thus not sufficient to collect and map technical facts, in order to 'let history emerge'; we must also understand the factors underlying their appearance and development.

I. CHOICE OF DATA FOR ANALYSIS

No field of activity can be neglected *a priori*: from the manufacture of artifacts to agriculture, and including food preparation and techniques of the body, any comparison of ways of doing things can provide an historical perspective on a population or region.

Analysis ideally involves first-hand data, collected from ethnographic contexts (see Lyons, this volume, pp. 270-274) and following appropriate protocols. The increasing disappearance of particular techniques, the need to broaden the comparison to large geographical areas, and the time available do, however, force researchers to use secondary sources, gleaned from the literature. These display huge disparities in their content and level of detail. As the rigour of a comparative approach lies in its systematic nature, the analysis must be adjusted by limiting it to the most commonly mentioned elements in the descriptions, and/or by adopting a level of detail that allows the inclusion of all or most of the available data.

II. DOCUMENTING AND ORDERING THE DATA

Technical processes are documented through an analysis of *chaînes opératoires* (Balfet 1991, Lemonnier 1992). In its canonical definition, this term refers to any sequence of operations aiming at transforming one or more primary materials into a finished product (e.g. from clay to pottery or from ore to some metal object). The scope can be extended to any change of state that produces an effect, allowing the inclusion of techniques of the body. In an analytical perspective, the *chaîne opératoire* should particularly be understood as a checklist (or template) used to structure and systematize the study of technical activity.

The first imperative is to generate 'meaningful observation units' (Balfet 1991: 12). The most basic of these units is the '**operation**', that is to say the isolated gesture or sequence of gestures. Above this, we find the '**sequence**', which is an organized set of operations. Finally, the '**phase**' is a set of sequences, corresponding to 'the major "logical" stages of a technical action' (ibid. 17). In a ceramic *chaîne opératoire*, for example, the phase of clay preparation may include a grog fabrication sequence, which itself includes the operations of grinding sherds and sorting by sieving.

This division into levels of analysis is essential, since it makes it possible to both associate comparable levels of information in different contexts, and to adjust the level of analysis based on the objectives and conditions of the research. If one is interested in the distinctive characteristics of individual production – the idiosyncrasies, so to speak – the attention will be focused on operations. Reversely, larger-scale comparisons will focus on sequences.

Each step – or 'phase' – in the technical process will be

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documented by means of a multiple-entry template: this is the '**checklist**' aspect of the *chaîne opératoire*. This template is primarily aimed at collecting comparative data, to better understand the logic of technical behaviors and the factors affecting their spatial and temporal evolution. Here is a concise overview of the kind of information to be collected:

A. Location
- characteristics;
- relationship with other areas of activity;
- ownership (individual or collective);
- possible sharing (with whom? occasionally or regularly?);
- relocation opportunities.

B. Actors
- identity of the people involved (gender, age, affiliation);
- socioprofessional status (membership in a group of specialists [caste, clan]; economic importance of the income from the activity);
- social relations between actors (types of relationships, possible contracts, relationships of subordination or authority);
- role (central or peripheral, occasional or regular involvement);
- level of competence (position in the process of apprenticeship).

C. Knowledge and expertise
- origin of knowledge (who? how? where? when?);
- degree of specialization (is knowledge widely shared outside the particular domain of activity?);
- alternative knowledge (different forms of knowledge exist, but are not put into practice).

D. Raw materials
- physical characteristics (type, composition, condition);
- origin (natural or human, original form, by-product of another activity, recycling);
- selection (types of criteria and justifications, tolerance for variation);
- alternative choices (knowledge of other potentially-usable materials).

E. Actions
- nature (basic actions on the material [Leroi-Gourhan 1971: 43-113], type of energy);
- organization (single or repeated);
- objectives.

F. Tools
- structure (material, shape, dimensions, weight, method of attachment, etc.);
- origin (manufacturer, place of manufacture, previous users);
- status (specialist or non-specialist, personal or shared);
- way or functioning (how the tool is set in motion, effects on the material being worked).

G. Relation with other activities
- actors: associations through status (e.g. caste) or practice (e.g. blacksmith/circumciser; potter/midwife);
- location (other uses of the location; primary or secondary);
- raw materials (uses in other activities);
- tools and actions (potential borrowing from other spheres of activity; similarity of bodily postures and functions);
- knowledge and know-how (transfer from one activity to another).

H. Organisation
- placement in the *chaîne opératoire* (as an essential or elective task);
- placement in the calendric cycle of the actors (seasonality, subordination to other activities).

I. Beliefs and religious practices
- nature (prohibitions, rites);
- scope (people and components involved);
- temporality (initiation and duration of activity);
- purpose (for the manufacturing process, the products, the artisan, the 'natural order'...).

J. Specialized vocabulary
(see Riquier, this volume, pp. 261-263).

III. SELECTION AND COMPARISON

The first imperative is to define a framework for comparison. Does the analysis involve examination of the history of a particular population? That of a set of populations? That of a particular region or a portion of a continent? In each case, the analyst must take care to document the technical processes within the targeted social or geographical unit, and among the surrounding communities or regions as well; it is through this process that relevant boundaries and historical relationships are liable to be identified.

Another imperative is the selection of the contributing elements for comparisons. If the *chaînes opératoires* are potential 'reservoirs of difference' (Hennion 2007), it remains necessary to identify the elements that can generate meaningful differences in a given comparative framework. Here, one should pay particular attention to changes in the nature and treatment of raw materials, in the structure and operation of tools, and in the actions or sequences of actions on materials. Among the variations, one should select those that reoccur with sufficient regularity (an isolated occurrence is rarely useful) and that seem to display contrasting distributions. One should also endeavour to identify elements that propagate and evolve along different trajectories (Gosselain 2016).

The status of similarities and differences between the *chaînes opératoires* must also be examined. Could these involve loans or innovations? Do they involve simple convergences in technical processes, without historical roots? A solid knowledge of technical processes on a continental or subcontinental scale can help the researcher evaluate these possibilities. Faced with a very specific modification to a more widespread technique, the metaphors of a 'grammar' and 'vocabulary' of technical processes may be relevant: for example, by substituting a hair roller for a cord roulette in order to produce designs on pottery, a potter follows the grammar of roulette impression, but changes the vocabulary. In contrast, technical processes that produce results very similar in appearance – as with divergent and convergent pounding in the shaping of pottery – sometimes reflect distinct operational grammars and can therefore indicate independent origins.

IV. MAPPING AND COMPARING

Three basic rules are to be followed in mapping the data. First, locate each information collection point as precisely as possible, ideally at the level of the village or neighbourhood. Second, do not place all of the information on a single map, in order to preserve its legibility. (The easiest method is to create a map for each category of data under study.) Third, if the objective is to map the presence of an element (rather than its variants), indicate the places where that element is absent, in such a way that it is easy to tell whether a blank space on a map indicates (the lack of) a particular technical process or simply a lack of data.

On the map, the spatial configuration of elements takes the form of a random distribution of points, dispersed (more or less regularly) or aggregated (in which case we speak of 'discrete distributions'). Rarely informative on their own, these distributions must be linked with other elements to make sense. The researcher must particularly seek to detect the potential effects of spatial dependence. These can include structuring elements in the landscape (lines of communication, physical barriers, ecological contrasts, variations in the density of human settlement, the presence of urban centres or of markets...) liable to affect the distribution of data being analyzed. Another form of dependence concerns social boundaries: languages, ethnic and geographical affiliation, social status, gender, and/or age groups. Finally, these distributions may be affected by political and administrative boundaries, both modern and ancient (Bromberger & Morel 2001).

The work of interpretation turns upon these phenomena of spatial dependence. It is first necessary to determine whether they directly or indirectly relate to technical factors. For example, an uneven distribution of raw materials or the existence of marked ecological contrasts can directly affect the distribution of particular technical behaviours. (Note, however, that environmental constraints often have less impact than we might think). At the same time, the micro-regional standardization of a practice may be directly linked to the presence of a commercial centre, where artisans from diverse backgrounds meet and interact with each other. However, in many cases, these relationships are indirect. One must thus identify those mechanisms that generate a correspondence between the spatial distribution of a technical trait, and a structural element of the landscape or a social or political boundary.

This is where the data collected by means of the *chaînes opératoires* are crucial, because they reveal the multiple logics underlying technical behaviour. Data on apprenticeship networks also enable us to retrace the genealogy of technical traditions. And it is through these genealogies that we can explore a multitude of socio-historical phenomena, including individual and collective mobility, marriage strategies, cultural exchanges, political developments, inter-regional relationships, and so on. (See Gosselain 2016 for a detailed development of these ideas).

Note, finally, that any technical tradition will usually appear as a heterogeneous aggregate: its components often have different origins, evolving under different conditions and at different speeds and with different distributions in space. But since they all tell us of different histories, they are necessarily complementary. It is crucial, therefore, to include the largest possible number of elements in the analytical comparison, and to augment the number of the distribution maps. Ideally, a comparative approach to technical processes should also take place simultaneously in different domains of activity.

REFERENCES

Balfet, H. (ed.). 1991. *Observer l'action technique. Des chaînes opératoires pour quoi faire ?* Paris: Éditions du CNRS.

Bartholeyns, G., Govoroff, N. & Joulian, F. (eds). 2010. *Cultures matérielles. Anthologie raisonnée* (special edition of *Techniques & Culture* 54-55, in two volumes). Paris: Éditions de la Maison des Sciences de l'homme.

Bromberger, C. & Morel, A. (ed.). 2001. *Limites floues, frontières vives. Des variations culturelles en France et en Europe*. Paris: Éditions de la Maison des Sciences de l'homme.

Gosselain, O.P. 2011. 'Technology'. In T. Insoll (ed.) *The Oxford Handbook of the Archaeology of Ritual and Religion.* Oxford: Oxford University Press, pp. 243-260.

Gosselain, O.P. 2016. 'The world is like a beanstalk : Historicizing potting practice and social relations in the Niger River area'. In A. Roddick & A. Brower Stahl (eds)? *Knowledge in motion. Constellations of learning across time and place*. Tucson: University of Arizona Press, pp. 36-66.

Haudricourt, A.G. 1955. 'Biogéographie des araires et des charrues'. *Comptes Rendus de la Société de Biogéographie* 280: 77-83.

Hennion, A. 2007. 'Those things that hold us together: taste and sociology'. *Cultural Sociology* 1 (1): 97-114.

Lemonnier, P. 1992. *Elements for an anthropology of technology* (*Anthropological Papers* 88). Ann Arbor: Museum of Anthropology, University of Michigan.

Leroi-Gourhan, A. 1971 [1943]. *L'Homme et la Matière*. Paris: Albin Michel.

GENETICS AND AFRICAN ARCHAEOLOGY

Scott MacEachern[1]

INTRODUCTION

Genetic research in Africa has the potential to inform archaeology in a whole variety of ways, most obviously through comparisons of archaeological and genetic reconstructions of historical processes, like the Bantu Expansion or the development of the Swahili states. If such reconstructions agree, our confidence in our understandings of the past is strengthened. If they do not agree, at least we know that something more complex is going on. In many ways, the relationship between genetic research and archaeology now is similar to that between radiocarbon dating and archaeological research fifty years ago: we are trying to fit a powerful new technique into our discipline, and it is both transforming our knowledge of the past and generating challenges for researchers.

I. VARIETIES OF ANALYSES

There are many different kinds of analyses used by genetic researchers in historical studies, and archaeologists need to understand the differences between them. Since the 1990s, much of this work has involved **lineage-based analyses,** which study those parts of the genome that do not undergo recombination and are thus passed down untransformed from one generation to the next. The best known such system is mitochondrial DNA (mtDNA), which is inherited maternally: all of us have inherited mtDNA from our mothers, who have in turn inherited it from their mothers, and so on. Similarly, men inherit the Non-recombining Region of the Y-chromosome (NRY) from their fathers, who inherited it from their fathers and so on back through time. This lack of recombination between generations makes the definition of historical lineages relatively straightforward. Both mtDNA and NRY mutate fairly rapidly, which allows studies of human population history at scales that are useful archaeologically. Since mtDNA and NRY are passed down maternally and paternally, researchers can compare them to gain information on social processes that affect men and women differently, such as marriage patterns. However, lineage-based analyses only provide information on one single line of maternal or paternal descent, among the vast number of ancestors of any individual. This is a major limitation.

Analysis of **autosomal DNA** (i.e. DNA from the recombining portions of the human genome) avoids this disadvantage, since it reflects genetic contributions from all of our ancestors. The disadvantage of autosomal analysis is that definition of historical lineages is impossible over significant time periods; instead, the result is a biogeographic comparison of sampled modern populations. Such research has recently advanced with new analytical techniques, especially using *single-nucleotide polymorphisms* (SNPs or 'snips'). These techniques allow simultaneous comparison of variation at tens or hundreds of thousands of genetic locations from thousands of individuals, in 'genome-wide' or 'whole-genome' scans. This allows a more complete examination of genetic similarities and differences, and more detailed analysis of the relationships between modern populations.

II. CHALLENGES OF DATA COMPARISON

Collaboration between geneticists and archaeologists can occur when comparable data sources deriving from the two fields can be tested against one another. Data from both fields must first exist for the area under study, which in Africa is by no means a given. For example, a great deal of genetic research has been undertaken on modern African forager groups, especially Khoisan and Pygmy/BaTwa populations (Tishkoff *et al.* 2007), and populations in certain geographical areas, like the southern Lake Chad Basin, are reasonably well known. On the other hand, genetic research on farming populations in most of central, southwestern and southern Africa is quite limited, little genetic research has been undertaken on Saharan populations, and in eastern Africa many Bantu-, Cushitic-, and Nilotic-speaking groups have never been studied. Archaeologically as well, some areas of Africa are far better known than are others, and few regions offer detailed archaeological and genetic data for the same populations.

Even if comparable genetic and archaeological data do exist, basic questions remain: how do we compare variation in genetic characteristics with variation in material culture? How can we tell, for example, that a particular distribution of material culture (pottery, let's say) and particular kinds of genetic variation both refer to a historical phenomenon that we call the 'Bantu Expansion'?

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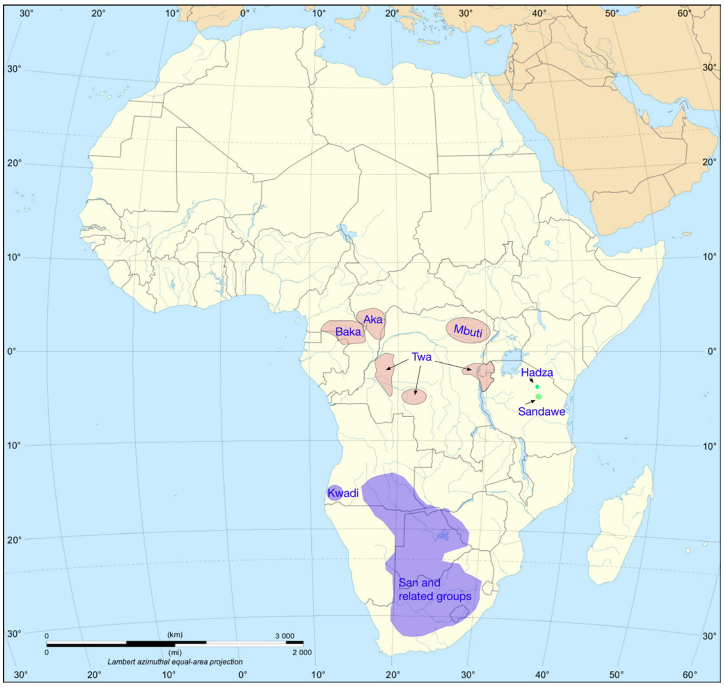

Fig. 1. Approximate extents of Pygmy/BaTwa (orange), San (purple) and Sandawe and Hadza (green) populations.

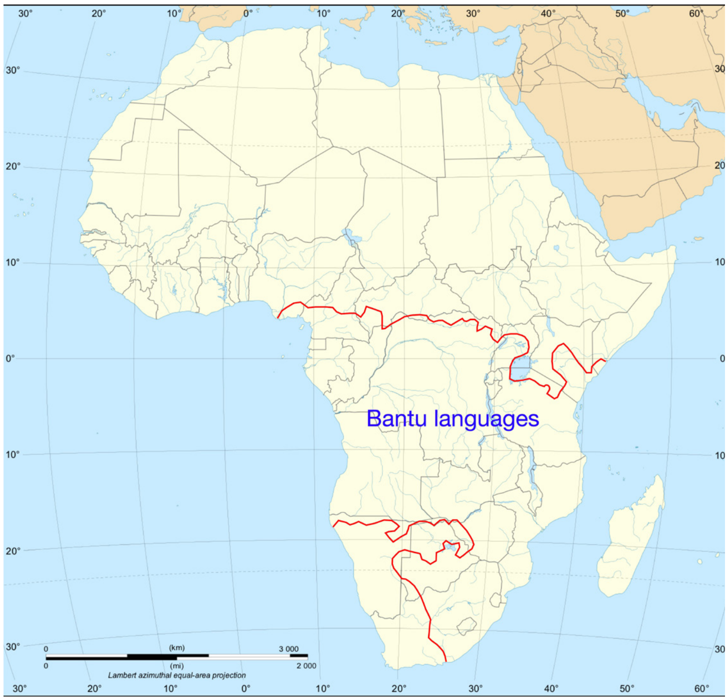

Fig. 2. Approximate extent of the Bantu languages.

This is particularly a problem because techniques for estimating the age of genetic processes – the occurrence of a particular mutation, for example – are far less precise than radiocarbon dating. Significant issues of scale also exist. Genetic research in Africa has been concerned with historical reconstructions that operate over large areas and significant time-scales. Geneticists rarely recognise intermediate level of genetic identity between the individual and the ethnic group, even we know that many modern African populations include people with very diverse ancestries. Analysts therefore know little about the structuring of genetic variability within ethnic groups or the relationships between ethnic boundaries and 'genetic boundaries' – even though this is an important question historically.

Finally, researchers working in Africa – both archaeologists and geneticists – often do not take enough account of research perspectives outside their own disciplines. Archaeologists and other social scientists are often intimidated by the specialised terminologies and complex procedures associated with genetic research. Geneticists often do not appear to appreciate the scope of research in the social sciences, including African archaeology, and in some cases employ inadequate or dated sources in formulating their own historical constructions. At the same time, effective collaboration does occur.

III. EXAMPLES OF RESEARCH

A. Origins of modern humans.

Some of the best-known genetic research in Africa involves the study of maternal and paternal lineages that link modern peoples around the world to the earliest populations of *Homo sapiens* (Cann *et al.* 1987). Current estimates for the most recent common ancestor of modern humans based on mtDNA data yield a date of approximately 160,000 years, in good agreement with skeletal evidence for the appearance of *Homo sapiens idaltu*, with a subsequent expansion of modern humans out of Africa approximately 70-50,000 years ago.

Research on the origins of modern humans in Africa mostly uses data from modern African forager populations. San and Pygmy/BaTwa populations (**fig. 1**) tend to exhibit mtDNA and NRY lineages that exist close to the roots of phylogenetic trees for these genetic systems, with evidence that these lineages were isolated in Africa during much of the Middle/Upper Pleistocene. Even the Sandawe and Hadza, living only about 150 km apart, are claimed to have been genetically isolated for 15-20,000 years, with such isolation ending only within perhaps the last 4000 years (Tishkoff *et al.* 2007).

Such data have implications for how archaeologists view the cultural evolution of modern humans during the Pleistocene. They are especially significant for un-

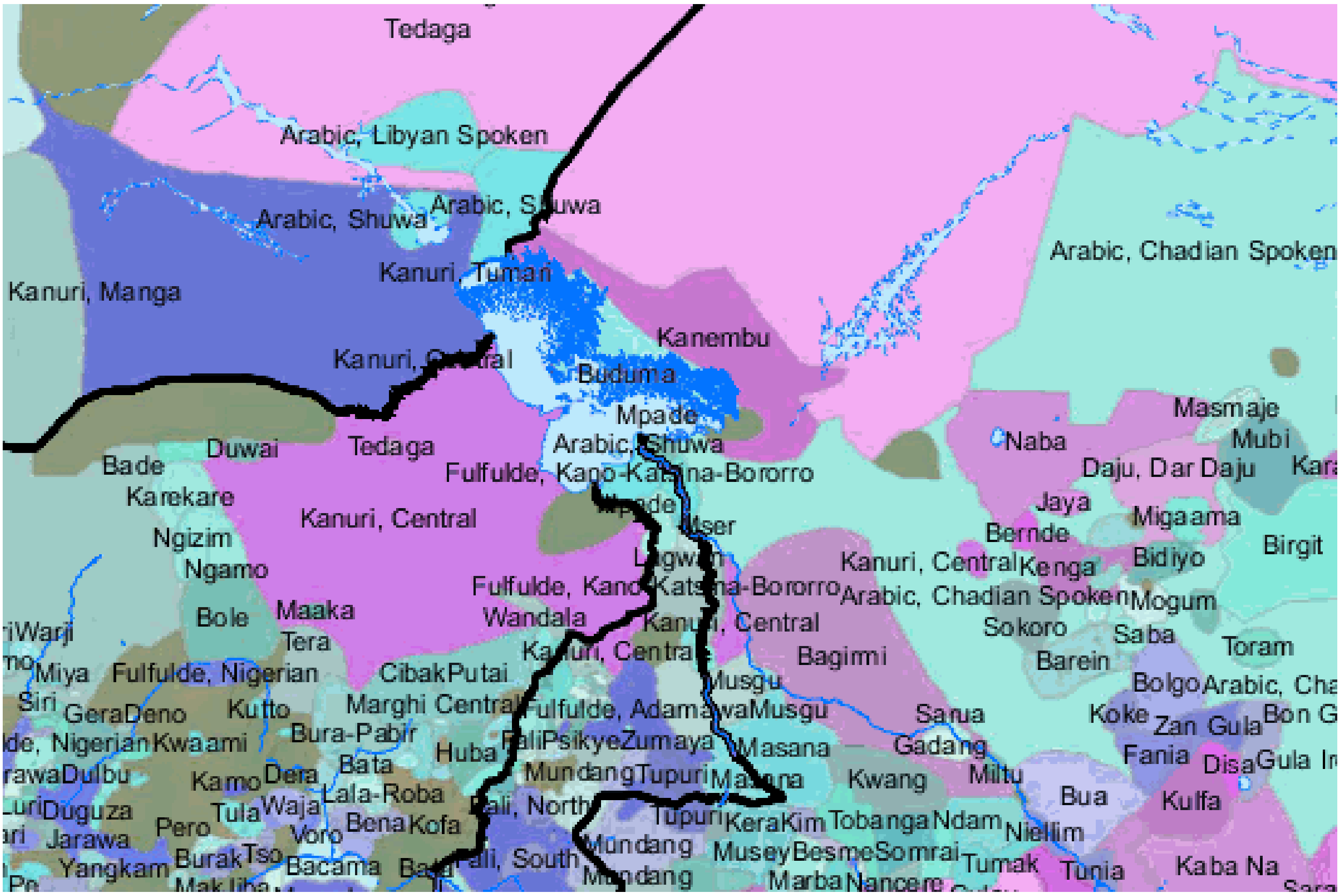

Fig. 3. Some representative ethnic groups of the Lake Chad Basin.

derstanding widespread Middle Stone Age industrial traditions since they imply the existence of only small and isolated human populations in eastern and southern Africa over much of the period of modern human evolution. Archaeological evidence does not, however, seem to support the isolation of these populations for tens of millennia for the late Pleistocene, although that might partly be due to assumptions that archaeologists have brought to their data. It is difficult to understand how environmental change could have enforced population separations on the order of 50-100,000 years, as interpreted from the mtDNA data.

B. The 'Bantu expansion'

Genetic analyses in Africa are often used to generate evidence for prehistoric population expansions and migrations in different parts of the continent, often with the assumption that such population expansions occur as well-integrated 'packages' as farmers spread into a region. Thus, the most intensively studied phenomenon in African genetic research is the 'Bantu Expansion' (Bostoen *et al*. 2009; Berniell-Lee *et al*. 2009). There is of course also a large linguistic, archaeological, and ethnographic literature on the processes through which Bantu languages came to be spoken over large areas of Africa (**fig. 2**) , which can be compared to the genetic data. One of the most important contributions of genetic research to this point has been in analysis of migration of Bantu populations in southwestern Africa, an area little known archaeologically.

Genetic evidence indicates that the Bantu expansion was indeed a demographic phenomenon, involving migrations of people as well as a spread of language and culture. At this point, genetic data are not sufficiently fine-grained to inform us about the origins of these population movements, and so geneticists and archaeologists use linguistic reconstructions to locate their origins in the southern borderlands between Nigeria and Cameroon. Genetic data can also provide us with information about the demography of the Bantu expansion. Diversity in NRY (paternal) lineages among modern Bantu-speaking populations is

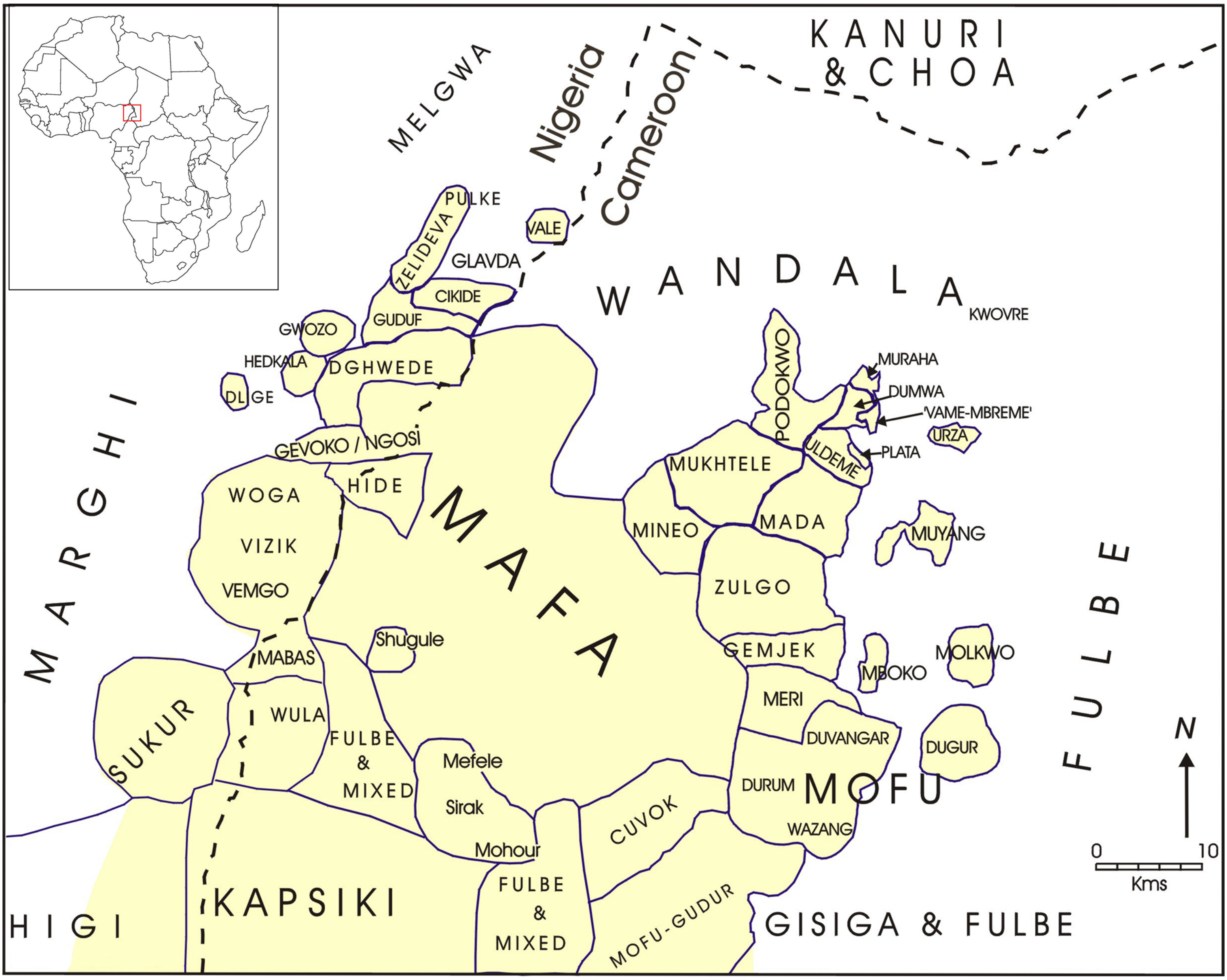

Fig. 4. Central Chadic-speaking and neighbouring populations of northern Cameroon and Nigeria.

significantly lower than is mtDNA (maternal) diversity (Bostoen *et al.* 2009). This may imply that women from forager communities more often married into Bantu-speaking farmer communities, and had children with men from those communities, than the other way around, and that men frequently had multiple wives. This would also be associated with adoption of Bantu languages by the in-marrying woman, and by the children of these couples.

C. Population dynamics in the southern Lake Chad Basin

In areas beyond those where Bantu is spoken, other ancient population relationships receive more attention. One such area has been the southern Lake Chad Basin, an area of great linguistic and cultural diversity (**figs. 3 and 4**), probably because of its central location along routes of migration and trade linking the Atlantic with the Nile and North Africa with areas south of the Sahara. Along the basin's southern peripheries, ethnic diversity is greater than almost anywhere else in Africa, especially among Chadic-speaking populations that have been one focus of genetic investigations for more than two decades. The region's location and cultural characteristics have also encouraged ethnographic, archaeological and linguistic research during the last 60 years, making it one of the few areas of sub-Saharan Africa where detailed comparisons between the findings of all these different disciplines may be feasible.

The results of this research have been varied. Genetic research from the late 1990s identified some Lake

Chad Basin populations as *paléonigritique*, an obsolete designation dating to before World War Two implying unchanged remnants of an ancient stratum of African humanity, isolated in refuge areas by more advanced societies. At more or less the same time, however, other researchers used NRY data to posit long-range connections between some of these 'isolated' Chadic-speaking groups and West Asian/North African populations, a connection which might be associated with early Holocene human movement across a 'Green Sahara'.

Ten years later, genetic understandings are much richer. We have data on mtDNA, NRY, and autosomal genetic variation for many Lake Chad Basin populations (Coia *et al*. 2005; Cerny *et al*. 2009; Cruciani *et al*. 2010), making possible interesting, albeit preliminary, reconstructions of population relationships and migrations over the last 7-8000 years. These involve an early Holocene movement into the region from the Nile Valley of ancestral Nilo-Saharan speakers, and their subsequent interactions with ancestral Chadic-speaking groups moving out of a drying Sahara (Tishkoff *et al.* 2009). One contribution of genetic research to these issues lies in its identification of significant east-west migrations and interactions south of the Sahara, between East Africa, the Nile and Lake Chad. Archaeologists working in this area have tended not to consider such east-west connections, because of the lack of archaeological data available east of Lake Chad and in southern Sudan. The genetic research thus provides valuable correctives for future archaeological fieldwork.

IV. AN INTERDISCIPLINARY FUTURE

Across the continent, there are still challenges in comparing archaeological and genetic data. How can researchers establish linkages between patterns in these different kinds of data? How do geneticists best account for different historical results when different genetic systems are being studied, just as archaeologists may get different results when comparing different realms of material culture? How do researchers reconcile anthropological evidence that African populations often have very diverse origins, with frequent genetic assumptions that groups are homogeneous? These challenges are significant, but archaeologists should not let these difficulties obscure the tremendous capabilities that exist in genetic studies of African history. The development of truly interdisciplinary research initiatives, involving genetics, archaeology, historical linguistics, and related disciplines, has the potential to transform our understanding of the African past.

REFERENCES

Berniell-Lee, G., Calafell, F., Bosch, E. *et al.* 2009. 'Genetic and demographic implications of the Bantu Expansion: insights from human paternal lineages'. *Molecular Biology and Evolution* 26(7): 1581-1589.

Bostoen, K., de Filippo, C. & Pakendorf, B. 2009. 'Molecular anthropological perspectives on the Bantu expansion: facts and fiction'. Paper presented at the Annual meeting of the African Studies Association, New Orleans, LA.

Cann, R., Stoneking, M. & Wilson, A. 1987. 'Mitochondrial DNA and human evolution'. *Nature* 325: 31-36.

Cerny, V., Fernandes, V., Costa, M. *et al.* 2009. 'Migration of Chadic speaking pastoralists within Africa based on population structure of Chad Basin and phylogeography of mitochondrial L3f haplogroup'. *BMC Evolutionary Biology* 9: 63.

Coia, V., Destro-Bisol, G., Verginelli, F. *et al.* 2005. 'mtDNA variation in north Cameroon: lack of Asian lineages and implications for back migration from Asia to sub-Saharan Africa'. *American Journal of Physical Anthropology* 128: 678-681.

Cruciani, F., Trombetta, B., Sellitto, D. *et al.* 2010. 'Human Y chromosome haplogroup R-V88: a paternal genetic record of early mid Holocene trans-Saharan connections and the spread of Chadic languages'. *European Journal of Human Genetics* 18: 800-807.

Tishkoff, S. A., Gonder, M.K., Henn, B.M. *et al.* 2007. 'History of click-speaking populations of Africa inferred from mtDNA and Y chromosome genetic variation'. *Molecular Biology and Evolution* 24(10): 2180-2195.

Tishkoff, S. A., Reed, F.A., Friedlaender, F.R. *et al.* 2009. 'The genetic structure and history of Africans and African Americans'. *Science*: 1172257. http://www.sciencemag.org/cgi/content/abstract/1172257v1

Chapter 7

Publishing archaeological research results

INTRODUCTION

Isabelle Gérard[1]

No research, no fieldwork, no laboratory analysis is really finished until its results are shared with the scientific community, with disciplinary colleagues scattered around the world. It is the publication of the findings, analyses and conclusions that permits this communication, and that stimulates debate and deeper insights and even the continuation of the project.

Preparing the manuscript of an article, or even a monograph, is an exercise that involves a large number of rules and best practices, beginning with the use of English, the language of international scientific communication, and respect for orthographic, grammatical and typographic usages (see the specialized literature[2]). One should not hesitate to ask for help with translation, revision, and proofreading, and one should always have one or more colleagues review the submission: be open to their comments and corrections, step back from the text.

Then, as **Peter Robertshaw** says, one has to contextualize the text, by reading many of the publications about the subject or the project and in particular consulting articles appearing in the journal where the author would like to submit an article. Reading these latter will also make it possible to see concretely how the ‘Instructions to authors’ for the journal are used; these will have been downloaded or requested from the publisher before anything else is done.

To help choose the periodical or editorial collection for submission of a manuscript, one must ask the right questions: “How is my article relevant to the discipline? Which journals are read by my target audience? Are there impact factor journals in my field, and which one is best? Are there any indexed journals? Are they open access?” **Elena A. Garcea**, in her review, gives a description of the most representative journals and series for archaeology, and **J.-P. Devroey** explains in detail the characteristics of online and open access (OA) journals.

Nevertheless, it will be necessary to remain realistic: a junior scholar will often find acceptance of their first article difficult, especially in a journal with high impact factor. The more the author aims for the reputation of publication in an international journal, the more ruthless the evaluation by the editorial board and the peer reviewers and the higher the rejection rate (see **Robertshaw**).

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1 Royal Museum for Central Africa, Tervuren, and Royal Belgian Institute for Natural Sciences, Brussels.

2 Dictionaries, grammar guides, and style guides: an example for English woudl be the *Chicago Manual of Style,* University of Chicago Press. Also pay attention to the presentation of bibliographical references, which reflects your precision and your attentiveness to the author guidelines.

At the beginning of a career, it is useful to find the proper balance between the best disciplinary choice and the modesty of someone just starting in the field; it is sometimes better to first publish in a journal without a (high) impact factor, or to approach a local journal or one dedicated to development cooperation, for example. Armed with this first article, one can then progressively move towards more ambitious submissions... even though we know that today publications in high-ranking journals are an essential element in building a scientific career.

The submission process is not negligible in and of itself! The text must first be reviewed and verified in terms of its conformance to the journal's requirements. Today, most submissions are made online, using platforms like Open Journal System or Editorial Manager that are used by journal publishers. One must register, observe the procedures and read all of the notices, even small ones and those 'hidden' in a second screen window, because that is where the contractual conditions will be found: does the author have to pay Author Processing Charges? Does the author maintain rights to their text and data? What can be published in parallel in a university repository or on social networks dedicated to researchers, such as Researchgate (a preprint, a postprint or the publisher's final PDF of the article)? **J.-P. Devroey's** warning about the hybrid journals that have made Open Access a profitable business helps us to understand this unavoidable context of open access publishing, which may permit more frequent publications but sometimes in rather unsavory conditions!

PREPARING A MANUSCRIPT AND THE PROCESS OF PEER-REVIEW

Peter Robertshaw[1]

I. THE MANUSCRIPT

Let's assume that you have collected and analysed some archaeological data. Perhaps you have incorporated this work within your completed master's thesis or doctoral dissertation or perhaps this was a smaller-scale research project. Either way you would like to publish your work, both because you think that it is interesting and potentially important for our discipline and because it may help you to advance your career. Thus, the question is, how do you go about the task of getting published? First, it is important that you recognize at the outset that just because you have some archaeological data and academic qualifications that demonstrate that you are a bona fide archaeologist, this does not mean that your data and your work are worthy of publication.

To be worthy of publication your work must do more than add data to the store of knowledge, it must also advance our knowledge by contributing something new to a debate in our discipline or by filling in a gap in our knowledge that thereby helps us to understand the African past better and in more detail. Therefore, it is crucial that you can place your work within an academic context. You probably did this already when you wrote your thesis or dissertation or your grant proposal that funded your work. However, it is also possible that you obtained a contract to do some CRM archaeology, e.g. surveying the route of a new pipeline, that did not require you to think about the importance of what you might find. Well, now you have to think about the relevance of your work, which means that you should be familiar with the academic literature, not just that about the archaeology of 'your' region of Africa but also whatever broader issues and trends in our discipline that interest you. The ability to place your work within an academic context is a crucial component of successful publication. If you do not have access, in person or online, to good library facilities, remember that most of your colleagues who do enjoy these advantages will be very happy to help you by sending relevant articles electronically. Also, many researchers now make their papers available to everyone using websites like academia.edu and researchgate.net.

Now let's assume that you can place your work within an academic context, that you know the relevant literature, and that you are reasonably confident that you have something important to contribute. If you cannot answer 'yes' to all these assumptions, then perhaps you can still publish your data somewhere where it will not be peer-reviewed, perhaps in *Nyame Akuma* (the bulletin of the Society of Africanist Archaeologists) or even on a website that you yourself might create. Publications that are not reviewed, prior to publication, by your peers (often more senior professional archaeologists) may contain important data but they are perhaps unlikely to help you advance your career.

Thus, let us assume that you are ready to publish something that will be peer-reviewed. Well, will it be a book or a journal article? And who will publish it? Many archaeologists publish their doctoral dissertations as reports in the 'British Archaeological Reports' series of Archaeopress; this is perfectly acceptable and a good way to publish your dissertation rapidly, though the drawbacks are that these are cheaply produced books that are often not reviewed by major journals and unlikely to sell many copies. Your book will receive much more attention and more sales if it is published by a major academic publisher such as a well-known university press. The problem is, of course, that these publishers will hold your work to much higher standards and will require you to submit a detailed book proposal that explains why your work is important, an outline of the contents of each chapter, a discussion of the potential market for your book and of its competition from similar books. This proposal will be sent to several senior reviewers and, probably after some months, you may or may not be offered a contract to write the book by a deadline. Once the book is written – no small job – then your manuscript will again be subject to rigorous refereeing. This does not mean that you should not even try to have your work published as a book, but it does mean that you must be prepared to work very hard and be very dedicated and determined. Even if you do want to write a book, I encourage you first to write a journal article on some aspect of your work because this will also require hard work and determination but without

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your having to commit several years of your life to the project.

There are numerous archaeological journals to which you could submit your work, such as prestigious international journals that accept articles about archaeology all around the world; to name but a few and in no priority order: *Antiquity*; *Journal of Social Archaeology*; *Journal of Anthropological Archaeology*; *Current Anthropology*; *Journal of World Prehistory*; *Journal of Archaeological Science*. Perhaps your work would be more at home in a peer-reviewed journal that focuses on African archaeology; for example, *African Archaeological Review*; *Azania: Archaeological Research in Africa*; *Journal of African Archaeology*; *South African Archaeological Bulletin*. To choose where to submit your work, look at past issues of the journal and see what kinds of articles each publishes: where would your work fit best?

Once you have selected your journal, go to the journal's website, download and print the 'instructions for authors'. You should follow these instructions closely throughout the process of preparing and submitting your article; failure to do so will annoy the editors of the journal. These instructions will, however, probably not tell you how to structure your paper; editors assume that authors are the experts on how best to organize the presentation of their work. To help you, look at published papers: how are they organized and what headings and sub-headings do they use? Decide how best to organize your paper and then write it. Be ready to rewrite and revise your paper several times; writing is a skill that requires a lot of practice. Are your arguments and your presentation of your data clear and logical? Have you written about things that are not relevant to the goals of your paper? If so, get rid of them. Have you stayed within the journal's word limit? Some journals will accept longer papers but not if the editors and referees think that the length is not justified by the content. Be concise and precise. Have you included all the relevant references, not just articles and books that you have written? If you have quoted somebody or paraphrased their writing a little, have you put the quotation in quotation marks and cited the source? The worst thing that can happen to you is to be found guilty of plagiarism; then you may never publish anything ever again.

OK, now you have written a draft of your paper that you feel is good, so what's next? Have you presented some of your data or other information in tables? That is much better than having lists, especially lists of numbers, in the text of your article. Never repeat in the text what is in a table. What about figures? Minimally you will probably need a map. If you cannot prepare a map yourself, e.g. by using Adobe Illustrator, you may need to pay somebody to do this for you. This is not the job of the journal's editors. The same is true of things like artifact illustrations. You can also include digital photos, which can often be published in color, but make sure that they convey information, have good contrast, and are at a high-enough resolution to satisfy the journal's publisher. Again, check the 'instructions for authors' and compare your work to published figures in the journal. Similarly, have you checked that your references are exactly in the format required by the journal? Finally, if you have not done so already, you need to write the abstract, again sticking to the word limit required by the journal. The abstract should concisely convey the subject of your paper and its major conclusions; write it in an active voice.

II. THE SUBMISSION PROCESS AND PEER REVIEW

If you are writing a book and you have a contract from a publisher, then send your editor a draft chapter before you have written the whole book. If your editor likes your draft chapter, then you will be more confident about writing the rest of the book. Once you have finished the book manuscript, send it to your editor. However, unlike a journal article, you probably will not need to have completed all the figures before sending in the manuscript. For a journal article, everything, including all the figures, should be complete before you submit it, following the journal's submission instructions. Often journal articles are submitted electronically on the publisher's website.

Once submitted, the editors will send your book or article to at least two and often several referees. The editors might also ask you to suggest the names of some potential referees, but it is the editors' job, not yours, to contact those people. Some referees will read an article and provide a report to the journal editors within a few days but others may take weeks, perhaps months. Usually editors allow about a month for referees to respond, but the process can often drag on for longer. Be patient, though it is OK to inquire politely about the status of your submission after a couple of months. Eventually the moment of truth will arrive and you will open the email from the editors with trepidation. There are four possible outcomes: 1) acceptance; 2) acceptance with minor revisions; 3) major revisions; 4) outright rejection. Be aware that the first outcome is very rare and so don't get your hopes too high. The second one is usually the best you can hope for. Do the minor revisions requested and resubmit your article as soon as you can. The editors will want to see that you made the requested revisions but they will probably not send the paper out to referees again. Outcome 3 is the most common response for major journals, especially where there are several referees. If you get this response, do not give up and do not take it as a personal attack or as an indication that your work is not worthy of publication. It is worthy but the referees believe that your paper can be considerably better. Believe them and do the revisions, but only after giving yourself a day or two to calm down and get beyond your initial disappointment. Work through the revisions methodically. The required changes may seem overwhelming at first, but do them one by one and they become manageable. You can disagree with the referees on some issues; if you do, when you resubmit your paper, make your case to the editors explaining why you rejected some suggested revisions. However, you cannot simply refuse to make all the revisions because you disagree with the referees. If you try to do that, your paper will be rejected. If your paper is rejected (outcome 4), you can be disappointed, even angry, but it will not do your reputation any good if you write an angry letter to the editors. The editors have used their professional judgment based on their knowledge and the referees' reports. They do not deserve your anger. Moreover, they are often unpaid and certainly underpaid for their work. They do the job out of their love for archaeology, which they share with you. If your paper is rejected, read the referees' reports and any remarks from the editors carefully; think about how you could make your paper better, not about what idiots the referees are. Perhaps you could revise it and send it to another journal, where a different set of referees may look at your work more favourably. Your paper might not be deemed good enough for *Science*, for example, but it might well be good enough for *Azania*. Remember that almost all your colleagues whom you respect have had papers rejected during their careers.

Finally, once your manuscript is accepted, make sure that you correct the proofs that you receive in a timely manner and following the journal's instructions. If you are prompt and easy to work with, the journal and its editors will be happy to work with you again.

WHERE TO PUBLISH?

Elena A.A. Garcea[1]

I. WHICH PUBLICATION FORMAT?

There are different formats for publishing scientific data: journals, chapters in edited books, contributions in conference proceedings, and monographic volumes. Chapters in edited books are usually compiled by ad-hoc editors of volumes who select the authors they consider to be knowledgeable and invite them to provide their contributions on a specifically identified subject. Among others, edited books on specific aspects of African archaeology include Shaw *et al*. (1993), Lenssen-Erz *et al*. (2002), Stahl (2005), and Mitchell & Lane (2013).

It is relatively easier to contact journal editors and the publishers of monographic volumes and this can be done individually, once an author is ready to submit his/her manuscript for publication (see Robertshaw, this volume, pp. 304-306).

The journals wherein to publish an article on African archaeology are virtually uncountable. **Table 1** provides a very partial, but sufficiently indicative, list of journals that have published articles on African archaeology from 2000 to early 2017.[2] However, there are many other archaeology journals with a worldwide scope, not included in this list, which can publish papers on African archaeology. The purpose of this list is to demonstrate that there exists a non-Africanist audience for papers devoted to African archaeology, and that publishers are increasingly keen on accepting contributions about this continent.

For reasons of space, this chapter cannot consider all these journals, but nevertheless seeks to provide a useful tool in mentioning some of them with their corresponding websites (**Table 1**), and in focusing on the major journals and book series entirely dedicated to African archaeology.

II. AFRICAN ARCHAEOLOGY ORIENTATED JOURNALS AND MONOGRAPHIC SERIES

There are several journals and monographic series dedicated to African archaeology. Here, they are presented in alphabetical order with their aims and major topics of interest. Most of them, but not all, are peer-reviewed (Robertshaw, this volume, p. 304-306). This means that submitted manuscripts are subject to initial appraisal by the journal editor, and, if found suitable for further consideration, to peer review usually by one or two independent, anonymous referees.

A. Journals

African Archaeological Review

Published in collaboration with the Society of Africanist Archaeologists (SAfA, http://www.safa.rice.edu), this journal aims at highlighting the contributions of Africa to key global archaeological issues, as well as enhancing the place of Africa in world archaeology. Papers should present new field data liable to improve the understanding of interregional processes, major cultural changes, and transitions in Africa's past. They can also offer new interpretations on cultural continuities and discontinuities, interregional interactions, biocultural evolution, cultural dynamics and ecology, the role of cultural materials in politics and ideology, the application of ethnohistorical, textual, and ethnoarchaeological data in archaeological interpretation, conservation, management of cultural heritage, information technology, and public archaeology. Some of the topics include earliest manifestations of human culture, the emergence of modern humans, and the origins of African plant and animal domesticates. Papers can be submitted in either English or French and are peer-reviewed.

Afrique : archéologie & arts

It is dedicated to the study of the archaeology and the arts of Africa with an art history approach. Articles on archaeological artistic productions from the entire African continent are welcome. This journal accepts original and unpublished works, as well as summaries on specific topics. A place is also given to current university research by publishing summaries of dissertations and theses. This journal is now also available on the OpenEdition platform of Revue.org (http://www.openedition.org/13352). Papers can be submitted in either English or French and are submitted to a reading committee usually composed of members of the editorial scientific board and occasionally external reviewers.

Azania: Archaeological Research in Africa

As the journal of the British Institute in Eastern Africa, it was originally created to publish papers on the archaeology

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2 Most information included in this list was kindly provided by Dominique Commelin of the library of the Laboratoire méditerranéen de préhistoire Europe Afrique (Lampea, Mediterranean Laboratory of prehistory, Europe Africa), whom I sincerely thank. Data on African archaeology orientated journals were updated by the present author.

and precolonial history of Eastern Africa, but now covers all aspects of African archaeology, as well as the connections between Africa and other parts of the world, regardless of temporal or spatial boundaries. It publishes original papers and briefer research reports on the results of fieldwork, new methodologies, syntheses of key topics or debates, issues of current theoretical concern, and connections of history, theory and methodology with other disciplines (for example, history, linguistics, genetics, etc.). Papers can be submitted in either English or French and are peer-reviewed.

Journal of African Archaeology
It is published in collaboration with the Society of Africanist Archaeologists (SAfA). Its main purpose is to provide scholars and students with a pan-African forum for discussing relevant topics on the cultural dynamics of past African societies. It publishes original papers on recent research and developments in African archaeology and related disciplines with no geographical, chronological, or thematic limitations. Theoretical considerations, synthesis, short notes, and reports on recent fieldwork are

Journal	**Website**	**No. of articles**
African Archaeological Review	http://link.springer.com/journal/10437	175
Afrique : Archéologie & Arts (since 2001)	http://etudes-africaines.cnrs.fr/prez_revue/afrique-archeologie-arts; http://www.openedition.org/13352; Contact: revue.aaa@mae-u-paris10.fr	64
Almogaren	www.almogaren.org	25
Antiquity	http://antiquity.ac.uk	47
Archéologia	http://www.archeologia-magazine.com	14
Azania: Archaeological Research in Africa	http://www.tandfonline.com/loi/raza20	236
Bulletin de la Société préhistorique française	http://www.prehistoire.org/515_p_21855/le-bulletin-de-la-spf.html	11
Bulletin du Musée d'Anthropologie préhistorique de Monaco	http://map-mc.org/bulletin	5
Bulletins et Mémoires de la Société d'Anthropologie de Paris	https://bmsap.revues.org	11
Cahiers de l'Association des Amis de l'Art rupestre saharien	http://aars.fr/cahiers_18_en.html	26
Comptes Rendus Palevol	http://www.sciencedirect.com/science/journal/16310683	12
Current Anthropology	http://www.press.uchicago.edu/ucp/journals/journal/ca.html	36
Geoarchaeology	http://eu.wiley.com/WileyCDA/WileyTitle/productCd-GEA.html	14
Ikosim	http://www.lemag.ma/english/Ikosim-journal-of-North-African-archaeological-studies-is-published_a1693.html	7
International Newsletter on Rock Art	http://www.icomos.org/en/about-the-centre/periodicals/periodiques-en-ligne-2/165-articles-en-francais/centre-de-documentation/557-inora-international-newsletter-on-rock-art	4
Journal of African Archaeology (since 2003)	**http://www.african-archaeology.de**	153
Journal of African Earth Sciences	http://www.sciencedirect.com/science/journal/1464343X	148
Journal of Anthropological Archaeology	http://www.sciencedirect.com/science/journal/02784165	19
Journal of Archaeological Science	http://www.sciencedirect.com/science/journal/03054403	129
Journal of Human Evolution	http://www.sciencedirect.com/science/journal/00472484	211
L'Anthropologie (Paris)	http://www.journals.elsevier.com/lanthropologie	12
Nature	http://www.nature.com	29
Nyame Akuma	http://safa.rice.edu/NyameAkumaBulletin	260
Palaeogeography, Palaeoclimatology, Palaeoecology	http://www.sciencedirect.com/science/journal/00310182	60
PLoS ONE	http://www.plosone.org	53
Préhistoires méditerranéennes auparavant Préhistoire Anthropologie méditerranéenne)	http://pm.revues.org	21
Proceedings of the National Academy of Sciences of the United States of America	http://www.pnas.org	64
Quaternaire	http://quaternaire.revues.org	17
Quaternary Geochronology	http://www.sciencedirect.com/science/journal/18711014	14
Quaternary International	http://www.sciencedirect.com/science/journal/10406182	181
Quaternary Research	http://www.sciencedirect.com/science/journal/00335894	23
Quaternary Science Reviews	http://www.sciencedirect.com/science/journal/02773791	56
Sahara. Preistoria e Storia del Sahara	arrêté	62
Science	http://www.sciencemag.org	47
South African Archaeological Bulletin	http://www.archaeologysa.co.za/saab	231
Sudan & Nubia	http://www.sudarchrs.org.uk/resources/publications/bulletin-sudan-nubia	261
The Holocene	http://hol.sagepub.com	15

Table 1. Indicative list of journals and total number of papers published on African archaeology from 2000 to early 2017 (modified from the database of the library of the Laboratoire méditerranéen de préhistoire Afrique Europe - Lampea: http://lampea.cnrs.fr).

also accepted. Papers can be submitted in either English or French and are peer-reviewed.

Nyame Akuma
It is the bulletin of the Society of Africanist Archaeologists (SAfA). It aims at publishing short articles on all aspects of African archaeology and at providing a regular update on current fieldwork in Africa. It is not refereed by peer reviewers and is not intended for the publication of major articles. Papers can be submitted in either English or French.

Préhistoires méditerranéennes
Previously called *Préhistoire Anthropologie méditerranéennes*, it welcomes any original contribution on the prehistory of the Mediterranean basin, including North Africa and the Sahara. It aims at offering a space for theoretical debates and at encouraging a lively forum for scientific discussions and diverging opinions. All articles in the new series of this journal are available online on the open-access portal OpenEdition (http://pm.revues.org) and are printed on paper in yearly issues. Special issues on specific topics can also be published in the form of supplements. Papers can be submitted in either English or French.

South African Archaeological Bulletin
It is the journal of the Association of Southern African Professional Archaeologists (ASAPA). Its founding principles were to balance so-called ‘academic excellence’ with a ‘fight against embroiled and over-complicated jargon’ and to offer a longstanding commitment to public archaeology. Its main purpose is to raise the profile of African archaeological research and to demonstrate the key importance of archaeology within post-colonial Africa. It publishes original research articles, field and technical reports, and discussion forum contributions on all aspects of African archaeology. Papers can be submitted in English and are peer-reviewed.

Sudan & Nubia
It is the bulletin of the Sudan Archaeological Research Society (SARS) and is dedicated to the archaeology of Sudan, South Sudan, and Egyptian Nubia. It includes short papers on recent fieldwork, including reports on just finished surveys and excavations. It presents the British archaeological activities in those areas, but also welcomes contributions by foreign scholars working in the areas. Papers can be submitted in English.

B. Books
Scientific volumes are also subject to peer review, usually consisting of a preliminary evaluation by the editor and, if approved, of at least two qualified outside reviewers familiar with the specific topics and areas who provide constructive commentary and advice regarding the manuscript.

‘*Journal of African Archaeology* Monograph Series’
This series is a supplement to the *Journal of African Archaeology*. It has been created to offer a platform for more extensive contributions on African archaeology and related disciplines, such as ample research data, refereed conference proceedings, and other collections that are too long and detailed to fit the journal’s scope. Volumes may take the form of monographs or multi-authored works including thematically diverse contributions. Manuscripts can be submitted in either English or French and are peer-reviewed (http://www.african-archaeology.de/?page_id=160).

‘SpringerBriefs in African Archaeology: contributions from Africa’
‘Contributions from Africa’ is a subseries within the series ‘SpringerBriefs in Archaeology’, which has been recently enlarged with a subseries devoted to African archaeology. It is sponsored, though not financed, by the Society of Africanist Archaeologists (SAfA), whose sponsorship with the publisher seeks to enhance the dissemination of knowledge about Africa’s past and to highlight the scientific relevance of African archaeology in broader archaeological debates. Contributions focus on the global implications of African archaeology with diverse theoretical and conceptual views and aim at developing the significance of African archaeology for readers unfamiliar with this continent. They cover all periods – from the earliest archaeological traces to the significance of contemporary material practice for archaeological interpretation – and encourage innovative thinking across traditional boundaries. Manuscripts can be submitted in English and are peer-reviewed (http://www.springer.com/series/13523).

‘The Sudan Archaeological Research Society’s Fieldwork Publications’
This is the series of the Sudan Archaeological Research Society (SARS), which also publishes the journal *Sudan & Nubia*. Like the journal, it is focused on the archaeology in Sudan, South Sudan, and Egyptian Nubia. Volumes are published with the purpose to provide a prompt

publication of the results of fieldwork projects and other works in those regions. Manuscripts can be submitted in English (www.sudarchrs.org.uk/resources/publications).

III. PUBLICATIONS FOR THE WIDER AUDIENCE

A final word should be said about the importance of publications aimed at a different but equally important audience than the scientific community. In fact, the ultimate purpose of archaeological research is to offer the public a better understanding of the human past. Regional and general syntheses on African archaeology have a vital role to play both in Africa and outside (see, for example, Connah 2001, 2004). Scholars should not forget that African archaeology can fulfil a dire need of dissemination of knowledge on the centrality of the African past for humankind. To quote V.G. Childe, archaeology helps people 'to think more clearly and so to behave more humanly' (Childe 1956: 127).

REFERENCES

Childe, V.G. 1956. *Society and Knowledge*. London: Allen and Unwin.

Connah, G. 2001. Writing Africa's Archaeological Past: Who Writes for Whom? *Australasian Review of African Studies* 23 (1): 32-37.

Connah, G. 2004. Publish and be damned? *Azania: Archaeological Research in Africa* 39 (1): 325-336.

Lenssen-Erz, T. *et al.* (eds). 2002. *Tides of the Desert: Contributions to the Archaeology and Environmental History of Africa in Honour of Rudolf Kuper*. Köln: Heinrich-Barth-Institut.

Mitchell, P. & Lane, P. (eds). 2013. *The Oxford Handbook of African Archaeology*. Oxford: Oxford University Press.

Shaw, T., Sinclair, P., Andah, B., & Okpoko, A. (eds). 1993. *The Archaeology of Africa: Food, Metals and Towns*. London: Routledge.

Stahl, A.B. (ed.). 2005. *African Archaeology: A Critical Introduction*. Oxford: Blackwell.

ON-LINE PUBLICATION AND OPEN ACCESS

Jean-Pierre Devroey[1]

From the end of the 1990s, scholarly communication has increasingly borrowed from electronic publishing, first in parallel with paper publications. Since the mid-2000s, an increasing number of traditional journals and new emerging publications have adopted the 'born digital' approach (Erway 2010), eliminating any reference to paper. The principal actors in the publishing market have multiplied the number of journals through increasing specialization, in order to inflate their content and justify increases in subscription prices. Between 1986 and 2003, increases of more than 200% on average were observed, while during the same period inflation in the United States (CPI) did not exceed 68% (Panitch & Michalak 2005). The growing concentration in the scientific publishing sector, and in particular the purchase of many periodicals previously published non-profit by learned societies, naturally favoured this inflationary tendency, which was slowed but not stopped by the consolidation of libraries into purchasing consortia. Faced with these economic developments, which exclude some scholars and some segments of the general public (especially those in developing countries) from access to information and hinder the free flow of ideas and knowledge, new forms of publication and dissemination of knowledge have developed in academic circles, as part of the Open Access movement.

FIRST FREE ACCESS INITIATIVES AND *PEER REVIEW*

Begun in 1991, arXiv.org laid the foundation for a dissemination model different from the traditional publishing system, providing immediate dissemination and open access for scientific articles which were often published later in conventional journals. The model was also original insofar as it replaced the submission process with the principle of moderation by a community of users, invited to judge whether the text was of the necessary quality and offering reactions on its content ex post facto. Initially covering physics, the server has gradually opened to other related subjects: mathematics, computer science, nonlinear sciences, quantitative biology and statistics (arXiv.org 2014).

In 2002, the Budapest Open Access Initiative (BOAI), begun by the Open Society Institute, marked the beginning of a global campaign 'in favour of open access for any new peer-reviewed research' (BOAI 2012). Highlighting the impediments to the dissemination of scientific literature defined as a 'public good', the declaration defines OA as the 'free and unrestricted online availability' of publications. It is important to note that for its initiators, OA did not call into question the existence of peer-reviewed journals, which are the guarantors of the transparency and quality of scientific publication. The declaration also underlines the individual benefits that open access brings 'to the author and his work [by giving them] a new visibility, a new impact, and a new, expanded and quantifiable audience' (BOAI 2012). It should be added that OA is accelerating the dissemination and citation of results, to the benefit of authors and research in general. These reflections, as we shall see, retain their full relevance.

The success of arXiv obviously stimulated the various actors in the field of academic publishing. Authors saw a means of decisively speeding up the dissemination of their publications by depositing them in open and free archives, even before their submission to a journal (in a preprint version; see below). The principle of peer ex post facto moderation remained for the most part confined to physics and related sciences. Recently, peer discussion has been implemented at social networking sites such as ResearchGate or Academia.edu, for example, where access is however conditional on individual registration. It should be noted that such sites tend to operate as archives by encouraging their members to deposit copies of their academic publications and make them freely downloadable, at the risk of encouraging the digital redundancy associated with such supplementary archives or of encouraging authors to disregard the embargo periods imposed by some journal publishers.

THE TWO ROUTES TO OPEN ACCESS

The implementation of Open Access is based on two possible avenues:

1. Self-archiving, that is the deposit by their authors of journal articles or texts (see below) in open electronic archives (Harnad 2001). This practice has been made possible by the establishment of institutional archives ('repositories'; see below) in universities.

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2. The creation of new journals engaged in open access and the transition from existing journals toward OA. 'Since journal articles should be disseminated as widely as possible, these new periodicals will no longer invoke copyright to restrict access and use of the material they publish' (Budapest 2002).

Because of the limitations of copyright (a somewhat misleading name, since it in fact involves often-exclusive rights granted by the author to the publisher), which limit its scope, self-archiving has moved away from the ideal of archiving the article in its definitive form (pubprint); some publishers allow only self-archiving and OA of publications as originally submitted (preprint) or as modified after peer review (postprint). These practices are a source of nuisance, since several versions of an article may be made public.

Open archives, 'repositories' in English, exist in the form of institutional archives, gathering for example all the scientific publications produced within a university, or thematic archives where publications are deposited by their authors. In universities, the policy of open access and repository of scientific publications is frequently defined by an institutional mandate, which precisely delineates the obligations of researchers with regard to their institution in terms of self-archiving. Such mandates can also be defined by a national agency (for example FNRS 2013) or an international research funding body, such as the European Union for example (European Commission 2013). In 2012, via a recommendation, the European Commission encouraged member states to make publicly-funded research results available in the public sphere, in order to strengthen science and the knowledge-based economy (European Commission 2012). At the end of 2014, the Registry of Open Access Repositories reported some 3,830 open archive repositories (ROAR 2014).

The free and open access provided by repositories is labelled the 'green road' (Suber 2013). It differs from a second category of OA, known as the 'golden road', mainly in that the archive is not restricted to items that have been peer reviewed but is extended to any type of scientific publication, without additional and specific verification.

The *Gold OA* principle assumes the publication of articles in peer-reviewed journals and their open and free access, without requiring an obligation to self-archive. A number of commercial publishers and learned societies have opted for this OA, but since it is above all a question of making money, they have linked this free access to payment by the author of a defined sum. If the author cannot or does not wish to pay this amount, then the article is only available through payment by the reader (via library subscriptions), which gives this model a hybrid character that must be resisted.

We should not confuse the open/free OA alternative, which defines the rights of users, with the green/gold alternatives, which distinguish modes of diffusion (archiving, publication in a periodical) (Suber 2013).

OA ECONOMIC MODELS

The opportunities offered by digital publishing and OA, but also the threats that they pose to the profits of commercial publishers, have led to many innovations in academic publishing business models and practices.

Concerning copyright, OA has led to a clarification of relations between authors and publishers and undermined the model of the exclusive assignment of copyright to the publisher which prevailed since the 1980s in the commercial publishing sector. Contracts now define the extent of the rights granted, for example by reserving the right of self-archiving and free access ('green OA'). The policies followed by publishers are conveniently gathered by sites such as SHERPA/RoMEO (2014). Authors, when confronted with requests for exclusive assignment of rights, can offer to the publisher an alternative institutional mandate.

Concerning publishing costs, some publishers have opted for financing in advance, by charges to authors (author-pays) or to research funding institutions/agencies (Suber 2013). These publication fees are commonly referred to as 'article processing charges (APC)'.

Since 2003, the Directory of Open Access Journal lists OA periodicals on the criteria of quality and accessibility. University libraries frequently integrate the Directory in their online catalogues or discovery portals. At the end of 2014, the DOAJ had 508 periodicals in anthropology and 60 in archaeology, giving access to more than 105,000 articles (DOAJ 2014).

ADVISORY NOTE CONCERNING PREDATORY PUBLISHERS

The author-pays system has led to the emergence of an increasing numbers of actors who are parasitizing upon the model of peer-reviewed academic publishing, by introducing the questionable practices of 'vanity press' book publishing. Between 2005 and 2012, the number of OA periodicals increased from 2,000 to 8,355 (Enserink

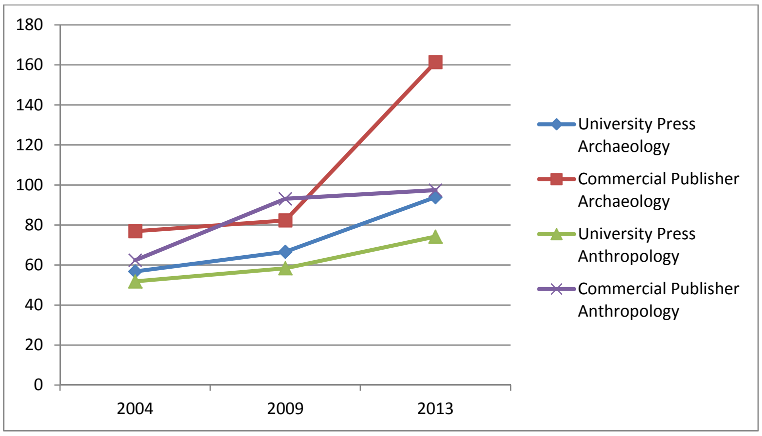

Fig. 1.Trends in monograph prices in the US domestic market (average price, in USD). Source : YPB Library Service 2014.

2012), including many scientific 'pseudo-periodicals'. At the end of November 2014, Jeffrey Beall's list of predatory publishers contained the names of 664 publishers and 480 isolated periodicals (Beall 2014).

These predatory publishers put authors who trust them doubly at risk, by: a) jeopardizing their reputation and scientific career; and (b) drowning their research in a mass of publications tainted by plagiarism and republication, or by pseudoscience ('junk science'). Yet the electronic image of 'vanity publishers' is carefully constructed to deceive potential authors and induce them to pay publication costs, which cumulatively generates substantial profit:

- the name of the publishing house or the title of the periodical imitates or borrows some of the keywords of scholarly communication (University Press, Academic, World/International/Scholarly Journal of, etc.);
- the official address of the publisher is a simple mailbox located in a country or a city with a strong academic profile. In reality, the publisher is located in an emerging country with a strong digital industry, such as India or Pakistan;
- the editorial boards are composed of people without a strong academic reputation, often coming from relatively lower-ranked universities;
- the editorial board promises a peer review process in just a few weeks, which hides the fact that most submitted papers are accepted;
- a spontaneous solicitation was sent to the author on the part of an alleged editorial board or publisher: this does not happen in scientific 'real life'!

In order to identify these OA predators and, more generally, to make the best choices about where to publish, a certain number of indices can be used by authors to measure the reputation of a periodical in OA (besides the general criteria of scientific profile of the editorial committee and the transparency of the peer review system):

- is the journal included in a general bibliometric index, such as the Web of Science or Scopus, or specialized indices? Note that a presence in Google Scholar only means that the digital trace of an article has been collected by this search engine, without any filter for quality;
- can the quality of the journal be measured by indicators such as the h-index, impact factor, SJR, SNIP and Eigenfactor (see definitions in University of California Santa Barbara Library 2014);
- is the journal archived in an academic database (such as JSTOR, Perseus, SCIELO, etc.) or is permanent access guaranteed by organizations such as PORTICO or LOCKSS (see definitions below)?

For a long time, the human sciences sector was spared the price over-inflation that characterized publications in the sciences. Unfortunately, this is a thing of the past.

Practices like the exclusive transfer of distribution rights, an absence of editorial effort by unscrupulous publishers who prefer to simply place articles on paper or on-line ('camera-ready'), lobbying against OA with public authorities, a disproportionate increase in prices (see figure 1) which results in a reduction in article views, may on the contrary lead to a vicious circle publishing of 'more expensive/fewer sold' in the human sciences, whether it involves books or magazines.

In 2006, a commercial periodical was 2.52 times more expensive than a non-profit periodical in the field of sociology, while the first of these journal categories was 2.6 times less cited than the second (Dewatripont *et al.* 2006)! During the period 2010-2014, the average increase in periodical cost was 6.24% per year, continuing the chronic over-inflation in the field. If these percentages, reduced by 2 to 3% in the case of purchases of full periodical portfolios by libraries, no longer reach the double-digit inflation which characterized the 'serial crisis' up to 2008, they still illustrate the relevance of the OA objectives defined by the BOAI in 2012.

All of this should encourage researchers to maintain and use their right of self-archiving and to create and publish widely (see for example SCIELO in the Luso-Hispanic world, and Revues.org and Érudit in French) in journals that adhere to OA and support non-profit models of scholarly communication.

REFERENCES

arXiv.org. 2014.: http://arxiv.org/help/primer (Consulted 24 November 2014).

Beall, J. 2014. 'Scholarly Open Access. Critical analysis of scholarly open-access publishing'. http://scholarlyoa.com/about/ (consulted 28 November 2014).

Budapest. 2002. 'Budapest Open Access Initiative', on line at http://www.budapestopenaccessinitiative.org/read (consulted 16 February 2017).

Dewatripont, M., Ginsburgh, V., Legros, P., Walckiers, A., Devroey, J.-P., Dujardin, M., Vandooren, F., Dubo-isFoncel, P. Ivaldi, J.-M. & Heusse, M.-D. 2006. *Study on the economic and technical evolution of the scientific publication markets in Europe*. Brussels: European Commission.

DOAJ (Directory of Open Access Journals). 2014. http://doaj.org/ (consulted 30 November 2014).

Enserink, M. 2012. 'As Open Access Explodes, How to Tell the Good From the Bad and the Ugly'. *Science* 338: 1018.

Erway, R. 2014. *Defining Born Digital. An essay*, OCLC Research, available at http://www.oclc.org/content/dam/research/activities/hiddencollections/borndigital.pdf?urlm=168879 (consulted 24 November 2014).

European Commission. 2012. 'Commission Recommendation of 17 July 2012 on access to and preservation of scientific information (2012/417/EU)'. *Official Journal of the European Union* I (194/39). Available online at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012H0417&rid=1 (consulted 28 November 2014).

European Commission. 2013. *Fact sheet: Open Access in Horizon 2020*. Available at https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/FactSheet_Open_Access.pdf (consulted 28 November 2014).

FNRS (Fonds national de la recherche scientifique, Belgique). 2013. 'Règlement relatif à l'application de la politique de libre accès (Open Access) aux publications scientifiques issues des programmes de recherche soutenus par le FRS-FNRS et les fonds associés'. Available at http://www.frs-fnrs.be/uploaddocs/docs/SOUTENIR/FRS-FNRS_Reglement_OPEN_ACCESS.pdf (consulted 28 November 2014).

Harnad, S. 2001. 'The self-archiving initiative. Freeing the refereed literature online'. *Nature* 410:1024-1025.

Panitch, J.M. & Michalak, S. 2005. 'The Serials Crisis. A White Paper for the UNC'. Chapel Hill Scholarly Communications Convocation. Available at http://www.unc.edu/scholcomdig/whitepapers/panitch-michalak.html (consulted 30 November 2014).

ROAR (Registry of Open Access Repositories). 2014. http://roar.eprints.org/ (consulted 29 November 2014).

SHERPA/RoMEO. 2014. 'Copyright policies & self-archiving'. http://www.sherpa.ac.uk/romeo/Site (consulted 28 November 2014).

Suber, P. 2013. 'Open Access Overview. Focusing on open access to peer-reviewed research articles and their preprints', placed online 28 June 2004, consulted 28 November 2014).

University of California Santa Barbara Library. 2014. 'Should I Publish in an Open Access Journal?' http://www-stage.library.ucsb.edu/scholarly-communication/should-i-publish-open-access-journal (consulted 28 November 2014).

YPB Library Service. 2014. http://www.ybp.com/book_price_update.html (consulted 30 November 2014).

Afterword

THE FUTURE OF THE PAST ON THE AFRICAN CONTINENT

Pierre de Maret

African cultures have been traditionally rooted in the past, with the cult of ancestry and the desire to perpetuate kinship and traditions. However, colonization and westernization and, most recently, urbanization have broken those ties. Nowhere has the break between the past and the present been more dramatic than in sub-Saharan Africa.

Except for a few well-known kingdoms, historians themselves are not very interested in the pre-colonial period. As this goes back only a little over a century, the history of the last five generations eclipses that of the hundreds of generations that preceded it.

This situation is more the result of the lack of knowledge of the richness and diversity of the pre-colonial past than indifference. On the contrary, when Africans become aware of the remains of the past and what they reveal about ancient civilizations, many of them are deeply interested.

Many African countries will be facing enormous challenges this century, not the least of which is a demographic explosion at a scale unprecedented in the history of humanity. By 2050, Africa will probably have 2 billion inhabitants. Today, one African out of three is under 25 years old. Africans are on the move, within their own country, across the continent, and outside of Africa. The demographic growth, combined with the rural exodus, will cause a dramatic increase in the number of city dwellers. In 2050, more than 60% of the population in Africa will live in cities. This demographic growth and the urban concentration of the population present an increased risk of conflict and catastrophic epidemics.

Africa's leaders, faced with these difficult choices, will prioritize education, health, food security, developing the infrastructure, controlling migratory flows, and fighting crime and terrorism.

At the same time, there is a promising outlook. A series of countries have seen significant economic development, progress in the democratic process, and an emerging middle class. This urbanization and the accompanying migration have generated a considerable intermixing of population without precedent. These economic and social changes are challenging the ethnic identities inherited from the past. There is a new class solidarity, whether between rich or poor. Inter-ethnic marriages are increasing, individualism is becoming more important, to the detriment of family or ethnic ties, and the level of education is greatly improving in many regions.

Parallel to this change, globalization brings about a search for identity and renewed interest in cultural heritage. Competition between countries to have their material and non-material monuments enrolled on UNESCO's World Heritage list is a striking example of this. With the urbanization of Africa also comes the emergence of an educated middle class, which has cultural aspirations and has begun to indulge in tourist travel. On other continents, the fast-growing African diasporas are in search of their roots.

The role of the archaeologist as the intermediary between archaeological data and the way the past is interpreted is locally changing. The idea of one's past on a local level is much more from the point of view of the city dweller than the villager. In addition, this point of view and these interests are no longer purely local. They result more and more from the interaction between national and global perspectives and have in fact become a blend of global, national and local.

There is a growing interest, on the part of the new middle class and their national leaders, in their own history and heritage; a desire to understand their roots and to glorify the accomplishments of their ancestors.

How can we archaeologists reconstruct a history that links the past to the present and, in so doing, respond to the expectations of a growing number of Africans? How can we contribute to placing ethnicity and autochthony in perspective, in order to downplay the ways in which these concepts have been manipulated to nourish hate and violence?

Our theories, our jargon and our meetings often give the impression that our research is targeted to our fellow academics. How can we better share the results of our work with general audiences, and with the African people in particular?

These are the greatest challenges confronted by African archaeology today. The development of contract and rescue archaeology is going to transform the way we work. It is a major opportunity that is not without risk. But it is up to us to step up to these challenges, to overcome the obstacles, and to seize the opportunities that will allow us to design the future of African archaeology.

May this manual be helpful in achieving this goal.