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Recent archaeological finds of domesticated *Sorghum bicolor* in the Lake Chad region

Carlos Magnavita
J-W-Goethe Universität
Seminar für Vor- und Frühgeschichte
Archäologie u. Archäobotanik Afrikas
Grüneburgplatz 1
60323 Frankfurt am Main, Germany
email: Magnavita@em.uni-frankfurt.de

Guinea corn or *Sorghum bicolor* is one of the most important staple foods for the rural communities living in the Lake Chad region. While other major cultivars (e.g. millet and maize) can only be grown during the rainy season, sorghum can yield harvests in both rainy and dry seasons. In the heavy clay soils to the south of Lake Chad, dry-season sorghum cultivation developed to an ingenious farming system called *masakwa*, a Kanuri word denoting a special technique of planting and soil preparation as well as a designation for the crop itself (Kirscht 2001:35). In years of adequate precipitation, farmers growing *masakwa* are able to extend the period of sorghum cropping to four months after the end of the rains, so that yields of this cereal can increase substantially and generate surpluses. In contrast, in years of infrequent precipitation and subsequent harvest failure for rainy-season cultivation, a recurrent threat in semi-arid environments as that of the Lake Chad region, dry-season planting of sorghum in the *masakwa* technique can be a more viable and less risky economic alternative for farmers. The reason is that a significant part of the tasks involving the cultivation of this crop only starts at the end of the wet season, a period when peasants are aware of the amount of moisture bore by the soil and when foresights about harvest yields and decisions about sowing can be made (Kirscht 2001:35f).

Though sorghum has a conspicuously vital importance in the diet and economy of the modern populations living in the Lake Chad region, very little is still known about its early history, let alone its significance for past communities. The earliest historic allusions to a probable cultivation of sorghum come from the late 16th century accounts of Ibn Fartua on the punishment campaigns of Mai Idris Alooma of Borno against Amsaka, a semi-independent polity situated to the south of Lake Chad (Lange 1987:60, see also Gronenborn 2001). Later, in the early 19th and 20th centuries, reports of European travellers and administrative officers not only refer to the growing of the crop in the same area, but for the first time unequivocally mention the use of the peculiar *masakwa* technique for its cultivation in the dry-season (Gronenborn 2001). Compared to the relative late evidence furnished by the historical sources, the archaeological investigations carried out in the central Chad Basin in the last four decades give more reliable data concerning the age of the crop. Research undertaken in the 1960's at the settlement mound of Daima (Figure 1), located in the vast *firki* clay plains to the south of Lake Chad, yielded charred grains of sorghum from deposits with a radiocarbon date of 1140 ± 90 BP (I-2368) (Connah 1981:189) (Table 1). The calibrated calendar date for this sample ranges, with 1-sigma, from 780 to 990 AD, and, with 2-sigma confidence, from 680 to 1040 AD. With this date and the paucity of further excavations, Daima's sorghum remained for a long time the earliest evidence for the cultivation of this crop in the Lake Chad area.

In the mid-1990s archaeological sites in the surroundings of Daima became the focus of archaeological excavations conducted by the Joint Research Project of the Universities of Frankfurt and Maiduguri (Gronenborn 1998). One research goal was to obtain additional data concerning the subsistence activities of the people living in this area during the Final Stone Age and Iron Age. Archaeobotanical sampling in Kursakata (Figure 1), a mound occupied between 1000 cal BC and 100 cal AD, did not furnish any evidence of the cultivation of sorghum (Klee and Zach 1999:87; Klee et al. 2000:232). Nevertheless, domesticated sorghum was found in the younger cultural deposits of Mege (Figure 1), a settlement mound just some 10 km SSE from Kursakata. A radiocarbon date on associated charcoal indicated that Mege's sorghum has an age ranging between the 15th and 17th centuries (Gronenborn 1998:253) (Table 1). As an earlier date than that coming from Daima was lacking, it was concluded that domesticated *Sorghum bicolor* was probably not introduced into the area prior to 800 cal AD (Klee et al. 2000:228). Following this conclusion and based on minor changes in pottery attributes and on supposed stratigraphic hiatuses,

Figure 1. Map of the Nigerian Southern central Chad Basin showing the location of sites mentioned in the text.

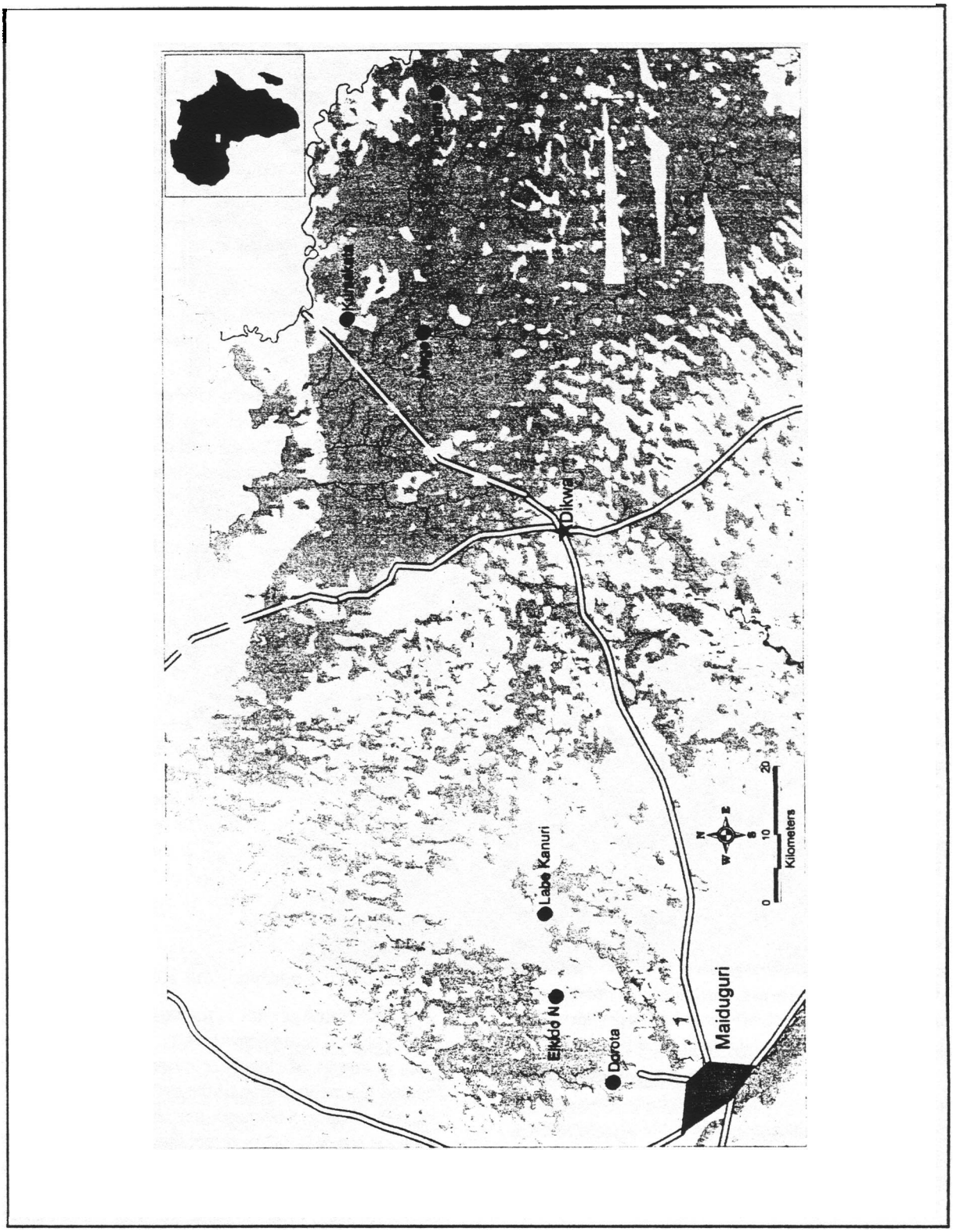


Table 1. Radiocarbon dates for domesticated sorghum in the Chad Basin (Age ranges obtained by the intercept method after Stuiver and Reimer 1993).

Site	Sample #	Radiocarbon Age	Cal Age (1-s)	Cal Age (2-s)	Source
Mege	Utc-4935	411 ± 36 BP	1443-1486 cal AD	1433-1628 cal AD	Gronenborn 1977:381
Daima	I-2368	1140 ± 90 BP	785-1005 cal AD	679-1037 cal AD	Connah 1981:189
Dorota	Erl-3103	1546 ± 35 BP	449-592 cal AD	426-610 cal AD	p. a.
Elkido N	Ki-4742	1660 ± 35 BP	384-426 cal AD	266-449 cal AD	p. a.

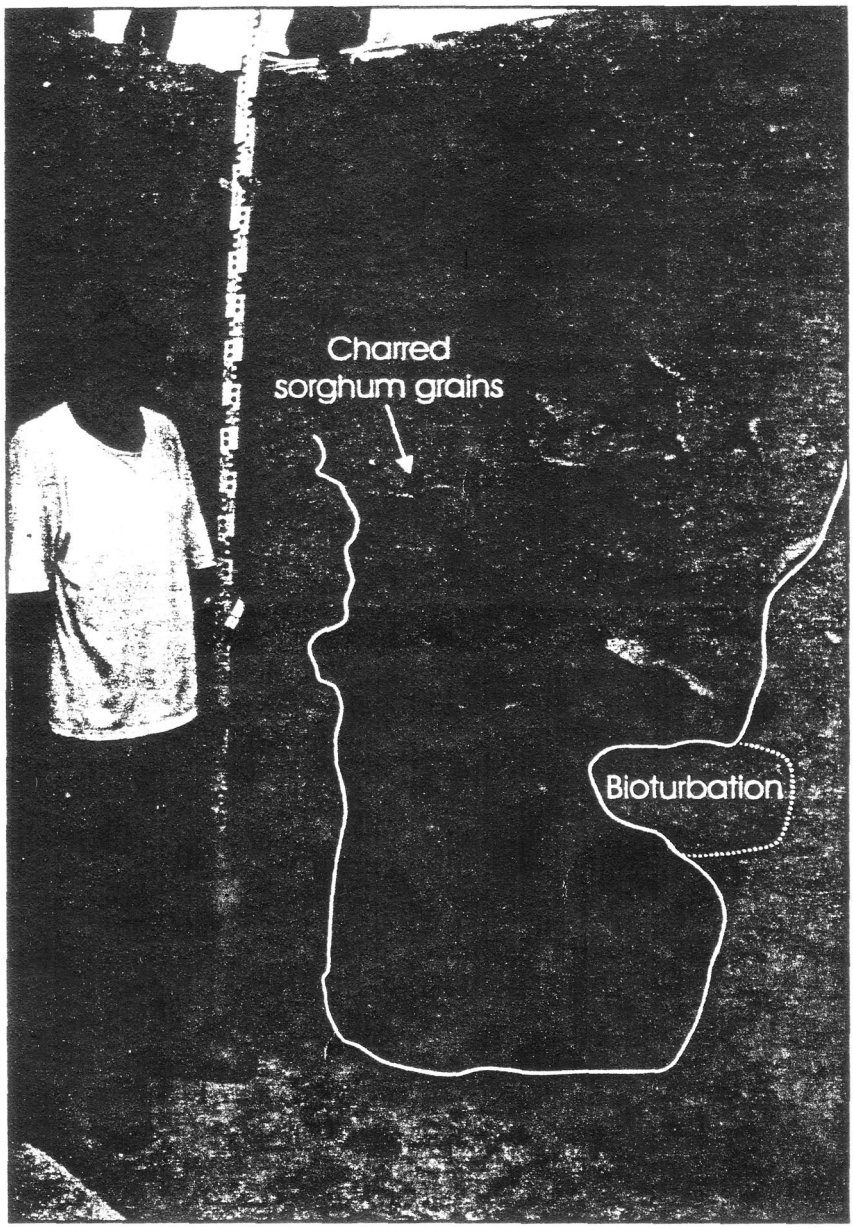
Gronenborn (2001:74) hypothesized that sorghum as cultivar was brought into the Chad Basin in the beginning of the Late Iron Age, i.e. 7th-8th century AD, by immigrants coming from the southeast.

This assumption is, however, not in accordance with the idea expressed by Connah (1985) who suggested a linkage between the appearance of iron and an alleged intensification of agricultural activities based on sorghum cultivation early in the first millennium AD in the *firki* clay plains. Connah's model is a logical concatenation of arguments primarily based on the emergence of huge settlement mounds in the first half of the first millennium AD. The large size and height of these mounds were seen as archaeological witnesses of an increasing sedentism of the *firki* inhabitants. This more sedentary way of life, on the other hand, so his arguments, possibly figures as a direct response to an agricultural intensification occurring in this period, which very probably was triggered by the use of iron tools. Indeed, iron plays a central role in this 'model of early first millennium AD intensive agriculture', as it would allow a more efficacious and therefore more productive management of cultivation areas, particularly concerning the *masakwa* technique chiefly practised in the heavy *firki* clay soils of northeast Nigeria, Cameroon and Chad.

Connah's arguments are admittedly very seductive and should be considered as a true possibility regarding the development of a new agricultural era coinciding with the time iron started becoming common. However, though there is no doubt that iron tools were in use by the inhabitants of the plains around the beginning of our era, up to 1999 the evidence for domesticated sorghum, one of the key-elements in the 'model of early first millennium AD intensive agriculture', remained restricted to the Late Iron Age finds of Daima and Mege. In that year, the final research program of the Joint Research Project started, concerned with the transition period between Stone Age and Iron Age in the sand plains to the west of the *firki*. In contrast to the region around Daima and Mege, the research area, located to the north of the road Maiduguri-Dikwa (Figure 1), is characterized by vast sand plains interrupted by small and larger patches of the same kind of *firki* clay, which constitutes the lands to the east. In the 1990s, the sand plains were the focus of extensive excavations carried out by the Joint Research Project on Final Stone Age settlement mounds (Breunig et al. 1996; Breunig and Neumann 2002), but research was not extended into the Iron Age. In relation to the final research goal of the Project, at the end of 1999 and beginning of 2000 the author conducted trial excavations in three Iron Age sites with the intent of establishing a preliminary ceramic sequence and collecting data on the economy and settlement modalities of communities inhabiting this area.

All Iron Age sites of the sand plains consist of relatively low settlement mounds, isolated or assembled in groups of closely or more loosely interconnected elevation. Some of the mound clusters reach an area of up to 5 hectares, and, in general, isolated mounds are only 1-2 ha large. One of the exceptions is the low, but extensive settlement mound of Dorota (Figure 1). An isolated mound located some 12 km to the north of Maiduguri, the capital of Borno State,

Figure 2. Probable storage pit found in the deposits of Dorota (Photo: P. Breunig).



this site has a surface of ca. 25 ha, but a maximum height of 1.8 m. It was the very first Iron Age settlement mound of the sand plains to be investigated archaeologically. Our initial intervention consisted of a 4 m² test trench dug in the northern part of the site to a depth of 2.3 m. Some 80 cm below the surface, the cut revealed a buried feature interpreted as a former storage pit (Figure 2). This pit is 1.0 m wide and has a preserved depth of about 1.5 m. It contained the usual household debris such as pottery, burnt daub, probable fragments of stone grinding equipment, bones, charcoal and charred plant remains as well as iron objects and two types of slags. Two other test pits of 1 m² were also dug in the central and southern parts of this large mound, but unfortunately they did not show any kind of feature. Despite

this, the composition of the recovered ceramic assemblages and available radiocarbon dates from all three pits strengthened our suspicion that the entire area of 25 ha probably constitutes the remains of a single relatively large settlement that existed between the 5th and the 7th century AD. More interesting was, however, the fact that some of the charred plant remains found in the storage pit of the northern cut could be identified as carbonized seeds of domesticated *Sorghum bicolor*. Accelerator radiocarbon dating on these seeds produced a date of 1546 ± 35 BP (Erl-3103), bearing a 1-sigma calibrated range between the 5th and the 6th centuries AD and a 2-sigma range between the 5th and the 7th centuries AD (Table 1). This shows that Dorota's sorghum is older than those found in Daima and Mege.

The second of the three sites excavated was Elkido Nord (Figure 1), located some 25 km northeast of Maiduguri and about 15 km east-northeast of Dorota. The settlement appears to constitute four adjacent and connected mounds spreading over an area of ca. 4 hectares and bearing a maximum height of 2 m. A 2 m² trial excavation conducted on the northern section of this mound cluster revealed that occupational deposits reached a depth of 3.3 meters. The stratigraphy can be divided into three distinct cultural layers which apparently correlate with phases of abandonment and resettling of the site or simply with a shift in zones of activity within the settlement. While the upper and lower cultural layers were formed by material of building decay as well as debris of household and craft activities, the middle deposits clearly comprised a graveyard, where four interments were discovered. Remarkable is the fact that, in the upper layer, a somewhat dense concentration of charcoal, charred plant remains and a particular kind of slag, normally a by-product of smithing processes, were found in a shallow pit-like feature resembling the kind of depression used by blacksmiths during forging nowadays. However, no tuyères or metallic slags were found associated with this feature, making its interpretation doubtful. Despite this, the presence of the charred plant remains cited above was in so far interesting as they were identified as carbonized seeds of domesticated *Sorghum bicolor*. A conventional radiocarbon age on seeds of 1660 ± 35 BP (Ki-4742), corresponds to a calendar date ranging between the 4th and 5th centuries AD, with 1-sigma confidence, and between 3rd and the 5th centuries AD, with 2-sigma confidence (Table 1). This date is somewhat older than that coming from Dorota and substantially earlier than those from Daima and Mege.

The third site excavated was Labe Kanuri (Figure 1), situated some 33.5 km northeast of Maiduguri and 12 km east-northeast of Elkido Nord. It is a ca. 1.5 m high and approximately 1 ha large mound located about 400 m away from other mounds of the same size. Labe Kanuri was found to be the oldest of all three Iron Age settlements examined in the area, with a charcoal date ranging between the 1st and the 2nd century AD. Unfortunately, the 2 m² test trench dug down to 2.3 m in its deposits did not reveal any features, and the archaeobotanical remains recovered by sampling each spit of 10 cm did not contain *Sorghum bicolor* (preliminary analysis by S. Kahlheber). Considering the presence of sorghum in the cultural deposits of Dorota and Elkido Nord dating from the 3rd to 7th century cal AD, two opposed possibilities arise from the negative evidence for this cereal in Labe Kanuri: either this crop was really not cultivated during the first and second centuries AD, or its lack in the excavation in Labe Kanuri is a mere misfortune. Though both alternatives are conceivable, in my opinion, the last one is most probable. Indeed, there is a virtual chance that just the spot where we dug in Labe Kanuri did not bear charred sorghum grains, a fact that gains support, if one considers that we did not find any kind of feature as in the other two sites. Contributing to this unfavourable situation is perhaps the relatively small size of our test pits and the relatively low volume of sediment used in archaeobotanical sampling (only 10 liters from 200 liters sediment were normally sampled in each spit). Hence, we hardly can talk about a representative sampling of botanical remains from the excavated sites, a factor that perhaps explain the lack of sorghum in the excavated deposits of Labe Kanuri and elsewhere. Klee *et al.* (2000:230f) already discussed the taphonomic and methodological problems related with the archaeobotanical sampling undertaken in the *firki* settlements and pointed out the importance of further research for confirming or refuting interpretations of former analysis. The results of trial excavations conducted in Dorota and Elkido Nord not only corroborate this research principle, but demonstrate the large potential of information relative to early cultivation of *Sorghum bicolor* possibly existent in the cultural deposits of Iron Age settlement mounds in the sand plains to the north of Maiduguri.

It is conceivable that future archaeological investigations in this region will push back in time the date for sorghum farming.

In the light of the new findings, the conclusions of Klee et al. (2000) and Gronenborn (2001) concerning the introduction of sorghum at the beginning of the Late Iron Age in the *firki* clay plains to the south of Lake Chad and its subsequent spread into regions to the west, i.e. the sand plains, can no longer be supported. Though the available dates rather indicate the contrary way for the diffusion of the crop, I believe that the inhabitants of both regions were simultaneously profiting from its cultivation at latest by the first half of the first millennium AD. As considerable innovations in patterns of dwelling and material culture are evident in settlements of the sand plains in the first centuries AD (iron as raw material widely replaces bone and stone in the manufacture of tool and jewellery, new ceramic decorative techniques are introduced), sorghum may well have been brought into the Chad Basin as element of a 'cultural package' coming from elsewhere. On the other hand, we definitely can not rule out that sorghum was domesticated on the spot some centuries prior to our era.

Besides their chronological implication, the secure evidence of early sorghum in the central Chad Basin possibly bear a large significance for the understanding of supposedly economical upheavals occurring in this region. Through the presence of the crop, Connah's 'model of early first millennium AD intensive agriculture' mentioned above gains a new impulse towards becoming a conceivable reality. Of course, the proof for the cultivation of *Sorghum bicolor* alone does not imply that the intensive dry-season planting technique *masakwa* has been also employed from this time onwards, since remains of early dams or agricultural iron or wooden implements used in this kind of cultivation have never been found. On the other hand, it is difficult to believe that changes in the technological basis of a community, as in the case of the advent of iron, would not have brought about some kind of human response towards the development of more efficacious and advantageous methods of intervening in the environment for the own benefit (McIntosh and McIntosh 1988:109f). The shifts observed by Connah (1981:161f, 1985:779-782) in early first millennium *firki* settlement patterns might well have had their origins connected with an intensification of agricultural practices, perhaps based on *masakwa*, which were initially promoted by the use of more efficient tools made of iron. But, though this model can not yet be proved to be correct, the new sorghum finds bring us a great deal of evidence supporting this idea.

Acknowledgements

I would like to thank Dr. Katharina Neumann and Stephanie Kahlheber for the identification of the charred sorghum remains found in Nigeria. I also thank Prof. Dr. Peter Breunig for the friendly support of my own work before and during the excavations of the archaeological sites presented here as well as for the welcoming and inspiring discussions concerning aspects of Iron Age life. I am also very grateful to Dr. Helmut Erlenkeuser and his team from the Kiel Radiocarbon Lab and Dr. Gerhard Morgenroth and colleagues from the Erlangen Radiocarbon Lab for the excellent co-operation concerning the radiometric analysis carried out on the organic samples quoted here. For the export permits of the archaeological and archaeobotanical materials coming from Nigeria, I thank the Director of the Gidan Makama Museum in Kano, Dr. Musa Hambolu, the Director of Research and Training of the National Commission of Museums and Monuments in Nigeria, Dr. L. I. Izuakor, as well as Mr. Abubakar Garba of the Centre of Trans-Saharan Studies, University of Maiduguri. I am also indebted to Dr. Katharina Neumann and Mr. Richard Bayr for the critical review and correction of the manuscript. The author is, however, responsible for discrepancies in the text.

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