FARMING BEYOND THE ESCARPMENT: SOCIETY, ENVIRONMENT, AND MOBILITY IN PRECOLONIAL SOUTHEASTERN BURKINA FASO

by

Daphne E. Gallagher

**A dissertation submitted in partial fufillment
of the requirements for the degree of
Doctor of Philosophy
(Anthropology)
in The University of Michigan
2010**

Doctoral Committee:

Professor Richard I. Ford, Co-Chair
Assistant Professor Rebecca D. Hardin, Co-Chair
Professor Paul E. Berry
Professor John D. Speth
Professor Henry T. Wright

To Stephen

ACKNOWLEDGEMENTS

A project of this scope is never the work of one person, and I am deeply grateful to all of those who have provided support throughout the process.

The pilot season of fieldwork in 2004 was funded by the University of Michigan Center for Afro- and African American Studies (CAAS-Africa Initiative) and the Museum of Anthropology Griffin Fund. A National Science Foundation Dissertation Improvement Grant provided the primary funding for the 2006 fieldwork in Burkina Faso, supplemented by additional funds from the Department of Anthropology. Additional post-field analyses were funded by The Richard I. Ford Fund for the Anthropological Study of Humans and the Environment (University of Michigan Museum of Anthropology).

In Burkina Faso, field research was facilitated by Dr. Lassina Kote of the University of Ouagadougou. Dr. Kote's insights on every aspect of the project from the practical to the theoretical were invaluable, and I am especially grateful for his taking time to visit me in the field. At the CNRST, Drs. Vincent Sedogo and Eloi Bambara ensured that we held all proper research permits, and Dr. Oumarou Nao at the Ministry of Culture granted export permits for the faunal and botanical samples. Drs. Millogo and Kiethega graciously supported the project and sponsored the participation of Marcel Zongo, a student at the University of Ouagadougou, who was an invaluable and enthusiastic assistant in the field. In Maadaga, our research was received with enthusiasm by the local community including the hundreds of farmers who answered our questions and allowed us to walk through their fields. In addition, I thank SIM for their hospitality over both field seasons. Yao Guire and his family were ambassadors for us with the local community, and provided incredible insights into the region. Finally, Diassibo "Zeze" Ouaba worked with us every day, acting as interpreter and guide. It is largely due to his dedication and patience that the project was successful. In Ouagadougou, the Tassin-Pelzer family and Scott and Liz Sommers generously invited us into their homes.

The University of Michigan Museum of Anthropology has been an incredibly stimulating environment in which to do this research- Kent Flannery, Joyce Marcus, John O'Shea, Jeff Parsons, Carla Sinopoli and Bob Whallon have all left their mark on this thesis. I also wish to thank the larger community of Africanist archaeologists who have supported and influenced me along the way including Hamady Bocoum, Mamadou Cisse, Barbara Eichorn, Alexa Hohn, Stefanie Kahlheber, Daouda Keita, Chapuruhka Kusimba, Sibel Kusimba, Shawn Murray, Katarina Neumann, Annet Schmidt, and Ibrahima Thiaw.

My cohort, Liz Bridges, Dan Pugh, Kenny Sims, and Sudha Shah, have seen me through the ups and downs of graduate school. Liz in particular went above and beyond during the last few months of this process to ensure that I was able to defend and deposit the thesis on schedule. Likewise the Africanist student community in the Museum- Amy Lawson, Cameron Gokee, Amanda Logan, and Anne Compton- is a cohort of its own.

A few others who require a particular mention: Christoph Pelzer and Richard Kuba for taking Shawn, Ellis, and myself to Timbuktu; Lucas Petit for answering pottery questions on short notice; Sunday Eiselt and Andy Darling for providing write-up space; Anna Marburg for the consultations on academia; and Amanda Edmonds for the moral support and tough love when I needed it.

Finally, three groups of people require special mention. Susan and Rod McIntosh introduced me to the possibilities of West African archaeology and took me with them to Mali while I was still an undergraduate. Without their inspiration, this project never would have been conceived, and their input has continued to be invaluable.

My committee -Richard Ford, Rebecca Hardin, Paul Berry, John Speth, and Henry Wright- has been unfailingly patient and supportive throughout the dissertation process. The influence of my co-chairs, Dick and Rebecca, is present on every page of this dissertation. Whenever I got bogged down in the details, Rebecca helped me find enthusiasm for the big picture. Dick has been my biggest supporter since the first day of graduate school, and graciously came out of retirement to see this dissertation through to its completion. Over the past ten years, both have transformed how I understand the environment and the ways people live in it, and I hope our conversations on these topics have only just begun.

Finally, my family and the one I married into have been unfailingly supportive- providing advice, encouragement, and a place to write. However, the one person without whom this work truly would not have been possible is my husband Stephen. He has been with me every step of the way and hopefully we'll have the chance to do it all again. Thanks.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER 1
INTRODUCTION

Building on a lengthy tradition of anthropological research on agricultural land use and society, this dissertation explores the transformations and continuities in agricultural practice over a period of ca. 1500 years in southeastern Burkina Faso. In the savanna zone of West Africa, numerous scholars have recognized the importance of agricultural systems, particularly in the major river valleys where intensification was a logistical necessity for the maintenance of large populations in and around early urban centers (e.g., McIntosh 2005). At the same time analyses of communities in the savanna that relied on shifting cultivation have, with a few important exceptions, assumed that these farming practices are a response to ecological variables and determined by a combination of carrying capacity, population, and desired yield (e.g., Breunig and Neumann 2002; Kahlheber 2004). In this dissertation, I argue that a pattern of dispersed, mobile settlement resulting from shifting agricultural strategies is not simply the result of environmental constraints, but is instead intricately linked with cultural practice and history.

The ecological approach to West African savanna agriculture is in part a legacy of colonial agricultural research. From the beginning of the 20th century, Europeans often assumed that local farming was environmentally destructive and unsustainable (see Mortimore 1998 and Baker 2000 for discussions), and frequently tried to replace lower-yielding traditional agricultural practices with "modern" technologies and approaches such as large-scale irrigation, intensive fertilization, higher yielding crop varieties and cash cropping (e.g., the Office du Niger, McIntosh 1998). However, following World War II, as documentation on rainfall variability, soil fertility, and the hardiness of indigenous crops became available, agronomists and ethnologists began to re-evaluate these traditional methods that produced reliable yields in an unpredictable environment. An emphasis on modernization was replaced with an appreciation for the skill of traditional farmers in optimizing their methods to meet their needs in local climatic and environmental conditions, and studies of "perfected systems of cultivation" became common (e.g. Savonnet 1959, Pelissier 1966). While in the latter half of the 20th century, fierce debates over the efficacy of traditional practices in the context of higher population densities and global climate change dominated the agronomy and ethnographic literature, the general conception of pre-colonial agriculture as stable, environmentally optimized systems has continued as the dominant framework in the archaeological and historical literature.

Although this has proven to be a productive line of research, the enthusiasm with which this approach has been applied sometimes resulted in less attention being paid to the choices available to farmers, and to the role of the political and cultural milieu in their decision-making. While it would be simplistic to imply a simple cause-effect relationship between cultural systems and agricultural techniques, it is indisputable that the economic decisions of a society, even in as risky and unreliable a farming landscape as the West African savanna, are not made using only ecological considerations. The effects of politics on desired yield have been well-documented (e.g., Clark 1966; Pedler 1955; Jean 1975; Kuba and Lentz 2006); however social structure or what Stone (1993) has termed "social technology" also affects such crucial aspects of agricultural practice as organization of labor, land tenure, and mobility.

This dissertation uses the cultural aspects of shifting cultivation, in particular the mobility associated with the practice, in order to explore long-term cultural change in the Gobnangou region, an area located along the southeastern border of the historic Gourmantche polity. I present the results of two seasons of fieldwork, comprising survey and excavations that located and studied over 500 sites, ranging from small activity areas to ancient household compounds. What is instantly striking about the archaeological landscape is the long term reliance on shifting cultivation which remains constant through numerous economic and social changes.

Shifting Cultivation: An Introduction

"Shifting cultivation" is a generic term that has been applied to a very diverse set of agricultural practices that have little in common other than relatively mobile field locations. Almost all authors agree that shifting cultivation refers to an agricultural practice in which fields are cleared, farmed for a short period, and then abandoned for at least 2-3 times the years they were farmed. Most definitions emphasize the relatively long fallow periods whether in terms of a specific length of time ["any system under which food is produced for less than ten years from one area of land, after which that area is abandoned temporarily and another piece of land cultivated" (Greenland 1978:5)] or as a ratio of cultivation period to fallow (Ruthenberg 1971; Allan (1965) develops a particularly elaborate sliding scale). While some definitions include moving residences with fields as an essential element, other scholars prefer to separate shifting cultivation (movement of fields with long fallows) from what they term shifting settlement (Duvall 2007).

Here, I reserve the term "shifting cultivation" for those farmers who move their primary residence on a regular basis to obtain or facilitate access to new land. This is distinguished from "land rotation" in which similarly long fallows are utilized but fields are rotated within a defined area such that the primary residence remains stable (Allan 1965), and from "mobile farmers" who inhabit multiple primary residences as part of their annual agricultural or season round (Graham 1994:1-2).

One constant question in the literature has been why shifting cultivators move so frequently. Colonial agronomists often ascribed these strategies to laziness and/or a lack of agricultural knowledge on intensive farming techniques. In the 1950s and 60s, there was a backlash against this mode of thought amongst ethnologists studying both forest swidden systems (pioneered by Conklin 1954) and savanna farming (Pelissier 1966, Savonnet 1959). Not only were the ecological benefits of shifting cultivation recognized, so was the social importance of mobility to the lifestyle of the shifting cultivator. Indeed, many attempts to force shifting cultivators to adopt a more sedentary lifestyle and intensive farming techniques have failed in spite of large economic incentives (see Chapter 2).

In the West Africa savanna, it is clear from the ethnographic record that the use of shifting cultivation, rather than land rotation, is not an ecological imperative. Residents of areas with similar soils and rainfall often have completely different systems of land use, even when controlled for desired yield, crop varieties, and other factors (e.g., Savonnet 1959, Barral 1968, Remy 1967). In order to proceed from this point, it is important to recognize that economic strategies are, despite environmental constraints, choices. Both archaeological and ethnographic research on the adoption of various domesticated crops and agricultural techniques have demonstrated clearly that these processes are fluid. Traditional farmers are rarely locked into a single regime, and often strategies will fluctuate significantly depending on local historical variables (Kuba and Lentz 2006). This can be seen in numerous cases across West Africa, including the Gobnangou, where previously mobile farmers were forced by the colonial regime to permanently locate their villages, and were able to relatively easily employ traditional techniques to maintain the fertility of the core land around the village (see Chapter 2).

In conclusion, even when one desires a certain yield or surplus, there is no one "best agricultural practice" to obtain it in a given location (Chapter 4). While microenvironments play a certain limiting role, traditional farming practices are intricately tied to social and political organization as land tenure and labor are key elements in the organization of an agricultural system. Modeling these systems is particularly difficult when shifting cultivators move frequently and use long fallow periods of more than twenty years. Community movement and land allocation are rarely events: rather they are processes that occur over multiple growing seasons, and in most traditional agricultural systems with long fallows, land access is constantly negotiated. Most ethnographic case studies lack the longitudinal nature necessary to fully describe practiced rather than idealized crop rotational schemes, gradual village relocation, and land reallocation. Archaeological data, while significantly lower resolution, have the time depth necessary to evaluate these processes.

The Gourmantche: Shifting Cultivators in Southeastern Burkina Faso

A society that demonstrates the deeply embedded nature of shifting cultivation is the Gourmantche,[1] who inhabit southeastern Burkina Faso, and neighboring parts of northern Benin and western Niger (Figure C.1). A key component of Gourmantche society is a strong hierarchical organization, historically legitimated by a belief that the ruling class subjugated indigenous populations at some point in the past. As is stressed by Madiega (1982:180-92), descent is recognized patrilineally, and patrilineages and patriclans structure social and political roles both locally, and also connect various political arrangements (formations) in the greater ethnic setting (see also Cartry 1966). The history and ethnology of the Gourmantche, however, are much more poorly understood than their neighbors the Mossi, owing to colonial era decisions and a perception that the region is peripheral to major historical events.

Consequently, the Gourmantche polity is one of the least studied complex societies in West Africa. The Gourmantche make few appearances in the accounts of Arab travelers or early European explorers, and remained largely unknown to the West prior to the 20th century. During the colonial era, an uncritical synthesis of oral traditions was compiled by an administrator (Davy 1952) and later revised by a church official (Chantoux 1966). Their work, which emphasized dynastic succession, remained the master narrative on the kingdom until the 1980s, when Y. Georges Madiega, a native Gourmantche historian working in a modern framework inspired by Vansina (1965),

1 The term "Gourmantche" is frequently written as "Gulmance" and can refer to the historical political entity, the language (*gulmancema*), or the speakers of the language (*gulmanceba*) (Madiega et al. 1983). Today, the three are coterminous, although there was likely significantly more variability in the past (see Appendix C). The spelling "Gourmantche" is used in this work to maintain continuity with other English language sources, and unless otherwise noted refers to the ethnic group (people who speak the language and practice the culture)

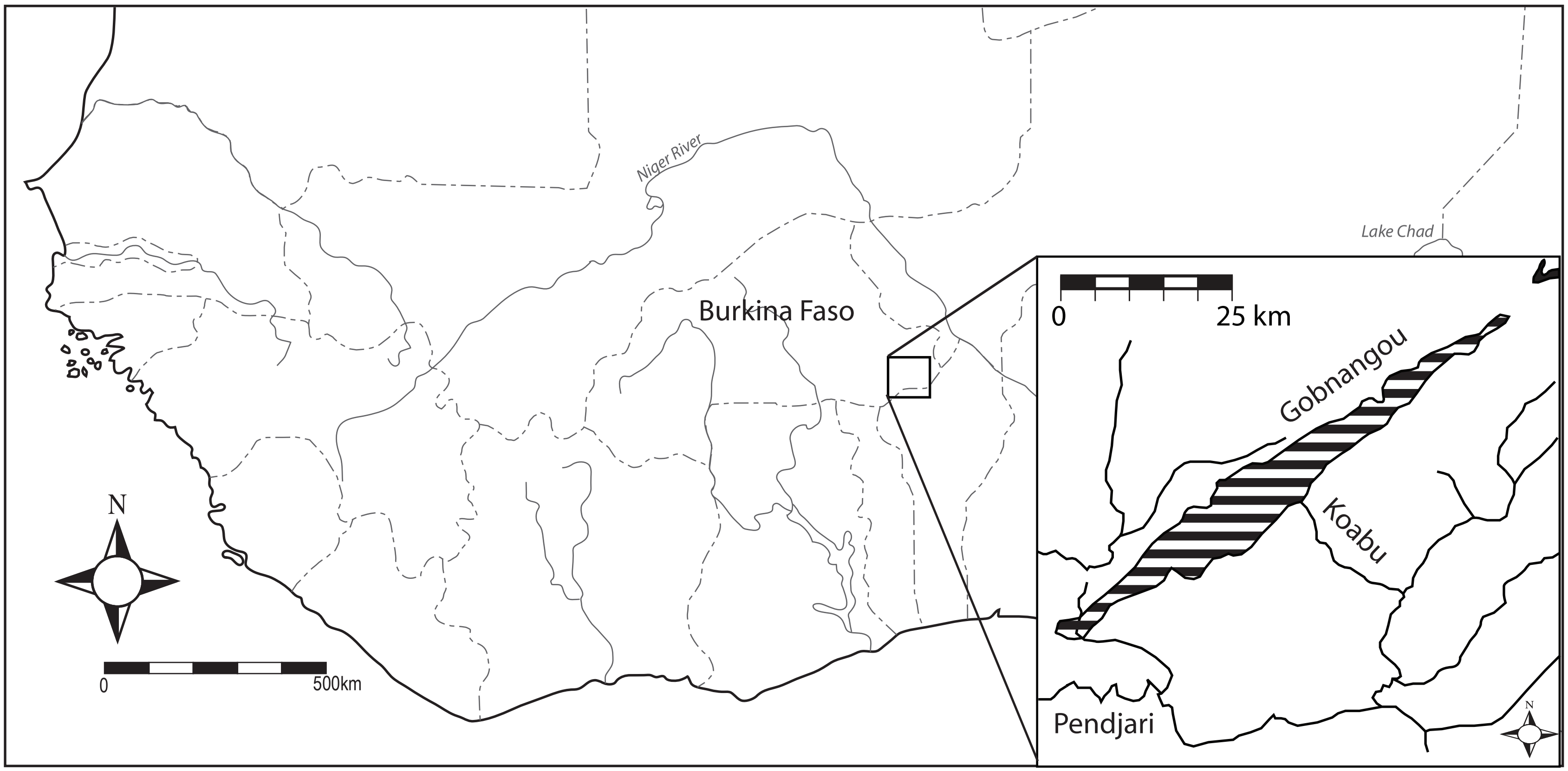

Figure 1.1: Location of the Study Region in West Africa

re-evaluated the oral historical record (Madiega 1982, Madiega et al. 1983).[2] The first anthropological research on the Gourmantche was carried out by a French ethnographer Michel Cartry (1963, 1966, 1968, see also Balandier and Sautter 1963), who worked primarily in the Gobnangou region in partnership with an agronomist (Remy 1967, see also Balandier and Sautter 1963). In the 1970s, Richard Swanson, an ethnologist raised by missionary parents in the Gobnangou, carried out several seasons of fieldwork throughout southern Gourmantche. While, like Cartry, his primary academic interest was in symbolic representation (Swanson 1985), he also compiled a practical review of Gourmantche agriculture for USAID (Swanson 1979). In the late 1980s, a German anthropologist documented traditional material culture throughout the Gourmantche region (Geis-Tronich 1989, 1991). Within the boundaries of modern Gourmantche, archaeological research has been confined to the Gobnangou, where, prior to the project presented here, Late Stone Age sites had been the focus of research (see below).

The pre-colonial Gourmantche polity has been variously characterized as a hierarchical state (Chantoux 1966), a paramount chiefdom (Swanson 1984), or a collection of independent chiefdoms that were never politically unified under a single ruler (Madiega 1982). In spite of the disagreement over the political system, these scholars agree that the Gourmantche have a very strong sense of common identity. Within Burkina Faso, the Gourmantche stand out for their relatively unified linguistic tradition and the modern ethnic homogeneity of their territory and communities (Cartry 1966; Madiega 1982; Pigeonniere and Jomni 1998). Another interesting feature of the Gourmantche setting in comparison with savanna neighbors is the very low population density of the region. Although calculated in the 1970s at 9 persons per km, it is much lower in some areas since the region includes widely dispersed pockets of higher population density. One of these is the Gobnangou escarpment in the extreme southeast of Burkina Faso. The deep cultural commitment to shifting agriculture is well-demonstrated in this area, which has been referred to as the "granary" of Gourmantche land (Cartry as quoted in Balandier and Sautter 1963:439).

The Gobnangou Escarpment: Archaeological Approaches

The Gobnangou escarpment is a sandstone massif 100 km long by a maximum of 10 km wide rising as much as 100 m above the surrounding savanna. Pocked with caves and canyons, it acts as an aquifer for the region and is drained by numerous small watercourses, a few of which remain into the late dry season. As a result, land at the base of the escarpment is particularly fertile, and the diverse microenvironments created

2 The oral history of the Gourmantche kingdom is presented in detail in Appendix C.

by both the escarpment itself and the soil diversity resulting from its position on the border between two major geologic regions contain a wide variety of plant and animal communities (see Chapter 3 for a more detailed discussion of natural environment of the Gobnangou). Combined with the availability of water, it is unsurprising that the Gobnangou supports much higher population densities than the surrounding savanna (Frank et al. 2001).

Attracted by the Gobnangou's status as an optimal niche and its location on the prehistoric forest-savanna margin, in 1988 the University of Frankfurt, in cooperation with the University of Ouagadougou, began archaeological fieldwork in the region in hopes of identifying early agricultural sites. Led by Drs. Peter Breunig and Karl Wotzka, the project, which was part of larger interdisciplinary effort on landscape ecology and cultural knowledge in the Burkinabe savanna, incorporated a large team of specialists including botanists and geologists and produced a significant literature on the geomorphology, ecology, and paleoenvironment of the region (Kuppers 1996; Muller-Haude 1995). Over the course of three seasons of fieldwork, numerous sites were identified through opportunistic survey and three (Maadaga, Pentenga, and Kidikanbou) were excavated extensively. The results were synthesized in a 63 page monograph (Frank et al. 2001, also Breunig and Wotzka 1991). Dr. Antoine Millogo of the University of Ouagadougou excavated a rockshelter in 1989 (Millogo 1993a, 1993b).

While the Frankfurt team had originally planned a long term project in the region, they were disappointed by the quality of the archaeological sites they identified. The few rockshelter sites were either heavily bioturbated (Pentenga Rockshelter) or had no organic preservation (Maadaga Rockshelter), and the open air sites were uniformly shallow and badly eroded – typical of those left by shifting cultivators who move their residences frequently. Not only did these sites lack the long occupation sequences the Frankfurt team felt were necessary to closely examine change in agricultural practices, but a paleo-ecological reconstruction using charcoal from Pentenga Rockshelter indicated that the local area was not heavily farmed until the relatively late date of AD 1100 (see Chapters 3 and 5). Given the fertility of the local landscape, these results were unexpected, and suggested reasons other than environmental constraints determined prehistoric agricultural practice in the region. I decided to initiate a new research project in the region that aimed to study the development of agricultural practices and their social milieu given the late adoption of agriculture and high degree of mobility in…

Directed by the author, the 2004/2006 full coverage archaeological survey of the catchment of the Koabu drainage (one of many with their headwaters in the escarpment), and area of over 75 km^2, confirmed the Frankfurt team's assessment that the region generally lacked sites with deep cultural deposits. While more than 500 previously undocumented sites were recorded (the vast majority dating to within the last 1000 years), over 90% were small single occupation scatters less than 50 cm deep (a complete inventory of sites is presented in Appendix D). However, the presence of a diversified pottery tradition and frequency of specialist activities such as iron smelting and (in more recent occupations) indigo cloth production indicate that these sites were part of a complex, economically integrated community, albeit one that relied on shifting cultivation as its primary farming practice.

This type of archaeological record is not rare in West Africa –perhaps the most well documented case being the megalith zone of the Gambia River valley (Lawson 2003)—and poses specific problems for analysis. Notably, the shallow nature of the sites hinders accurate dating. Not only are secure radiocarbon samples difficult to obtain, the lack of stratified deposits makes even the relative sequencing of ceramics problematic. Even when the sites can be roughly sequenced, as is the case in the Gobnangou region (see below), dating is necessarily broad. Furthermore, the classic problem of palimpsest in a mobile landscape is difficult to resolve. We will likely never know whether 50 sites in this region are the result of five families moving 10 times or 25 families moving twice, not to mention the potential impact of processes such as budding or immigration. Despite these limitations, a broad view of social processes and their associated agricultural practices were identified over the first and second millennia AD, providing both direct evidence for and contextual information regarding the long-term evolution of society in the region.

In analyzing the sequence, I placed a strong emphasis on the mobility of the prehistoric population. During my fieldwork in southeastern Burkina Faso, I was struck by the fact that local social networks and relationships were rarely governed by spatial location of residence. Individuals, particularly those living in dispersed compounds, often had closer social ties with distant villages than with their neighbors. In my conversations with locals (and confirmed in my reading of the academic literature on the Gourmantche), it was clear that this phenomenon was the result of frequent relocation of the physical residence, and that mobility was an integral element of Gourmantche society. As discussed above, it was instantly apparent in the archaeological record that this strategy had great antiquity in the region. Given the importance of mobility and its close ties to the practice of shifting cultivation, it quickly became clear that in order to understand the prehistory of the region, it would be necessary to explore this core societal dynamic (Chapter 2).

Occupation	Estimated Dates	Number of Occupied Sites
Pwoli	ca. AD 700-1000	3
Siga	ca. AD 1100-1650	344
Tuali	ca. AD 1650-1900	135

Table 1.1: Archaeological Sequence for the Gobnangou Region

Society Beyond the Escarpment: A Long View

This thesis takes as central the importance of the long term perspective for understanding societies. As described above, an exploration of concepts of mobility provides a framework with which to interpret the archaeological data (Chapter 2). The environment of the study region is then described in detail, with particular attention to human interaction with the natural resources (Chapter 3). After a brief review of traditional savanna farming practices (Chapter 4), I present a synthesis of the archaeological results and interpret them within a social context (Chapters 5-8). More technical analyses of the ceramics and excavation sequences are available in Appendices A and B, while Appendix C provides an overview of the available historical data on the Gourmantche. Finally, Appendix D consists of a comprehensive site inventory.

I begin the prehistoric sequence with a critical summary of previous research on Middle Stone Age and microlithic Late Stone Age sites in the region, supplemented with observations from one additional site identified and studied by my project (Chapter 5). Using recent research on the general characteristics of microlith using hunter-gatherers in other regions of Africa, I suggest that the Gobnangou region was a rich micro-environment with predictable resource availability. From there, I move to the main contribution of this thesis; the development of the sequence from ca. AD 700 onward.

While the Frankfurt project had developed a preliminary ceramic chronology for the Gobnangou region (Frank et al. 2001; Wotzka and Goedicke 2001), it relied predominantly on samples from the north side of the escarpment, emphasized occupation prior to the 2nd millennium AD, and had few points of concurrence with the ceramics recovered by this project. Therefore, in order to place the identified sites within a chronological framework, I developed a local ceramic chronology consisting of three occupations: Pwoli, Siga, and Tuali (Table 1.1).[3]

3 The occupation names, Pwoli, Siga, and Tuali, are drawn from Gourmantche locative particles that roughly translate, respectively, to “behind”, “middle”, and “in front.” The use of the term “occupation” rather than the more common “phase” is meant to emphasize the preliminary nature of the sequence and allow for possible temporal overlap between the ceramic divisions.

The Pwoli occupation sites (ca. AD 700-1000) provide the earliest conclusive evidence for the exploitation of domesticated plants and animals in the study region (Chapter 5). These sites are mounded tells with architectural sequences including multiple floors, and are known primarily through excavation. While Pwoli occupation sites have the strongest evidence for sedentary occupation identified in the region, the diversity of the wild fauna, including fish from deep river channels, indicates that the residents of these sites exploited resources beyond their local area.

The Siga occupation (ca.AD 1100-1650) is characterized by an explosion of ephemeral residential sites, and is the first occupation in which shifting cultivation is the dominant economic strategy (Chapter 6). Despite the mobility of the population, the occupation is characterized by a diversified ceramic assemblage, significant iron smelting, and possible involvement in regional exchange. Inhabitants relocated their residences freely within (and likely beyond) the study region, and there is evidence of active social and economic networks that tied the region together despite the mobility of the population. Finally, I critically evaluate the Siga occupation in the context of proposed timelines for the foundation of the Gourmantche polity.

The Tuali occupation (ca. AD 1650-1900) is signaled by a significant homogenization of the ceramic assemblage, accompanied by a general shift in settlement towards the escarpment (Chapter 7). Although residents maintain their mobility, the distribution of both residence and specialist activities like iron smelting becomes more restricted. Towards the end of the Tuali occupation, several complexes of plastered pits for dyeing cloth with indigo were constructed. These high investment installations could be indicative of greater involvement in regional trade networks. The Tuali occupation is placed within the context of the historic Gourmantche polity.

I conclude the thesis with a discussion that reviews the Gobnangou sequence within two major themes: subsistence and community (Chapter 8). I then place the data in a greater context by discussing their implications for colonial and post-colonial narratives of environmental degradation, insecurity and peripheralization. Finally, returning to the theme of mobility, I detail the long term stability and adaptability of the practice in the study region despite numerous social and economic transformations.

CHAPTER 2
MOBILITIES: MOVING IN TIME, SPACE, AND SOCIETY

Mobility in agricultural societies can occur at a variety of scales along numerous social axes and is generally considered complex and fluid. Threshold concepts of mobility/sedentism have long been discarded and even conceptualizing mobile-sedentary as two poles of a continuum has been criticized for obscuring variability in mobility within a community (Rafferty 1985, Kelly 1992, Varien 1999, Berelov 2006). As Kelly (1992) has noted, archaeologists tend to focus either on the processes by which people become sedentary or on changes in sedentism, whereas in many cases mobility may be the default; he argues that “sedentism probably occurs under or soon results in, conditions where residential and/or long term mobility are no longer viable solutions to local resource failure” (Kelly 1992: 58). In other words, while archaeologists are looking for reasons (conscious or unconscious) that people move, for prehistoric peoples the question, if raised at all, may have been why stay?

Despite the widespread acknowledgement in ethnology as well as most modern agricultural development literature that mobility is a cultural practice, many archaeologists have continued to emphasize the economic aspects of mobility: particularly notable in discussions of agricultural populations is the idea of “push” factors such as environmental degradation, health, nutrition, disease, population pressure, and conflict (e.g., Nelson and Schachner 2002). While mobility is certainly an economic strategy that would not be viable if it were not in some way environmentally advantageous or at least compatible, terms like “push” contain an inherent assumption that the preferred choice would be to stay in one place. As will be seen in the discussion below, the frequency of moves, their distance, and the length of residence at the scale of individuals, households, and communities fundamentally affect the ways in which these social units are constructed and maintained.

This chapter begins with a brief review of mobility in agricultural societies at the individual, household, and community level, followed by an argument for mobility as a social and political, as well as economic practice. This discussion is then brought to the archaeological record through an exploration of the ways in which mobility is materialized. Finally, I examine the political, economic, and social implications of mobility as specifically practiced by shifting cultivators.

Coming and Going: Mobility Within Social Units

"Residential mobility" is generally used in anthropology to refer to the movement of individuals between households and can take forms such as fostering, extended visits, or marriage (Kelly 1992).[1] Bohannan (1954:4), in his study of the Tiv noted the ever changing composition of any given household ("I know compounds which were swarming with children one week and almost without children the week after"). Bohannan's experience is not atypical, and an enormous literature surrounds the difficult question of defining household membership (for an Africa centered review, see Guyer 1981). While this type of mobility can be challenging to spot archaeologically, especially in areas with a poorly defined prehistoric material culture, even more difficult to discern is the mobility of individuals through domestic labor groups within a household. A young man may, through the course of his life, work in and be fed from his mother's fields, then fields held by the compound head, and upon marriage open his own fields, all while maintaining residence in the same compound.   Consequently, new economic units may be formed without segmentation of residences, just as single households can split into multiple residences while maintaining their unified economic structure (Bohannan 1954, Goody 1958).

Much as residential mobility is fairly ubiquitous, seasonal movement by subsets of either the community or household population are extremely common among traditional farming communities. While in the modern era seasonal migration is most frequently to urban areas or plantations in search of wage labor (FAO 1984), in precolonial societies these movements were usually logistical to better exploit specific economic resources. These movements may occur between growing seasons, or (as in the case of Powahtan foraging expeditions in eastern North America), in the periods between planting and harvest (Rountree 1989). During the dry season in the West African savanna, groups (and in some cases entire communities) frequently move to the banks of major rivers to catch and smoke fish. Likewise, small parties may make

1 This defintion of "residential mobility" follows the term's use in the ethnographic literature on households in primarily agrarian societies, an intellectual tradition which forms the basis for significant portions of the discussion in this chapter. In contrast, scholars of hunter-gatherer societies tend to use "residential mobility" when discussing movement of the entire band to a new primary residence or home base. This definition, which is often contrasted with logistical mobility (seasonal or temporary movements of population subsets while maintaining a primary residence of the band) was popularized in the archaeological community by Binford (1980).

extended hunting trips in search of large game. Finally, amongst cattle-keeping societies, young men are often sent away from the village with the cattle during the growing season to prevent them from grazing on crops. They return with the cattle in the dry season to feed on the remnants and fertilize the fields.

During the growing season, the construction of temporary residences near agricultural fields is a frequently employed strategy to avoid long commutes.[2] Field huts may be inhabited by entire families or simply a few children charged with protecting the crop from birds and other foraging animals, depending on the accessibility and the nature of the crops grown on these fields (e.g., Remy 1967, Kohler 1992). Prussin (1969) notes that Konkomba bush farms often cannot be visited during heavy rains, and are consequently used primarily for low-maintenance cash crops. While many authors (e.g., Remy 1967, Swanson 1979, Gabrilopoulos et al. 2002) have suggested that this type of seasonal field residence is a response to increased population pressure or a land shortage, there is no evidence that this is universally the case (e.g., Prussin 1969). Overall, it is more the exception than the rule for all members of the traditional farming household to be based from a single residence throughout the year (Kelly et al. 2006).

Moving House: Relocating the Primary Residence

In the above cases, mobility does not usually result in the construction of new permanent dwellings; if any are built, they tend to be ephemeral, leaving few archaeological remains.[3] In contrast, the movement of households or entire communities to new locations is frequently accompanied by the construction of significant structures. Provided that the construction of the new residence is a case of relocation of an existing residential group rather than a budding process in which a new residential group is created[4], this may be accompanied by the abandonment of the old site. However, these previous residence locations often remain significant both as activity areas and as social

2 While field huts are usually employed when the distance between the field and residence is such that a daily commute is prohibitive, Preucel (1988 fide Kohler 1992) notes cases in the historic Southwest where field huts are close to primary residences.

3 There are exceptions in the ethnographic record. Rountree (1989:41) describes Powahtan late fall hunting camps as follows: "Living conditions in the camps closely approximated those in the towns. Housing was similar [matting lashed to wooden frames] . . . , and so was the cuisine, for the women brought their mortars and supplies of dried corn and acorns and (probably) cooking pots into the wilderness with them."

4 In order to streamline the discussion, the emphasis is on relocation rather than fission. While in practice the fission process is very similar to moving (such that most of this section would apply), the motives and causes are very different. For further discussion of household fission or budding, see Goody 1958, Guyer 1981, and Stone 1996.

markers on the landscape (Sahlins 1957, Cameron and Tomka 1993, Stone 1996, Varien 1999).

The decision of any given household to abandon their old residence and construct a new one results from multiple, particularistic factors. In general, moving is a process that takes place at the household level; simultaneous relocation of an entire community is unusual except in cases of natural disasters or other strong external stimuli. Moves within the current field system are often short distances: the new compound can be as little as 20 meters from the previous residence. Frequently cited proximal causes include both those listed as "push" factors above such as aging of the compound structure (accumulation of trash, increased health problems) as well less quantifiable factors such as death of a compound head or accusations of witchcraft (Schlippe 1956, Prussin 1969, Stone 1996). The site of the new house is often on land controlled by the lineage, or in unclaimed space within the community (permission may be required if land is communally controlled) (Prussin 1969, Swanson 1979). The effects of these moves on the village structure are fairly minimal: in dispersed communities the move may be inconsequential, while in more nucleated communities the cumulative effect of individual moves can result in either tell formation or a gradual drift, such that the "old" abandoned town is contiguous with the "new" inhabited town.[5] In some cases, the drift may be intentional: in The Gambia, Lawson (2003:18) notes that Mandinka villages of up to 1000 individuals may gradually relocate to a new site (often only ca. 1 km distant) upon the death of a chief.

In contrast, shifting cultivators often move significantly longer distances in search of new fields. The precise timing of these moves is usually triggered by the fallow cycle or other agricultural issues (e.g., weeds, pest infestations), although, as mentioned above, a social imperative towards mobility may be the ultimate cause of the rapid field exhaustion. Site selection requires access to fields: claims to land not already controlled by kin can be established through a relationship with the local earth spirits (mediated by a spiritual leader) (e.g., Tauxier 1912), by permission of a community leader (e.g., Schlippe 1956), or simply by the act of clearing the land (e.g., Swanson 1979).

Moving the primary residence can be a rapid process or one that takes place gradually over many years. At one end of the spectrum, a new site is selected, often with the help of a spiritual advisor and/or permission of a political leader. A new residence is constructed, and the household moves their possessions fairly quickly. If the old residence is not too far away, the family may return to exploit edible plants

5 In the Bwa village of Yankui, Mouhoun Province, Burkina Faso, the author observed a more unusual form of this phenomenon. Households, seeking more space for their newly acquired domestic animals, had moved towards the periphery of town, leaving a largely abandoned core.

(domesticated, cultivated and wild) that will take multiple years to establish in their new location (Schlippe 1956), but otherwise the old residence is rapidly abandoned. In contrast, the move to a new location can be a gradual, almost unintentional process. If the close fields are exhausted, and the farmer finds a particularly fertile or otherwise advantageous location for his bush fields, he or she may begin spending more time there each successive growing season, building more permanent structures, and bringing more of the household with them until eventually, over a period of years, the old residence is completely abandoned (Remy 1967, Swanson 1979, Stone 1996).

At the community level, a long distance move is almost always gradual as individual families follow their own moving programs. In areas where community boundaries and membership are fluid, impromptu villages can form in prime locations, only to disperse as local fields are exhausted. In some areas, where community boundaries are more social and less physical, households will move as they wish within a broadly defined territory (e.g., Rountree 1989). These territories can overlap with those of other communities: in the study region it was not unusual to find households that considered themselves residents of Nampuansiga and Maadaga living a few hundred meters apart ten kilometers away from either village.

Mobility as a Social Phenomenon

The most common explanation for mobility at all levels is as a risk buffering strategy (e.g., Varien 1999). Individuals move to where there is economic opportunity, marry to extend kin networks, and visit to maintain social relationships. Seasonal logistical mobility facilitates the exploitation of multiple resource niches. Households and communities move to locations with better or more fertile agricultural land, more reliable water supplies, or even simply to stake claim to broader territories for future use.

The economic advantages of mobility for agriculturalists should not be underestimated. When land is plentiful enough to allow adequately long fallow periods, shifting cultivation strategies have been demonstrated as highly efficient in terms of the labor input/crop yield ratio (in forest environments, the cost of clearing the land is balanced by the rich soil produced by burning while in savannas the low levels of labor necessary to clear land offset the higher yields possible through intensive farming techniques) (Shipton 1994, Stone 1996). As will be discussed in subsequent chapters, new approaches to savanna ecology reinforce the potential benefits of mobility as a way to optimally exploit patchy and variable environments.

Discussions of the environmental and economically driven aspects of mobility almost inevitably draw on “push” and “pull” factors, and the proximal cause for any given individual decision by a farmer to move to a new location is often related to these factors, particularly local field fertility, although weed control and even wild resource depletion have also been cited (e.g., Gross 1975, Gooneratne et al. 1980, Stone 1996). However, proximal causes for economic decisions are inherently particular and historical. A single phenomenon, exhaustion of a particular field, may have multiple explanations. Are farmers moving because they have been "pushed" from that location, or was the field fertility not maintained because moving is expected and preferred? It is necessary to understand the farming system to understand why proximal causes exist.

Even at a larger scale, in almost no case is the choice of economic strategy as simple as balancing yield, risk, and labor. As will be seen in Chapter 4, there can be multiple optimal farming solutions for any given ecological zone, and while mobility is *a* risk buffering strategy, it is rarely the *only* risk buffering strategy. The choices between sedentary and shifting (i.e., intensive and extensive) farming strategies, while environmentally constrained, are fundamentally socially mediated (Shipton 1994, Stone 1996, Baker 2000). A crop cannot be planted without access to land, labor, and capital: Stone (1993:78) in particular notes that both mobile and intensification strategies require what he terms "social technology" to facilitate labor availability, land disputes, and other concerns, and that social systems adapted to the requirements and problems of a mobile strategy may not be suited to a sedentary lifestyle.

Indeed, the requirement of frequent access to new fields has resulted in specific limitations on the political control of land amongst shifting cultivators. In many cases, land tenure is divided into political rights (control) and economic rights (access), with centralized authorities having little power over the latter (Turner and Brush 1987:15). For instance, amongst the Azande of Central Africa, chiefs controlled the land itself and received tribute from crops grown in their territories although they had little influence over the location of individual farms (Schlippe 1956: 12-3). Mobility can also facilitate the distribution of land: in the study region, Remy (1967:37) notes that village relocation allowed the community of Yobri, without transferring land rights, to "periodically redo the spatial projection of social groups by the function of their quantitative and qualitative evolution." Yobri is also illustrative of the difficulty of maintaining Gourmantche tenure traditions associated with frequent mobility in a sedentary context: colonial settlement resulted in a complex, highly problematic layering of land claims leading to frequent disputes (Remy 1967, see Chapter 4 for more details). In both cases, mobility is embedded in the political structure of the community and is intrinsic to the roles and rights of leaders. Likewise, mobility is often central to the religious practices of shifting cultivators, as specific rituals may be associated with elements of the shifting process, notably the frequent opening of new fields and construction of new residences (e.g., Jha 1997).

Guyer et al.(2007:11) have characterized "observed persistences" of shifting cultivation as particularly puzzling given the radical ecological and social transformations of sub-Saharan Africa in the 20th century, most of which have encouraged or rewarded sedentary farming techniques at the expense of mobile methods. Documented cases of failure in attempts to settle shifting cultivators are numerous, regardless of whether the carrot of economic incentives or the stick of forced settlement is employed (e.g., Whittlesy 1937, Harroy 1944, Allan 1949, 1965; for examples outside sub-Saharan Africa see Graham 1994, Ramakrishnan et al. 2006). The outcomes of these situations suggest both that 1) shifting cultivators are able to effectively practice sedentary farming and 2) they often prefer not to, even when it is the best economic choice. The reason for this is hardly puzzling; while mobility may have arisen as an economic strategy, it has become culturally embedded in labor and land tenure to the point where intensification may not even be a functional option (Stone 1993, 1996). This is not to say that shifting cultivators must remain mobile and cannot choose to use intensified farming techniques. However, the transition is not as simple as changing farming practices: it must be accompanied by significant social transformations.

For the archaeologist, a cultural approach to mobility provides a particularly distinct advantage for studying the ephemeral sites left by shifting cultivators. These sites often have few *in situ* features, and little in the way of biological preservation. However, by focusing on the social and political context in which mobility takes place, it is possible to build upwards from farming *practice*, with its significant cultural variation, rather than farming *products* which are often relatively uniform within an ecological zone at the scale visible to archaeologists.

Materialization of Mobility

To interpret the spatial and temporal dimensions of mobility in the archaeological record, it is essential to understand the ways in which mobility is materialized. As mentioned above, most of the archaeological mobility literature is focused on hunter-gatherers, and sedentism is usually discussed within the context of a transition from mobile foraging to sedentary agriculture (e.g., Ames 1991). The result of this research trend has been a set of archaeological indicators that are based more on correlates of foraging and farming economies than on mobility (for a recent synthesis, see Berelov

2006:124). Consequently, archaeologists who focus on mobility within agricultural populations have begun to emphasize the materialization of mobility itself, i.e. evidence of occupation length and intensity of site use (e.g., Varien 1999).

At the level of the individual household, building, maintaining, and living in a residence creates a material record. In the study region, residences are generally constructed using puddled mud, although temporary dwellings may be constructed from wooden frames wrapped with grass mats (Geis-Tronich 1991). The weaving of these mats is not necessarily faster than mud construction, but they can be made at the primary residence well in advance and easily transported to the desired location. In contrast, mixing mud suitable for structures is physical, dirty labor that must be done at the building site.

Mud architecture is also more persistent than grass architecture, but it requires a high level of maintenance: yearly plastering and thatching, frequent reflooring, and often complete reconstruction. If the residence is maintained for an extended period of time, the result is the creation of the mini-tells common in western Burkina Faso. This effect can be seen in extreme form in the town of Djenne, Mali, where many mud-brick houses have been occupied for hundreds of years: the ground surfaces of the interiors have moved upwards as layers of floor are added, resulting in thresholds well above the street. Consequently, a puddled mud residence that is occupied for a longer period will leave a more robust archaeological deposit. Likewise, the location and density of trash can be direct indicators for intensity of occupation, although if household waste is deposited on fields rather than near the residence, accurate data may not be available (Killion 1990, Graham 1994).

Similarly, mobility in space affects the nature of the archaeological record. Short distance moves can either significantly accelerate tell formation, or, in the case of the village drift discussed above, create extensive palimpsestic archaeological deposits. In contrast, long distance moves to dispersed locations will create very ephemeral deposits, which are disproportionately affected by formation processes (Binford 1980, 1982; Schiffer 1987; Dunnell 1992). The distance moved also has a significant impact on the material culture of abandoned sites: heavy, easily replaceable items are more likely to be left behind, while smaller or more expensive items are likely to be moved (Graham 1994). However, choices regarding the transfer of material possessions may not be purely practical: they are often culturally mediated, particularly in the case of a move spurred by the death of a household head, where inheritance customs rather than distance may be the dominant factor.

Archaeology of mobile peoples frequently suffers from the lack of chronological resolution: it is difficult to determine which residences in a dispersed setting were occupied simultaneously, and almost impossible to know which of the previously occupied residences at a given point in time were known elements of the cultural landscape. The complicated histories of ephemeral field systems generally cannot be untangled (although some vegetation historians have made the attempt (Lentz and Sturm 2001)). However the archaeological perspective is not as skewed as it might seem. At the community or regional level, mobility leaves a lasting impact on the landscape, one that is both recognized by residents and structuring to the organization of their community. The end result of hundreds of years of shifting cultivation and its accompanying residential moves within a given piece of land is the creation of a cultural (or built) landscape.[6]

The term "built environment" is traditionally used to describe built forms (structures) and spaces that are "defined and bounded by them." (Lawrence and Low 1990). Since the built environment literature is strongly influenced by architectural theory, and many of the pioneering works (e.g., Oliver 1969, Rapoport 1969) are by architects, the emphasis has been on the built forms themselves. Likewise, in the archaeological literature, researchers are more likely to have data on internal built form structure than on the spatial distribution of forms, as the latter requires extremely large exposures if the settlement is nucleated (e.g., Kent 1990). However, Prussin (1969), with her inclusions of dispersed and nucleated villages, clearly demonstrates the importance of space between structures: the environment deliberately created by the dispersion of built forms is in many ways as structuring as the compact village. In addition unoccupied residences, fallowed fields, patches of wilderness, and economically and symbolically significant natural and constructed features all actively structure the lived environment (Schlanger 1992). For instance, choices on where to build new residences are made with knowledge of all of these landscape elements, whose purpose, role, and valuation in the cultural landscape are constantly shifting. Thus in cases such as that of the study region, where we have little intra-structure data and instead data on the space between sites, built landscape is a valuable theoretical tool.

6 The concept of built landscape is a natural development from approaches such as landscape archaeology or off-site archaeology (Rossignol 1992, Anscheutz et al. 2001) which differ from classic regional survey and settlement pattern analysis only in their increased emphasis on the inclusion of isolated artifacts and minor natural features (Parsons 1972, Blanton 2005).

Mobility as an Element of Shifting Cultivation

While an emphasis on the materialization of mobility itself is productive for understanding the nature of the landscape, it is necessary to go a step further, and examine whether the mobility of shifting cultivators impacts their political, social, or economic organization. Although farming techniques are in part shaped by local environment and the demands of specific crop plants (e.g., yam cultivation is not necessarily facilitated by use of a plow), no clear relationship is known between shifting cultivation and political organization. For example, it has been suggested that mobility is an indicator of non-centralized societies with limited political hierarchy (Ganguly 1969; Prussin 1969), but also argued that shifting cultivation is characteristic of more vertically complex societies (chiefdoms and states- see Shipton 1994).

In the former cases, the strong household autonomy common among shifting cultivators is seen as an indicator of “primitive farming” that lacks intensifying strategies. Within this framework, researchers emphasize the relative poverty of shifting cultivators (a paucity of material possessions owing to frequent movement), including the low incidence of livestock that would allow intensification through animal traction, but also serve as a currency of social wealth.

In contrast, Shipton points out that in the Great Lakes region of East Africa shifting cultivation is only possible when there is a powerful central government that can assure security for vulnerable dispersed homesteads. When there is a weaker political structure, people cluster together in villages for safety. This same phenomenon was observed by Netting (1969) and Hocking (1977) in the Jos and Abuja regions of Nigeria respectively. In both cases, shifts during the early twentieth century away from nucleated settlements towards dispersed homesteads are attributed to the security provided by the colonial government. What is common to these seemingly contradictory frameworks is simply that shifting cultivation is associated with household autonomy, but that this can be politically articulated in a variety of ways.

While there are few commonalities amongst shifting cultivators in terms of political complexity, they do tend to have unilineal inheritance. Goody (1962) points out that in many dual inheritance systems, which tend to distribute rather than concentrate wealth, the possessions of the deceased are normally divided into immobile (land and architecture) and movable goods (including livestock wealth), with the former most frequently passing to the patriline, while the latter can be dispersed to widely distributed matrilineal relations. In the case of shifting cultivators, where the social right of access to land is generally significantly more valuable than land itself, dual inheritance is extremely rare (Goody 1962). This is not to say that the accumulation of wealth is only possible through livestock or other valuable movable goods: amongst the Tiv, those with the largest fields can afford more of the beer used to get others to help clear and farm their land, and thus are able to maintain and increase their higher yields (Bohannan 1954).

The focus of this chapter has been on the diverse meanings and practices associated with mobility in agricultural communities and the ways in which their materialization results in culturally constructed landscape. While acknowledging the importance of the local ecological constraints and economic considerations, I argue that the social environment is as important as the natural environment to the maintenance of and changes in these strategies. It essential that both arenas be considered in any comprehensive study of a mobile society. Therefore, an essential first step in understanding the extent to which mobility strategies in farming practices are determined by social variables is to address the ecological context in which those decisions are made.

CHAPTER 3
THE ETHNO-ECOLOGY OF SOUTHEASTERN BURKINA FASO

Agriculture is inextricably entwined with its physical setting. Soil can be enriched, but only to a degree. Crops can be irrigated, but only if there is water available. Even within a highly anthropogenic landscape such as the West African savanna, the precipitation, groundwater, soils, geomorphology, temperature, day length, and numerous other factors affect the plants and animals (domestic or wild) that flourish. Thus, in order to understand the cultural factors that shape subsistence practice, it is necessary to account for the natural constraints on the range of options available.

Likewise, the modern natural landscape is itself a cultural artifact. Humans may optimize and encourage a natural resource or virtually eliminate it from the landscape. Whether the results of cultural action are purposeful (e.g., preserving edible plants when clearing land) or unintentional (e.g., colonization of abandoned settlements by ruderal herbs), the cumulative effects of even low density human occupation of a region shape the modern landscape.

This chapter's focus is on the physical landscape of the study region and the plants and animals that live there. Drawing heavily on the work of geologists, botanists, and zoologists, the discussion emphasizes the limits and opportunities the environmental setting provides for those who derive their subsistence and livelihood from its resources.

Geology

Central West Africa is an ancient landscape with no significant tectonic activity since the Precambrian (Sattran and Wenmenga 2002). The terrain is relatively flat and what relief exists is heavily eroded. In this landscape, the sheer cliffs of the Gobnangou escarpment dominate the surrounding terrain and are frequently referred to locally as "mountains" despite a maximal effective elevation of only 200 meters (Müller-Haude 1995).

The Gobnangou escarpment is the northernmost of a series of sandstone outcrops and chains running along the border of two major geologic formations: the Volta Basin and a vast peneplain known colloquially as the Mossi Plateau (Figure 3.1). The latter,

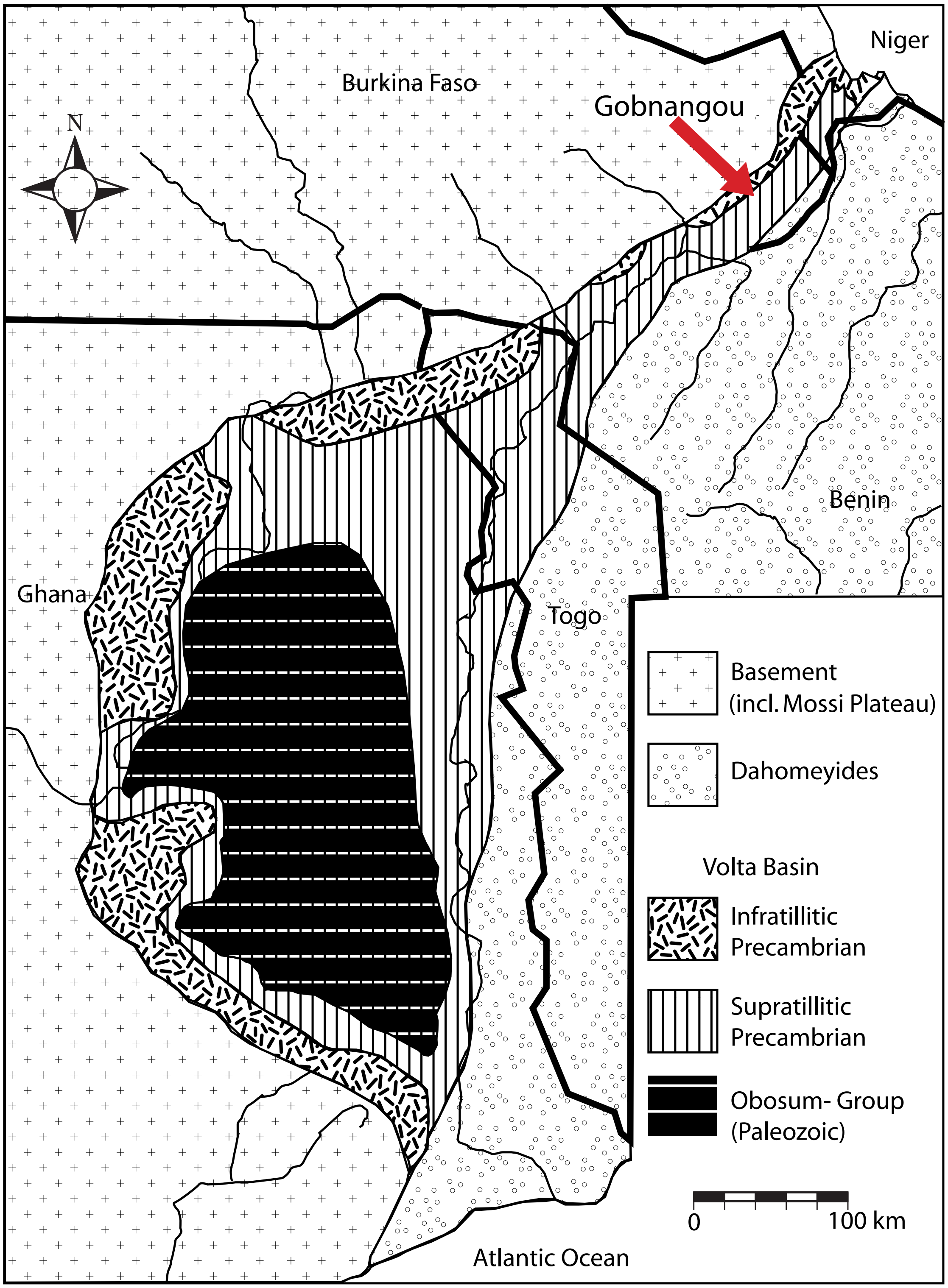

Figure 3.1: Geology of the Volta Basin (Redrawn from Frank et al. 2002).

which covers the bulk of modern Burkina Faso, is composed predominantly of a lateritic duracrust punctuated by hills and outcrops of metamorphic quartzites and volcanic rocks (Sattran and Wenmenga 2002).

The Gobnangou, however, lies within the narrow northern extension of the sedimentary Volta basin. The cliffs themselves are an outcrop of the basal geological formation in the area, a fine-grain quartzitic sandstone known as the Dapaong-Boumbouaka Group (Sattran and Wenmenga 2002). The current form was created largely through erosion, and both water and wind continue to modify the escarpment. In the plains surrounding the Gobnangou, this basal layer is overlain with ca. 50-100 m of sedimentary horizons known collectively as the Pendjari or Oti Group. Significant members of this group include the tillites, dated to ca. 650 mya, which are indicative of glacial activity in the region, and the high quality cherts found in the Gobnangou that were deposited into areas scoured by these glaciers. As will be seen in Chapter 5, this prime tool-making material may have attracted some of the earliest inhabitation in the region.

Today, the Gobnangou runs approximately 100 km NE-SW, and reaches up to 10km in width. Although cut by numerous canyons and valleys, some of which are filled with sediment, the top of the escarpment is generally flat and rocky. In contrast, the edges of the formation vary from sheer rock faces (with or without substantial talus slopes) to gradual slopes formed by large, stepped layers of sandstone. Small stack caves are common, both on the external faces and internal canyons of the formation. While the Gobnangou is striking as a physical landmark, its most significant role locally is as an aquifer.

The porous sandstone absorbs and stores water from the seasonal rains, and consequently many of the small drainages originating in the escarpment run deep into the dry season (Müller-Haude 1995). Even when not actively flowing, the preponderance of vegetation around the channels throughout the year indicates sub-surface moisture, and many pools at the base of the escarpment are important sources of dry season water for both humans and animals. As will be seen below, these high dry season moisture levels of the Gobnangou result in important microenvironments within and around the escarpment. In contrast, the rapid, high-volume run-off of the rainy season creates flowing rivers that connect the escarpment to the resources of the Pendjari River system while distributing alluvial elements to the region.

The study region is located along the south side of the Gobnangou. With the exception of a few canyons, the escarpment limit is composed of steep cliff faces, pocked with several caves of varying size and accessibility. Inside the largest of these is the

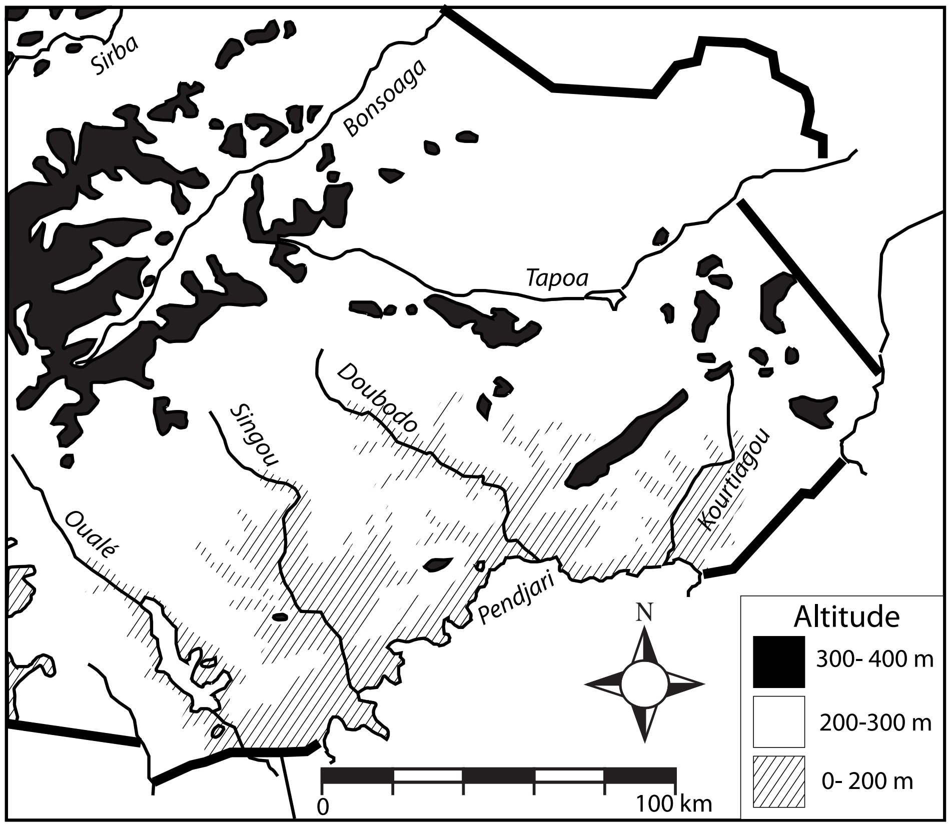

Figure 3.2: Major Rivers and Geographic Features of Southeastern Burkina Faso (Redrawn from Pigeonnière and Jomni 1998)

archaeological site of Maadaga. In addition to numerous paths through the canyons, the escarpment faces are rugose and can be easily scaled in most areas. The cliff reaches its maximum height of ca. 150 m near the center of the survey region, and descends to heights as low as 20-30 m at the northern and southern limits.

Hydrology

In general, the Gobnangou is within the Volta drainage system. (The exception is the northwestern section of the escarpment, which drains into the Tapoa River and ultimately the Niger River) (Figure 3.2). Water from the escarpment flows through numerous small tributaries into the Pendjari River, which today forms the border between Benin and Burkina Faso. The Pendjari joins with the Oti River in northern Togo, eventually flowing into Lake Volta in central eastern Ghana.

The Pendjari River originates in the Atakora mountains of Benin, which are the source of much of its water (Hughes and Hughes 1992). After skirting the southern edge of the Atakora massif as it flows north, the Pendjari takes a sharp turn and flows back towards the south. Now fed by tributaries from the Gobnangou as well as additional run-off from the Atakora, the river slows and widens. Rainy season flooding peaks in September, when the river rises as much as four meters and its floodplain can reach more than 5 km in width (in contrast to the dry season channel width of less than 0.5 km) (Hughes and Hughes 2002). Like most major permanent rivers in the region, the organisms that carry onchoceriasis (river blindness) and schistosomiasis are endemic.

While most drainages originating in the Gobnangou flow towards the Pendjari, the geography is such that those on the north and south sides of the escarpment follow very different paths. To the north, water from the escarpment flows into a wide, shallow channel that runs generally parallel to the cliff face. In the south, where the study region is located, drainages flow perpendicularly from the escarpment for about 20 km before reaching the Kourtiagou, a major tributary of the Pendjari with its own relatively minor floodplain (Hughes and Hughes 1992). As a result, each primary drainage channel in the south has a smaller catchment. The channels of these southern drainages are for the most part narrower and deeper than their northern counterparts, perhaps indicative of faster flowing water. As will be seen below, these streams deposit erosional sand from the Gobnangou along their paths.

As mentioned above, the Gobnangou acts as an aquifer for the region, and water tables, particularly near the seasonal drainages, remain high year-round. Aside from a few pools, surface water during the dry season is a rarity. Although major seasonal drainages may remain moist, particularly near the escarpment where they are fueled by springs, they are generally reduced to a trickle, and are easily crossed. As a result, despite the complexity of the drainage system, the dry season landscape is easily and rapidly traversed on foot.

During the rainy season, precipitation, run-off from the escarpment and backflow from the rising waters of the Pendjari combine to fill the network of small drainages that dissect the landscape, as well as flood low-lying areas. In some cases, these marshy lands are only covered with a few inches of water: sufficient to smother the roots of non-aquatic plants. In other locations, the water fills deep pools (often depressions running parallel to the banks of the primary seasonal drainages) that persist well into the dry season. While flowing, the drainages fill with river fish and other resources, and are an easily accessible source of water. However, the drainages and flooded areas compartmentalize the landscape, significantly inhibiting ease of movement. According to modern residents, travel times between villages can triple in the summer months.

The study region is organized around the catchment of one such primary seasonal drainage and its tributaries. The Koabu is a spring-fed stream originating in the escarpment. Throughout the year, water emerges from a crack on top of the escarpment approximately 20 m from the edge of the cliff. It flows over the edge of the cliff (in the late dry season, the waterfall may be reduced to a trickle), and fills a permanent pool known locally as Odundo. The primary channel of the Koabu originates from this pool, and follows a shallow valley along the escarpment for ca. 500 m, passing through several smaller permanent pools before meandering south towards the Kourtiagou. Within the study region, the Koabu has a clear stream cut, usually ca. 2-3m deep and 3-5 m wide. Near the escarpment, the channel is set in a wide valley with natural levees, formed through natural deposition of the heavier sand particles eroding from the escarpment. As the Koabu flows to the south, these levees become smaller and gradually disappear. Simultaneously, the parallel pools and flooded areas mentioned above become more common: these are often characterized by layers of alluvial clay. In contrast to the Koabu itself, feeder drainages tend to be gently rounded valleys of varying depth and width that lack a clear channel.

Soils and Mineral Resources

On the most frequently reproduced soil map of Burkina Faso, the Gobnangou region is classified as "hydromorphic raw soils up to pseudo-gleys on material of different composition" (Pigeonnière and Jomni 1998). This catch-all classification for frequently water-logged soils includes both tropical ferruginous soils, as well as brown eutrophic soils. The latter, with their high organic content and rich chemical composition, are significantly better for agriculture than the eroded, low-nutrient tropical ferruginous soils that cover much of West Africa (Ahn 1970). However, in both cases, regular inundation compacts the soil, restricting the flow of oxygen and affecting the ability of roots to penetrate the matrix. These soils generally follow the same line as the geological limits of the Volta Basin, while to the northwest of the escarpment, pockets of eutrophic brown soils are present amongst the dominant tropical ferruginous soils.

A slightly more detailed soil map of eastern Burkina Faso (Boulet and Leprun 1969 as reproduced in Müller-Haude 1995), also classifies the bulk of the area immediately surrounding the escarpment as pseudo-gleys (Figure 3.3). However, on the south side of the Gobnangou, this map differentiates a strip of soils 2-10km wide along the base of the escarpment. These soils are heavily influenced by the composition of the escarpment itself. In the north near Kodjari, where the geological composition of the Gobnangou shifts from sandstone towards shale, there are pockets of vertisols (heavy, clayey soils). In the study region, however, the soils become significantly sandier as you approach the escarpment, an effect exacerbated by the significant leaching of clay

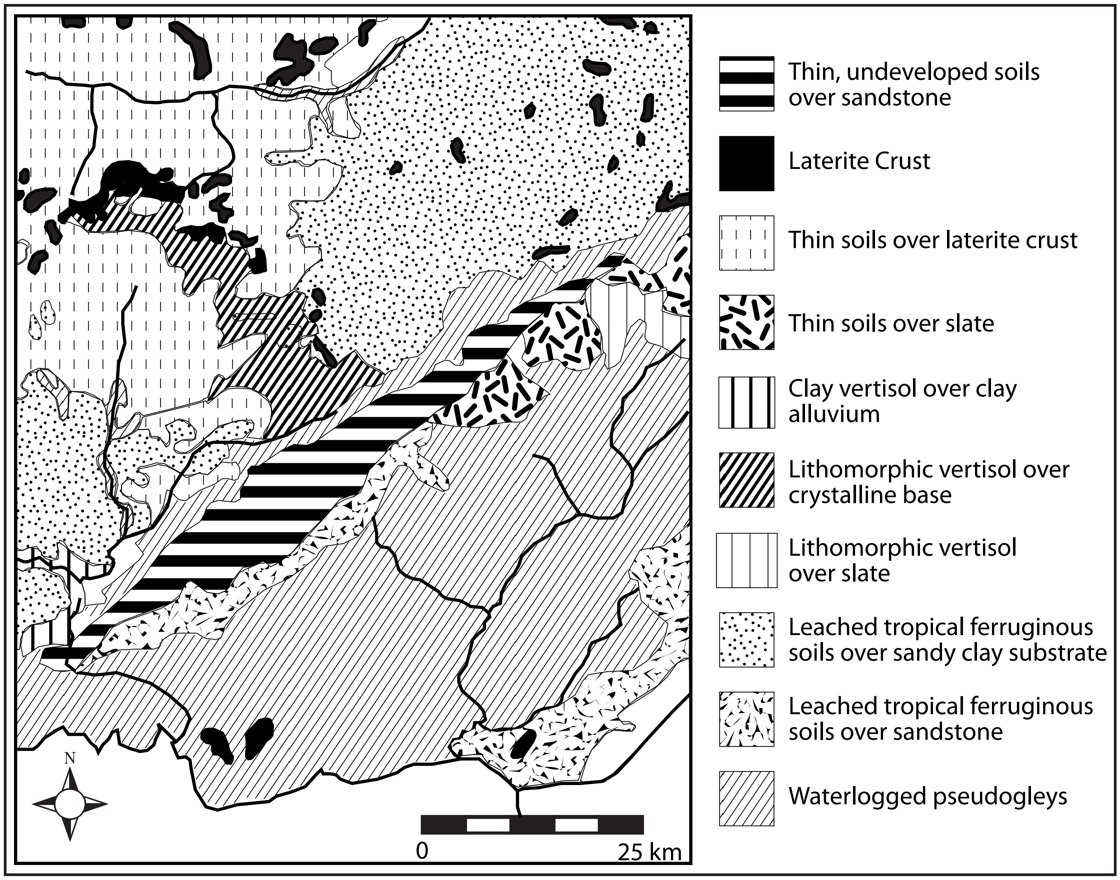

Figure 3.3: Soil Map of Southeastern Burkina Faso
(Redrawn from Müller-Haude 1995, based on Boulet and Leprun 1969)

particles into the B horizon. Better drainage near the escarpment is also apparent in the red color of the soils (indicative of air moving through the soil and oxidizing the free iron (Ahn 1970: 9,70)). Boulet and Leprun consider these a variant on tropical ferruginous soils.

Overall, the soil maps cited above are of limited utility for understanding the practical soil landscape, particularly at the scale of the study region. These macro-scale maps of necessity subsume significant variability, and fail to account for local natural and anthropogenic processes that affect soil properties including porosity, texture, drainage, and ultimately fertility. (For example, the extension of sandy deposits along the path of the Koabu channel mentioned in the previous section is not apparent). Although detailed maps are not available for the region, a sense of the diversity of local soils is apparent in two studies of Gourmantche soil classification systems (Swanson 1979, Müller-Haude 1995).

Separated by 16 years, Swanson and Müller-Haude's studies are in many respects complementary. Swanson, a trained anthropologist, provides a general overview of the

Table 3.1: Traditional Gourmantche Soil Typology

Soil Type (Swanson 1979)	Soil Type (Müller-Haude 1995)	FAO Classification (Müller-Haude 1995)	Description (S = Swanson, MH= Müller-Haude)	Preferred Crops (Swanson 1979)	Probable Occurrence in Study Region
tinpienga	*tinpienga*	Acrisol/Lixisol	porous, light colored, sandy	late season pearl millet peanut early season pearl millet	near the base of the escarpment
tinmoanga	*tinmuanga*	rhodi-haplic Acrisol/ Lixisol	coarse, red colored S- high clay content MH- usually very sandy	late season pearl millet sesame cowpea	near the base of the escarpment
tinboanga	*tinbuanli*	dystric Planosol	loamy with a high humus content, high moisture retention	sorghum kenaf sweet potato cowpea	low-lying areas that do not flood, usually gentle depressions in the drainway of a watershed
tinanbiima	*tintanbima*	Acrisol/Lixisol	porous, sandy, very similar to *tinpienga*	pearl millet tuber peanut Bambara groundnut	sandy levees along Koabu drainage (?)
tinlubili *ligbali* *buali-tinpia*	*tinlubili*	ferric Lixisol	dark and compact with high clay content	sorghum maize	over lateritic crust (rare in study region)
tancagi-boangu	*tintancaga*	eutric Acrisol	lateritic, gravelly, dark, dry out rapidly	sorghum maize okra	over lateritic crust (rare in study region)
tancagi-moangu	*tintancaga*	?	lateritic, gravelly, red, dry out rapidly	late season pearl millet cowpea sesame	over lateritic crust (rare in study region)
lilianli	*lianli*	salic Fluvisol	salty	salt lick for animals	?
obualigu *boalli*			dark clay with high organic content	rice dry season gardens	?
	bolbuonli *tinbisimbili*	Vertisol vertic Cambisol	dark, rich soil		over lateritic crust (rare in study region)

Surface Feature Type (Swanson 1979)	Surface Feature Type (Müller-Haude 1995)	FAO Classification (Müller-Haude 1995)	Description (S = Swanson, MH= Müller-Haude)	Probable Occurence in Study Region
fuanu			Draining center of a watershed, characterized by high soil moisture without flooding	Occurs in very thin strips along the Koabu and its feeders
gbangbanli			High, often gently sloping land between two watersheds. Require frequent rainfall due to rapid run-off	Covers much of the study region
jaduoli	*tialu*	dystric Leptosol	Fertile pockets of land on top of sandstone plateaus, generally very shallow	Located on the escarpment, outside the study region
kpenbala			Floodplains of major rivers	Occurs along the Pendjari, south of the study region
boanbala	*buanbalgu*	eutric Fluvisol	Land along the edge of streams, particularly in the lower reaches of a watershed	Land along the Koabu in the southern portion of the study region
baagu	*baagu*	eutric Fluvisol	Seasonally innundated land with dark, heavy soils	Seasonally flooded pockets of land throughout the study region, often in parallel to the Koabu
ogbaanu	*gbanu*	eutric Leptosol	very flat land with little run off	does not occur in study region
tinbuooli			small depressions where water drains and is absorbed	
otialu			flat surface with scattered laterite pebbles and little vegetation	occurs in isolated locations along the southwestern edge of the study region
	kpamkpagu	stagnic Solonetz	soil with high clay content and high absorption of sodium	At the edge of low-lying areas near Maadaga

Table 3.2: Traditional Gourmantche Surface Feature Typology

entire Gourmantche region aimed primarily at agricultural development workers while Müller-Haude, a soil scientist, focused exclusively on the Gobnangou and coordinates the indigenous terms with analyses of the soil profiles.   In general, Gourmantche description of the landscape includes two cross-cutting sets of terminology: soil types (Table 3.1) are based on texture, color, and properties of the soils themselves, while surface feature types (Table 3.2) emphasize slope and drainage -- factors that can be as important for vegetation as composition (Ahn 1970:222). Since either dialect/regional differences or translation difficulties (Swanson is fluent in gulmancema while Müller-Haude worked through interpreters) could account for discrepancies between them, points of disagreement are incorporated into this summary.

Like Boulet and LePrun, the Gourmantche classifications draw a distinction between the sandier, better drained soils near the escarpment (*tinpienga, tinmoanga*) and the more compact, seasonally water-logged soils further downstream (e.g., *tinboanga, boanbala, baagu*). However, they point to the distinct functional effects of minor changes in slope, texture, and drainage. For instance, while both *boanbala* and *baagu* can be characterized as eutric fluvisols, the lack of standing water in *boanbala* results in different vegetation communities and higher agricultural potential.

Although soil type was not systematically recorded during this project, it was apparent that, given the dynamic hydrology of the region, soils could vary considerably in their characteristics within very small areas. While the macro-pattern of sand content and soil drainage decreasing in proportion to distance from the escarpment generally holds, local variability on the scale of the individual agricultural field can significantly affect fertility and yield, while differences in vegetation communities on fallow and virgin land may likewise occur. Thus, in the absence of detailed soil maps, the Gourmantche classifications (particularly those for surface features) can provide the basis for a more developed discussion of land use.

In addition to the diverse agricultural uses of the soils, there are several mineral resources commonly exploited by humans in the region. The most common of these are potting clay and iron ore, although ocher and chert are also widely collected.[1] Clay (discussed in greater detail in Appendix A) is found along the banks of most seasonal drainages, and can usually be obtained from shallow deposits. While most archaeological and modern pots are made with this fairly standard clay, a few vessels are constructed from clay with dense, naturally occuring mica. While the exact locations of micaceous clay sources were not surveyed, some local potters obtain micaceous clays from the escarpment plateau. Like clay, iron ore is farily ubiquitous in the study region. As discussed above, the natural soils are very iron rich, and easily form laterite deposits on both the surface and as a hardened subsurface bedrock. While neither is a particularly high quality ore both can be smelted in traditional furnaces. Red ocher is also associated with iron deposits, and is easily obtained within the region. High quality chert is more rare, but at least two deposits are known, one of which is slightly to the south of the study region (see Chapter 5, Figure 5.1).

---

1 Phosphorus occurs in natural deposits at the foot of the escarpment to the north of the study region (in areas with underlying slate bedrock). Commercially mined today, these deposits would likely not have been accessible prehistorically, and may not have been usable without industrial processing. No digestible mineral salts occur in or near the study region.

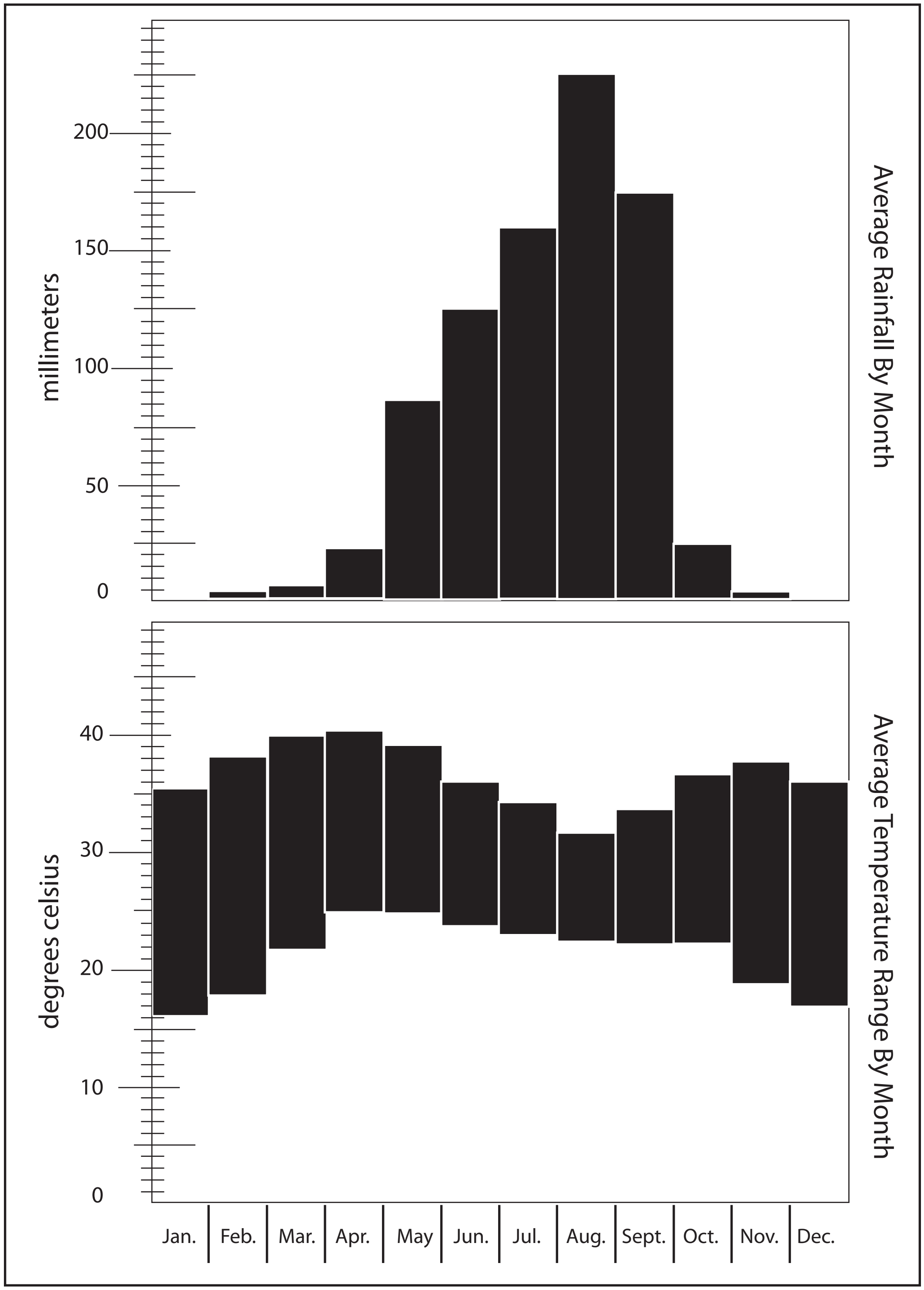

Figure 3.4: Average Annual Temperatures (1935-55) and Rainfall (1935-85) in Fada n'Gourma by Month: (Data from Frank et al. 2002 and Geis-Tronich 1991)

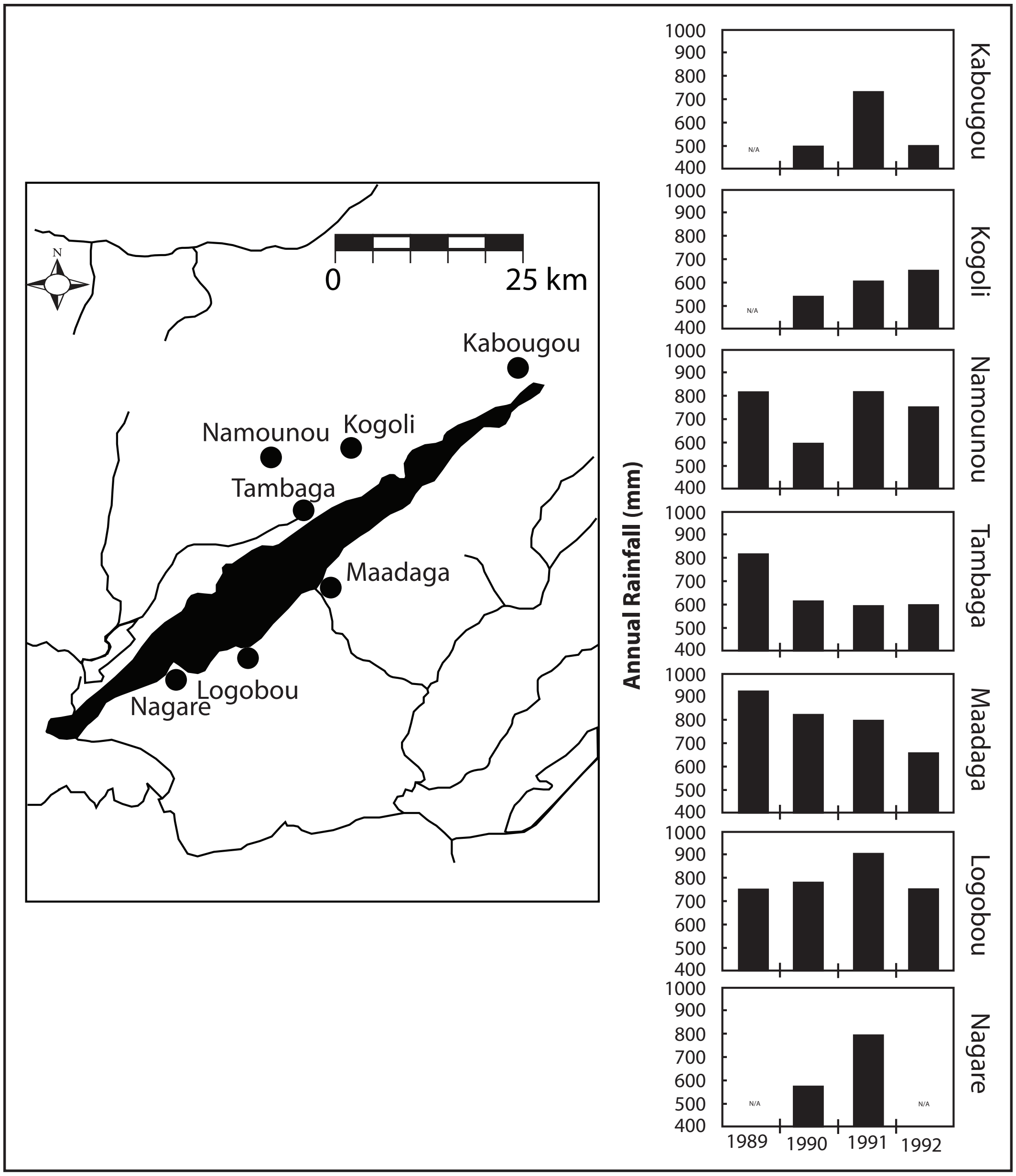

Figure 3.5: Local Variability in Annual Rainfall: 1989-1992 (Data from Küppers 1996)

Climate

Temperature patterns in southeastern Burkina Faso are bimodal although average monthly highs and lows fall within the fairly restricted ranges of 31-41°C and 16-24°C respectively (Geis-Tronich 1991). Temperatures are at their maxima in late April and early May, shortly before the rains begin. They decrease throughout the monsoon season, and daytime temperatures reach their lowest point of the year at the height of the rains in August. Although high temperatures rise in the early autumn before dipping slightly in midwinter, overnight lows decline steadily reaching their lowest point of the year in January (Figure 3.4). On an inter-annual scale, the local effects of temperature on vegetation and agriculture are significantly less deterministic than those of rainfall.

Rainfall in West Africa is controlled by seasonal movement of the inter-tropical Convergence Zone (ITCZ), the boundary between a moist monsoonal airmass originating over the Atlantic, and the dry hot winds of the Sahara desert (Grove 1985a, 1985b). In the spring, as the ITCZ shifts northward, the dry season is broken by the waves of often violent storms that form along the boundary between the two airmasses. Behind them, the monsoons bring the gentler, often persistent rains that feed the landscape. In the early fall, as the ITCZ retreats south, rainfall amounts drop precipitously: during the winter months, little to no rainfall occurs. As a result, the timing and quantity of the rain an area in West Africa receives is strongly linked to its relative latitude. Precipitation zones (and their accompanying vegetation) occur in lateral bands across the continent, each grading into the next (Pigeonnière and Jomni 1998). The further north, the less precipitation a region is likely to receive.

On average, the Gobnangou region likely receives ca. 820 mm of rain a year (based on rainfall at Maadaga 1981-1990 (Küppers 1996), consistent with longer records from Fada n'Gourma (Frank et al. 2001) and Pama (Remy 1967)). However, due to the extreme interannual variation in the timing and movement of the ITCZ, the average precipitation figures for West Africa are often not representative of the rainfall in any given year. For example, annual rainfall at Fada n'Gourma from 1951-85 ranged from 650mm (1984) to 1310mm (1958). Nine years had less than 800mm, while twelve had over 1000mm (Geis-Tronich 1991). Thus while in most years the precipitation fell in the expected range of 800-1000 mm, outliers were not uncommon.[2]

In addition to inter-annual variability, an examination of detailed rainfall records for Tapoa province from 1989-92 demonstrates significant variability in the spatial distribution of rainfall (Figure 3.5) (ORD Diapaga, fide Küppers 1996). As illustrated by the data for Maadaga and Logobou alone, towns 10 km apart regularly differ by more than 100 mm in their precipitation totals. Further complicating prediction for farmers, differences in rainfall totals are not consistent, and this year's prime location can be next year's dry spot.

Equally critical, and also highly variable, are the commencement, distribution, duration, and termination of the rains (Kowal and Kassam 1978). For example, a short, intense rainy season that ends early may result in a less productive growing season than a smaller amount of precipitation distributed over more time. Likewise, an early rain

2 This data incorporates the drought years of the late 1970s and 1980s. However, rainfall data from the early 1900s onward suggests that while this drought was particularly sustained, its intensity was well within the range of normal rainfall variation (Koechlin 1997).

followed by several weeks of drought can trick farmers into planting too soon and result in the loss of valuable seed. In the Gobnangou, while the rains usually start in the last weeks of May and end in late September or early October, the actual dates can vary by several weeks (Küppers 1996, Swanson 1979). Likewise, the spatial variability discussed above affects timing and distribution of rainfall as well (Küppers 1996). Consequently, farmers tend to be conservative in their approach and often plant varieties of staples with different maturation rates and rainfall needs to ensure a successful harvest.

Vegetation

While in the past, savanna ecology was commonly seen as following a predictable regime of vegetation succession interrupted only by human impact (Trochain 1940, Hopkins 1974), today, savannas are understood to be unpredictable, resilient systems driven by abiotic factors (e.g., Baker 2000). Adapted to extreme variation in rainfall, savanna vegetation communities have low resistance (they change easily) and can turn into any number of stable states (Walker and Noy-Meir 1982). Consequently, they are commonly thought to exist in a non-equilibrium state. Menaut et al. (1995) note that they are driven by stochastic, successional, and primarily interactive processes.

The modern vegetation of the Gobnangou is an anthropomorphic savanna typical of the Sudan zone. With the exception of useful species commonly protected when clearing fields, the forelands of the escarpment are largely devoid of mature trees and are instead dominated by farmland and shrubby fallows at various stages of maturity. The escarpment itself, in contrast, is home to numerous diverse plant communities that exploit the various microenvironments provided by its cracks, depressions, ravines, and rocky slopes. Since numerous excellent resources provide detailed analyses of the biology of West African savanna ecosystems (e.g., Cole 1986, Guinko 1984, Lawson 1986, Trochain 1940, Menaut and Cesar 1982, Walker and Noy-Meir 1982; including some devoted specifically to southeastern Burkina Faso and its environs: Koster 1981, Küppers 1996), this discussion will focus primarily on the distribution of economically useful plant species.

Tables 3.3-3.11 present the useful species known for the Gobnangou. The species themselves and their associations are compiled primarily from Küppers' (1996) analysis of the Gobnangou vegetation. As will be apparent in the discussion below, the vegetation of each microregion consists of multiple plant communities, and these tables of necessity collapse significant variability. The weighting is based not on the absolute number of plants, but rather the relative frequency of that particular species within the plant community: in cases where there are significant differences between communities within a microregion, the highest weight is given.

The primary source for ethnobotanical information is the exhaustive second edition of *The Useful Plants of West Tropical Africa* (Burkhill 1985-2004), supplemented with several resources focused specifically on southeastern Burkina Faso (Geis-Tronich 1991, Martin 1993 fide Küppers 1996, Neumann 1999, Wittig and Martin 1995). The tables have been divided according to the following major categories: food, firewood, construction, fodder, fiber, medicinal, dye, and miscellaneous.   Many plants occur on more than one table.

Wild plants still play a significant role in the local diet, and some species, notably shea butter (*Vitellaria paradoxa*) and locust bean (*Parkia biglobosa*) can be considered staples. Each is nutritionally rich (shea butter is a solid vegetable fat of almost pure triglycerides, while locust beans contain 30% protein, 20% fat, and 12% sugar (NRC 2006)), and both are storable in their processed form. Leafy greens are an important component of sauces and, along with wild fruits, add significant diversity in addition to essential vitamins and minerals to the diet. Most of the high value species in these categories are actively managed by modern populations, and may be cultivated if sufficient quantities do not grow naturally. Wild grains, a common element of the diet further north, were traditionally an important option in times of famine although their use has declined significantly in the modern era. Similarly, most wild tubers are no longer considered worth the significant processing required although they may have been used more frequently in the past.

Availability of adequate wood for fuel and construction is a significant factor for agricultural populations. Areas around settlements are often denuded of the appropriate species, and in the past the large quantities of fuel necessary for iron smelting would have been exploited in addition to that required for cooking, parching, and pottery firing. Shrubs and young trees are often an adequate source for firewood, but the primary posts used for construction often force individuals to seek out mature individuals with large, straight branches or trunks. Termite resistant species are particularly desirable, as posts need to last at least the lifetime of the building and are often reused in multiple successive structures.[3] Multiple uses of a single species (food, fuel, construction) can put conflicting pressures on vegetation, and consequently firewood preferences are notoriously variable and locally sensitive (Neumann 1999).

3 The lifetime of a residential mudbrick structure can vary from as little as five years to as many as fifty depending on maintenance (Prussin 1969). In the Inland Niger Delta region of Mali, some residences are hundreds of years old.

Fodder plants are primarily of importance during the dry season. The Gobnangou is well within the tsetste fly zone, and traditionally, resident livestock would have been primarily small populations of dwarf species resistant to trypanosomiasis (sleeping sickness) (see below). Although modern animal husbandry has expanded due to recent government spraying programs, the bulk of livestock in the region are still the herds brought south by nomadic pastoralists during the dry season to forage. Consequently, nutritious plants that stay green well into the dry season or are among the first to leaf in the spring are particularly valued, although the aquifer effect of the escarpment makes it a propitious place to graze throughout the winter months.

Wild plants are exploited in innumerable other settings. They may be valued for their medicinal properties, or used to treat and dye leather or cotton. Fibers are used to bind thatch roofs and make fish traps and nets. Incense, poisons, and adhesives are but a few of the additional elements of the regional ethnobotany, and these tables list only the most important examples of each.

The following sections discuss the spatial distribution of these species within the Gobnangou landscape.

The Gobnangou Escarpment

The Gobnangou Escarpment is notable for the diversity of its flora. The micro-environments created by rocky surfaces, soil pockets, canyons, and eroded slopes are home to unique plant communities. Differences between the escarpment and its surrounding regions are exacerbated by the presence of numerous springs which provide a steady supply of water deep into the dry season, particularly to plants in shaded canyons. Despite the generally hospitable conditions, the escarpment is not usually exploited for farmland. The thin and undeveloped soils maintain their fertility with the regular renewal of humus from wild vegetation, but if cleared they would likely degenerate rapidly and recover slowly. Today, given the impact of centuries of shifting cultivation in the Gobnangou region, the lack of fallow plant communities further distinguishes the escarpment vegetation from that of its forelands.

Cracks and Depressions

The rocky surfaces and shallow depressions of the Gobnangou escarpment are characterized by sparse, non-woody plant communities dominated by species that thrive in the low nutrient conditions. In general, these areas are not heavily exploited. While grasses like *Brachiaria villosa* are present, they do not occur in the dense stands that facilitate grain collection, and the aromatic *Aeollanthus pubescens* is one of the few examples of an edible species confined to these locations. Although adequate for grazing, the majority of fodder plants are not preferred species.

Highland Savannas

Superficial soil layers on the high plateaus of the Gobnangou have resulted in the growth of several communities of savanna vegetation, the nature of which are strongly dependant on local sediment depth and fertility. Küppers (1996) identified four major variants: *Loudetia togoensis*-Savanna (maximum height 80-110 cm); species poor and species rich *Terminalia laxiflora-Combretum glutinosum*-Savannas (maximum height 3-10 m); and, in the northeast of the escarpment, *Burkea africana*-Savanna (maximum height over 12m). The latter three are notable for their established communities of woody vegetation which today stand in sharp contrast to the agricultural landscapes of the escarpment forelands.

Amongst the edible plants, the diversity of useful trees and shrubs is particularly striking. These include: *Bombax costatum*, whose flowers are frequently collected, dried, and sold in markets; *Ceratotheca sesamoides*, the leaves of which are harvested for sauces; *Acacia macrostachya* whose beans the Mossi collect and prepare in a manner similar to domestic cowpeas; and a broad assortment of fruit trees, amongst them *Sclerocarya birrea* and *Detarium microcarpum*. Herbaceous edibles, such as *Brachiaria ramosa* and *Setaria pumila* are generally of lesser importance.

Unsurprisingly, the highland savannas are also an excellent source of wood for fuel and construction. The eponymous *Combretum glutinosum* and *Burkea africana* are both quality firewoods, as are many of the less frequently occurring species such as *Combretum nigricans.* The species rich *Terminalia laxiflora-Combretum gultinosum*-Savanna and *Burkea africana*-Savanna are likely preferred among highland plant communities for construction and fiber species due to the taller average height of the shrubs and trees. The number and diversity of high value fodder plants in the highland savannas also makes them favored areas for grazing.

Slopes

The slope vegetation of the Gobnangou escarpment ranges from the woody bush of the gentle rocky talus slopes to the hardy species that grow in the crevices of the sheer rock face. While these plant communities are similar to those of the highlands in their species composition and diversity, they tend to be significantly sparser and lack the coherency of the highland savannas. Thus while more convenient for people living at the base of the escarpment, useful plants common in both regions are more easily exploited in bulk on the highlands.

Like the highlands, the woody vegetation dominates the useful plant assemblage. Edible species are dominated by the fruit trees: their diversity is at its greatest here, where both the highland species discussed above and the canyon species discussed below thrive, in addition to those such as *Uapaca togolensis* and *Grewia villosa* that are found only on the slopes. Sources of fuel are common, and as are species appropriate for construction.

Canyons and Ravines

The shaded canyons and ravines of the escarpment are characterized by lush vegetation. Relatively limited in their extent, these streambed environments are generally inappropriate for intensive use and are of greater importance during the dry season when they are one of the few sources of fresh greenery. Although the species composition has many similarities to the other plant communities of the escarpment, isolated examples of species characteristic of moister conditions are common. Additionally, both annual and perennial vegetation can achieve greater height in these environments.

While fruit trees are most common among the edible plants, these environments are most important as a source of leafy vegetables. In addition to plants such as *Celtis integrifolia, Cissus populnea,* and *Senna obtusifolia* that are primarily used for their greens, species used primarily for their fruits (e.g., *Vitex doniana, Lannea microcarpa*) may be more valuable as a source of early or late vegetation. Likewise, while not as rich or diverse a grazing area as the highland savannas, the available fodder plants take on greater importance during the dry season. A rich source of construction and firewoods, notably *Daniella oliveri*, woody resources in these environments could be rapidly depleted without careful management due to their limited extent. With other sources available, the drawbacks to removing the woody vegetation (i.e., increased evaporation, less hospitable to wild animals) likely outweigh the benefits. Today, the woody vegetation in the escarpment streambeds, particularly those that are spring-fed, is often protected. Finally, *Antaris africana*, the only plant in the region from which a high quality bark cloth can be made, is found exclusively in these environments.

Agricultural Parklands

The modern forelands of the escarpment are an anthropogenic landscape characterized by agricultural fields interspersed amongst fallows in various stages of regrowth. As mentioned above, several species of useful tree —*Adansonia digitata, Vitellaria paradoxa, Lannea acida, Lannea microcarpa, Parkia biglobosa,* and *Tamarindus indicus* — are preserved when clearing fields (Küppers 1996:13). However, due to Küppers' use of 50 x 50 m sampling blocks, several of these species are under-represented or absent in the tables. These trees are often the oldest and largest plants in the agricultural savanna, and their visual dominance on the landscape belies their sparse distribution. As mature individuals, they often significantly out-produce the larger populations of fruit trees growing in the less fertile soils of the escarpment and are among the most economically valuably wild plants in the region. Shea butter (*Butrospermum paradoxum*) and locust bean/nere (*Parkia biglobosa*) can be considered staples, while baobab (*Adansonia digitata*) and tamarind (*Tamarindus indicus*) are significant elements of the diet. Since their productive lifespans can last hundreds of years (possibly thousands in the case of baobab), these trees are found in all stages of fallow in addition to active agricultural fields.

Young Fallows (1-3 years from cultivation) and Medium Fallows (5-10 years from cultivation)

The soils of young fallows are generally exhausted with very low humus content. During the first few years of growth, the vegetation is dominated by non-woody species that colonize open areas and thrive in low nutrient conditions. As mentioned above, soils in the region recover slowly and although species composition changes, medium fallows are likewise dominated by non-woody and grassy vegetation.

Most of these plants are of limited utility to humans, and grazing is the primary activity. In young fallows, grain can be harvested from uniform stands of wild grasses such as *Brachiaria villosa* or *Dactyloctenium aegyptium* but more frequently they are either used as fodder or cut for thatch. Medium fallows are still grazed, but the grasses (e.g., *Andropogon* ssp.) shift towards species less amenable for human consumption. Plants used for fruit, fiber, firewood and construction are usually not yet mature enough to be exploited.

Old Fallows (20-30 years from cultivation) and Very Old Fallows (>30 years)

In the second and third decade of fallow, the vegetation has matured and the community is dominated by a shrubby bush characterized by such plants as *Combretum* ssp., *Piliostigma* ssp., and *Terminalia* ssp. Grazing use is slightly improved with the addition of shrubs to the still extant grassy and other non-woody species. In old fallows, food plants are still relatively rare in comparison to the highland savannas, although a few fruits and some leafy greens become available.[4] However, in the very old fallows, the assortment of mature edible plants, particularly trees and shrubs increases significantly and begins to approach the diversity of options in the highland savannas.

The woody vegetation is most significant as a source of wood for construction and fuel. Several significant firewood species, notably *Anogeissus leiocarpus, Combretum glutinosum, Piliostigma thonningii* and *Vitellaria paradoxa* (see footnote 2), are common in these fallows. Many of these can also be used for construction, although those in old fallows are more likely exploited for the slender poles that support granaries and temporary housing, as opposed to primary house posts that come from mature trees more commonly found in very old fallows and less anthropogenic landscapes.

Minimally Anthropogenic Savanna

As mentioned above, today the forelands of the escarpment are shaped by hundreds of years of shifting cultivation. The impact of this cultivation has increased significantly over the last century due to the combined factors of increased population and decreasing settlement mobility. The result has been a more intensive agricultural strategy in which more land is brought under cultivation and fallow periods are reduced. Consequently, modern vegetation surveys like Küppers' are of limited use in characterizing what the lowland savannas of the Gobnangou looked like during periods of less intensive cultivation.

Much of southeastern Burkina Faso, northern Benin, and southwestern Niger was set aside as parkland (Arly, Pendjari, W) or partial reserves (Kourtiagou, Singou) in the 1930s, and most of the few remaining villages were relocated to outside park boundaries in the 1950s (Koster 1981). Prior to their establishment as parkland, population densities were low and these areas were spared most of the effects of rapid population growth and agricultural expansion in the latter third of the 20th century.[5] While not perfect replicas of the pre-modern savanna landscape, particularly given controlled burning strategies

4 Although shea butter trees (*Vitellaria paradoxa*) appear to increase in frequency as fallows age, their productive life cycle is significantly longer than the fallow cycle. These trees usually bear fruit from ca. 50-250 years of age: a productive tree in a 20-30 year fallow would predate the cultivation of the field. The increasing numbers of shea butter trees in the fallow landscape may be the result of sampling, but more likely reflect a propensity for spontaneous growth. The majority of *Vitellaria paradoxa* plants in a fallow area are likely used for firewood, with only the largest and strongest preserved for their fruits. These protected fruit trees are relatively rare, and consequently are not noted in the young and medium fallow inventories.

5 Satellite images of southeastern Burkina Faso from 1973 and 2005 clearly show the increasing differentiation between parkland and agricultural territories (UNEP 2008:102-103)

designed to increase the visibility of game for tourists (Koster 1981), national parks are the best available analogue.

Drawing on his own research as well as previous studies and herbarium samples, Koster's (1981) characterization of wooded savanna flora in the Nigerien section of Park W bears many similarities to the savannas of the highland Gobnangou described by Küppers. While similar in species composition, notably in the predominance of *Combretum* ssp. as well as the presence of *Burkea africana* and *Terminalia* sp. variants, Park W vegetation is often significantly more robust, with canopy heights reaching 15-20 m. However, within the park, hardpans and other regions of shallow or rocky soils exhibit vegetation heights closer to those of the escarpment. More significantly, the park savannas are frequently broken by patches of open grasslands, albeit characterized by species such as *Loudetia togoensis* and *Microchloa indica* that are not favorable for ungulate grazing. These grasslands differ from those on the escarpment highlands in overall species composition as well as in the presence of isolated shrubs.

Given their similarity, it is not surprising that the useful plants of the Park W savanna largely mirror those found on the escarpment. The greatest difference between the two zones is in the realm of fodder plants. The minimally anthropogenic savanna has a greater diversity of higher quality fodders than the highland savannas, and would be significantly better for grazing use (perhaps in part accounting for the significant problems with illegal grazing in national parks (Koster 1981)). Additionally, the more robust woody vegetation is more desirable for construction use. The only significant food plant not found on the escarpment is the fast growing, heavily fruiting *Moringa oliefera*, which is valued for its leaves and seeds.

Aside from these fairly marginal benefits (especially given the relative unimportance of livestock in the region) the close availability of minimally anthropogenic savanna would have added little diversity to the resources already available on the escarpment. The primary effect would have been on ease of access and increased supply. Most of these resources (with the exception of firewoods) are exploited with relative ease today: while they would have been even more readily available in the past, it is unclear to what extent increased accessibility would affect their use.

Riverine

Although slightly outside the study region, the riparian environments along the Pendjari River, while in many respects similar to minimally anthropogenic savannas, include several species characteristic of guineean forest (e.g., *Combretum paniculatum, Dialium guineense*). The riverine environment can be divided into three simplified zones: the aquatic plants of the river itself; the grasses, sedges and other herbs that grow in its floodplain; and the gallery forests along the banks. These moisture loving plants often extend from the Pendjari along its seasonal feeder drainages, particularly in areas where the water table is high. Today, gallery forests abut the escarpment only within the confines of Arly National Park, although their current range has likely been restricted by the intensive agricultural activity mentioned above.

Amongst the edible plants of these regions, most prominent are several types of leafy greens.[6] While these do not fill any dietary niche not already covered by more savanna plants, vegetation along the river often maintains its leaves longer, if not year-round, and these plants could be a source of fresh potherbs during the dry season. Several plants with edible roots are also present, notably *Cyperus esculentus*, which can be harvested and consumed in bulk although it is not usually available in local markets today. In other realms, the riverine environment offers few unique resources. *Dialium guineense* is an excellent firewood, and the advantages of moister, older vegetation communities for construction wood have already been discussed. The tall grasses are useful for woven matting due to their length and flexibility.

Specialized Plant Communities

Several specialized plant communities are located around the fringes of the Gobnangou. While in most cases they differ from the areas already discussed in species distribution and frequency rather than in composition, they are important sources of variability.

In the northeastern area of the escarpment near Kodjari, the flora is similar in composition to the *Burkea africana*-Savanna of the highlands due to similarities in their soils created by the underlying slate bedrock. However, this lowland slate community has some significant differences. Notably, *Crossopteryx febrifuga*, an important fever reducer, is dominant amongst the tree species.

To the northwest of the escarpment, where the Volta Basin abuts the Mossi Plateau, the boundary is marked by laterite hills and their forelands. These areas are at some distance from the study region, and are home to few economic species not well-represented in closer environments. Even those not commonly found elsewhere, e.g., *Combretum molle*, are equi-functional with numerous other species. Since there is significant overlap with the slate-based plant communities, these areas may play a similar role to the Kodjari region for people living on the northern side of the Gobnangou.

---

6 While there are numerous species found in both the savanna and riverine plant communities, this discussion is confined to species not also found in environments more proximal to the study region. See Tables 3.3-3.11 for the availability of these plants in riverine environments.

Finally, isolated pockets of salty soils can be found at the foot of the escarpment, notably near the modern towns of Maadaga and Yobri. These soils are significant in and of themselves as salt licks for animals, but the economic value of the alkali-tolerant plants that grow there is minimal.

Crop Plants

To distinguish crop plants from many of the economically useful "wild" plants discussed above is to create a false dichotomy. Humans often cultivate many of the most intensively utilized species, notably (but not limited to) baobab, locust bean, and shea butter, and it is probable that some selection has taken place among the dominant wild strains. The effort that goes into caring for these plants may outstrip that of some of the planted crops. Additionally, many wild species hybridize easily with their domestic counterparts. While rice is the most notorious example, cross-breeding in amaranths has resulted in a range of variability such that it is not always possible to characterize a strain as one or the other (NRC 2006).

The species included in this section are generally planted in prepared fields or gardens, rather than encouraged when they sprout spontaneously, and their seeds are stored between growing seasons. All are known to have been cultivated in the Gobnangou region at one time, and most play a very significant role in the local economy. Consequently, these are the species that, as a group, will be referred to most frequently in subsequent chapters. This discussion is restricted primarily to the biology and use of these crop plants: agronomy will be addressed in more detail in Chapter 4.

Located near the southern limit of the soudanian savanna, residents of the Gobnangou grow a particularly diverse spectrum of crops (Table 3.12). Rainfall totals are low enough that savanna crops like groundnut and pearl millet can thrive, but also high enough that some forest crops, such as yams, can also be cultivated. Additionally, the diverse soils include the sandy, well drained matrices preferred by legumes as well as waterlogged lowlands suitable for growing small crops of rice. The long growing season adds further flexibility, and Swanson (1979:35) notes that space and labor are often the limiting factors. As mentioned above, multiple varieties of almost every crop listed are grown. Intra-species varietal differences not only act as a buffer against climatic uncertainty, they also help farmers space out the harvest over several months and mix preferred characteristics in the total harvest (e.g., storability, parasite resistance, flavor, etc.) Significant effort is made to maintain varietal seed stocks (Swanson 1979).

The following discussion of crop plants is organized around role in the diet. The typical meal throughout much of the soudanian savanna consists of a starchy preparation served with a sauce (e.g., Tauxier 1912, Swanson 1979). The starch is usually grains, pounded and either steamed as a couscous or, more frequently, cooked to make a thick porridge known as toh. The sauce is usually a thick stew that often combines wild and domestic plants: these diverse ingredients provide important nutrients and account for a significant portion of the variability in the diet. The sauce is usually vegetarian, although meat will be incorporated when it is available. While many other dishes can be made with these ingredients, their general roles and relative importance in the diet are fairly constant.

Staples

Sorghum (*Sorghum bicolor*) and pearl millet (*Pennisetum glaucum*) are the most frequently grown crops in the region and together account for by far the majority of subsistence crop acreage. Sorghum is the dominant staple crop in the Gobnangou today and at minimum 12 varieties are cultivated in the region (Swanson 1979).[7] Sorghum is eaten by most individuals on a daily basis and is the preferred grain for making *daama*, the local beer (although different varieties are generally used for consumption and fermentation). Sorghum plants have high yields (relative to millet), self-pollinate, and are resistant to the *Striga* parasite common in low fertility soils (NRC 1996).

Pearl millet crops are often split between early and late maturing varieties. Although it has lower yields and requires more effort to weed than sorghum, millet is a very hardy, drought-resistant crop that can be grown on fields too exhausted for sorghum (NRC 1996, Swanson 1979). Early millet can mature in as little as 70-90 days, and is an important grain source in the late summer when supplies from the previous year's harvest are running low. It is usually consumed rapidly, as it does not store well (Swanson 1979:106). Late millet is considered supplemental to sorghum.

Rice *(Oryza glaberrima*) is cultivated on a limited basis in the Gobnangou. The traditional crop was a rapidly growing (95 day) small-seeded red rice planted along the edges of waterlogged lowlands as an insurance crop (Swanson 1979). Surprisingly, fonio (*Digitaria exilis*) is not known in the region today (Geis-Tronich 1994: Swanson 1979). The small-seeded grain could be easily grown (it is common in northern Benin and western Burkina Faso); has low labor requirements; and matures in as little as six weeks (NRC 1996).

The Gobnangou region also has sufficient rainfall for yams (*Dioscorea* ssp.), and they have long been cultivated on a limited scale. Yams require relatively high quality

7 While significant diversity in the types of crops has been maintained, seed stocks of local varietals have decreased rapidly over the past 30 years due to the commercialization of subsistence agriculture. It is unclear whether all of the varieties documented by Swanson (1979) are still in existence.

soils, and are fairly labor intensive, which perhaps accounts for their role as a minor crop, given the availability of grains. Swanson (1979:185) notes that yam cultivation may have been more extensive prior to the colonial period, when grain prices rapidly outstripped those for yams.

Several new world staples have gained traction in the Gobnangou region. Rapidly maturing varieties of maize are often grown in small quantities, and usually eaten shortly after harvest.[8] Sweet potatoes are widely consumed, but since storage is particularly difficult, their cultivation is limited and they are usually considered a delicacy. Finally, manioc, despite the labor intensive preparation it requires, has been gradually growing in popularity.

Legumes

Legumes are a particularly flexible class of crops that play both an important role in the diet and, as will be discussed in Chapter 4, in maintaining the fertility of agricultural fields. There are two primary types of beans cultivated in the region: cowpeas (*Vigna unguiculata*) and groundnuts (*Vigna subterranea*). Both can be prepared in multiple ways: they may be powdered and mixed with grain flours to make a porridge or beignet batter or they can be boiled whole and served in a sauce. Groundnuts can also be boiled or roasted in the pod, then eaten whole.

Cowpeas are a nutritious, tasty legume that is widely cultivated. At least eight varieties are known in the region,[9] and all are very high in protein. They are considered tasty, and cooked in a variety of dishes. Cowpeas are a fairly labor intensive crop: they require frequent hoeing and must be picked promptly when ripe or the pods will burst. Harvest is considered particularly arduous as pods are picked one at a time in a stooped position. Storage is difficult and requires particular care as cowpeas are very susceptible to weevils (NRC 2006, Swanson 1979).

Groundnuts, which grow in a manner similar to peanuts, handle storage extremely well (up to three or four years) and are often amongst the last of the previous year's harvest to be consumed. Also like peanuts, they require loose, well-drained soil to prevent rot in the underground seedpods. Nutritionally, however, their profile is more similar to that of beans (NRC 2006). They are significantly more drought-tolerant than cowpeas. Today, groundnuts have been partially replaced in the diet by peanuts, although peanuts have not become as dominant of a sauce ingredient as in other areas of

8 In Western Burkina Faso, maize has in some cases supplanted the niche previously filled by fonio. In the town of Douroula, fonio was common in 1999, but by 2006 was difficult to obtain as most farmers had switched to the higher yielding maize as a primary early crop.

9 Like sorghum, cowpeas are self-pollinating. This feature makes it easier to maintain varietal differences.

West Africa. There is significant cultivation of peanuts as a cash crop (Küppers 1996), particularly in the sandy soils near the escarpment.

Vegetables

Most vegetables in the region are consumed in the form of thick stews: raw vegetables are rarely served at meals, although they may be consumed on an *ad hoc* basis. Throughout the savanna region, baobab leaves and okra are traditionally the most common sauce ingredients. Okra (*Abelmoschus esculentus*) is valued in part for its mucilaginous texture, and many varieties are cultivated. Additional common sauce plants include roselle, squash, eggplant, onions, and several leafy greens (many of which are equally likely to be planted in dedicated fields or protected when they volunteer). Sauce vegetables are usually grown in small quantities, and are often cultivated in irrigated dry season gardens in addition to rainy season fields.

Many of the vegetables sold at markets today are of foreign origin. Introductions from the Americas, including tomatoes, chili peppers, and squash, have become essential elements of the diet and likely have been grown in the region for several hundred years. More recently, colonial officials and missionaries have introduced a bevy of European garden plants like carrots, lettuce, and cabbage (not included in Table 3.12).

Other Edibles

Small quantities of several moisture-loving crop plants are cultivated in gardens along the seasonal drainages. Banana, sugar cane, and even occasionally oil palm can be found, although they require frequent watering during the dry season. These plants are frequently joined by several fruits originating in the Americas.

Most indigenous fruits are not cultivated *per se*, but included with the wild fruits in the previous section. An exception is the horned melon, which, amazingly, can be stored up to six months at room temperature in the tropics. Interestingly, none of the researchers in the region has documented the presence of the indigenous melons: watermelon/egusi (*Citrullus* ssp.) and melon (*Cucumis* ssp.) (Geis-Tronich 1991, Küppers 1996, Remy 1967, Swanson 1979).

Other Crop Plants

In addition to the edible crops, there are several additional economic crops. The most significant today is cotton (*Gossypium* sp.), however the varieties grown today are predominantly commercial and destined for export. These have largely supplanted the indigenous strains, and only a small portion of the harvest is used for local spinning and weaving. Not only has local cloth production declined, but in the Gobnangou region cloth-dyeing is now done almost exclusively with commercial dyes. Consequently, cultivation of domestic indigo (*Indigofera* ssp.) is virtually non-existent, whereas until the 1990s it was ubiquitous in small plots (Remy 1967, Swanson 1979, Geis-Tronich 1991).

Despite the introduction of commercial rope and plastic bowls, two local crop alternatives remain important. Kenaf (*Hibiscus cannabinus*) is commonly used as a fiber, particularly for ties in the roof and granary. The most ubiquitous crop, however, is the bottle gourd or calabash (*Lagenaria* ssp.). When properly dried and cleaned, calabashes are strong, durable containers used for a variety of tasks. Different varieties produced shapes appropriate for bowls, spoons, and bottles.

Wild Fauna

Wild animals are a significant element of savanna ecosystems. They distribute seeds, clear brush and are integral in shaping both flora and vegetation. For humans, the local fauna can be an important source of meat and hides, although they may also negatively impact fields and raid livestock. There have been no comprehensive local surveys of the regional fauna, and consequently while the ranges and presence of larger animals are fairly established, we know significantly less about smaller species. As with the vegetation, the focus of this discussion will be on those animals that are utilized by and most significantly impact human populations (Table 3.13).

At a basic level, the fauna of the region can be divided into a few major ecological zones. Aquatic species, like hippopotamus or crocodile, reside in permanent rivers or pools, and the gallery forests along river banks are home to primates and many small antelopes. Forest ungulates tend to be solitary or live in pairs, unlike their savanna relatives who are found in small herds throughout the bush (Kingdon 2004). Many of the savanna species need water daily or every couple of days, and are to a certain extent tied to permanent sources during the dry season. Finally, a few specialized species, such as rock hyrax, are confined to the rocky areas (Kingdon 2004). A focus on these divisions, however, obscures significant variability in the ways in which wild fauna interact with human populations.

Most significant for farmers, many classes of wild animals feed on agricultural fields. Wild fowl often raid newly planted fields for seed during the early dry season (Donkin 1991); small ungulates graze on the tender shoots of young crops (Kingdon 2004); and cane rats will consume almost any grass at any stage of growth (Kingdon 2004), as well as melons and other vegetables. Even underground crops like yams are not entirely safe from warthogs, who will dig them out with their tusks. A patchwork layout of fields and bush provides easy access to useful wild plants, but also habitat for these raiders, most of whom favor littoral zones. Dry season gardens are often fenced to protect crops, but this strategy is not practical at a large scale. As will be seen in Chapter 4, farmers and their families often reside near their fields during the growing season in order to protect them. While destructive, these animals are also easy targets for garden hunting –a practice that provides a small, steady supply of meat (see discussions in Dueppen 2008). Garden hunting often involves the use of traps, slings, and other expedient methods, in addition to more traditional bows and spears, and may be carried out by any member of the family.

Hippopotami and elephant may also destroy fields: although instances are rarer than with the smaller animals above, each has the potential to be devastating. Hippo will come out of the river to feed on near-by fields during the night, but do not stray far and can usually be avoided by allowing a buffer zone along the river (Kingdon 1997). Elephants destroy far more fields, and can cause significant damage even by walking through, aside from uprooting useful trees and other activities (Estes 1991). Both animals are among the deadliest to humans, and there is little history of hunting them in the region.

Carnivores can also cause problems, as they frequently raid domestic livestock and occasionally attack humans. While small carnivores may target domestic fowl, the larger cats and hyena pose the greatest danger to herds (Estes 1991). While the meat of these animals is usually considered inferior, they may be hunted for their hides.

Most of the ungulate species in the region avoid humans. Generally larger, these herd animals, including hartebeest, roan antelope, buffalo, and topi, are usually seen far from human settlement (Kingdon 1997). Consequently, they tend to avoid the densely populated escarpment despite its utility as an aquifer. They are frequently hunted, usually with highly ritualized expeditions that take place during the dry season (when hunters are free from agricultural labor and animals are more easily located near water sources). Their contributions to human economy, in the form of meat and hides, are almost entirely positive.

Fish and Shellfish

Like most rivers in West Africa, the Pendjari has a diverse understudied population of fish. Estimates of the species diversity range from 41 to 85 spread over ca. 20 families, and little is known regarding their distribution (Schwahn 2003). During the dry season, most fish are confined to the main channel of the Pendjari as remnant pools along seasonal drainages normally lack the necessary oxygen to support significant populations (stranded individuals are also usually trapped shortly after the waters recede).

Today, specialized winter fishing camps (legal and illegal) are common along the Pendjari River, and preserved smoked fish is sold at local markets throughout the region.

During the wet season, fish are present throughout the network of seasonal drainages (including the Koabu). In addition to opportunistic line fishing, small weirs and traps are set in the channel. Little data is available on the efficacy and scope of this practice, and it is unclear to what extent it contributes to the diet.

Freshwater mollusks are common in permanent waterways and ponds. They are usually harvested during the dry season.

Domestic Animals

Domestic animals are an integral part of savanna subsistence. They are intimately involved in agricultural systems, act as social wealth, play roles in rituals, guard property, all in addition to being an important food source. Due to the modern cultural setting and development projects, the number of breeds and species present is expanding rapidly.

Goats (*Capra hircus*), and to a lesser extent sheep (*Ovis aries*) are historically the most common stock in the region. Herds were composed almost exclusively of dwarf varieties, selected for tsetse resistance and hardiness.[10] Although their diets (primarily browse for goats and graze for sheep) are similar to those of other varieties, dwarf livestock are generally considered village animals, and rarely stray far from settlements (Epstein 1971). While they significantly affect their local vegetation, dwarf livestock have a minimal effect in comparison to the larger Sahelian breeds. Within the last century, Fulani herders driven by environmental degradation have taken advantage of government tsetste eradication programs and moved larger sheep and goats into the region. As a result, there are two domestic livestock production systems in place today: a residential, sedentary program based around dwarf breeds and a nomadic, seasonal element that significantly impacts vegetation (Koster 1981). Cattle (*Bos taurus*) follow essentially the same patterns as sheep and goat. Dwarf varieties have antiquity in the region, while the larger Sahelian breeds are newer additions primarily associated with nomadic Fulani herders. Additionally, some larger Fulani breeds of cattle (i.e., oxen) have been acquired by Gourmantche farmers as animal traction has become more popular (Swanson 1979).

Sheep, goats, and cattle are all forms of storable wealth and are used in social transactions, although cattle are usually accorded greater prestige. With their higher social value, cattle are rarely slaughtered outside of special occasions and most are

10 It is a topic of debate whether dwarfism is a linked to tsetse resistance or simply an adaptation to hot and humid climates (Epstein 1971).

consumed only after they die naturally (Remy 1967). Sheep and goat are more commonly consumed and are a primary source of meat. Most dwarf breeds have limited dairy production, and are far more important as a source of manure (Epstein 1971). Since they tend to stay close to settlements, during the dry season they fertilize near-by fields while feeding on the crop remnants: in the wet season they are more confined and their manure may be collected.

Chickens (*Gallus gallus*) and guinea fowl (*Numida meleagris*) are possibly the most economically significant of the domestic animals. They feed themselves on seeds, bugs, and trash found near settlements, and are an affordable, reliable, and low investment source of meat. Consequently, they are frequently consumed and often used in ritual sacrifice (e.g., Tauxier 1912, Swanson 1985).

Dogs (*Canis familiaris*.) are an extremely flexible species, adapted to a variety of environments and used for herding, guarding, and companionship. Their diet is omnivorous, and drawn primarily from scavenging at the edge of settlements (Epstein 1971). Historically, dog meat was a popular food in West Africa (Tauxier 1912), although its consumption was discouraged by colonial officials and missionaries. Dogs are not commonly eaten in the region today.

Donkeys (*Equus asinus*) and pigs (*Sus scrofa*) are traditionally infrequent although their use has expanded in recent years. Donkeys were primarily used for portage along trade routes, and would have had difficulty due to their lack of tsetse resistance. Given their feeding requirements and lack of use for manure, meat, or milk, they would likely have been a luxury item. Pigs are omnivorous animals that can feed themselves on settlement trash. They are a good source of meat, and can be used for wealth. It is not clear why they were uncommon in the past: today there are no local taboos against their consumption.

Prehistoric and Historic Climate and Vegetation

The discussion to this point has been for the most part restricted to current conditions in the region. However, the local environment has changed significantly over the past several thousand years due to a combination of natural and anthropogenic processes. The nature and extent of the latter are a focus of this work, and will be discussed as relevant throughout the dissertation: this section provides background on natural processes of climate change and their overall effects on vegetation.

During the Holocene, the most important source of climate change has been several major shifts in the timing and extent of ITCZ boundary movement.[11] While minor

11 This discussion draws on syntheses by Dueppen 2008 and McIntosh 2005, in addition to cited sources.

differences in temperature likely accompanied these shifts, the more significant impact was on average precipitation. Through the use of lake level chronologies and pollen cores, significant progress has been made over the last ten years towards documenting the timing and degree of dry and wet periods in the region. However, locations appropriate for these studies (the Saharan highlands (Petit-Maire 1986), Lake Chad (Brunk and Gronenborn 2004; Maley 1981), and Lake Bosumptwi (Shanahan et al. 2006; Talbot and Delibrias 1980)) are far flung, and conclusions are only relevant at a macro-scale. As was noted above, inter-annual variation in the quantity and spatial distribution of rainfall is extremely high, and general trends towards greater aridity or moisture did not reduce the level of unpredictability on a local scale although the cumulative effects of these trends would have been felt over a period of years if not decades.

Together, the studies cited above suggest that from ca. 2200 through 300 BCE there was a tendency towards greater aridity culminating in a stable dry spell that lasted until ca. AD 300. Increased precipitation, up to 150% of current totals, throughout the remainder of the first millennium AD resulted in a humid optimum. Ca. AD 1100 marked the beginning of a new dry spell that brought rainfall totals to around current levels. Although AD 1500 is often cited as the end of this new dry spell, data on second millennium AD climate are vague and often contradictory. Perhaps all that can be said conclusively is that local variability was more significant than large scale trends.

Vegetation zones in West Africa are generally delimited using rainfall isohyets, and historically advances and retreats of these zones accompanied transitions from dry to humid periods. The study region sits near the southern border of the Sudanian savanna (ca. 1200mm) and during the humid optimum of the first millennium AD, the vegetation would likely have been similar to that of modern guineean forest. As can be seen in Tables 3.3-3.11, a comparison of the minimally anthropogenic savannas and the riverine forests (which contain guineean elements) demonstrates that with a few exceptions, the differences would have been predominantly in species balance rather than composition.

A counterpoint to the regional pollen sequence is provided by the charcoal excavated and identified by the Frankfurt team at the site of Pentenga rockshelter (Frank et al. 2001).[12] While charcoal sequences tend to provide a very localized picture of the vegetation, in this case the results notably support the hypothesis of increased aridification during the early second millenium AD, although these results are complicated by a corresponding expansion in farming.

12 The Frankfurt project obtained pollen cores from several moist areas near the base of the escarpment, but testing found that the oldest identified pollen dated to the early 20th century (Frank et al. 2001).

The earliest charcoal samples date to around 6100 cal. BC and indicate a relatively high degree of woody plant cover and probably minimal human impact on the landscape. Precipitation may have increased during the mid-Holocene (to ~900-1200mm/year), but not enough to drastically affect the vegetation and species composition of dry forests. Beginning c. 3600 cal BC, species composition changed to reflect a more arid climate, although species indicative of remnant dry forests remain. In addition, the appearance of more fire-resistant species and evidence of trauma-affected rings in larger trees indicates that brush fires became more common. Whether these were a side effect of less precipitation or intentionally set by humans is not yet known. The diverse savanna environment, including dry guineean forests, remained fairly constant until at least AD 1100 (the end of the charcoal sequence). It is noteworthy that the severe dry spell from 300 BCE to AD 300 is not apparent in the charcoal data. This suggests that the escarpment contained suffient moisture for pockets of dry guineean forest to persist, likely in ravines and canyons, throughout this period, .

More interesting than the species present are those which are conspicuously absent, notably *Combretum glutinosuim*. This shrub, which is an excellent firewood, is particularly abundant in fields lying fallow. Other species indicative of agriculture or large fallows are also missing (e.g. *Guiera senegalensis*, *Annona senegalensis*). Thus, the vegetation history indicates that intensive farming occurred for the first time after AD 1100 and perhaps corresponds with the retreat of the guineean forest at the end of the humid optimum. The consequent effects on vegetation are dramatic and marked more by the appearance of fallow species like *Combretum* ssp. and *Terminalia* ssp. than the advance of the savanna.

Conclusion

Although limited by soil fertility and rainfall variability, the Gobnangou region is a hospitable landscape for humans. The diverse flora includes primarily savanna species with some guineean elements, and useful plants are abundant. The climate supports a mixture of the savanna and forest crop complexes, and the effects of agriculture are seen in the dominance of fallow plant communities. While not ideal for domestic animals, some breeds are adapted to local conditions and the diet can be supplemented with wild game.

A defining characteristic of the West African savanna is extreme seasonality. For several months a year, there is no rainfall and water can easily become scarce, making aquifers like the Gobnangou escarpment attractive locations for humans and wild animals. The importance of dry season water sources cannot be overstated, particularly since the beginning of the rains is often unpredictable. In the next chapter, the impacts of human exploitation, cultivation, and management of this environment will be explored in more detail.

Table 3.3: Key to Tables 3.4-3.12

Family and Scientific Name (follows Burkhill 1985-2004)	
*	Not in Küppers 1996, listed by Wittig et al. 2000
**	Not in Küppers 1996, listed by Geis-Tronich 1991
***	Not in Küppers 1996, listed by Koster 1981
other species with no location information are listed in Küppers 1996 general inventory only	

Sources for Ethnobotanical Information	
B	Burkhill 1985-2004
GT	Geis-Tronich 1991
K	Küppers 1996
M	Martin 1993 fide Küppers 1996
N	Neumann 1999
NRC	National Research Council 1996-2008
R	Remy 1967
S	Swanson 1979
WM	Wittig and Martin 1995

Ecological Frequency	
***	Küppers 1996 category V
**	Küppers 1996 categories IV, III
*	Küppers 1996 categories II, I
x	present, no information on frequency

Importance (All Other Categories)	
***	Preferred or highest quality
**	Used regularly, but not preferred
*	Rarely used

Importance (Edible Plants Only)	
****	Staple food. These plants are the major caloric contributors to the diet, and include grains, fats, and pulses. All of these plants are cultivated or strongly encouraged today.
***	Common food. These plants are widely collected and consumed, even among modern agricultural populations, and may be managed. Many of the foods in this category are foundations for sauces, and provide significant diversity and essential nutrients to the diet
**	Opportunistic food. These edible plants are either irregularly consumed or consumed on a limited scale. They may occur infrequently in the landscape
*	Famine food. These edible plants have high processing or collection costs relative to their nutritional return, or are not very palatable. Likely eaten only when absolutely necessary.

Table 3.4: Edible Plants of Southeastern Burkina Faso

							Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
	Family	Scientific Name	Diet Importance	Edible Parts	Notes	Sources	Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forest	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
Oil	SAPOTACEAE	*Vitellaria paradoxa* Gaertn. f.	****	seed	shea butter extracted from kernal is a primary cooking oil	B, GT		*	**		x					**	***	*	x			*	*	
Oil	LABIATAE	*Hyptis spicigera* Lam.	***	seed	oily black seed, plant is often cultivated or encouraged	B																		
Oil	MALVACEAE	*Urena lobata* L.	**	young leaf, seed	fatty seeds added to stews	B			*	*	x								x	x				
Oil	LEGUMINOSAE-PAPILIONOIDEAE	*Tephrosia platycarpa* Guill. & Perr.	*	seed	cooking oil can be extracted from seed	B									*									
Legumes	LEGUMINOSAE-MIMOSOIDEAE	*Parkia biglobosa* (Jacq.) R Br.	****	seed	storable vegetable butter made from fermented seed is a sauce base	B, GT			*	*			*				*		x					
Legumes	LEGUMINOSAE-MIMOSOIDEAE	*Acacia macrostachya* Reichenb.	**	seeds	seeds are cooked and consumed like beans	B		**	*		x					*	**					**	**	
Legumes	LEGUMINOSAE-MIMOSOIDEAE	*Prosopis africana* (Guill. & Perr.) Taub.	**	seed		B		*	*	*	x						*					*		
Legumes	LEGUMINOSAE-MIMOSOIDEAE	*Acacia polyacantha* Willd.	*	seed		B																		
Leafy Vegetable	AMARANTHACEAE	*Alternathera sessilis* (L.)DC.	***	leaf		B																		
Leafy Vegetable	AMARANTHACEAE	*Amaranthus hybridus* L.*	***	leaf/seed	the best of the Amaranth spinaches, it is not known when this plant was introduced from Asia	B, WM																		
Leafy Vegetable	AMARANTHACEAE	*Amaranthus spinosus* L.	***	leaf, flower	introduced from Asia at an unknown point	B, WM		*																
Leafy Vegetable	BOMBACACEAE	*Adansonia digitata* L.	***	leaf, fruit	leaf is among the most common sauce ingredients; fruit pulp is often dried, powdered, and used as a sweetener	B, GT, M			*		x								x	x				
Leafy Vegetable	BOMBACACEAE	*Bombax costatum* Pellegr. & Vuillet	***	flowers	flowers valued for creating mucilage in sauce	M		**	*	*	x						*		x			*	*	
Leafy Vegetable	CAPPARIDACEAE	*Cleome gynandra* L.*	***	leaf/root, seed	leaf appreciated in sauces for its bitterness	B, WM																		
Leafy Vegetable	CONVOLVULACEAE	*Ipomoea eriocarpa* R. Br.	***	leaf		B, WM			*						*			*						x
Leafy Vegetable	LEGUMINOSAE-CAESALPINIOIDEAE	*Senna obtusifolia* (L.) Irwin & Barneby	***	young leaf, flower, seed	young leaf and flower can be dried for use in sauce, roasted seeds can be used as a coffee substitute	B, WM				*							*							
Leafy Vegetable	MORINGACEAE	*Moringa oleifera* Lam.***	***	leaf, root, seed	leaf has smell of mustard and is eaten raw and cooked. Seeds eaten fried and used for their oil	B					x								x					
Leafy Vegetable	PEDALIACEAE	*Ceratotheca sesamoides* Endl.	***	leaf, seed		B, WM		***			x												*	
Leafy Vegetable	PORTULACACEAE	*Portulaca oleracea* L.	***	leaf	leaves consumed raw or cooked	B, WM		*																

Table 3.4: Edible Plants of Southeastern Burkina Faso (continued)

	Family	Scientific Name	Diet Importance	Edible Parts	Notes	Sources	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
							Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forest	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
Leafy Vegetable	TILIACEAE	*Corchorus fascicularis* Lam.*	***	leaf	leaf, stem, and flower can be dried for use in sauce	WM																		
	TILIACEAE	*Corchorus olitorius* L.	***	leaf, fruit	leaf, stem, and flower can be dried for use in sauce	B, WM																		
	TILIACEAE	*Corchorus tridens* Lam.	***	leaf	leaf, stem, and flower can be dried for use in sauce	B, WM										*								x
	ULMACEAE	*Celtis integrifolia* Lam.	***	leaf, young fruit	leaf frequently used in sauce, fruit edible only when young	B				*									x					
	VITACEAE	*Cissus populnea* Guill. & Perr.	***	mucilage, leaf, fruit		B		*	*	*							*							
	AMARANTHACEAE	*Amaranthus graecizans* L.*	**	leaf		B, WM																		
	ANACARDIACEAE	*Lannea acida* A. Rich.	**	young leaf, fruit, gum		B		**	**	*	x						*					**	**	
	ANNONACEAE	*Annona senegalensis* Pers.	**	leaves, flowers, fruit	flowers used as flavoring	B		**	**	*						*	**	*				**	*	
	ARACEAE	*Stylochiton hypogaeus* Lepr.*	**	leaf, flower		B, WM																		
	ASCLEPIADACEAE	*Leptadinia hastata* (Pers.) Dec'ne***	**	flower, leaf, shoot	usually consumed cooked in sauces	B					x								x	x				
	BOMBACACEAE	*Ceiba pentandra* (L.) Gaertn.	**	seed/young leaf, flower		B																		
	CAPPARACEAE	*Cadaba farinosa* Forssk.***	**	leaf, bark	pounded leaves cooked in sauce or mixed with cereals	B					x								x					
	CAPPARACEAE	*Cleome viscosa* L.	**	leaf, seed	acrid leaf used in sauces, seed used as a spice	B		*	*										x	x				
	CAPPARACEAE	*Crateva adansonii* DC.***	**	leaf, fruit	crushed and cooked in sauces	B													x					
	COMBREATACEAE	*Combretum paniculatum* Vent.***	**	leaf	used in soups	B													x	x				
	CONVOLVULACEAE	*Jacquemontia tamnifolia* (L.) Griesb.***	**	leaf															x	x				
	LEGUMINOSAE-CAESALPINIOIDEAE	*Afzelia africana* Sm.	**	unripe fruit, young leaves, aril		B			**	*	x						*		x				*	
	LEGUMINOSAE-CAESALPINIOIDEAE	*Isoberlinia tomentosa* (Harms) Craib & Stapf	**	leaf		B			*															
	LEGUMINOSAE-MIMOSOIDEAE	*Albizia zygia* (DC.) JF Macbride***	**	young leaf		B													x					
	LEGUMINOSAE-PAPILIONOIDEAE	*Pterocarpus lucens* Lepr.**	**	leaf		B																		
	LILIACEAE	*Aloe macrocarpa* var. *major* A. Berger	**	flower		B	*																	
	LOGANIACEAE	*Strychnos spinosa* Lam.	**	young leaf, fruit	young leaf commonly used in sauces, while fruit is barely edible	B		**	*	*	x						**					**	*	

Table 3.4: Edible Plants of Southeastern Burkina Faso (continued)

	Family	Scientific Name	Diet Importance	Edible Parts	Notes	Sources	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
							Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forest	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
Leafy Vegetable	MORACEAE	*Ficus sur* Forssk.	**	young leaf, aerial root, fruit		B				**														
	NYCTAGINACEAE	*Boerhavia erecta* L.	**	leaf		B, WM		*									*							
	POLYGONACEAE	*Polygonum senegalensis* Meisn.***	**	leaf		B													x	x				
	SAPINDACEAE	*Cardiospermum halicacabrum* L.***	**	leaf		B					x								x	x				
	AMARANTHACEAE	*Celosia trigyna* L.	*	leaf	bitter leaf used as a famine food	B, WM				*				*										
	ARACEAE	*Stylochiton lancifolius* Kotschy & Peyr.	*	leaf, root	leaves and root can be eaten if leached to remove acridity	B								**										
	COMMELINACEAE	*Commelina forskalaei* Vahl*	*	leaf	leaf can be used in sauces	WM					x	x												
	COMMELINACEAE	*Cyanotis villosa**	*	leaf	leaf can be used in sauces	WM																		
	COMPOSITAE	*Coreopsis borianiana* Sch. Bip.	*	leaf	leaf can be used in sauces	WM		*								*						*		
	COMPOSITAE	*Vicoa leptoclada* (Webb) Dandy	*	leaf	freah and dried leaves can be used in sauces	WM								*								*		
	CONVOLVULACEAE	*Ipomoea aquatica* Forssk.	*	leaf, root	complete plants can be eaten when young	B													x	x				
	CONVOLVULACEAE	*Ipomoea coscinosperma* Hochst.	*	leaf	leaf, flower, and stem can be used in sauces	WM		***	*						*	*								
	EUPHORBIACEAE	*Acalypha ciliata* Forssk.	*	leaf	leaf can be used in sauces	B, WM											*							
	EUPHORBIACEAE	*Acalypha segetalis* Mull.-Arg*	*	leaf	leaf can be used in sauces	B, WM																		
	LABIATAE	*Leucas martinicensis* (Jacq.) Ait.f.	*	leaf	leaf can be used in sauces	B		*						**		*	*						*	
	LEGUMINOSAE-CAESALPINIOIDEAE	*Daniella oliveri* (Rolfe) Hutch. & Dalz.	*	young leaf	young leaf can be used in sauces	B		*	*	***	x							**	x					
	LEGUMINOSAE-CAESALPINIOIDEAE	*Piliostigma thonningii* (Schum.) Milne-Redh.	*	young leaf, seed	young leaf can be used is sauces, isolated records of grain consumption	B		*	*	*	x		*			*	**		x	x		*	*	
	LEGUMINOSAE-PAPILIONOIDEAE	*Crotalaria naragutensis* Hutch.	*	leaf	leaf can be used in sauces	WM		*	*					*	*									
	LEGUMINOSAE-PAPILIONOIDEAE	*Zornia glochidata* Reichb.	*	plant		B		*			x				*									
	MALVACEAE	*Pavonia triloba**	*	leaf	leaf, flower, and stem can be used in sauces	WM																		
	MORACEAE	*Ficus ingens* (Miq.) Miq.	*	fruit, young leaf		B			*									*						
	POLYGALACEAE	*Polygala multiflora* Poir.	*	leaf		WM		***	*						*	*	*							
	PTERIDOPHYTA	*Ceratopteris thalictroides* (L.) Brong.	*	leaf		B				*		x												

Table 3.4: Edible Plants of Southeastern Burkina Faso (continued)

	Family	Scientific Name	Diet Importance	Edible Parts	Notes	Sources	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
							Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forest	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
Leaf	PTERIDOPHYTA	*Ophioglossum reticulatum* L.	*	leaf		B		*																
Leaf	RUBIACEAE	*Mitragyna inermis* (Willd.) O. Ktze.	*	leaf		B		*									*	*	x			*		
Leaf	COMMELINACEAE	*Commelina benghalensis* L. var. *benghalensis*	*	leaf, rhizome	leaf can be used in sauces, edible rhizome	B, WM		*						*			*							
Fruits	ANACARDIACEAE	*Sclerocarya birrea* (A. Rich.) Hochst.	***	fruit	fruit can be fermented to make an alcoholic beverage. Fruit has oily, edible kernals.	B, GT		*	*		x													
Fruits	LEGUMINOSAE-MIMOSOIDEAE	*Tamarindus indica* L.	***	leaf, fruit, seed	fruit can be eaten fresh or dried and powdered	B			*	*									x	x				
Fruits	MALVACEAE	*Hibiscus asper* Hook.f.	***	fruit	young fruit commonly used to thicken soups	B		*	**	*	x			*	*	**	**						*	
Fruits	MORACEAE	*Ficus sycamorus* L. ssp. *gnaphalocarpa*	***	young leaf, fruit	fruit is the best of the *Ficus* sp.	B				*														
Fruits	RHAMNACEAE	*Ziziphus mauritiana* Lam.	***	fruit	Best of the Ziziphus sp. fruits, often dried, powdered, and made into sweets	B					x													
Fruits	VERBENACEAE	*Vitex doniana* Sweet	***	young leaf, fruit	fruit can be fermented to make an alcoholic beverage.	B, GT		*	*	*									x			*		
Fruits	ANACARDIACEAE	*Lannea microcarpa* Engl. & K. Krause	**	leaf, fruit, gum	fruit may be dried and/ or fermented to make an alcoholic beverage	B, GT		*	*	*	x						*	*				*		
Fruits	ANNONACEAE	*Hexalobus monopetalus* (A. Rich) Engl. & Diels	**	fruit		B																		
Fruits	APOCYNACEAE	*Saba senegalensis* (A. DC.) Pichon	**	leaf, fruit		B				*														
Fruits	BALANITACEAE	*Balanites aegyptiaca* (L.) Del.	**	leaf, fruit		B		*	*		x							*	x			*		
Fruits	EBENACEAE	*Diospyros elliotii* (Hiern.) F White***	**	fruit		B													x					
Fruits	EBENACEAE	*Diospyros mespiliformis* Hochst.	**	fruit		B		*	*	***								**	x					
Fruits	EUPHORBIACEAE	*Bridelia scleroneura* Mull.-Arg.	**	fruit		B		*	**	*						*	*					**		
Fruits	EUPHORBIACEAE	*Securinega virosa* (Roxb.) Baill.	**	fruit		B		*	*		x		*	*			*		x	x		**	*	
Fruits	EUPHORBIACEAE	*Uapaca togoensis* Pax	**	fruit		B			*															
Fruits	HYDROCHARITACEAE	*Ottelia ulvifolia* (Planch) Walp.***	**	fruit, leaf		B															x			
Fruits	LEGUMINOSAE-CAESALPINIOIDEAE	*Detarium microcarpum* Guill. & Perr.	**	fruit		B		**	**	*	x						*	*				**	**	
Fruits	LEGUMINOSAE-CAESALPINIOIDEAE	*Dialium guineense* Willd.	**	fruit, seed		B												*						
Fruits	LEGUMINOSAE-CAESALPINIOIDEAE	*Piliostigma reticulatum* (DC.) Hochst.	**	fruit	pods edible when young	B		*	*		x		*			*			x	x				

Table 3.4: Edible Plants of Southeastern Burkina Faso (continued)

	Family	Scientific Name	Diet Importance	Edible Parts	Notes	Sources	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
							Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forest	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
Fruits	LEGUMINOSAE-MIMOSOIDEAE	*Acacia nilotica* (L.)Willd.	**	young fruit	fruit edible when young	B					x								x	x				
	LEGUMINOSAE-PAPILIONOIDEAE	*Lonchocarpus laxiflorus* Guill. & Perr.	**	flower, fruit, leaf	fruit can be dried and stored	B			*		x						*							
	MORACEAE	*Ficus abutifolia* (Miq.) Miq.	**	fruit		B		*	**	*									x					
	MORACEAE	*Ficus glumosa* Del.	**	fruit, young leaf		B		*	*		x													
	NYMPHAEACEAE	*Nymphaea maculata* Schum. & Thonn.	**	fruit, root	some varieties have edible roots	B																		
	NYMPHAEACEAE	*Nymphaea micrantha* Guill. & Perr.	**	fruit, root, seed		B															x			
	OLACACEAE	*Ximenia americana* L.	**	fruit, seed	vegetable butter can be made from seed	B		*	*	*	x						*		x	x				
	PALMAE	*Phoenix dactylifera* L.**	**	fruit		B																		
	RHAMNACEAE	*Ziziphus spina-christi* (L.) Desf.	**	fruit		B																		
	SAPINDACEAE	*Allophylus africanus* P. Beauv.	**	fruit		B			*	**														
	TILIACEAE	*Grewia bicolor* Juss.	**	fruit		B		*	*		x						*					*		
	TILIACEAE	*Grewia mollis* Juss.**	**	fruit, leaf, bark		B					x								x					
	TILIACEAE	*Grewia villosa* Willd.	**	fruit		B			*															
	VERBENACEAE	*Lantana camara* L.	**	fruit	Introduced from the Americas (after AD 1500)	B																		
	VITACEAE	*Ampelocissus leonensis* (Hook.f.) Planch	**	fruit		B			*															
	VITACEAE	*Cissus quadragularis* L.	**	fruit		B		*	*	*	x								x	x				
	ASCLEPIADACEAE	*Glossonema boveanum* (Dec'ne) Dec'ne***	*	flower, fruit		B					x								x	x				
	BIGNONIACEAE	*Stereospermum kunthianum* Cham.	*	fruit		B		*	**		x				*	*	*		x				*	
	CAPPARACEAE	*Boscia senegalensis* (Pers.) Lam. ***	*	fruit, leaf	fruit and leaves consumed more frequently to the north but generally a famine food this far south	B					x													
	CAPPARACEAE	*Capparis tomentosa* Lam. ***	*	fruit		B																		
	EUPHORBIACEAE	*Phyllanthus reticularis* Poir.***	*	fruit		B					x													
	LOGANIACEAE	*Strychnos innocua* Del.	*	fruit pulp	fruits have edible pulp and toxic seeds	B		*	*		x												*	
	MELASTOMATACEAE	*Tristemma mauritianum* J F Gmel.	*	fruit		B				*														
	MORACEAE	*Ficus platyphylla* Del.	*	fruit	latex can be used as a chewing gum	B				*									x					
	MORACEAE	*Ficus populifolia* Vahl	*	fruit		B																		

Table 3.4: Edible Plants of Southeastern Burkina Faso (continued)

	Family	Scientific Name	Diet Importance	Edible Parts	Notes	Sources	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
							Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forest	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
Fruits	RHAMNACEAE	*Ziziphus abyssinica* Hochst.	*	fruit		B		*	*		x						*					*	*	
Fruits	RHAMNACEAE	*Ziziphus mucronata* Willd.	*	fruit		B		*	*	*	x						*		x					
Fruits	RUBIACEAE	*Gardenia erubescens* Stapf & Hutch.	*	fruit	fruit is edible, but not palatable	B			*				*				*					*		
Fruits	RUBIACEAE	*Gardenia ternifolia* Schum. & Thonn.	*	fruit		B					x								x					
Fruits	RUBIACEAE	*Ixora brachypoda* DC.	*	fruit		B				*														
Fruits	RUBIACEAE	*Sarcocephalus latifolius* (JE Sm.) EA Bruce	*	fruit	fruit can be eaten in small quantities	B			**	**														
Fruits	SOLANACEAE	*Physalis micrantha* Link	*	fruit		B																		
Fruits	TILIACEAE	*Grewia flavescens* Juss.	*	fruit		B		*	*								*					*	*	
Fruits	TILIACEAE	*Grewia lasiodiscus* K Schum.	*	fruit		B			*	*			*				*	*					*	
Fruits	ULMACEAE	*Trema orientalis* (L.) Blume	*	fruit		B		*		*														
Fruits	VERBENACEAE	*Vitex simplicifolia* Oliv.	*	fruit		B			*		x								x					
Fruits	VITACEAE	*Ampelocissus africanus* (Lour.) Merr.***	*	fruit		B					x								x	x				
Grain	GRAMINEAE	*Brachiaria deflexa* (Schumach.) CE Hubbard	***	seed		B																		
Grain	GRAMINEAE	*Panicum laetum* Kunth	***	seed		B																		
Grain	GRAMINEAE	*Brachiaria lata* (Schumach.) CE Hubbard	**	seed		B					x					*			x	x				
Grain	GRAMINEAE	*Brachiaria ramosa* (Linn.) Stapf	**	seed		B																		
Grain	GRAMINEAE	*Brachiaria villosa* Vanderyst	**	seed		B	*	*	*		x			**	*	*	*		x				*	
Grain	GRAMINEAE	*Panicum subalbidum* Kunth	**	seed		B		**	*		x								x			*		
Grain	GRAMINEAE	*Pennisetum unisetum* (Nees) Benth.	**	seed		B																		
Grain	GRAMINEAE	*Rottboellia cochinensis* (Lour.) WD Clayton***	**	seed		B													x					
Grain	LEGUMINOSAE-PAPILIONOIDEAE	*Sesbania pachycarpa* DC.	**	seed	seeds can be used to produce a vegetable butter	B																		
Grain	GRAMINEAE	*Brachiaria stigmatisata* (Mez) Stapf	*	seed		B																		
Grain	GRAMINEAE	*Cenchrus biflorus* Roxb.	*	seed	small grains are particularly nutritious, but very difficult to thresh,	B					x													
Grain	GRAMINEAE	*Dactyloctenium aegyptium* (L.) P. Beauv.	*	seed	small-seeded edible grain, currently collected (and may have been cultivated) in more arid region	B		*			x			**		*							*	x
Grain	GRAMINEAE	*Digitaria ciliaris* (Retz.) Koel.	*	seed		B																		
Grain	GRAMINEAE	*Digitaria deliculata* Stapf	*	seed		B																		
Grain	GRAMINEAE	*Digitaria nuda* Schumach.	*	seed		B																		

Table 3.4: Edible Plants of Southeastern Burkina Faso (continued)

							Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
	Family	Scientific Name	Diet Importance	Edible Parts	Notes	Sources	Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forest	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
Grain	GRAMINEAE	*Eleusine indica* (L.) Gaetrn.	*	seed		B		*			x					*								
Grain	GRAMINEAE	*Eragrostis pilosa* (L.) P Beauv.**	*	seed	stockpiles of grain may be recovered from termite mounds during times of dearth	B																		
Grain	GRAMINEAE	*Eragrostis tremula* Hochst.	*	seed		B					x	x		*		*								
Grain	GRAMINEAE	*Eragrostis turgida* (Schum.) de Wild.	*	seed		B		*				x		*	**	*							*	
Grain	GRAMINEAE	*Oryza barthii* A. Chev.	*	seed		B																		
Grain	GRAMINEAE	*Oryza longistaminata* A. Chev. & Roehr.	*	seed		B																		
Grain	GRAMINEAE	*Panicum fluviicola* Steud.***	*	seed		B						x							x	x				
Grain	GRAMINEAE	*Panicum pansum* Rendle	*	seed		B								*	*	*			x	x			*	
Grain	GRAMINEAE	*Paspalum scrobiculatum* L.	*	seed	not all varieties are edible	B													x					
Grain	GRAMINEAE	*Sacciolepsis africana* CE Hubbard & Snowden***	*	seed		B														x	x			
Grain	GRAMINEAE	*Setaria pumila* (Poir.) Roem. & Schult.	*	seed		B	*	**				x		***	*	**	*			x		**	*	x
Grain	GRAMINEAE	*Sporobolus pyramidalis* P. Beauv.	*	seed		B						x			*		**	*	x	x				
Roots and Tubers	CYPERACEAE	*Cyperus digitatus* Roxb. ssp. *auricomus* (Spreng) Kuk.***	**	rhizome	small fragrant edible rhizomes	B														x				
Roots and Tubers	CYPERACEAE	*Cyperus esculentus* L.***	**	tuber	small tubers can be prepared fresh or roasted. Importance varies between ethnic groups	B													x					
Roots and Tubers	NYMPHAEACEAE	*Nymphea lotus* L.***	**	rhizome, calyx, seed	rhizome eaten raw or cooked: can be a staple or a famine food	B															x			
Roots and Tubers	ZINGIBERACEAE	*Siphonochilus aethiopicus* (Schweinf.) BL Burtt	**	tuber	tuber has a gingery flavor	B																		
Roots and Tubers	ALISMATACEAE	*Burnatia enneandra* M. Micheli	*	tuber		B																		
Roots and Tubers	ARACEAE	*Amorphophallus dracontoides* (Engl.) N.E. Br.***	*	tuber	requires treatment to remove acridity	B													x					
Roots and Tubers	DIOSCOREACEAE	*Dioscorea bulbifera* L.***	*	bulbil	require elaborate preparation to leach toxins	B					x								x	x				
Roots and Tubers	DIOSCOREACEAE	*Dioscorea dumentorum* (Kunth) Pax	*	tuber	tubers can be made edible through leaching of toxins	B		*	*	**	x						*	*						
Roots and Tubers	DIOSCOREACEAE	*Dioscorea schimperana* Hochst.	*	bulbil		B			*															
Roots and Tubers	LILIACEAE	*Asparagus africanus* Lam.	*	young shoot, root	roots edible only if well cooked	B		*	*		x						*		x					
Roots and Tubers	TACCACEAE	*Tacca leontopetaloides* (L.) O. Ktze.	*	tuber	careful preparation needed to remove toxicity, usually only cultivated varieties are considered edible	B					x													

Table 3.4: Edible Plants of Southeastern Burkina Faso (continued)

							Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
	Family	Scientific Name	Diet Importance	Edible Parts	Notes	Sources	Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forest	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
Aromatics	CYPERACEAE	*Kyllinga squamulata* Thonn.	**	culm	fragrant culm used as flavoring	B																		
	CYPERACEAE	*Mariscus alternifolius* Vahl.***	**	rhizome	fragrant rhizome used as flavoring	B													x	x				
	LABIATAE	*Aeollanthus pubescens* Benth.	**	leaf	aromatic herb used as flavoring	B	*																	
	VERBENACEAE	*Lantana rhodensis* Moldenke	**	leaf	sweet aromatic leaves often used as flavoring	B										*								
	BURSERACEAE	*Commiphora africana* (A. Rich.) Engl.	*	root, fruit		B		*			x								x					
	GRAMINEAE	*Vetiveria fulvibarbis* (Trin.) Stapf	*	root	root may be used to flavor drinking water	B						x							x	x				
Other	GRAMINEAE	*Echinochloa pyramidalis* (Lam.) Hitchc. & Chase	***	seed, salt	palatable mineral salt can be made from the culm	B					x								x	x				
	ARACEAE	*Pistia stratiotes* L.***	**	salt	burned to produce a vegetable salt	B															x			
	CAPPARACEAE	*Boscia angustifolia* A. Rich.***	**	bark, fruit, seed	bark pounded with cereals or added to soups. Berries are bitter.	B					x								x	x				
	CARYOPHYLLACEAE	*Polycarpea* [three species]	**	leaf	stimulating infusion drunk against fatigue	B		*			x												*	
	LEGUMINOSAE-PAPILIONOIDEAE	*Abrus puchellus* Wall.	**	plant	stems used as sweetener	B												*						
	LEGUMINOSAE-PAPILIONOIDEAE	*Pterocarpus santalinoides* L'Her. ex DC.***	**	seed, leaf	oily seeds eaten with suitable preparation	B													x					
	PALMAE	*Borassus aethiopium* Mart.	**	fruit, sap	sap can be used to produce a palm wine	B													x					
	PALMAE	*Raphia sudanica* A Chev.	**	fruit, sap	sap can be used to produce a palm wine	B				*									x					
	COMMELINACEAE	*Aneilema lanceolata* Benth.	*	sap	leaf has sufficient sap to boil yams during drought	B																		
	LEGUMINOSAE-MIMOSOIDEAE	*Acacia sieberiana* DC.	*	gum		B					x								x	x				
	STERCULIACEAE	*Sterculia setigera* Del.	*	seed, gum	trunk contains a potable fluid, useful in times of drought	B		**	**		x					*	*					**		

Table 3.5: Firewoods of Southeastern Burkina Faso

Family	Scientific Name	Firewood Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
COMBRETACEAE	*Anogeissus leiocarpus* (DC.) Guill. & Perr.	***		B, N			*	*	x		*				**	**	x				*	
COMBRETACEAE	*Combretum glutinosum* Perr.	***		B, N		***	*	*	x					**	**		x	x		***	**	
COMBRETACEAE	*Combretum micranthum* G. Don.	***		B, N		*	***	*	x								x				**	
COMBRETACEAE	*Combretum molle* R. Br.	***		B, N			*				*				*					**	***	
COMBRETACEAE	*Combretum nigricans* Lepr.	***		B, N	*	**	*		x						*	*	x			*	**	
COMBRETACEAE	*Terminalia glaucescens* Planch.	***		B				*														
COMBRETACEAE	*Terminalia macroptera* Guill. & Perr.	***		B					x													
EUPHORBIACEAE	*Bridelia scleroneura* Mull.-Arg.	***		B		*	**	*						*	*					**		
EUPHORBIACEAE	*Hymenocardia acida* Tul.	***		B		*	*														*	
EUPHORBIACEAE	*Securinega virosa* (Roxb.) Baill.	***		B		*	*		x		*	*			*		x	x		**	*	
EUPHORBIACEAE	*Uapaca togoensis* Pax	***		B			*															
LEGUMINOSAE-CAESALPINIOIDEAE	*Burkea africana* Hook.	***		B, N		***	**	*	x						**		x			***	*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Daniella oliveri* (Rolfe) Hutch. & Dalz.	***		B		*	*	***	x							**	x	x				
LEGUMINOSAE-CAESALPINIOIDEAE	*Dialium guineense* Willd.	***		B												*						
LEGUMINOSAE-CAESALPINIOIDEAE	*Piliostigma thonningii* (Schum.) Milne-Redh.	***	Charcoal used by Gourmantche for smithing iron (GT)	B, GT		*	*	*	x		*			*	**		x	x		*	*	
LEGUMINOSAE-MIMOSOIDEAE	*Acacia polyacantha* Willd.	***		B																		
LEGUMINOSAE-MIMOSOIDEAE	*Prosopis africana* (Guill. & Perr.) Taub.	***		B, N		*	*	*	x						*					*		
LEGUMINOSAE-PAPILIONOIDEAE	*Swartzia madagascarensis* Desv.	***		B																		
MELIACEAE	*Khaya senegalensis* (Desv.) A Juss.	***	Charcoal used by Gourmantche for smithing iron (GT)	B, GT		*	*	**									x					
OLACACEAE	*Ximenia americana* L.	***		B		*	*	*	x						*		x	x				
SAPINDACEAE	*Allophylus africanus* P Beauv.	***		B			*	**														
SAPOTACEAE	*Vitellaria paradoxa* Gaertn. f.	***	Charcoal used by Gourmantche for smelting iron (GT)	B, GT		*	**		x					**	***	*	x			*	*	
ULMACEAE	*Trema orientalis* (L.) Blume	***		B		*		*														
ANACARDIACEAE	*Ozoroa insignis* Del.***	**		B					x													

Table 3.5: Firewoods of Southeastern Burkina Faso (continued)

Family	Scientific Name	Firewood Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
COMBRETACEAE	*Terminalia avicennoides* Guill. & Perr.*	**	Charcoal used by Gourmantche for smithing iron (GT)	B, GT, N					x		*						x	x				
COMPOSITAE	*Aspilia africana* (Pers.) C. D. Adams	**		B		*	*							*								
EBENACEAE	*Diospyros mespiliformis* Hochst.	**	N notes cases where species is avoided as a firewood	B, N		*	*	***								**	x					
LEGUMINOSAE-CAESALPINIOIDEAE	*Cassia sieberiana* DC.	**	Charcoal used by Gourmantche for smithing iron (GT)	B, GT			*	*								*						
LEGUMINOSAE-CAESALPINIOIDEAE	*Detarium microcarpum* Guill. & Perr.	**		B, N		**	**	*	x						*	*				**	**	
LEGUMINOSAE-CAESALPINIOIDEAE	*Tamarindus indica* L.	**	N notes cases where species is avoided as a firewood	B, N			*	*									x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Acacia nilotica* (L.)Willd.	**		B					x								x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Albizia zygia* (DC.) JF Macbride***	**		B													x					
LEGUMINOSAE-MIMOSOIDEAE	*Dichrostachys cinerea* (L.) Wight & Arn.	**		B, N				*	x					*	*		x					
LEGUMINOSAE-PAPILIONOIDEAE	*Pterocarpus erinaceus* Poir.	**		B		*	**								**	*	x			*	*	
LEGUMINOSAE-PAPILIONOIDEAE	*Pterocarpus lucens* Lepr.**	**	Charcoal used by Gourmantche for smithing iron (GT)	B, GT																		
RHAMNACEAE	*Ziziphus spina-christi* (L.) Desf.	**		B																		
RUBIACEAE	*Crossopteryx febrifuga* (Afzel.) Benth.	**		B, N		*	*		x		*			**	*		x	x		***	*	
RUBIACEAE	*Gardenia ternifolia* Schum. & Thonn.	**		B, N					x								x					
ANACARDIACEAE	*Mangifera indica* L.	*	cultivar not frequently used despite excellent properties. Introduced from India via Americas	B																		
CAPPARACEAE	*Maerua angolensis* DC.	*		B					x								x					
LEGUMINOSAE-CAESALPINIOIDEAE	*Afzelia africana* Sm.	*	N notes a case where species is avoided as a firewood	B, N			**	*	x						*		x				*	
LEGUMINOSAE-MIMOSOIDEAE	*Acacia seyal* DC.**	*		B					x													
LEGUMINOSAE-MIMOSOIDEAE	*Acacia sieberiana* DC.	*		B					x								x	x				

Table 3.5: Firewoods of Southeastern Burkina Faso (continued)

Family	Scientific Name	Firewood Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
LEGUMINOSAE-MIMOSOIDEAE	*Entada africana* Guill. & Perr.	*	N notes cases where species is avoided as a firewood	B, N			*		x		*			*								
LEGUMINOSAE-PAPILIONOIDEAE	*Pterocarpus santalinoides* L'Her. ex DC.***	*		B													x					
MORACEAE	*Ficus platyphylla* Del.	*		B				*									x					
MORACEAE	*Ficus sur* Forssk.	*		B				**														
RHAMNACEAE	*Ziziphus mauritiana* L.	*		B					x													
RUBIACEAE	*Gardenia erubescens* Stapf & Hutch.	*		B, N			*				*				*					*		

Table 3.6: Construction Woods of Southeastern Burkina Faso

Family	Scientific Name	Construction Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
COMBRETACEAE	*Anogeissus leiocarpus* (DC.) Guill. & Perr.	***		B, GT			*	*	x		*				**	**	x				*	
COMBRETACEAE	*Combretum micranthum* G. Don.	***		B, GT		*	***	*	x								x				**	
COMBRETACEAE	*Combretum molle* R. Br.	***		B			*				*				*					**	***	
COMBRETACEAE	*Terminalia macroptera* Guill. & Perr.	***		B					x													
EBENACEAE	*Diospyros mespiliformis* Hochst.	***		B, GT, N		*	*	***								**	x					
LEGUMINOSAE-CAESALPINIOIDEAE	*Afzelia africana* Sm.	***		B, N			**	*	x						*		x				*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Tamarindus indica* L.	***		B			*	*									x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Acacia seyal* DC.**	***		B, GT					x													
LEGUMINOSAE-MIMOSOIDEAE	*Prosopis africana* (Guill. & Perr.) Taub.	***		B		*	*	*	x						*					*		

Table 3.6: Construction Woods of Southeastern Burkina Faso (continued)

Family	Scientific Name	Construction Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
LEGUMINOSAE-PAPILIONOIDEAE	*Pterocarpus erinaceus* Poir.	***		B		*	**								**	*	x			*	*	
MELIACEAE	*Khaya grandifolia* C. DC.	***		B			*	**														
MELIACEAE	*Khaya senegalensis* (Desv.) A Juss.	***		B		*	*	**									x					
MELIACEAE	*Pseudocedrela kotschyi* (Schweinf.) Harms***	***		B													x					
RUBIACEAE	*Mitragyna inermis* (Willd.) O. Ktze.	***		B, GT		*									*	*	x			*		
SAPOTACEAE	*Vitellaria paradoxa* Gaertn. f.	***		B, GT		*	**		x					**	***	*	x			*	*	
VERBENACEAE	*Gmelina arborea* Roxb.	***	Recently introduced from South Asia	B																		
ANNONACEAE	*Hexalobus monopetalus* (A. Rich) Benth.	**		B																		
ANNONACEAE	*Xylopia parviflora* (A. Rich.) Benth.	**		B																		
COMBRETACEAE	*Combretum glutinosum* Perr.	**		B		***	*	*	x					**	**		x	x		***	**	
COMBRETACEAE	*Terminalia avicennoides* Guill. & Perr.*	**		B, GT					x		*						x	x				
COMBRETACEAE	*Terminalia glaucescens* Planch.	**		B				*														
LEGUMINOSAE-CAESALPINIOIDEAE	*Cassia sieberiana* DC.	**		B			*	*								*						
LEGUMINOSAE-MIMOSOIDEAE	*Acacia nilotica* (L.)Willd.	**		B					x								x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Acacia sieberiana* DC.	**		B					x								x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Dichrostachys cinerea* (L.) Wight & Arn.	**		B				*	x					*	*		x					
LEGUMINOSAE-PAPILIONOIDEAE	*Swartzia madagascarensis* Desv.	**		B																		
RHAMNACEAE	*Ziziphus mauritiana* L.	**		B					x													
ULMACEAE	*Trema orientalis* (L.) Bl.	**		B		*		*														
VERBENACEAE	*Vitex doniana* Sweet	**		B		*	*	*									x			*		
ANNONACEAE	*Annona senegalensis* Pers.	*		B		**	**	*						*	**	*				**	*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Burkea africana* Hook.	*		B		***	**	*	x						**		x			***	*	
LEGUMINOSAE-MIMOSOIDEAE	*Acacia polyacantha* Willd.	*		B																		

Table 3.7: Fodder Plants of Southeastern Burkina Faso

Family	Scientific Name	Fodder Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
ACANTHACEAE	*Nelsonia canescens* (Lam.) Spreng	***	important salty fodder	B															x			
BALANITACEAE	*Balanites aegyptiaca* (L.) Del.	***		B		*	*		x							*	x			*		
BOMBACACEAE	*Bombax costatum* Pellegr. & Vuillet	***		B		**	*	*	x						*		x			*	*	
BURSERACEAE	*Commiphora africana* (A. Rich.) Engl.	***		B		*			x								x					
COMBRETACEAE	*Combretum glutinosum* Perr.	***		B		***	*	*	x					**	**		x	x		***	**	
COMBRETACEAE	*Combretum micranthum* G. Don.	***		B		*	***	*	x								x				**	
COMMELINACEAE	*Commelina forskalaei* Vahl*	***		B					x	x												
CONVOLVULACEAE	*Merremia pinnata* (Hochst. ex Choisy) Hallier f.	***		B	**	*																
GRAMINEAE	*Acroceras amplectens* Stapf	***		B															x			
GRAMINEAE	*Andropogon gayanus* Kunth	***		B	*		***	*	x	x		*	**	**	*	*	x	x			*	
GRAMINEAE	*Andropogon tectorum* Schumach. & Thonn.	***		B			*		x								x					
GRAMINEAE	*Brachiaria comata* (Hochst.) Stapf***	***		B					x								x					
GRAMINEAE	*Brachiaria deflexa* (Schumach.) CE Hubbard	***		B																		
GRAMINEAE	*Brachiaria lata* (Schumach.) CE Hubbard	***	can be cut and dried, one of the earliest grasses to develop	B					x					*			x	x				
GRAMINEAE	*Brachiaria mutica* (Forssk.) Stapf***	***	considered one of the best tropical forage plants	B					x								x	x				
GRAMINEAE	*Brachiaria ramosa* (L.) Stapf	***		B																		
GRAMINEAE	*Brachiaria stigmatisata* (Mez) Stapf	***		B																		
GRAMINEAE	*Brachiaria villosa* Vanderyst	***		B	*	*	*		x			**	*	*	*		x				*	
GRAMINEAE	*Brachiaria xantholeuca* (Hack.) Stapf.	***		B	*	*	*															
GRAMINEAE	*Cenchrus biflorus* Roxb.	***	only grazed when young (before spikes form)	B					x													
GRAMINEAE	*Chloris pilosa* Schumach.	***		B	*	*						**	*				x	x				
GRAMINEAE	*Cynodon dactylon* (L.) Pers.***	***		B																		
GRAMINEAE	*Dactyloctenium aegyptium* (L.) P. Beauv.	***		B		*			x			**		*							*	x
GRAMINEAE	*Digitaria ciliaris* (Retz.) Koel.	***		B																		
GRAMINEAE	*Digitaria deliculata* Stapf	***		B																		
GRAMINEAE	*Digitaria horizontalis* Willd.	***		B																		x
GRAMINEAE	*Digitaria nuda* Schumach.	***	can be cut and dried	B																		
GRAMINEAE	*Echinochloa pyramidalis* (Lam.) Hitchc. & Chase	***		B					x								x	x				
GRAMINEAE	*Eleusine indica* (L.) Gaertn.	***	fodder is particularly high in N	B		*			x					*								
GRAMINEAE	*Eragrostis tremula* Hochst. & Steud	***		B					x	x		*		*								
GRAMINEAE	*Panicum laetum* Kunth.	***		B																		
GRAMINEAE	*Pennisetum hordeoides* (Lam.) Steud.***	***		B					x								x					
GRAMINEAE	*Pennisetum pedicellatum* Trin.	***	good fodder prior to flowering	B	**	***	*	*	x			***	*	*	***	*	x	x		**	***	

Table 3.7: Fodder Plants of Southeastern Burkina Faso (continued)

Family	Scientific Name	Fodder Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
GRAMINEAE	*Pennisetum unisetum* (Nees) Benth.	***	can be cut for storage multiple times a season	B																		
GRAMINEAE	*Rottboellia cochinensis* (Lour.) WD Clayton***	***		B													x					
GRAMINEAE	*Setaria pumila* (Poir.) Roem. & Schult.	***		B	*	**				x		***	*	**	*			x		**	*	x
LEGUMINOSAE-CAESALPINIOIDEAE	*Afzelia africana* Sm.	***	leaves are among the first to appear at the end of the dry season	B, K			**	*	x						*		x				*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Piliostigma reticulatum* (DC.) Hochst.	***		B		*	*		x		*			*			x	x				
LEGUMINOSAE-CAESALPINIOIDEAE	*Piliostigma thonningii* (Schum.) Milne-Redh.	***		B		*	*	*	x		*			*	**		x	x		*	*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Tamarindus indica* L.	***		*B*			*	*									x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Acacia nilotica* (L.)Willd.	***		B					x								x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Acacia sieberiana* DC.	***	one of the last trees to drop its leaves	B					x								x	x				
LEGUMINOSAE-PAPILIONOIDEAE	*Alysicarpus ovalifolius* (Schum. & Thonn.) J. Leonard	***		B		*							*	*							*	
LEGUMINOSAE-PAPILIONOIDEAE	*Pterocarpus erinaceus* Poir.	***	one of the last trees to drop its leaves	B, K		*	**								**	*	x			*	*	
LEGUMINOSAE-PAPILIONOIDEAE	*Zornia glochidata* Reichb.	***		B		*			x				*									
MELIACEAE	*Khaya senegalensis* (Desv.) A. Juss.	***		B		*	*	**									x					
RUBIACEAE	*Feretia apodanthera* Del.	***	dried leaves can be consumed as fodder	B		*	*		x		*						x					
ULMACEAE	*Celtis integrifolia* Lam.	***		B				*									x					
ACANTHACEAE	*Blepharis linariifolia* Pers.	**		B		**			x													
ASCLEPIADACEAE	*Glossonema boveanum* (Dec'ne) Dec'ne***	**		B					x								x	x				
BOMBACACEAE	*Adansonia digitata* L.	**		B			*		x								x	x				
CAPPARACEAE	*Boscia angustifolia* A. Rich.***	**	preferred more by game than livestock	B					x								x	x				
CAPPARACEAE	*Cadaba farinosa* Forssk.***	**		B					x								x					
CARYOPHYLLACEAE	*Polycarpea* [three species]	**		B		*			x			*								*		
COMBRETACEAE	*Guira senegalensis* J. F. Gmel.	**		B		**			x						*	*				*	*	
COMMELINACEAE	*Commelina benghalensis* L. var. *benghalensis*	**		B		*						*			*							
COMMELINACEAE	*Commelina erecta* L.	**		B																		
COMPOSITAE	*Aspilia africana* (Pers.) C. D. Adams	**		B		*	*							*								
CONVOLVULACEAE	*Merremia hederacea* (Burm. f.) Hallier f.***	**		B													x	x				
CUCURBITACEAE	*Cucumis melo* L. var. *agrestis* Naud.	**		B		*						**	*	*								
CYPERACEAE	*Cyperus esculentus* L.***	**		B													x					
CYPERACEAE	*Mariscus squarrosus* (L.) C.B. Cl.***	**		B					x								x					

Table 3.7: Fodder Plants of Southeastern Burkina Faso (continued)

Family	Scientific Name	Fodder Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
EBENACEAE	*Diospyros mespiliformis* Hochst.	**		B		*	*	***								**	x					
EUPHORBIACEAE	*Acalypha ciliata* Forssk.	**		B											*							
GRAMINEAE	*Andropogon pseudapricus* Stapf	**		B		**	*		x	x		**	***	***	***					**	***	x
GRAMINEAE	*Chasmodium caudatum* (Hack.) Stapf	**		B	*				x								x					
GRAMINEAE	*Eragrostis pilosa* (L.) P Beauv.**	**		B																		
GRAMINEAE	*Eragrostis tenuifolia* (A Rich.) Hochst.***	**		B						x												
GRAMINEAE	*Eragrostis turgida* (Schum.) de Wild.	**		B		*				x		*	**	*							*	
GRAMINEAE	*Heteropogon contortus* (L.) P. Beauv.	**	grazed when young, not very nutritious	B																		
GRAMINEAE	*Hyparrhenia* cf. *diplandra* (Hack.) Stapf	**	grazed when young, not very nutritious	B																		
GRAMINEAE	*Hyparrhenia filipendula* (Hochst.) Stapf***	**		B					x								x					
GRAMINEAE	*Oryza barthii* A. Chev.	**	grazed only before flowering due to spiky awns	B																		
GRAMINEAE	*Oryza longistaminata* A. Chev. & Roehr.	**	grazed only before flowering due to spiky awns	B																		
GRAMINEAE	*Pennisetum polystachion* (L.) Schult.	**	only grazed before flowering	B	*	**	***	***	x			**		**	**	*	x	x		***	***	
GRAMINEAE	*Sacciolepsis africana* CE Hubbard & Snowden***	**		B														x	x			
GRAMINEAE	*Schizachyrium sanguineum* (Retz.) Alston	**		B																		
GRAMINEAE	*Schoenefeldia gracilis* Kunth	**		B		*			x			**		*			x	x				x
GRAMINEAE	*Setaria longiseta* P. Beauv.	**		B			**															
GRAMINEAE	*Setaria sphacelata* (Schumach.) Stapf & CE Hubbard***	**	can be cut to produce new green growth, drought resistant	B													x	x				
GRAMINEAE	*Sporobolus festivus* Hochst.***	**		B						x							x	x				
GRAMINEAE	*Vossia cuspidata* (Roxb.) Griff.***	**	also a favored food of hippopotamus	B						x							x					
LEGUMINOSAE-MIMOSOIDEAE	*Acacia seyal* DC.**	**		B					x													
LEGUMINOSAE-MIMOSOIDEAE	*Albizia zygia* (DC.) JF Macbride***	**		B													x					
LEGUMINOSAE-MIMOSOIDEAE	*Entada africana* Guill. & Perr.	**		B			*		x		*			*								
LEGUMINOSAE-MIMOSOIDEAE	*Prosopis africana* (Guill. & Perr.) Taub.	**		B		*	*	*	x						*					*		
LEGUMINOSAE-PAPILIONOIDEAE	*Alysicarpus rugosus* (Willd.) DC.	**		B		*		*														x
LEGUMINOSAE-PAPILIONOIDEAE	*Crotalaria goreensis* Guill. & Perr.	**	plants withstands flooding	B										*								
LEGUMINOSAE-PAPILIONOIDEAE	*Crotalaria macrocalyx* Benth.	**		B		*			x			*	*	*	*						*	

Table 3.7: Fodder Plants of Southeastern Burkina Faso (continued)

					Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
Family	Scientific Name	Fodder Importance	Notes	Source	Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
LEGUMINOSAE-PAPILIONOIDEAE	*Desmodium hirtum* Guill. & Perr.	**	only grazed when young	B	*	*		*							*							x
LEGUMINOSAE-PAPILIONOIDEAE	*Desmodium velutinum* (Willd.) DC.	**		B												*						
LEGUMINOSAE-PAPILIONOIDEAE	*Tephrosia bracteolata* Guill. & Perr.	**		B	***	*	*		x					*						*	*	
LEGUMINOSAE-PAPILIONOIDEAE	*Tephrosia platycarpa* Guill. & Perr.	**		B									*									
LEGUMINOSAE-PAPILIONOIDEAE	*Vigna racemosa* (G. Don) Hutch. & Dalz.	**		B			*	**							*	*	x	x				
MALVACEAE	*Sida cordifolia* L.	**		B		**						*	*	*	*						*	
MALVACEAE	*Urena lobata* L.	**		B			*	*	x								x	x				
MORACEAE	*Ficus sycamorus* L. ssp. *gnaphalocarpa*	**		B				*														
MORACEAE	*Ficus platyphylla* Del.	**		B				*									x					
PEDALIACEAE	*Ceratotheca sesamoides* Endl.	**		B		***			x												*	
PORTULACACEAE	*Portulaca foliosa* Ker-Gawl.	**	particularly important during drought	B													x	x				
PORTULACACEAE	*Portulaca oleracea* L.	**		B		*																
RHAMNACEAE	*Ziziphus mauritiana* L.	**		B					x													
RHAMNACEAE	*Ziziphus spina-christi* (L.) Desf.	**		B																		
RUBIACEAE	*Kouhautia grandiflora* DC.	**		B				**				**										
RUBIACEAE	*Mitragyna inermis* (Willd.) O. Ktze.	**		B		*									*	*	x			*		
SAPOTACEAE	*Vitellaria paradoxa* Gaertn. f.	**		B		*	**		x					**	***	*	x			*	*	
SCROPHULARIACEAE	*Scoparia dulcis* L.***	**		B					x								x	x				
STERCULIACEAE	*Sterculia setigera* Del.	**		B		**	**		x					*	*					**		
TILIACEAE	*Corchorus fascicularis* Lam.*	**		B																		
TILIACEAE	*Corchorus tridens* Lam.	**		B										*								x
TILIACEAE	*Grewia bicolor* Juss.	**		B		*	*		x						*					*		
ULMACEAE	*Trema orientalis* (L.) Blume	**		B		*		*														
VITACEAE	*Cissus populnea* Guill. & Perr.	**		B		*	*	*							*							
AMARANTHACEAE	*Acyranthes aspera* L.	*		B		*	***	*							*		x			*	*	
AMARANTHACEAE	*Alternathera sessilis* (L.) DC.	*		B																		
AMARANTHACEAE	*Amaranthus graecizans* L.*	*		B																		
AMARANTHACEAE	*Amaranthus spinosus* L.	*	introduced from Asia	B		*																
AMARANTHACEAE	*Celosia trigyna* L.	*		B				*				*										
ANACARDIACEAE	*Ozoroa insignis* Del.***	*		B					x													
ASCLEPIADACEAE	*Calotropis procera* (Ait.) Ait. f.**	*		B																		
ASCLEPIADACEAE	*Leptadinia hastata* (Pers.) Dec'ne***	*		B					x								x	x				
BOMBACACEAE	*Ceiba pentandra* (L.) Gaertn.	*		B																		

Table 3.7: Fodder Plants of Southeastern Burkina Faso (continued)

Family	Scientific Name	Fodder Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
CAPPARACEAE	*Capparis tomentosa* Lam. ***	*		B													x					
COMBRETACEAE	*Anogeissus leiocarpus* (DC.) Guill. & Perr.	*		B			*	*			*				**	**					*	
COMBRETACEAE	*Terminalia macroptera* Guill. & Perr.	*		B					x													
COMMELINACEAE	*Aneilema lanceolata* Benth.	*		B																		
COMPOSITAE	*Eclipta alba* (L.) Hassk.	*		B																		
CONVOLVULACEAE	*Ipomoea eriocarpa* R. Br.	*		B			*						*			*						x
CONVOLVULACEAE	*Jacquemontia tamnifolia* (L.) Griesb.***	*		B													x	x				
CYPERACEAE	*Fuirena umbellata* Rohb.***	*		B													x	x				
EUPHORBIACEAE	*Phyllanthus reticularis* Poir.***	*		B					x													
GRAMINEAE	*Cymbopogon schoenanthus* (L.) Spreng	*		B																		
GRAMINEAE	*Eragrostis atrovirens* (Desf.) Trin.***	*		B					x								x					
GRAMINEAE	*Eragrostis tenella* (L.) P Beauv.***	*		B						x												
GRAMINEAE	*Hyparrhenia subplumosa* Stapf.***	*	may be grazed by game	B					x								x					
GRAMINEAE	*Hyperthelia dissoluta* (Nees) WD Clayton***	*		B													x					
GRAMINEAE	*Oxytenanthera abyssinica* (A. Rich.) Munro	*		B				*														
GRAMINEAE	*Panicum fluviicola* Steud.***	*	grazed when young	B						x							x	x				
GRAMINEAE	*Panicum pansum* Rendle	*		B								*	*	*			x	x			*	
GRAMINEAE	*Panicum subalbidum* Kunth	*		B		**	*		x								x			*		
GRAMINEAE	*Paspalum scrobiculatum* L.	*		B													x					
GRAMINEAE	*Setaria barbata* (Lam.) Kunth	*		B											*							
GRAMINEAE	*Sporobolus microprotus* Stapf	*		B																		
GRAMINEAE	*Sporobolus pyramidalis* P Beauv.	*		B						x			*		**	*	x	x				
GRAMINEAE	*Vetieria fulvibarbis* (Trin.) Stapf	*		B						x							x	x				
LABIATAE	*Leucas martinicensis* (Jacq.) R. Br.	*		B		*						**		*	*						*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Chaemacrista mimosoides* (L.) Greene	*		B	*	***	*					*	***	**	**					***	**	x
LEGUMINOSAE-CAESALPINIOIDEAE	*Senna obtusifolia* (L.) Irwin & Barneby	*		B				*							*							
LEGUMINOSAE-MIMOSOIDEAE	*Acacia kamerunensis* Gandoger	*		B		*		*												*		
LEGUMINOSAE-MIMOSOIDEAE	*Acacia macrostachya* Reichenb.	*		B		**	*		x					*	**					**	**	
LEGUMINOSAE-MIMOSOIDEAE	*Acacia polyacantha* Willd.	*		B																		
LEGUMINOSAE-MIMOSOIDEAE	*Dichrostachys cinerea* (L.) Wight & Arn.	*		B				*	x					*	*		x					
LEGUMINOSAE-MIMOSOIDEAE	*Parkia biglobosa* (Jacq.) Benth.	*		B			*	*			*				*		x					

Table 3.7: Fodder Plants of Southeastern Burkina Faso (continued)

Family	Scientific Name	Fodder Importance	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
LEGUMINOSAE-PAPILIONOIDEAE	*Crotalaria retusa* L. *(RECORD KUPPERS)*	*		B																		
LEGUMINOSAE-PAPILIONOIDEAE	*Indigofera* [multiple species]	*		B	**	**	**	*	x			**	**	*	*	*				***	***	
LEGUMINOSAE-PAPILIONOIDEAE	*Sesbania pachycarpa* DC.	*		B																		
LOGANIACEAE	*Strychnos innocua* Del.	*		B		*	*		x												*	
MALVACEAE	*Sida rhombifolia* L.	*		B		*						*										
MORACEAE	*Ficus ingens* (Miq.) Miq.	*		B			*									*						
RHAMNACEAE	*Ziziphus mucronata* Willd.	*		B		*	*	*	x						*		x					
RUBIACEAE	*Gardenia erubescens* Stapf. & Hutch.	*		B			*				*				*					*		
RUBIACEAE	*Gardenia ternifolia* Schum. & Thonn.	*		B					x								x					
RUBIACEAE	*Mitracarpus hirtus* (L.) DC.	*		B								**	*	*							*	
RUBIACEAE	*Spermacoce stachydea* DC.	*		B		*	***	*							*						**	
TILIACEAE	*Corchorus olitorius* L.	*		B																		
TILIACEAE	*Grewia flavescens* Juss.	*		B		*	*								*					*	*	
TILIACEAE	*Grewia villosa* Willd.	*		B			*															
VITACEAE	*Ampelocissus africanus* (Lour.) Merr.***	*		B					x								x	x				

Table 3.8: Important Medicinal Plants of Southeastern Burkina Faso

Family	Scientific Name	Medicinal Part	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
AMARANTHACEAE	*Celosia trigyna* L.	leaf	anti-helmitic	B				*				*										
ANACARDIACEAE	*Lannea acida* A. Rich.	bark	various	B		**	**	*	x						*					**	**	
ANACARDIACEAE	*Ozoroa insignis* Del.***	root	febrifuge	B					x													
ANNONACEAE	*Annona senegalensis* Pers.	root	various	B		**	**	*						*	**	*				**	*	
ASCLEPIADACEAE	*Calotropis procera* (Ait.) Ait. f.**	bark	emeto-cathartic, various	B																		
BIGNONIACEAE	*Stereospermum kunthianum* Cham.	bark, root, leaf	various	B		*	**		x				*	*	*		x				*	
BORAGINACEAE	*Heliotropium indicum* L.***	plant	various	B					x								x	x				
CAPPARACEAE	*Capparis tomentosa* Lam. ***	leaf, root	various	B													x					
COMBRETACEAE	*Combretum micranthum* G. Don	leaf	diuretic, febrifuge, digestive	B		*	***	*	x								x				**	
COMBRETACEAE	*Guira senegalensis* J. F. Gmel.	leaf	various	B		**			x						*	*				*	*	
EUPHORBIACEAE	*Hymenocardia acida* Tul.	leaf, bark	various	B		*	*														*	
EUPHORBIACEAE	*Jatropha curcas* L.	plant	various. Introduced from the Americas (after AD 1500)	B																		
GRAMINEAE	*Cymbopogon schoenanthus* (L.) Spreng	plant	various	B																		
LABIATAE	*Hyptis spicigera* Lam.	plant	various	B																		
LEGUMINOSAE-CAESALPINIOIDEAE	*Cassia sieberiana* DC.	leaf, root	purgative, diuretic, febrifuge	B			*	*								*						
LEGUMINOSAE-CAESALPINIOIDEAE	*Chaemacrista absus* (L.) Irwin & Barneby	plant	antimicrobial properties	B		*	*															
LEGUMINOSAE-CAESALPINIOIDEAE	*Chaemacrista mimosoides* (L.) Greene	leaf	wound-dressing	B	*	***	*		x			*	***	**	**		x			***	**	x
LEGUMINOSAE-CAESALPINIOIDEAE	*Daniella oliveri* (Rolfe) Hutch. & Dalz.	bark	various	B		*	*	***	x							**	x	x				
LEGUMINOSAE-CAESALPINIOIDEAE	*Senna occidentalis* (L.) Link	leaf, root	various. Likely introduced from the Americas (after AD 1500)	B		*																
LEGUMINOSAE-PAPILIONOIDEAE	*Erythrina sengalensis* DC.	plant	various	B			*															
LEGUMINOSAE-PAPILIONOIDEAE	*Xeroderris stuhlmannii* (Taub.) Mendonca & EP Sousa***	bark, root	vermifugal	B					x													
LILIACEAE	*Sansevieria liberica* Gér. & Labr.	plant	various	B																		
LOGANIACEAE	*Strychnos spinosa* Lam.	plant	various	B		**	*	*	x						**					**	*	
MALVACEAE	*Sida cordifolia* L.	plant	contains ephedrine	B		**						*	*	*	*						*	
MELIACEAE	*Khaya senegalensis* (Desv.) A. Juss.	bark	febrifuge, emetic, purgative	B		*	*	**									x					
MORINGACEAE	*Moringa oleifera* Lam.***	plant	antimicrobial properties	B					x								x					
OLACACEAE	*Ximenia americana* L.	plant	various	B		*	*	*	x						*		x	x				
POLYGALACEAE	*Securidaca longepedunculata* Fres.	plant, esp. root	various	B		*															*	
RUBIACEAE	*Crossopteryx febrifuga* (Afzel.) Benth.	bark	common febrifuge	B		*	*		x		*			**	*		x	x		***	*	
RUBIACEAE	*Gardenia ternifolia* Schum. & Thonn.	plant	various	B					x								x					
RUBIACEAE	*Mitracarpus hirtus* (L.) DC.	leaf	fungicide	B								**	*	*							*	
RUBIACEAE	*Sarcocephalus latifolius* (JE Sm.) EA Bruce	bark	common febrifuge	B			**	**														
SAPINDACEAE	*Paullina pinnata* L.	plant	various, introduced from the Americas	B													x					

Table 3.9: Dye Plants of Southeastern Burkina Faso

Family	Scientific Name	Color	Part	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communnities		
						Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
AMARANTHACEAE	*Amaranthus hybridus* L.*	red	plant	introduced from Asia	B																		
ANACARDIACEAE	*Lannea egregia* Engl. & K. Krause	red	bark		B																		
ARACEAE	*Stylochiton lancifolius* Kotschy & Peyr.	yellow	plant		B								**										
COCHLOSPERMACEAE	*Cochlospermum tinctorium* A. Rich.	yellow-brown	root		B		***	*		x				*	**						***	*	
COMBRETACEAE	*Anogeissus leiocarpus* (DC.) Guill. & Perr.	yellow-brown red-brown	leaf/ bark		B, GT			*	*	x		*				**	**	x				*	
COMBRETACEAE	*Terminalia avicennoides* Guill. & Perr.*	yellow	root		B					x		*						x	x				
COMPOSITAE	*Eclipta alba* (L.) Hassk.	black	leaf/ sap		B																		
EUPHORBIACEAE	*Phyllanthus reticularis* Poir.***	black, red	bark, root		B					x													
LABIATAE	*Leucas martinicensis* (Jacq.) R. Br.	yellow	root		B		*						**		*	*						*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Burkea africana* Hook.	black	bark		B		***	**	*	x						**		x			***	*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Piliostigma thonningii* (Schum.) Milne-Redh.	red	bark, root bark		B		*	*	*	x		*			*	**		x	x		*	*	
LEGUMINOSAE-CAESALPINIOIDEAE	*Tamarindus indica* L.	brown	bark		B			*	*									x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Acacia nilotica* (L.) Willd.	black	seed		B					x								x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Parkia biglobosa* (Jacq.) Benth.	black	fruit		B, GT			*	*			*				*		x					
LEGUMINOSAE-PAPILIONOIDEAE	*Lonchocarpus laxiflorus* Guill. & Perr.	blue	leaf		B			*		x						*							
LEGUMINOSAE-PAPILIONOIDEAE	*Pterocarpus santalinoides* L'Her. ex DC.***	brown	bark		B													x					
MELIACEAE	*Pseudocedrela kotschyi* (Schweinf.) Harms***	brown	bark		B													x					
MORACEAE	*Ficus glumosa* Del.	red	bark		B		*	*		x													
MORACEAE	*Ficus platyphylla* Del.	green	leaf		B				*														

Table 3.10: Fiber Plants of Southeastern Burkina Faso

Family	Scientific Name	Fiber Importance	Notes	Sources	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
BOMBACACEAE	*Adansonia digitata* L.	***		B, GT			*		x								x	x				
LEGUMINOSAE-CAESALPINIOIDEAE	*Piliostigma reticulatum* (DC.) Hochst.	***	Cordage is used for rainy season hut roofs, plunge basket frames, and to string bows (GT)	B, GT		*	*		x		*			*			x	x				
LEGUMINOSAE-CAESALPINIOIDEAE	*Piliostigma thonningii* (Schum.) Milne-Redh.	***		B		*	*	*	x		*			*	**		x	x		*	*	
LEGUMINOSAE-MIMOSOIDEAE	*Acacia kamerunensis* Gandoger	***		B		*		*												*		
LILIACEAE	*Sansevieria liberica* Gér. & Labr.	***		B																		
MALVACEAE	*Urena lobata* L.	***		B			*	*	x								x	x				
POLYGALACEAE	*Securidaca longepedunculata* Fres.	***		B		*															*	
TILIACEAE	*Grewia bicolor* Juss.	***		B		*	*		x						*					*		
ULMACEAE	*Trema orientalis* (L.) Blume	***		B		*		*														
ANNONACEAE	*Hexalobus monopetalus* (A. Rich) Benth.	**		B																		
EUPHORBIACEAE	*Caperonia fistulosa* Beille***	**	fine fiber often used for fishing lines	B													x	x				
LEGUMINOSAE-MIMOSOIDEAE	*Dichrostachys cinerea* (L.) Wight & Arn.	**		B				*	x					*	*		x					
LEGUMINOSAE-MIMOSOIDEAE	*Entada africana* Guill. & Perr.	**		B			*		x		*			*								
MALVACEAE	*Hibiscus scotellii* Bak.f.	**		B	**		*															
MALVACEAE	*Hibiscus squamosus* Hochr.	**		B			*															
MALVACEAE	*Sida cordifolia* L.	**		B		**						*	*	*	*						*	
MORACEAE	*Ficus sur* Forssk.	**		B				**														
TILIACEAE	*Grewia flavescens* Juss.	**		B		*	*								*					*	*	
TILIACEAE	*Grewia lasiodiscus* K. Schum	**		B			*	*			*				*	*					*	
TILIACEAE	*Grewia mollis* Juss.**	**		B					x								x					
TILIACEAE	*Grewia villosa* Willd.	**		B			*															
ANACARDIACEAE	*Lannea egregia* Engl. & K. Krause	*		B					x													
ANACARDIACEAE	*Lannea microcarpa* Engl. & K. Krause	*		B		*	*	*	x						*	*				*		

Table 3.10: Fiber Plants of Southeastern Burkina Faso (continued)

					Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
Family	Scientific Name	Fiber Importance	Notes	Sources	Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
ANACARDIACEAE	*Sclerocarya birrea* (A. Rich.) Hochst.	*		B		*	*		x													
ANNONACEAE	*Annona senegalensis* Pers.	*		B		**	**	*						*	**	*				**	*	
ANNONACEAE	*Xylopia parviflora* (A. Rich.) Benth.	*		B																		
APOCYNACEAE	*Strophanthus sarmentosus* DC.	*		B				*														
ASCLEPIADACEAE	*Calotropis procera* (Ait.) Ait. f.**	*		B																		
LILIACEAE	*Asparagus africanus* Lam.	*		B		*	*		x						*		x					
MALVACEAE	*Hibiscus asper* Hook.f.	*		B		*	**	*	x			*	*	**	**						*	
MALVACEAE	*Hibiscus* cf. *vitifolius* L.	*		B																		
MALVACEAE	*Sida rhombifolia* L.	*		B		*						*										
MALVACEAE	*Sida urens* L.	*		B																		
MORACEAE	*Ficus ingens* (Miq.) Miq.	*		B			*									*						
MORACEAE	*Ficus platyphylla* Del.	*		B				*									x					
PALMAE	*Borassus aethiopium* Mart.	*		B													x					
TILIACEAE	*Corchorus tridens* Lam.	*		B										*								x
VERBENACEAE	*Lantana camara* L.	*	Introduced from the Americas (after AD 1500)	B																		
VITACEAE	*Cissus populnea* Guill. & Perr.	*		B		*	*	*							*							

Table 3.11: Some Additional Useful Plants of Southeastern Burkina Faso

Family	Scientific Name	Primary Use	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
COMBRETACEAE	*Combretum nigricans* Lepr.	adhesive		B	*	**	*		x						*	*	x			*	**	
LEGUMINOSAE-MIMOSOIDEAE	*Acacia dudgeoni* Craib*	aromatic resin		B							*											
LEGUMINOSAE-MIMOSOIDEAE	*Acacia seyal* DC.**	aromatic resin		B					x													
BURSERACEAE	*Commiphora africana* (A. Rich.) Engl.	aromatic resin	known as African myrrh for its fragrance	B		*			x								x					
LEGUMINOSAE-CAESALPINIOIDEAE	*Daniella oliveri* (Rolfe) Hutch. & Dalz.	aromatic resin		B		*	*	***	x							**	x	x				
MORACEAE	*Antaris africana* Engl.	bark cloth	very high quality bark cloth	B				**														
PALMAE	*Borassus aethiopium* Mart.	basketry		GT													x					
COMBRETACEAE	*Combretum micranthum* G. Don.	basketry		GT		*	***	*	x								x				**	
RUBIACEAE	*Mitragyna inermis* (Willd.) O. Ktze.	basketry		GT		*									*	*	x			*		
EUPHORBIACEAE	*Securinega virosa* (Roxb.) Baill.	basketry		GT		*	*		x		*	*			*		x	x		**	*	
TILIACEAE	*Grewia mollis* Juss.**	bows	wood used to make bows for hunting	GT					x								x					
BOMBACACEAE	*Ceiba pentandra* (L.) Gaertn.	canoes, stuffing	light buoyant wood is often favored for canoe; fibers can be used for stufing pillows and mattresses (not traditional)	B																		
GRAMINEAE	*Oxytenanthera abyssinica* (A. Rich.) Munro	furniture and fencing	culms of this bamboo-like grass used for fencing and furniture	B				*														
LABIATAE	*Hyptis spicigera* Lam.	insect repellant	ash rubbed as an insect repellant	B																		
LABIATAE	*Hyptis suaveolens* Poit.	insect repellant		B																		
LABIATAE	*Leucas martinicensis* (Jacq.) R. Br.	insect repellant		B		*						**		*	*						*	
MORACEAE	*Ficus ingens* (Miq.) Miq.	latex		B			*									*						

Table 3.11: Some Additional Useful Plants of Southeastern Burkina Faso (continued)

Family	Scientific Name	Primary Use	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
APOCYNACEAE	*Saba senegalensis* (A. DC.) Pichon	latex	latex is usable but not high quality	B				*														
MORACEAE	*Ficus glumosa* Del.	latex, bark cloth	latex is high quality, not preferred for bark cloth	B		*	*		x													
GRAMINEAE	*Andropogon gayanus* Kunth	matting	long culms used for matting	B	*		***	*	x	x		*	**	**	*	*	x	x			*	
GRAMINEAE	*Hyperthelia dissoluta* (Nees) WD Clayton***	matting	culms frequently used for woven matting	B													x					
GRAMINEAE	*Phacelurus gabonensis* (Steud.) WD Clayton***	matting	culms frequently used for woven matting	B														x				
GRAMINEAE	*Rottboellia cochinensis* (Lour.) WD Clayton***	matting	culm may be used to make matting	B													x					
EUPHORBIACEAE	*Euphorbia unispina* NE Br.***	poison	caustic latex commonly used in arrow poison	B					x													
LILIACEAE	*Gloriosa superba* L.	poison	plant, esp. root is highly toxic	B													x					
THYMELACEAE	*Gnidia kraussiana* Meissner***	poison	leaf and root broadly used as poisons	B					x								x					
APOCYNACEAE	*Strophanthus sarmentosus* DC.	poison	seeds can be used as a poison	B				*														
LEGUMINOSAE-PAPILIONOIDEAE	*Swartzia madagascarensis* Desv.	poison	fruit pod is an important fish poison	B																		
LEGUMINOSAE-MIMOSOIDEAE	*Acacia polyacantha* Willd.	potash	potash from carbonized wood	B																		
AMARANTHACEAE	*Acyranthes aspera* L.	potash	entire plant is high in potash	B		*	***	*							*		x			*	*	
ACANTHACEAE	*Nelsonia canescens* (Lam.) Spreng	potash		B																		
BOMBACACEAE	*Bombax costatum* Pellgr. & Vuillet	stuffing	although not a traditional activity, fibers can be used for stufing pillows and mattresses	B, GT		**	*	*	x						*		x			*	*	
LEGUMINOSAE-MIMOSOIDEAE	*Acacia nilotica* (L.)Willd.	tanning and hide treatment	pods and seeds used in tanning	B, GT					x								x	x				

Table 3.11: Some Additional Useful Plants of Southeastern Burkina Faso (continued)

Family	Scientific Name	Primary Use	Notes	Source	Gobnangou Escarpment				Minimally Anthropogenic Savanna			Agricultural Parkland				Riverine				Specialized Communities		
					Cracks and Depressions	Highland Savannas	Rocky Slopes	Canyons and Ravines	Park W Wooded Savannas	Park W Grassland	Savannas of SE Burkina Faso	1-3 Year Fallow	5-10 Year Fallow	20-30 Year Fallow	30+ Year Fallow	Arly Gallery Forests	Park W Riverine Woodland	Park W Floodplain Grassland	Park W Aquatic	Slate Communities	Laterite Hills & Forelands	Salty Soils
MORACEAE	*Ficus platyphylla* Del.	tanning and hide treatment, latex		B				*									x					
MORACEAE	*Ficus populifolia* Vahl	tanning and hide treatment, latex	used to dehair hides	B																		
GRAMINEAE	*Andropogon pseudapricus* Stapf	thatch	frequently favored	B		**	*		x	x		**	***	***	***					**	***	x
GRAMINEAE	*Andropogon tectorum* Schumach. & Thonn.	thatch	frequently favored	B			*		x								x					
GRAMINEAE	*Eragrostis pilosa* (L.) P Beauv.**	thatch		GT																		
GRAMINEAE	*Heteropogon contortus* (L.) P Beauv.	thatch	frequently favored	B																		

Table 3.12: Crop Plants of Southeastern Burkina Faso

	Family	Scientific Name	Common Name	Primary Useful Part	Rainfall in mm (NRC)	Notes	References
Staples	DIOSCOREACEAE	*Dioscorea* ssp.	yam	root		Numerous varieties of yams most of which are consumed in the pounded form known commonly as fufu.	B, GT, S
	GRAMINEAE	*Digitaria exilis*	fonio	seed	400-1500	Currently fonio is only grown in the far north of the Gourmantche region. It may have been supplanted as an early crop by maize.	B, GT, NRC, R, S
	GRAMINEAE	*Oryza glaberrima*	African rice	seed	700+	A local variety of African rice was grown in the region but is now very rare. S characterizes it as a hunger crop.	B, NRC, R, S
	GRAMINEAE	*Pennisetum glaucum*	pearl millet	seed	200-1500	Pearl millet is a staple grain, slightly less popular than sorghum. There are numerous varieties including early and late maturing strains. Pearl millet is difficult to store for periods of multiple years.	B, GT, K, NRC, R, S
	GRAMINEAE	*Sorghum bicolor*	sorghum	seed	variable	A staple grain, sorghum is used not only as a starch, but also fermented to make the most common traditional alcohol. Varieties have different maturation rates and rainfall requirements.	B, GT, K, NRC, R, S
	GRAMINEAE	*Sorghum bicolor*	sweet sorghum	culm	variable	Sweet varieties of sorghum are cut green for their stalk juice.	B, GT, K, NRC, R, S
Legumes	LEGUMINOSAE-PAPILIONOIDEAE	*Vigna subterranea*	groundnut Bambara groundnut earth pea	seed	600-1000+	A very storable legume, there are many local varieties. Formerly a staple, it has been supplanted in some areas by *Arachis hypogaea.*	B, GT, K, NRC, R, S
	LEGUMINOSAE-PAPILIONOIDEAE	*Vigna unguiculata*	cowpea	seed	300+	The most commonly consumed legume in the region, cowpeas are prepared in a variety of ways. Eight varieties are known from the Gourmantche region.	B, GT, K, NRC, R, S
Vegetable	LILIACEAE	*Allium ssp.*	onion	bulb		Onions originated in central Asia, and though they reached the Mediterranean 5000 years ago, it is uncertain when and how they entered West Africa (some sources put the date at the 14th century AD). They are grown in gardens with irrigation.	B, S
	MALVACEAE	*Abelmoschus esculentus*	okra	fruit	various	Favored for its mucilagineous qualities, okra is one of the most common sauce ingredients in the region. Some varieties are consumed fresh, while others are sliced and dried for use during the winter and spring.	B, GT, K, NRC, R, S
	MALVACEAE	*Hibiscus sabdariffa*	roselle	fruit, calyx, seeds		The sour leaves and fleshy calyces are commonly eaten in sauces. The iron-rich calyx can be dried for storage. The seed may be used to make soumbala if *Parkia biglobosa* is not available.	B, GT, K, R, S
	SOLANACEAE	*Solanum sp.*	African eggplant	fruit	500-1200+	The fruits of the African variety are small, egg-shaped and come in many colors. They are easy to raise, although not particularly nutritious. Leaves and fruits consumed, primarily in sauces.	B, K, NRC, S

Table 3.12: Crop Plants of Southeastern Burkina Faso (continued)

	Family	Scientific Name	Common Name	Primary Useful Part	Rainfall in mm (NRC)	Notes	References
Vegetable			*anyinkpina*	leaf		Sauce plant that is likely a cultivated version of a wild leafy green such as amaranth or corchorus	S
			apzala	root		Bush potato brought under cultivation in the Gobnangou region. Possibly *Solenostemon rotundifolius?*	NRC, S
			tikpankpandi	leaf		Sauce plant that is likely a cultivated version of a wild leafy green such as amaranth or corchorus	S
			tinalifadi	leaf		Sauce plant that is likely a cultivated version of a wild leafy green such as amaranth or corchorus	S
Other Edible	CUCURBITACEAE	*Cucumis metuliferus*	horned melon	fruit	350+	Cut in half and eaten raw, this refreshing fruit can be stored at room temperature for up to 6 months.	B, GT, K, NRC, S
	GRAMINEAE	*Saccharum officianarum*	sugar cane	culm		Grown primarily in gardens to be cut and chewed on an opportunistic basis: there is no local tradition of sugar refinement. Needs a high year-round water table or heavy irrigation.	B, GT, R, S
	MUSACEAE	*Musa* sp.	banana/plantain	fruit		In the study region, bananas are located in gardens on seasonal drainages and consumed primarily as fruit.	B, S
	PALMAE	*Elaeis guineensis*	oil palm	nut		A staple in the forest belt, oil palm prefers moister climates than those of the study region. Only isolated, cultivated examples are found, particularly since the naturally growing *Vitellaria paradoxa* fills the same dietary niche.	B, K
	PEDALIACEAE	*Sesamum orientale*	sesame	seed		In West Africa, the oily seed is usually consumed whole, cooked in porridge or added to sauce. Traditionally grown in limited quantities, cultivation has expanded due to its value as a cash crop.	B, GT, S
Other Crop Plant	CUCURBITACEAE	*Lagenaria siceraria*	calabash	fruit		The fruits of this plant have woody, impermeable shells used as containers. Different varieties are used as bottles, bowls, ladles, etc.	B, GT, K, S
	CUCURBITACEAE	*Luffa cylindrica*	loofah	fruit		While the plant has antiquity in Africa, use of the fibrous vascular network as a sponge may be more recent. Traditional uses include filtering liquids and consumption of the seed as a purgative.	B, K
	LEGUMINOSAE-PAPILIONOIDEAE	*Indigofera sp.*	indigo	leaf		Branches, leaves, and flowers are used to create a deep blue dye for cotton.	B, GT, S
	MALVACEAE	*Gossypium sp.*	cotton	fruit		Cotton is known in West Africa from at least the first millenium AD, and is traditionally handspun, dyed with indigo and woven in thin strips. Indigenous plants have been largely supplanted by commercial varieties.	B, GT, S

Table 3.12: Crop Plants of Southeastern Burkina Faso (continued)

	Family	Scientific Name	Common Name	Primary Useful Part	Rainfall in mm (NRC)	Notes	References
Other C.	MALVACEAE	*Hibiscus cannabinus*	kenaf	bark		Plants are grown to the maximum possible height (often into the early dry season). Stems are soaked for several days, then stripped of their bark to make a coarse, strong fiber that is resistant to rot.	B, GT, S
			mibelima			Small shrub used as a fish poison: cultivation forbidden under colonial rule	S
Staple	CONVOLVULACEAE	*Ipomoea batatas*	sweet potato	root		Sweet, starchy tuber usually used as a dietary supplement due to the fact that it is difficult to store.	B, GT, S
	EUPHORBIACEAE	*Manihot esculentus*	manioc	root		Manoic requires an elaborate leaching process to become edible. Although it originally entered the region as a famine food, manioc cultivation is expanding.	B, GT, K, S
	GRAMINEAE	*Zea mays*	maize	seed		Maize was introduced to West Africa in the 16th century, and has increased in popularity in recent years. It has been primarily adopted as an early crop.	B, GT, K, S
Legumes	LEGUMINOSAE-PAPILIONOIDEAE	*Arachis hypogea*	peanut	seed		Introduced from South America, peanuts expanded rapidly in West Africa and there are numerous indigneous varieties. Peanuts can be grown as a cash crop, but are also used in local diets. A roasted peanut oil is occasionally made in the region.	B, GT, K, S
	LEGUMINOSAE-PAPILIONOIDEAE	*Vigna radiata*	green gram	seed		Recently introduced from India, green grams are grown on a very limited basis.	B, K
Vegetable	AMARANTHACEAE	*Amaranthus hybridus*	amaranth	leaf	3000+	This amaranth spinach grows spontaneously but may also be cultivated. The leaves are eaten fresh or in sauces. Of American origin, it is unknown when it entered the region. It has hybridized with indigenous varieties	B, K, NRC
	CUCURBITACEAE	*Cucurbita pepo*	squash	fruit		Several varieties of this edible squash are commonly cultivated. Introduced from the Americas.	B, GT, K, S
	SOLANACEAE	*Capsicum annuum*	chili pepper	fruit		Spicy pepper used as flavoring and introduced from the Americas.	B, K
	SOLANACEAE	*Capsicum fructescens*	cayenne pepper	fruit		Spicy pepper used as flavoring and introduced from the Americas.	B, GT, K, S
	SOLANACEAE	*Lycopersicum esculentum*	tomato	fruit		Tomatoes are a common sauce ingredient, and are often grown in dry season gardens. Widely adopted following their introduction from the Americas.	B, K
Other Edible	ANACARDIACEAE	*Anacardium occidentale*	cashew	seed		Local consumption is generally minimal (most are grown for export). Native to the Americas, the cashew was introduced to West Africa by the Portugese in the 17th century.	B, K
	ANACARDIACEAE	*Mangifera indica*	mango	fruit		Mangos mature late in the dry season when they are one of the few fresh fruits available. Although of Indian origin, the mango seems to have been introduced to West Africa from the Americas in the 19th century.	B, GT, K, S

Table 3.12: Crop Plants of Southeastern Burkina Faso (continued)

	Family	Scientific Name	Common Name	Primary Useful Part	Rainfall in mm (NRC)	Notes	References
O.E.	CARICACEAE	*Carica papaya*	papaya	fruit		Fruit is eaten raw when ripe or cooked when green. It is commonly grown in residential compounds. Introduced from the Americas	B, S
	MYRTACEAE	*Psidium guajava*	guava	fruit		Introduced from the Americas, guava is notable for bearing fruit within a few years of planting.	B, K
O.C.	SOLANACEAE	*Nicotiana tabacum*	tobacco	leaf		Cured and used locally (chewed, smoked, or as snuff). Introduced from the Americas.	B, GT, K, S
Staple	DIOSCOREACEAE	*Dioscorea esculenta*	yam	root		Variety of yam recently introduced to the region from southeast Asia. Although they have a relatively high yield, they are not suitable for making fufu.	B, K
	GRAMINEAE	*Oryza sativa*	rice	seed		Asian rice was introduced to the region by the French in 1952-53 in order to expand local rice production.	B, R, S

Table 3.13: Wild Fauna of Southeastern Burkina Faso
(Compiled from Kingdon 2004)

	Scientific Name	Common Name	Size	Savanna Grassland	Forest Mosaic	Rocky Slopes	Marsh/ Riverine	Raids Agricultural Fields	Diet
Primates	*Cercopithecus patas*	Patas Monkey	7-25kg	x	x			x	flowers, fruits, leaves, seeds: favors *Acacia* and *Balanites*
	Cercopithecus tantalus	Tantalus Monkey	5.5-9kg	x	x			x	bark, buds, fruit, gum, roots, seeds, cultivated plants
	Galago senegalensis	Senegal Galago	112-300 g	x	x				fruit, gum, invertebrates
	Papio anubis	Olive Baboon	11-50kg	x	x	x		x	fruit, grass
Insectivores	*Atelerix albiventris*	African Hedgehogs	250-1600 g	x					fruit, fungi, invertebrates, small vertebrates
	Crocidura sp.	White-Toothed Shrews	11-40 g	x	x	x	x		invertebrates, small vertebrates
Hares	*Lepus capensis*	Cape Hare	1- 3.5 kg	x				x	grass, herbs
	Lepus saxatilis	Scrub Hare	1.5-4.5 kg	x	x			x	grass
Rodents	*Cricetomys gambianus*	Giant Pouched Rats	1- 1.4 kg	x	x				fruit, leaves, nuts, roots
	Hystrix cristata	Crested Porcupine	12- 27 kg			x			bark, fruit, roots
	Thyronomys swinderianus	Marsh Cane Rat	4.5- 8.8 kg				x	x	grass
Carnivores	*Acinonyx jubatus*	Cheetah	35- 65 kg	x	x				gazelle, impala, kob, springbok
	Aonyx capensis	African Clawless Otter	12- 34 kg				x		crabs, frogs
	Atilax paludinosus	Marsh Mongoose	2.2- 5 kg				x		catfish, crabs, frogs, lungfish, mussels, snails
	Canis adustus	Side-Striped Jackal	7.3- 12 kg	x					omnivorous
	Civettictis civetta	African Civet	7- 20 kg		x		x		omnivorous
	Crocuta crocuta	Spotted Hyaena	40-90 kg	x					carnivorous scavenger
	Felis caracal	Caracal	12- 19 kg	x		x			antelopes, birds, hares, hyraxes, small monkeys, rodents
	Felis serval	Serval	6- 18 kg	x	x		x		birds, insects, small mammals, reptiles
	Felis sylvestris	Wild cat	3- 6.5 kg	x	x				birds, small mammals, mice, rats
	Genetta genetta	Common Genet	1.3- 2.25 kg	x					fruit, invertebrates, small vertebrates
	Genetta thierryi	Hausa Genet	1.3- 1.5 kg	x					?
	Genetta tigrina	Blotched Genet	1.2- 3.1 kg		x				invertebrates, rodents
	Herpestes ichneumon	Ichneumon Mongoose	2.2- 4.1 kg				x		birds, invertebrates, frogs, reptiles, rodents
	Herpestes sanguinea	Slender Mongoose	350-800 g	x	x	x	x		birds, insects, frogs, reptiles, rodents
	Ichneumia albicauda	White-tailed Mongoose	2- 5.2 kg	x	x				frogs, invertebrates, mice, reptiles
	Ictonyx libyca	Zorilla	700- 1400 g	x					invertebrates
	Lutra maculicollis	Spot-Necked Otter	4- 6.5 kg				x		crabs, fish, frogs, mollusks, other aquatics
	Lycaon Pictus	Wild Dog	18-36 kg	x	x				mammals
	Mellivora capensis	Ratel (Honey Badger)	7- 16 kg	x	x				omnivorous
	Mungos gambianus	Gambian Mongoose	1- 2 kg	x	x				invertebrates, small vertebrates

Table 3.13: Wild Fauna of Southeastern Burkina Faso (continued)
(Compiled from Kingdon 2004)

	Scientific Name	Common Name	Size	Savanna Grassland	Forest Mosaic	Rocky Slopes	Marsh/ Riverine	Raids Agricultural Fields	Diet
Carnivores	*Mungos mungo*	Banded Mongoose	1.5- 2.25 kg	x	x				beetle larvae, termites
	Panthera leo	Lion	122- 260 kg	x	x	x	x		medium-large mammals
	Panthera pardus	Leopard	28- 90 kg	x	x	x			birds, small-medium mammals
	Vulpes pallida	Sand Fox	2- 3.6 kg	x					invertebrates, small vertebrates
Afrotheria	*Loxodonta africana*	African Elephant	2,200- 6,300 kg	x	x	x	x	x	vegetation
	Orycteropus afer	Aardvark	40- 82 kg	x	x				ants, larvae, termites
	Procavia	Rock Hyraxes	1.8- 5.5 kg			x			grass, herbs
Ungulates	*Alcelaphus buselaphus*	Hartebeeste	116- 218 kg	x	x				grass, herbs
	Cephalophus maxwelli	Maxwell's Duiker	6- 10 kg		x				fruits, herbs
	Cephalophus rufilatus	Red Flanked Duiker	6- 14 kg		x		x		
	Cephalophus silvicultor	Yellow-Backed Duiker	45- 80 kg		x		x		bark, berries, fruits, herbs, moss, seeds
	Damaliscus lunatus	Topi	75- 160 kg				x		grass
	Gazella rufifrons	Red-Fronted Gazelle	15- 35 kg	x					grass, herbs, leaves, seeds
	Giraffa camelopardalis	Giraffe	450- 1930 kg	x	x				leaves: prefers *Acacia*, *Commiphora* and *Terminalia*
	Hippopotamus amphibius	Hippopotamus	510- 3,200 kg				x	x	grass
	Hippotragus equinus	Roan Antelope	223- 300 kg	x	x				grass, herbs, occasional shrubs
	Kobus ellipsiprymnus	Waterbuck	160- 300 kg	x	x		x		grass, reeds, rushes
	Kobus kob	Kob	60- 121 kg	x	x		x		grass
	Ourebia ourebi	Oribi	12- 22 kg	x				x	grass
	Phacochoerus africanus	Common Warthog	45- 150 kg	x	x			x	grass
	Redunca redunca	Bohor Reedbuck	35- 65 kg	x	x		x		grass, herbs
	Sylvicapra grimmia	Bush Duiker	11- 25.5 kg	x	x			x	fruits, leaves, shoots
	Syncerus caffer	African Buffalo	250- 850 kg	x	x				grass, swamp vegetation
	Taurotragus derbianus	Derby's Eland	300- 907 kg	x					grass, herbs, leguminous trees
	Tragelaphus scriptus	Bushbuck	24- 80 kg	x	x				grass, leguminous herbs, shrubs
	Tragelaphus spekei	Sitatunga	40- 130 kg				x		grass, herbs, shrubs
Fowl	*Francolinus sp.*	Francolins		x	x	x		x	seeds
	Numida maleagris	Helmeted Guineafowl		x	x	x		x	?

CHAPTER 4
AGRICULTURE IN THE WEST AFRICAN SAVANNA

Although agricultural techniques are to a certain extent constrained by the local environment, they are fundamentally cultural practices that are significantly shaped by social, economic, and political conditions. Rather than attempt a comprehensive review of the vast literature on farming in the West African savanna, this chapter instead places Gourmantche agriculture within the larger regional context. I begin with brief history of the study of agriculture in the West African savanna, then move to a discussion of an idealized savanna farming system with special attention to points where this system is flexible. I then address challenges that farmers face in the savanna region regarding soil and water conservation, and explore some of the strategies they can use to address them.

With this background, I summarize Gourmantche agricultural practice with particular emphasis on the social aspects of the system and the ways in which mobility plays an integral role, which leads into a comparison of Gourmantche land tenure with that of other Burkinabe ethnic groups. Finally, I use ethnographic data to highlight the diverse possibilities for prehistoric population density in the Gobnangou region.

History of the Study of Agriculture in West Africa

The study of traditional farming practices bridges at least three major disciplinary literatures: ecology, agricultural development, and anthropology. Each is heavily influenced by its unique intellectual history and disciplinary conventions, and each has provided specific insights into agriculture in the West African savanna.

Early ecologists working in West Africa were predominantly concerned with documenting the "natural" vegetation, and consequently tended to characterize farming as a destructive force responsible for deforestation, uncontrolled burns, desertification, and other practices that prevented vegetation communities from reaching their climax state (e.g. Aubréville 1949, Stebbing 1935, see critical discussions in Bassett and Crummey 2003; Mortimore 1998; Swift 1996). Researchers assumed that many southern savanna regions were "derived" and would have been forested had they not been farmed (e.g., Keay 1959). While terms like "derived savanna" have remained in popular use, over the past 30 years ecologists have significantly refined their understandings of savanna environments, recognizing them as dynamic, unpredictable, resilient systems (see discussion in Chapter 3). The result has been a more nuanced framework for understanding of the impact of humans and, in particular their farming practices on the local environment.

In contrast, agronomists and development workers have traditionally been concerned with increasing the quantity and reliability of agricultural yields, and their papers often have an experimental tone, whether they are testing the efficacy of different types of fertilizer, documenting soils' water retention, or trying to find the best method by which to encourage local farmers to take up the plow (e.g., Nye and Greenland 1960, Schultz 1964, Wills 1962). Along with ecologists, these scholars tended to be critical of shifting cultivation due to its low yields and lack of focus on capital improvements to farmland (e.g., FAO 1957, Nye and Greenland 1960). However, agronomists are responsible for most of our knowledge regarding the soils and traditional crops of the West African savanna (Ahn 1970; Nye and Greenland 1960; Kowal and Kassam 1978), although their publications often include lengthy sections on encouraging the adoption of cash cropping, plow agriculture, pesticides, and chemical fertilizers. While more recent studies demonstrate a greater awareness of the savanna environments and cultural context, the emphasis remains the practical concerns of agricultural production (e.g., NRC 1996, 2006, 2008).

Finally, anthropologists in West Africa were interested in the ways in which agriculture practice was culturally constructed, and in the 1960s, the influence of cultural materialism led to an explosion of research in West Africa and beyond, demonstrating the efficacy, reliability, and resilience of traditional agricultural practice (e.g., Conklin 1954, 1963; Haswell 1953, Netting 1968, Pelissier 1966, Savonnet 1959). This work inspired a classic series of French case studies documenting agrarian structures for West African groups within a cultural context (*Structures Agraires au Sud du Sahara*, which includes, among others, Barral 1968; Remy 1967; Savonnet 1970, 1976), and the approach was also adopted by researchers in associated disciplines such as geography and economics (Clark and Haswell 1966). In spite of this overwhelming documentation, Baker (2000:67-69) notes that the importance of the cultural setting was largely ignored in the development literature until recently, although there are notable exceptions (e.g., Swanson 1979)

Over the past 30 years, the most effective research has integrated the respect for cultural traditions of anthropologists, the emphasis on practical data of agronomists, and the sophisticated understandings of ecosystem function from ecologists. Projects

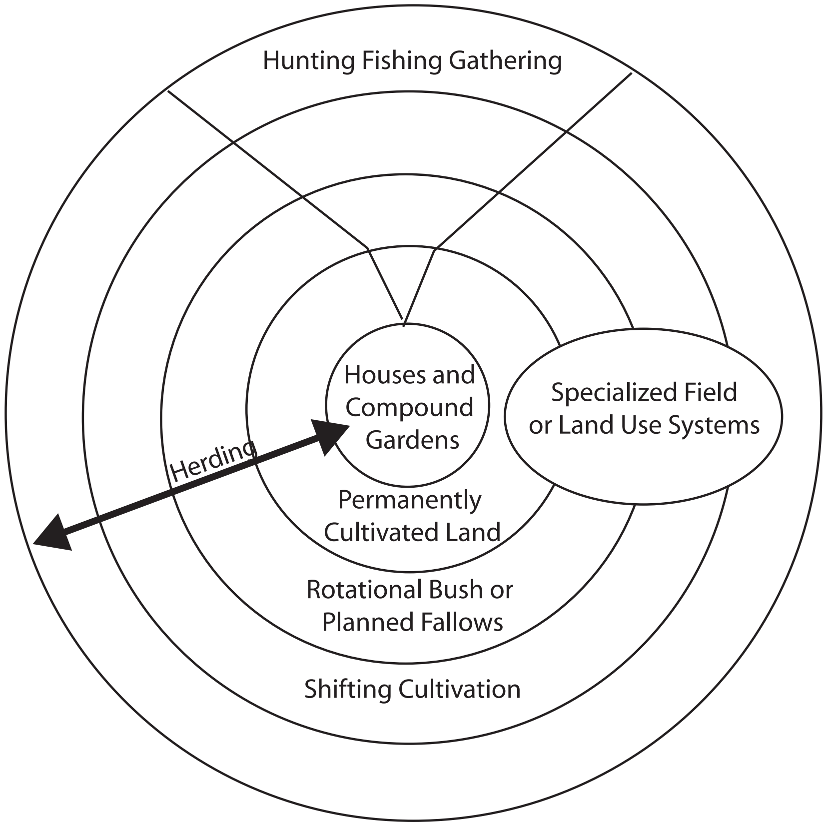

Figure 4.1: Idealized Savanna Farming System (modified from Grove and Klein 1979)

are frequently interdisciplinary, and modern scholars have combined advances from multiple literatures to transform understandings of traditional agriculture (e.g., Baker 2000, Bassett and Crummy ed. 2003, Fairhead and Leach 1996, Mortimore 1998). All of the above authors argue effectively for the sustainability of traditional practices, for the dynamism of the agricultural landscape, and for the importance of long term perspectives in understanding the impact of farming on local environments. Despite its clear relevance to prehistoric analyses of agricultural practice, to date this literature has had only minimal impact in archaeological discussions (e.g., Neumann et al. 2003; van der Veen 1999).

The Ring Model: An Idealized Savanna Farming System

In order to discuss farming in the West African savanna, it is useful to begin with a generalized model of subsistence farming. Within the dynamic literature discussed above, the ring model, initially proposed by Pelissier (1966) has proven remarkable robust due to the flexibility of the concept. Most farmers in the savanna zone employ mixed agricultural strategies that can be conceptualized as a series of rings in which the highest input fields are located closest to the residence (Figure 4.1) (Pelissier 1966, Grove and Klein 1979, Okigbo 1984). These rings may be oriented around a village, or dispersed households may each be at the center of an individual set of fields. In the latter case, rings can overlap such that the outer fields of one household may actually be closer to a second household (Prudencio 1993). While the emphasis on different elements of the model can vary dramatically depending on local circumstances and the boundaries between rings may be difficult to determine in practice, almost all types of fields discussed below will typically be utilized to a certain degree.

In the center of the ring are compound gardens, which are normally used to grow a mixture of vegetables and the early season staple crops.[1] These fields are often the most heavily fertilized with household waste and manure. In the second ring, permanently cultivated fields, priority is also usually given to early season staple crops, and significant effort may be put into weeding, maintaining soil fertility using techniques such as manure or burning of collected brush, and soil conservation strategies such as mulching (Prudencio 1993). In both of these field sections, intercropping and succession strategies are common. Early season crops are often kept close to the residence since they are among the first plants to fruit and consequently often suffer greater losses to birds and other animals than late season crops (Swanson 1979).[2]

The next two rings are generally used for late staple crops, and, if located far from the settlement, small huts may be built so that farmers can live near their fields (e.g, Remy 1967). For these fields, less energy is expended once the crop is planted, i.e., the fields are rarely fertilized, and often less frequently weeded. Successions of different crop types will be used on rotational bush fields (sorghum-millet-cowpea is a common sequence (Swanson 1979)), while for the distant shifting fields, new land may be cleared on a regular basis. Specialized land use systems take advantage of specific features; in the savanna, these are most commonly inundated lowlands suitable for rice cultivation. Also traversing the rings are herding practices. While dry season herding can occur in all rings depending upon quality of grazing fodder, during the growing season, livestock are

1 In the historical period, tobacco is commonly planted in the innermost fields once the early staple crops have been harvested, in part because it is often cultivated by elderly members of the household (e.g., Remy 1967, Prudencio 1993)

2 According to Prudencio (1993) this susceptibility of early crops to birds is one reason why indigenous early crops (fonio, varieties of millet and sorghum) are being displaced by maize; the latter's seeds are more protected.

often penned and kept under close supervision to avoid destruction of fields.[3]

Finally, hunting, fishing, and gathering are placed in the outer circle, although useful trees and good fishing spots will be interspersed throughout the village catchment. Buchanan and Pugh (1955:107) draw attention to the importance of these "wild" spaces within the agricultural landscape, as they are not only a source for numerous plant foods and home to wild animals, but also essential for the collection of firewood (Tables 3.4-3.11, 3.13). Trees, notably shea butter, baobab, and locust bean, are particularly important dietary resources, and are often left in undisturbed when clearing agricultural fields (Ahn 1970; Swanson 1979; Gray 2003). As will be discussed below, the resulting "parklands" have numerous advantages for cultivation besides easy access to these crucial economic trees (Pullen 1974).

These cross-cutting resources can further complicate the cultural landscape, as rights of access and ownership are often independent of the associated farmland. In particular, the economic importance of trees is such that planting them in an agricultural field is considered a particularly strong statement of ownership, as those who plant the trees often retain rights to the products (Swanson 1979). In many societies, one of the only improvements prohibited on borrowed land is the planting of useful tree species (de Zeeuw 1997).

Challenges of Savanna Farming

While the ring systems conceptually describe farming intensity and crop types within space, practice varies considerably based upon local geography and the particular local history of agricultural choices. In this section I explore the two of the major variables to which societies must respond in devising agricultural strategies, and address some of the variations that are realized despite these constraints.

Challenges of Savanna Farming I: Managing Unpredictable Rainfall

As described in Chapter 3, the West African savanna has very high inter-annual, intra-annual and spatial variability in the distribution of rainfall. Farmers must be prepared for seasons of abnormally high as well as abnormally low precipitation, an

3 In many areas of West Africa, herding is entrusted to seasonally nomadic populations such as the Fulani. Livestock breeds from area to area are contingent on both the local environment, and the presence of specialized herding populations (Epstein 1971). Non-dwarf breeds are found in drier northern areas, and where nomadic herders are inserted into local economies, these breeds are seasonally found in southern locations during the dry-season. The Gobnangou is in a region where non-dwarf livestock must leave during the rainy season (see discussion in Chapter 3).

unpredictability which can have a significant effect on local harvests.[4] Particularly crucial for farmers is choosing when to prepare and sow their fields. If the field is prepared and the crop planted too early, the dry exposed topsoil may erode, and birds will often consume much of the planted seed before it sprouts. On the other hand, if the farmer plants too late, there may not be sufficient rainfall during the fruiting and the crop can easily dry out before it can be harvested (Kowal and Kassam 1978).

Traditional farmers have numerous strategies available to them for buffering against unpredictable rainfall, including mulching to improve water retention (Lal 1974), and spacing fields over a large area (Savonnet 1970). One common method is the use of multiple varieties of multiple crops. Swanson (1979) documented numerous varietals of staples, legumes, and other crop plants among the Gourmantche (see Chapter 3). Many of the breeds were specifically developed and preserved to buffer against bad years; some prefer wet conditions, while others thrive in dry, and some require rain early, while others will produce provided there is rain late in the season. Swanson (1979) notes that farmers make an active effort to maintain the diversity of their seed stock, planting at least small quantities of most varieties available to them in most years. However, crop varieties can be very localized and certain plants often play a major ritual role (e.g., fonio among the Batammaliba [Blier 1989]; pearl millet among the Lobi [Labouret 1931]).

Challenges of Savanna Farming II: Maintaining Soil Fertility

Savanna soils are known for their relatively low fertility, and without additional inputs can often be farmed for only five to seven years, after which they are generally left fallow for up to thirty years (see Chapter 3). Fallowing is the lowest cost method for regenerating the soil fertility of an exhausted field, and is generally preferred if adequate land is available.[5] Even when fields are cultivated for only 5-7 years, farmers will also rotate crops and intercrop grains and legumes to extend the life of the field.

Soils are also improved or maintained through addition of manure and other fertilizers that are often applied to areas close to the residence, although it is rare that enough is available for anything other than gardens and crucial early season crops. Fields are commonly burned, which discourages weed growth and can rid the soil of pests and

4 As an example, Swindell (1992:171) charts the success of major crops in The Gambia from 1912-31. Over this period, the millet harvest was good or excellent 10 years, modest or poor 6 years, and failed completely 3 years.

5 Given the unpredictability of savanna environments discussed in Chapter 3, it is difficult to predict exactly how long a particular patch of exhausted land will take to regenerate. The most commonly cited figure is around 20 years (e.g., Ahn 1970, Kowal and Kassam 1978), although the length of time may depend on the reasons for abandonment of the field (pests, disease, weeds, soil nutrients, erosion, etc.) (Moody 1974, Kowal and Kassam 1978). Although the key element is terms of soil regeneration is the accumulation of humus, the elimination of weeds may be a longer process (Nye and Greenland 1960).

diseases (Moody 1974, Baker 2000), although when savanna environments are burned any carbon, nitrogen, or sulfur in the vegetation itself is lost, not enough ash is produced to significantly change the soil pH, and the burned material does not decompose into humus (Nye and Greenland 1960; Ahn 1970; Kowal and Kassam 1978). Although considered labor intensive, mulching, whether with weeds pulled from the field or specifically collected and transported dry matter (e.g., grass, millet stalks, etc.) not only protects the soils from run-off, but also adds to humus content as it decays, and may even attract termites, whose activity can enrich the soil (Slingerland and Masdewel 1996).

While in some regards counter-intuitive, economic trees can have a positive effect on grain production in addition to providing shade and making important contributions to the diet.[6] While the area directly under the tree crown will have lower yields (Bayala et al. 2002), the areas directly around the canopy have richer soils, higher soil moisture, and consequently grain plants in these locations have higher production than those in the middle of fields (Manshard 1992, Boffa et al. 2000). Boffa et al. (2000) found that total yields were higher in sorghum fields with shea butter trees at 12-31 trees/ha than in fields without trees. Lastly, hoe cultivation itself offers certain advantages for the preservation of poor soils: by never completely clearing fields, farmers mitigate the effects of heavy down pours and the resulting run-offs which remove essential nutrients (Pieri 1992).

Gourmantche Farming

As described in the introduction, the Gourmantche are committed shifting cultivators who value mobility in their approach to farming. While there is significant variability over Gourmantche territory, since the northern and southern boundaries are over 400 km distant, household independence in agricultural decision is at the core of Gourmantche identity and shapes numerous aspects of their land tenure system. Gourmantche agriculture has been extensively studied by two researchers, both of whom considered the cultural context of production as an essential variable: Remy (1967) presents a focused look at the community of Yobri located at the base of the Gobnangou escarpment, while Swanson (1979) contributes a comprehensive survey of Gourmantche agriculture throughout eastern Burkina Faso.

In some respects Gourmantche agriculture is typical of the region; the primary staple crops are sorghum and pearl millet, which are supplemented with a diverse assortment of legumes and vegetables (see Chapter 3 for a discussion of crops grown in

6 The economic importance of these trees is such that planting trees on farmland is considered a particularly strong statement of ownership, as those who plant the trees often retain rights to the products (Swanson 1978). In many societies, one of the only improvements prohibited on borrowed land is the planting of useful tree species (de Zeeuw 1997).

the Gobnangou region). Staple crop fields, while closer than those farmed by sedentary villagers, are furthest from the residence, and are cultivated for 5-7 years before farmers open new fields, while vegetables and early staple crops are planted directly adjacent to the household compound.

Agricultural labor amongst the Gourmantche is almost entirely performed by the household unit, with communal labor employed only rarely for weeding or harvest (Swanson 1979). Fields can be divided into two major categories for labor purposes: ca. 75% of fields are controlled by the head of the compound and are worked by all household members; additionally women and other male members of the house will have personal fields. While all household members cultivate staple grains, additional crops are often highly gendered (e.g., women cultivate okra, while men cultivate yams).

Like many shifting cultivators, the Gourmantche gain perpetual rights to land by clearing and farming it. Local chiefs do not have authority over the distribution of land, and in general an individual farmer may open a field in any unclaimed patch. However, in practice the farmer has relatively little authority, as he is obligated to lend any of "his" land not currently under cultivation to anyone who requests it. In contrast, the products of useful trees on the land remain the property of the farmer, although a borrower may keep the rights to any trees they plant.[7] Within this land tenure system, mobility acts as a crucial "reset" mechanism; in cases like the Gobnangou where populations were tied to a single location by colonial authorities, complex webs of borrowed and lent land quickly developed, and residents were forced to develop new mobile strategies to maintain access to land (Remy 1967).

A central element of Remy's work is an explanation of the *kwadiegu* or bush field system, which both he and Swanson characterize as a recent innovation developed in response to attempts to encourage more sedentary agricultural practices. While farmers maintain their residences in villages during the dry season, during the rainy season they will move to dispersed compounds close to their agricultural fields. The same *kwadiegu* is frequently employed for multiple growing seasons, and several farmers may locate their *kwadiegu* in the same general area, forming impromptu neighborhoods that dissolve when households move to a new location.

7 Tree ownership is a major source of disputes, and one that has gotten worse as development agencies encourage the planting of exotic fruit trees such as mango. Swanson (1979) documents several cases where farmers uprooted saplings planted on borrowed land, a problem exacerbated by the monetary investment in the trees.

Cultural Mediation of Farming Practice

While many of the same strategies characterize agricultural practices throughout the savanna, great diversity is found from place to place in how and where fields are distributed in relation to the social groups who work them. While land tenure in African societies was frequently characterized by colonial authorities as simple communal systems, anthropologists recognized the complex bundles of rights and diversity of approaches (see historical review in Lentz 2006). Taking the Gourmantche case as a point of departure, in this section I contrast their land tenure systems with those practiced by other groups inhabiting a similar environment. As will be seen, the agricultural practices are intricately tied to the land tenure systems

The constant mobility of Gourmantche residences, and consequently of dispersed ring systems contrasts greatly with societies that inhabit more concentrated settlements, who tend to have a more formalized system of land tenure. For example, the Gourounsi of west-central Burkina Faso, while sharing the Gourmantche pattern of permanent garden rings around the household compound, are highly sedentary, such that decisions regarding access to land in zones surrounding the village must be more codified (Barral 1968).

In general, the Gourounsi land tenure system is derived from anteriority of settlement, with the oldest households, those related to the village founder, or multiple households who co-founded the village together controlling access to portions of land that represent sections of each ring that extend out from the village to the ends of the village territory. This enables households to schedule their cultivation and fallow over long periods of time, although great care must be taken in maintaining the fertility of the gardens that surround the household. Immigrants to villages must borrow land from these households, and can never achieve the status of landowners. This is in sharp contrast to Gourmantche, where mobility is encouraged by a system that offers little incentive to stay in one place.

Like the Gourounsi, the Bwa have a very codified system of land cultivation, with access to the best fields similarly based upon antiquity of residence in the village community and successful participation in communal events (see Capron 1973, Manessy 1960, and Savonnet 1959). Bwa villages are tightly clustered, and households live within wards rather than compounds. While, as in the Gourounsi case, the village is at the center of the ring model, land is communally controlled and residents may have access to fields in any part of the rings. When a new immigrant settles in a Bwa village, they are first allowed only to farm in bush fields or occasionally in semi-permanent fields; however, access to the permanent "village" fields in the innermost rings can be earned through successful participation in the community over the course of several years. The Bwa are extremely sedentary, with some villages continuously occupied for well over a thousand years (Dueppen 2008), and as a consequence they are considered to have a very intensive agricultural regime that maintains fertility in both the village fields and also some semi-permanent fields. In both the Bwa and Gourounsi cases, large households (often over 100 people) facilitate the maintenance of permanent fields.

Finally, I consider the case of the Mossi. The Mossi are closely related to the Gourmantche, and a first glance their villages can seem very similar, as both have very dispersed compounds at the center of individual rings of farmland. However, the organization of Mossi land tenure is strikingly different. Unlike Gourmantche chiefs, who do not control access to farmland, Mossi villages control discrete territories. Although technically owned by the corporate community, the authority over the land and its distribution is maintained by the chief (Swanson 1979).

Modeling Prehistoric Population Densities in the Gobnangou Region

As described above, the distribution of farmland is historically contingent, and the density of land under cultivation in a given region is the result of both ecological and cultural factors (Marchal 1983). As discussed in Chapters 1 and 2, the archaeological record of the Gobnangou region is particularly challenging to interpret due to the high numbers of dispersed sites representing short occupations of single households. While at this stage contemporaneity cannot be established archaeologically, it is possible to bracket the number of sites that could reasonably have been occupied at a given point in time, given the available land.

Mikesell (1963) has accused anthropologists of "deriv[ing] a sophisticated view of culture from a naïve view of nature." If anything, dabbling in ecological modeling has become more fraught as our understandings of building good models have improved. This has been particularly true in the case of calculating carrying capacity: an extremely complicated process that requires detailed knowledge of numerous variables and their average variation through time in order to obtain a reasonable result. While the environmental data available for the study region is unusually fine grained for Burkina Faso, it still lacks the necessary specificity to construct a reliable simulation. In addition, key variables like household size and the importance of cash crops have changed dramatically over the past 100 years.

Table 4.1: Estimates of Possible Population Density for the Study Region

	Swanson (1979)	Hough (1989)	Barral (1968)	Marchal (1983)
Location	Eastern Burkina Faso	Tanougou, Benin	Tiogo, Burkina Faso	Eastern Burkina Faso
Ethnic Group	Gourmantche	Gourmantche	Lele	Gourmantche
Households Studied (N)	21+	36	23	NA
Average persons/household	7.7	12.2	14.8	determines from aerial photographs that 5% of land is cultivated (in 75 km^2, 325 ha cultivated, 975 ha fallow) Estimates for the study region are based on calculations for land needed per person and per household from Barral, Hough, and Swanson
Average land cultivated/ household	7.0 ha	5.7 ha	11.4 ha	
Average land cultivated/ person	1.18 ha	0.47 ha	0.68 ha	
Average land cultivated/ household excluding cash crops	5.6 ha	4.3 ha	11.4 ha	
Average land cultivated/ person excluding cash crops		0.35 ha	0.68 ha	
Land needed per person with 3:1 fallow ratio		1.4 ha	2.72 ha	
Land needed per household with 3:1 fallow ratio	22.4 ha	17.2 ha	45.6 ha	
Estimated people supported in area the size of the study region (75 km^2)		5357	2757	476-928
Estimated households supported in area the size of the study region (75 km^2)	335	436	165	28-76

Despite these limitations, it is possible to calculate a set of rough estimates using available ethnographic data (Table 4.1).[8] In this table, average hectares farmed per person and per household are calculated from three different studies (described below). Assuming a 3:1 fallow to cropping ratio (i.e. that four times the land farmed in a given year would be necessary to sustainably support a household), the number of individuals and households that could be supported in the study region was obtained. For the sake of simplicity, it was assumed that all 75 km^2 were arable land. Based on current areas of inundation, the number could be significantly lower.

Swanson (1979) conducted a large scale survey of Gourmantche farmers in eastern Burkina Faso, but collected data on the number of fields rather than the area farmed. However, by combining his results with a much smaller study he was able to provide figures for an "average" household that are reproduced here. Hough (1987) gives composite figures (total number of inhabitants, households, and hectares farmed) for a small Gourmantche village in village in northern Benin, which were extrapolated to calculate per household and per individual data. In contrast, Barral (1978) presented individual data on compound size and field size for 32 Lele households, which were averaged to obtain a composite value.

The wide range in the resulting estimates is indicative of the difficulties and local circumstances involved in calculating "average" values for farmed territories. However, across the board these numbers suggest that more than half, or even almost all of the sites could have been simultaneously occupied. This, however, does not mean that they were. A counterpoint is provided by Marchal (1983) who, working from aerial photos estimated that on average only 5% of land was farmed in Tapoa Province. Using the estimated household requirements calculated from Barral (1968), Hough (1987), and Swanson (1979), I estimate the numbers of households that would be occupied at that cultivation density. In conclusion, while of limited utility for interpretation, this exercise does provide a sense of scale as to what the possible and probable levels of occupation in the study region may have been during the prehistoric period.

Discussion

Depending on the combination of agricultural techniques employed, a household may be able to farm effectively for hundreds if not thousands of years in one location despite the poor soils common in the savanna, as evidenced by research at tell sites throughout northern and western Burkina Faso (Dueppen 2008; Marchal 1979), among

8 Remy (1967) is not included in this section as he provides no numerical figures on the extent of cultivation.

other locations. The details of these land tenure systems are largely invisible in the archaeological record: we know that people are growing a mixture of grain staples and legumes and that tree fruits play an important role. Using weeds, we make educated guesses as to the quality of the soil where crops are being grown, and we can hypothesize the likely locations of fields. We know there were systems in place for allocating land, but what is visible in the deposits is the product, not the territory.

In contrast, some farmers choose to move their homes with a frequency of anywhere from 10 to 50 or a couple hundred years, and as a result utilized more confined field systems. Our understandings of the agricultural economy is to some extent more limited; well provenienced direct evidence of crops is rare, and evidence regarding the internal organization of sites is limited due to poor preservation in shallow deposits. However, in cases such as the Gobnangou region, the scattering of short occupation sites can give us insight into the structure of the agricultural system, and the balance between permanent and shifting fields.

CHAPTER 5
HUNTING, GATHERING, FARMING, HERDING: THE MSA, LSA, AND PWOLI OCCUPATIONS

The rich microenvironment of the Gobnangou region has made the escarpment a favorable location for human habitation for the past several thousand years, resulting in one of the longest sequences in West Africa. While the early phases of occupation are patchy and poorly dated, an exploration of them is crucial to understanding the development of subsistence strategies in the region. This chapter begins with a short discussion of the Middle Stone Age, then moves on to a consideration of both the pre-ceramic and ceramic Late Stone Age data. Finally, I present the data for the Pwoli occupation (ca. AD 700-1000), the earliest of the three temporal divisions I defined for the study region.

Although represented by only three sites, the Pwoli occupation was characterized by its comparatively stratified archaeological deposits, including multiple flooring episodes, that yielded the earliest evidence for both domestic crops and animal husbandry in the region. By phasing out aspects of the mobility of hunter-gathers while progressively increasing their reliance on domesticated plants and animals, residents of Pwoli occupation sites become more local in their economic practices throughout the occupation.

Previous Archaeological Work in the Gobnangou Region

The first archaeological sites noted near the Gobnangou escarpment were paleolithic, and were identified by Oliver Davies during a brief driving tour of the region (Davies 1967).[1] Characterized by microliths (Clark's (1969) Mode 5), the chipped stone tools and debitage recovered from these surface scatters were notable in part for the quality of the chert, similar to that available near the escarpment. Following the publication of these few short notes, the Gobnangou remained largely unexplored until

1 Davies sent a small collection (ca. 15) of these lithic artifacts to Raymond Mauny at the Archaeology Laboratory of IFAN in Dakar, Senegal. These lithics were examined there by the author in Winter 2005. They consisted of unretouched unifacial flint flakes and debitage.

the late 1980s, when the University of Frankfurt began a large, interdisciplinary project in the region.

As described in the introduction, the Frankfurt project hoped to isolate the transition from hunting-gathering to settled cultivation economies (Frank et al. 2001). The few recorded lithic industries in Burkina Faso are generally assumed to have been created by hunter-gatherers, but the understanding of the relationships between the inhabitants of these lithic sites and those of early farming villages (e.g. Marchal 1978) is poorly understood.[2] The Frankfurt project was attracted by the diversity of Mode 5 tools known to exist in the Gobnangou, which suggested to them a lengthy hunter-gatherer occupation, and by the fertility of the region, which made it attractive for early agriculture. They hoped that the numerous rock-shelters in the escarpment would contain stratified deposits that could be used to chart the adoption of cultivars.

As is so often the case in West Africa, these researchers did not find what they were looking for. The rockshelter sites they excavated (described below) pushed the Gobnangou sequence possibly thousands of years earlier than previously suspected, to the Middle Stone Age. However, they contained few organics, deposits were often mixed, and there was little evidence of agricultural activity. The open-air agricultural sites they identified were eroded, unstratified, and dated to the last 1000 years.

Seeking the Middle Stone Age

Maadaga Rockshelter is frequently cited as the location of one of the longest archaeological sequences in West Africa, a claim that rests almost exclusively on the recovery, from the basal level of a small excavation unit, a collection of chipped stone tools attributed to the Middle Stone Age (MSA).

The MSA includes most of the last 100,000 years and is traditionally thought to have terminated around the Pleistocene-Holocene transition (ca. 11,000 BCE). While the term MSA originally implied a package of technology and economic behaviors, it is now used more frequently to simply indicate a temporal period. Clark's (1969) mode system to characterize progressively more advanced techniques of stone tool production has been adopted widely, and while Mode 3 (flake tools) is still closely associated with MSA deposits, the correlation is no longer considered exclusive, as will be seen below. While some researchers (e.g., Barham and Mitchell 2008) have abandoned terms like MSA almost completely in favor of independent chronological frameworks such as the global marine isotope record, the term remains widespread in the West African literature. Its

2 A notable exception is the site of Rim, in northeastern Burkina Faso (Andah 1978)

use, however, is less the result of conservatism and more an indication of the paucity of archaeological materials from this phase.

In 1989 and 1990, the Frankfurt Project conducted excavations at Maadaga Rockshelter --the largest known shelter in the escarpment (Breunig and Wotzka 1991:172-6; Frank et al. 2001:134-40). They placed three excavation units along a transect across the inner part of the shelter, covering a total of 14 m^2 and reaching 1.9 m in depth, and encompassing five defined layers. Below a loose, mixed surface matrix, they excavated increasingly consolidated and rocky deposits until forced to stop before reaching bedrock. While layers 2-4 have not been fully analyzed, layer 5 (1.10-1.90 m) contained numerous stone artifacts characteristic of a Mode 3 lithic industry.

Despite the small sample size (ca. 1.6 m^3 from one excavation unit), 3,632 stone artifacts were recovered, most of which are quartzite or quartzitic sandstone. Cores are generally irregular, although levallois cores are present. Scrapers, notched pieces, denticulates, and truncated flakes are the only retouched tools identified, and these are both rare and lack standardization. These types of Mode 3 artifacts are generally considered characteristic of MSA deposits in West Africa, although they are known to persist well into the late Holocene (MacDonald and Allsworth-Jones 1994). Indeed, Millogo (1993b) noted a similar Mode 3 assemblage in the basal layers of his excavations at Yobri Rockshelter (only 5 km from Maadaga Rockshelter). His deposits were mixed with undecorated ceramics, which, if not intrusive, could indicate a later date for Mode 3 industries in the Gobnangou specifically. However, at Maadaga Rockshelter no ceramics were recovered from below Layer 2, and even in Layer 2 they were considered intrusive.

Similarities between the Maadaga Rockshelter Layer 5 assemblage and those from the few other documented MSA sites in West Africa (e.g., Allsworth-Jones 1987), combined with the absence of microliths and pottery, were considered sufficient evidence by Frank et al. (2001) to attribute this assemblage to the MSA, although the similarities or lack thereof with the Yobri assemblage were not addressed. Unfortunately, direct dating of the assemblage is virtually impossible since no organic remains, hearths or other burnt locations were identified during excavations of layers 3-5 at Maadaga Rockshelter. The absence of these classes of evidence also prevents any characterization of economic activity in the region.

Given the rarity of stratified MSA sites in West Africa, the limitations of the Maadaga Shelter deposits are frustrating. It is generally assumed that human occupation of sub-Saharan West Africa during the MSA was extremely sparse, a fact often attributed to the possible challenges posed by rainforests to hunter-gatherers (Bailey et al. 1989, for an example of use of this theory in West Africa see Casey 2005, for a counterargument see Bahuchet et al. 1991), although the location of Maadaga Rockshelter is far enough north that it could have been located in a forest-savanna ecotone environment. More likely, MSA populations in West Africa were no smaller than MSA populations in other mild climates. A reliance on organic tools (such as fiber) and a paucity of deep rockshelters is a more plausible explanation for the meager archaeological record. However, such hypotheses cannot be effectively addressed without data on the range of resources exploited by MSA peoples.

MSA layers have not been found at any other excavated rockshelters in the Gobnangou escarpment, and no MSA rockshelters or open-air assemblages were identified during the 2004 and 2006 surveys directed by the author. For the present, the MSA remains an intriguing, poorly understood prelude to the Gobnangou sequence.

Microlithic Sites and Strata: Pre-Ceramic Late Stone Age Hunter-Gatherers in the Gobnangou?

The Late Stone Age (LSA) in West Africa spans much of the Holocene (from ca. 11,000 BCE to well into the 1st millennium BCE) and encompasses a wide range of societies from hunter-gatherers to early settled villages. The original regional conception of the LSA was very much tied into notions of a “Neolithic Revolution,” and was marked by proxy measures for agricultural exploitation such as groundstone, pottery, and Mode 5 microlithic tools. However, as with the MSA, the association of the term with specific social processes and technologies has long since been discredited. In the West African case, numerous sites with geometric microliths pre-date pottery in the region, and links between agriculture and pottery have been broken for some time as pottery in the Sahara significantly pre-dates known domesticated crops. Even leaving aside the presence/absence of certain artifacts, most archaeologists now draw significant distinctions between the use of and reliance on technologies such as domesticated crops (e.g., Ford 1985, Harris 1989, Smith 2001). Today, the term LSA functionally refers to the temporal space between the introduction of Mode 5 technology and the appearance of iron smelting.

In the Gobnangou, geometric microliths appear as early as 6600 BCE and are found at sites throughout the sequence. However, three primary divisions can be made: sites with only Mode 5 lithic tools and debitage; sites dominated by Mode 5 industries but with associated ceramics and groundstone; and sites at which Mode 5 lithics are peripheral to the primary artifact assemblage. This section and the next are concerned with the first two categories, the sites of which likely predate ca. 1 AD: the third group will be discussed in subsequent chapters.

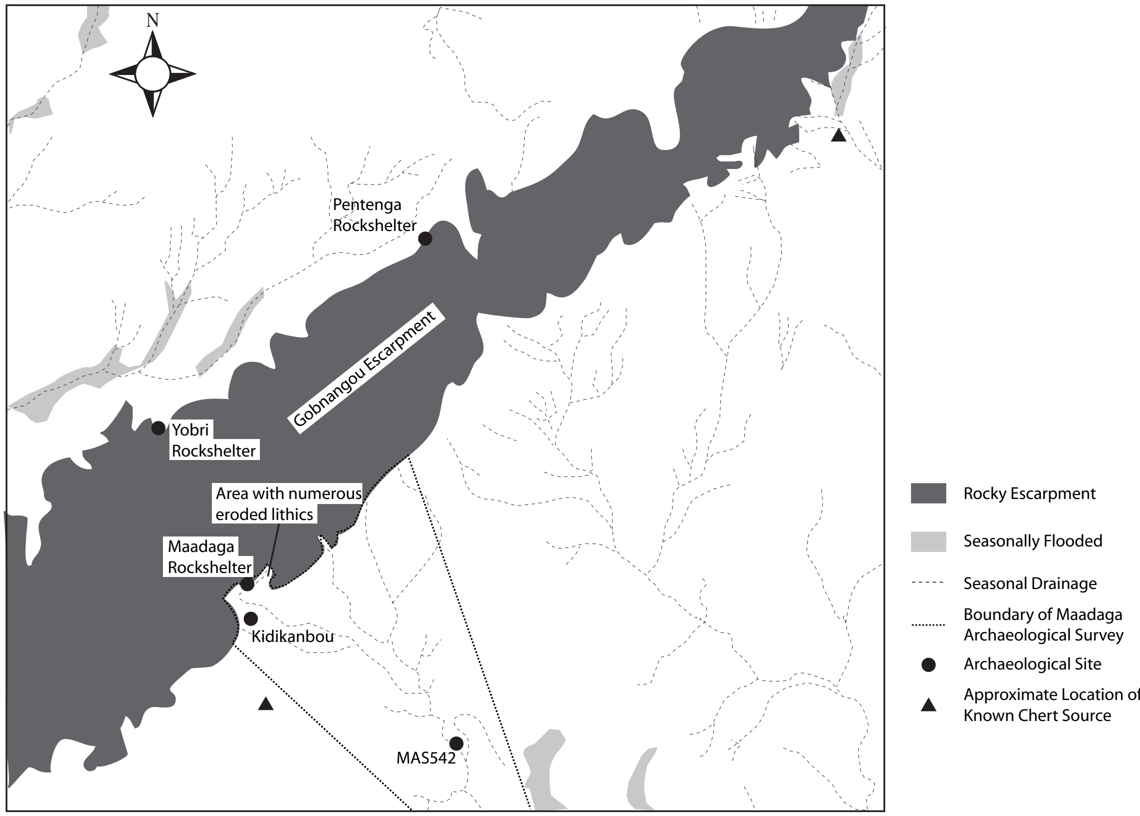

Figure 5.1: Location of LSA sites near the Gobnangou Escarpment

Several sites with aceramic microlith assemblages have been identified near the Gobnangou escarpment (Figure 5.1). Pentenga rockshelter likely contains exclusively microlithic deposits; two open-air microlithic chipped stone assemblages, Kidikanbou and MAS542, have been identified in erosional contexts and excavated; and additional areas have been identified as possible talus slopes for rockshelters no longer in existence. Since Pentenga and Kidikanbou have been fully published by the Frankfurt Project (Frank et al. 2001), their deposits will only be summarized briefly here; MAS542, which was identified and excavated by the author will be treated in more detail.

Pentenga Rockshelter

The site of Pentenga (Frank et al. 2001: 150-70) is located near the upper edge of the escarpment adjacent to a large sandstone boulder, which likely formed an overhang before breaking away from the cliff face. Excavation of a 6 m^2 unit to a depth of 1.86m yielded a loose sandy matrix with ceramics, charcoal, animal bones, and Mode 5 lithic tools. Refitting of pot sherds and comparison of TL dates from the pottery with radiocarbon dates on the charcoal yielded clear evidence of mixed deposits, although the unit could be divided into four temporal strata: c. 6600-5450 cal BC, c. 3600 cal BC, c. 820-570 cal BC, and c. 150-1250 cal AD. The earliest set of dates comes from charcoal in the lowest levels of the stratigraphy. Although these deposits include microliths and ceramics, the ceramics are TL dated to 3600 cal. BC and the Frankfurt Project assumed that they were intrusive. Several of the microliths, however, have been burned which may indicate association with the charcoal. Identification of the charcoal suggests that forests (including *Anogeissus leiocarpus, Allophylus,* and *Pterocarpus* cf. *erinaceus*) grew in the sandy soils at the base of the escarpment, while savanna species such as *Terminalia* sp. were common on the slopes.

The Mode 5 lithic assemblage at Pentenga is typical of the Gobnangou region: geometric microliths dominate the formal tool assemblage, with crescents and micropoints being by far the most common forms, followed by trapezes and triangles. As is to be expected, ca. 95% of the assemblage is composed of un-retouched debitage, including a small percentage of blades and bladelets.

Kidikanbou

Kidikanbou is a dense open air scatter of microliths located ca. 300 m southeast of the Gobnangou cliff face near Maadaga Rockshelter (Frank et al. 2001: 141-9). The deposit is bioturbated by small animals and possibly eroded. Over 6000 chert artifacts were recovered from 10 m^2 excavated to a depth of ca. 0.6 m, although the artifacts may have originally been in a sloping sub-surface stratum. Mode 5 microlithic formal tools were unusually frequent (15% of the total assemblage vs. 2.5% at Pentenga). Fragmentary microliths were also unusually common for the region (36% of the total microlith population). Micropoints and triangles dominated the assemblage, with crescents and trapezes present in much smaller numbers. The site could not be dated due to a lack of organic preservation. Frank et al. (2001) interpreted Kidikanbou as a hunting camp where broken points were removed from shafts and replaced with new microliths, thus accounting for the high percentage of fragmentary examples.

MAS542

MAS542, the only Late Stone Age site identified and excavated by the author, is located in an erosional gully near the main channel of the Koabu (see Figure 5.2). The site was immediately notable for the large numbers of chert flakes clustered near the base of the gully wall. Given the site's vulnerability to further erosion, my team made large surface collections in 2004, and cut an excavation unit (Unit 1) into the side of the gully in an attempt to identify the primary lithic strata. An additional small test unit was placed on the opposite gully wall to estimate the original slope of the strata (Unit 2). In 2006, the site was revisited and additional surface collections of newly exposed artifacts were taken. Only lithic artifacts were recovered; there were no datable materials.

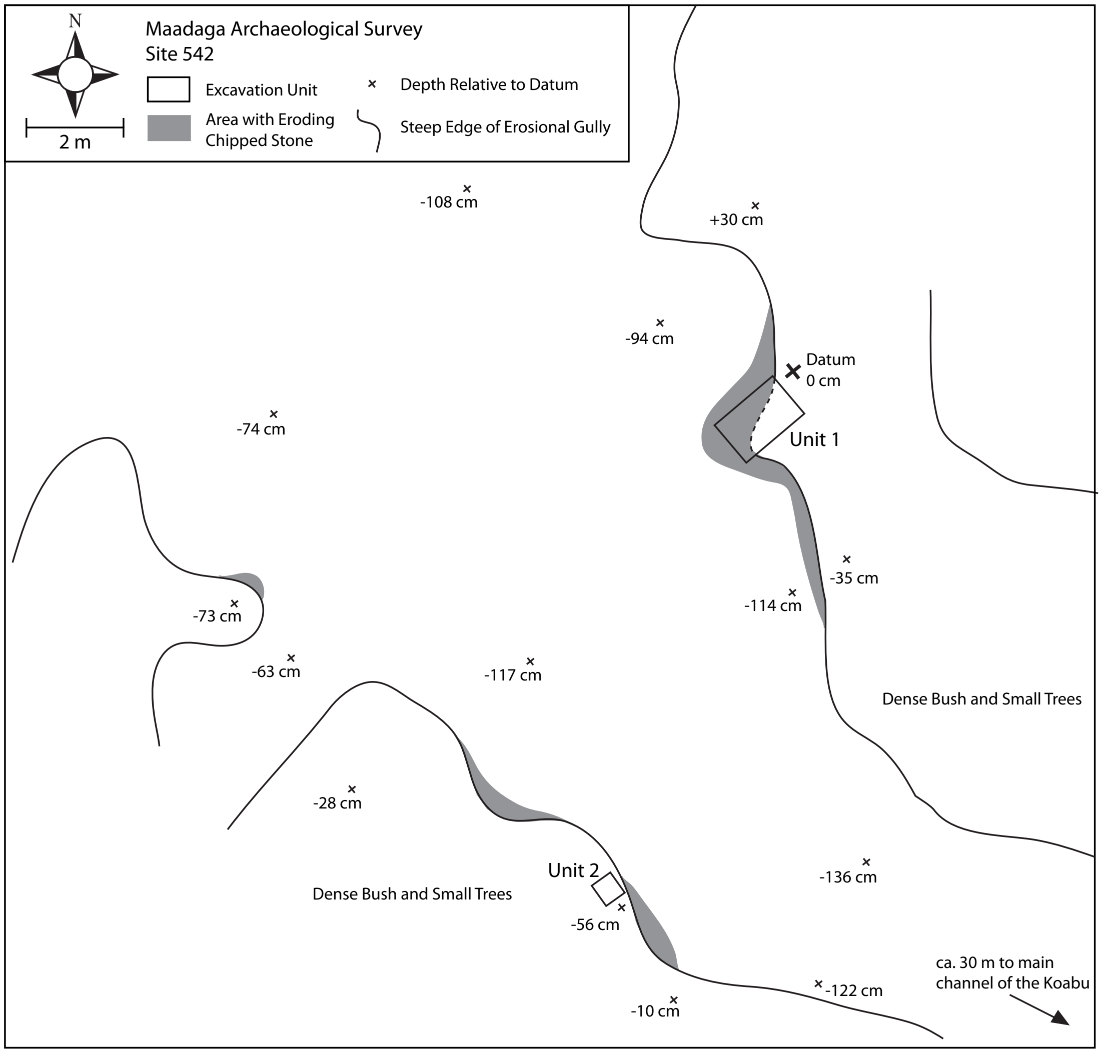

Figure 5.2: Map of Site MAS542

Both excavation units were topped with a loose gray sandy matrix mixed with matted dried vegetal material. This layer was significantly deeper in Unit 2, probably due to the denser brush growing on this part of the site. Below the loose surface materials, the deposit was an extremely compact hard yellow sediment with numerous small ferrous inclusions.

Unit 1 had a clear concentration of lithics between 60-75 cm depth. Below this point, all artifacts recovered were located at the erosional edges of the unit, and may have originated from this lens. Despite the apparent constrained nature of the lithic assemblage, close examination of the profiles revealed no differentiation between artifact-bearing strata and sterile deposits. Excavations in Unit 2 indicated that the lithic stratum was present at approximately the same absolute elevation. Artifacts from the deeper strata in Unit 2 may be have fallen into the unit as it was difficult to control the loose surface layer during excavation.

	MAS542		Surface near Maadaga Rockshelter	
	N	%	N	%
Chipped Stone Artifacts	273	100.0	819	100.0
Flint Artifacts	248	90.8	351	42.8
Quartz Artifacts	25	9.2	469	57.2
Formal Tools	2	0.7	6	0.7
Artifacts with Cortex	137	50.1	337	41.1
Measurable Flakes	62	NA	92	NA
Average Flake Length (mm)	33 mm	NA	22 mm	NA

Table 5.1: Characteristics of LSA Assemblages in the Study Region

A summary of the lithic data for MAS542 is presented in Table 5.1. Over 90% of collected artifacts were gray flint, about half of which had visible cortex. The flakes were exclusively unifacial, and only two formal tools were recovered, neither of which was *in situ* (Figure 5.3).

Eroded Surface Deposits Near Maadaga Rockshelter

Maadaga rockshelter is located at the mouth of a small valley that runs parallel to the escarpment. The valley extends ca. 400 m along the primary channel of the Koabu, terminating at a spring-fed waterfall, and is bordered on the south by a sandstone outcrop. Forming the north edge, the escarpment face is pocked with small rockshelters, most of which are filled with termite nests and none of which have *in situ* deposits. In 2004, survey along the base of the escarpment in this valley revealed ubiquitous surface scatters of Mode 5 lithics extending past Maadaga Shelter and along the foot of the cliff. Three shovel tests in the densest of these scatters confirmed them as exclusively surface features, and given the degree of fluvial activity at the region, they are assumed to be erosional. Most likely, they originated in rock-shelter or former rockshelter deposits. While little can be learned from their context, they do provide a point of comparison for the MAS542 assemblage, which has a significantly higher percentage of flint. Visually, the flakes at MAS542 were significantly longer and broader than those recovered near the escarpment, an impression confirmed by measurements on intact flakes (Table 5.1, Figure 5.3).

Dating Mode 5 Industries: an Exercise in Frustration?

Dating of the sites listed is tentative at best. Although a series of seemingly reliable radiocarbon dates exists for Pentenga Rockshelter (the 6500-5500 cal BC date is based on 5 individually dated samples from three strata), their association with the microlithic assemblage must be regarded somewhat skeptically given the issues of stratigraphic integrity at the site. Even if the date is accepted for Pentenga, it may not be applicable to the undated sites of Kidikanbou and MAS542, as the duration of the microlith industry in the region is unknown. Worked chert flakes encased in laterite duracrust were observed near Maadaga Shelter. Unfortunately, this stone matrix, which is the result of erosion and leaching processes that leave heavier ferrous elements in place, can form in as little as a few hundred years.

Little data are available regionally to provide a larger context for the Gobnangou specimens. While several clearly pre-ceramic Mode 5 sites are known in West Africa (e.g., Vernet 1996, Ide 1997, MacDonald 1997, Petit 2005), the samples remain small and widely spaced. No chronologically significant stylistic patterns have been noted that could place the Gobnangou assemblages in a temporal framework. Likewise, no chronologically significant patterns have been noted for the Gobnangou itself: geometric microliths from throughout the sequence fall well into the range of variation present in the large samples from Pentenga and Kidikanbou.

Given the persistence of Mode 5 industries, caution is necessary in interpreting sites such as Kidikanbou and MAS542; they could be specialized activity areas from any part of the sequence. Two sites, MAS865 and MAS867, could also fit this description as their surface materials included numerous chert flakes and cores (no formal tools), mixed with isolated ceramics from some of the later phases occupation. However, the total lack of ceramics or other classes of artifacts at Kidikanbou and MAS542 would suggest that they are associated with either the early phase at Pentenga or the microlith dominanted assemblages discussed below.

Early Ceramics: Changes in the Hunter-Gatherer Tool-kit

Unlike many regions of the world, early ceramics in West Africa are associated with mobile hunter-gatherers and significantly pre-date agricultural exploitation. To date, the earliest ceramics identified in sub-Saharan West Africa are from the 8th millennium BC levels at Ounjougou (Huysecom et al. 2004). By the 4th millennium BC, ceramics are present in Cameroon (Shum Laka: Lavachery 1990), Nigeria (Konduga: Wotzka and Goedicke 2001), Mali (Korounkorokale: MacDonald 1997), Ghana (Bosumpra: Shaw 1985), as well as Pentenga Rockshelter. At the majority of these sites, pottery is a secondary artifact class in assemblages dominated by Mode 5 lithics.

In the Gobnangou Region, two such sites have been excavated: Pentenga and Yobri Rockshelters. No new sites from this phase were identified by the author.

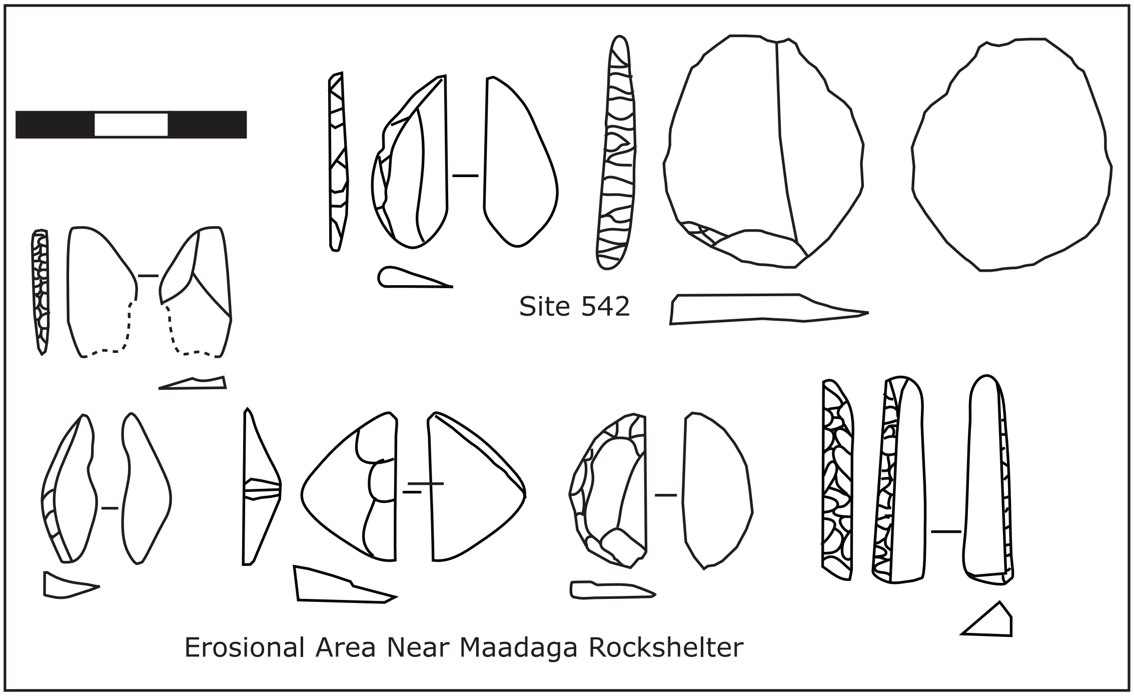

Figure 5.3: Microliths from LSA sites in the study region

Pentenga Rockshelter

As described above, Pentenga rockshelter has issues with chronological mixing. Direct thermoluminesence dating of the pottery (predominantly quartz tempered open vessels with simple rims and rocker-comb decoration) recovered in layers with a microlith assemblage generally similar to that from the earlier layers yielded dates from the 2nd-3rd millennium BC. Roughly contemporary with the described pottery, the species composition in the identified charcoal changed to reflect a more arid climate, although species indicative of remnant forests remain. In addition, the appearance of more fire-resistant species and evidence of trauma-affected rings in larger trees indicates that brush fires became more common. Whether these were a side effect of less precipitation or intentionally set by humans is not yet known. The diverse savanna environment, including dry forests, remained fairly constant through the Pwoli occupation.

More interesting is the poorly dated animal bone assemblage, which provides evidence for subsistence practices during this period (see Table 3.13 for information on local species). The fauna in spits containing both microliths and early pottery shows a strong emphasis on aquatic resources such as fish, freshwater mollusks, and aquatic reptiles, almost all of which could have been caught or collected in the seasonal pools and drainages near the base of the escarpment. There is some evidence of the hunting of larger mammals- notably oribi and hartebeest which could have been found in the savannas at the base of the escarpment.

Yobri Rockshelter

From 1989-90, Millogo (1993b) excavated five 1 x 1 m units at the rockshelter site of Yobri. These units uncovered a rich cultural deposit including a mixed lithic industry including Mode 5 elements. The microlith assemblage was dominated by crescents and micropoints, although retouched flake tools were also present. Ceramics are common throughout the deposit, which Millogo considers otherwise comparable to the site of Rim in northwestern Burkina Faso (Andah 1978). A preliminary analysis of the animal bone identified a range of mammals and some freshwater mollusks.

Mobility and Hunting Practices During the LSA: Implications of Microlith Use

Aside from the limited finds at Pentenga and Yobri Rockshelter (both of which have significant stratigraphic mixing), there is very little data other than the Mode 5 microlithic tools from which to directly characterize mid-Holocene populations near the Gobnangou escarpment. Despite the lack of *in situ* deposits in the study region, research on better documented microlithic industries in other parts of Africa allows us to speculate on some of the possible economic strategies of mid-Holocene hunter-gatherers.[3]

Backed microliths are often assumed to have been hafted into composite tools, particularly arrows, a practice well documented in the ethnographic and ethno-historical record (see discussion in Bousman 2005). Cases of hafting of prehistoric examples are documented at Makwe, Zambia, where mastic traces were found on geometric microliths (Phillipson 1976). Phillipson posited the presence of a variety of hafted tools, including chisels, arrow barbs, scrapers, and cutting implements, as well as the use of un-hafted backed points and scrapers. Further studies on microliths from Egypt and South Africa have confirmed that a variety of types, including crescents, were used for scraping and cutting tasks, often without hafting (e.g., Becker and Wendorf 1993, Binneman and Mitchell 1997). To date, no microscopic use-wear analysis has been made of any microliths from the Gobnangou region.

Regardless of their specific use, it seems clear based on the data from Pentenga Rockshelter that in the study region microliths were an important element of a hunting-gathering economy. Shaw (1985) originally posited that microliths were associated with savanna adaptations requiring greater mobility, while Holocene Mode 3 industries (such as at Iwo Eleru, Nigeria and Shum Laka, Cameroon) were a forest phenomenon.

3 Much of the literature on backed microlith use focuses on the Mode 3/Mode 5 transition and addresses microlithic industries through a primarily comparative lens (e.g., Ambrose 2002, discussion in Barham and Mitchell 2008). Since Mode 3 deposits in the Gobnangou are of such a limited scope, the emphasis here will be on the mid-Holocene assemblages themselves, without reference to previous occupations.

However, even if one sets aside the Gobnangou case (on the forest-savanna margin), Holocene macrolithic industries are now widely known in the northern savanna (Huysecom et al. 2004, MacDonald and Allsworth-Jones 1994) while Mode 5 industries have been identified in southern Ivory Coast (Chenorkian 1983). However, if anything, the decoupling of lithic modes from ecological zones throws into sharper relief the question of why some groups used Mode 3 flakes while others employed Mode 5 microliths.

A recent trend has been to suggest that microlithic industries are associated with more mobile settlement systems, as their efficient use of raw material would have been advantageous both in terms of decreasing loads and increasing the time between visits to raw material sources (Barham and Mitchell 2008). Unlike much of West Africa, where quartz or quartzite chipped stone industries are the norm, the Gobnangou escarpment has numerous outcrops of fine-grained flint. In a brief survey of the region, Müller-Haude (1995) identified flint sources south of present-day Kidikanbou and near Kodjari. There are almost certainly additional sources: conservation of raw material would thus likely not have been necessary. The frequency of cortex is often used as a proxy measure for distance from the primary source material, and the most distant identified site from known chert sources (MAS542) actually has a higher percentage of cortex than sites close to the escarpment (as well as larger flakes), indicating that access to sources within the region was not difficult. If mobility was a factor in the use of Mode 5 industries, the Gobnangou may have been a seasonal residence (probably during the dry winters given its status as an aquifer).

Ambrose (2002), drawing on South African data, has proposed an alternate interpretation of Mode 5 industries: he suggests that they could indicate more predictable resource patterns. Since microlithic composite tools are both more complex and more specialized, their use could indicate advance information of tasks to be performed (whether through networks or stable environments).

In the Gobnangou case, this hypothesis is potentially supported by the excessive number of broken microliths at Kidikanbou, which Frank et al. (2001) attribute to the repair of hunting implements. Recent work by Bousman (2005) suggests that this phenomenon could be indicative of low resource stress. In his study of the Robberg Mode 5 industry in South Africa, he argues that during periods of high resource scarcity, hunters were more likely to keep their hafted weapons in excellent repair, replacing complete microliths more frequently. Conversely, during times of abundance, hunters would have followed a time-minimization strategy and only repaired their weapons once microliths actually broke. Bousman has several coordinating lines of evidence to support

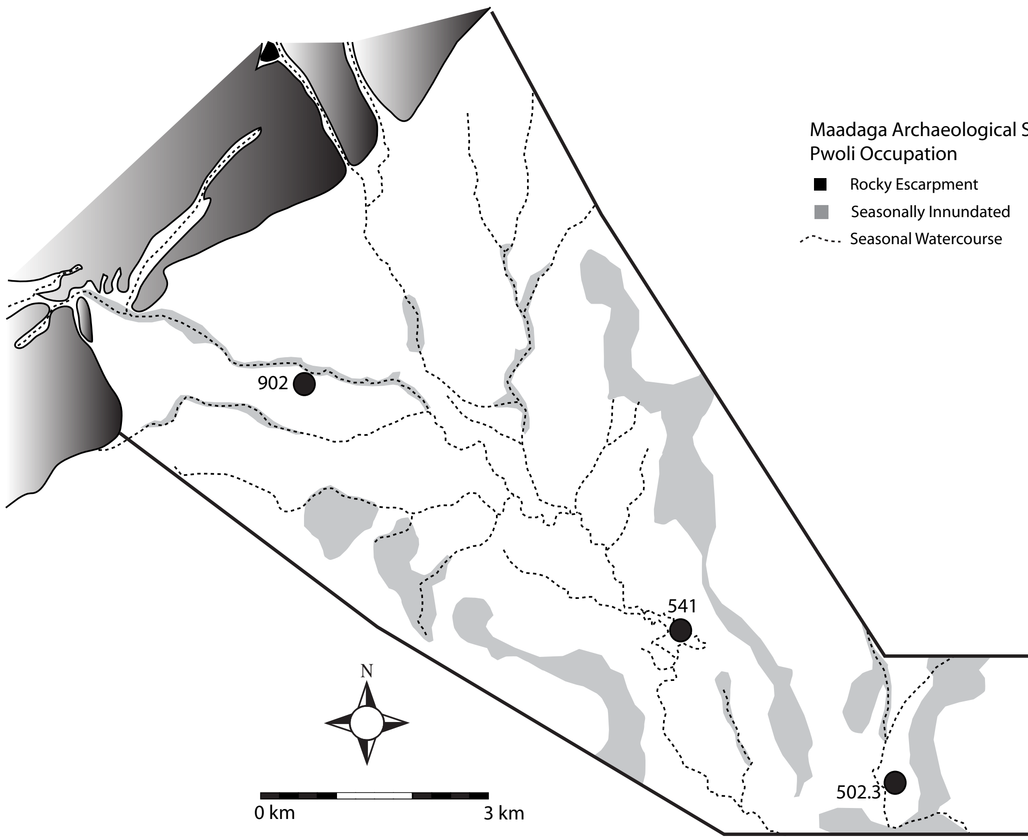

Figure 5.4: Location of Pwoli Occupation Sites

his hypothesis in the Robberg case. Of course, this assumes that microlith breakage was from use, not from manufacture (e.g., Close and Sampson 1998), a possibility that Frank et al. (2001) dismiss given the high percentage of broken microliths. Although the study is intriguing, and coordinates well with a reconstruction of the Gobnangou as a relatively rich microenvironment, more data would be necessary to evaluate this hypothesis for the Gobnangou.

All of the arguments in this section are tenuous at best. However, together they present a fairly consistent picture in line with paleo-environmental data of the Gobnangou as a rich microenvironment with reliable resource distribution that, like many niches exploited by hunter-gatherer groups, was not a year-round residence.

The Pwoli Occupation: Sites and Excavations

The earliest evidence for farming dates to the Pwoli occupation (ca. AD 700-1000). The Pwoli occupation was identifed exclusively at mound sites, i.e. tells, two of which were chosen for excavation based on their assumed depth of deposit (see Appendix B). While several excavated mounded sites yielded only superficial deposits (see Chapter 6), in the case of those associated with the Pwoli occupation stratified

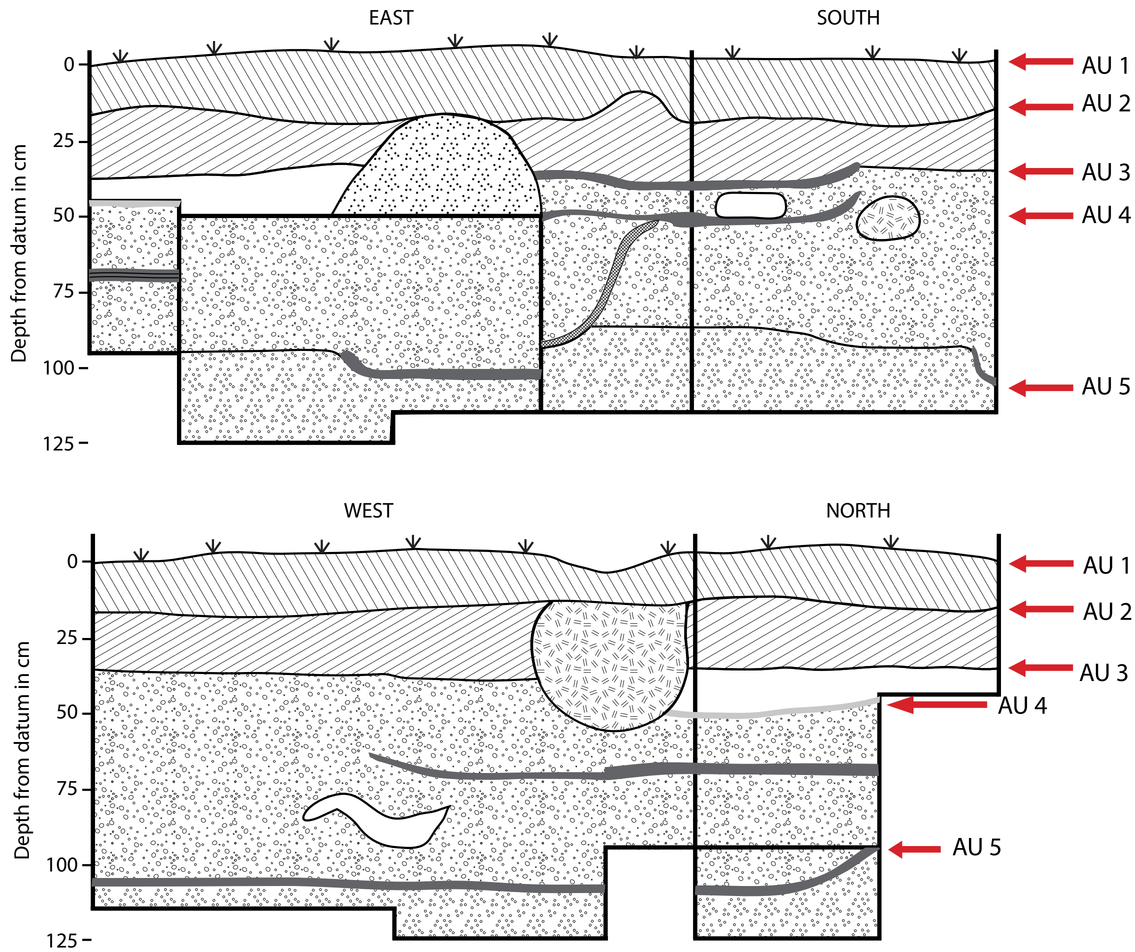

Figure 5.5: Unit E Profiles

architectural remains were identified. These sites, 541 and 502.3 (Figure 5.4) yielded the evidence for cultivation of domestic crops and use of domestic animals in the Gobnangou region. At the same time, their faunal assemblages suggest significant movement within the greater region and continued exploitation of wild resources, notably fish. The Pwoli ceramic assemblage, which consisted primarily of thin quartz and/or grog tempered pottery with polished surfaces and lightly impressed decoration was, with one exception, confined to these excavation contexts. In this section, the architecture, material culture, and economic data for the Pwoli occupation are described by site: a synthetic discussion follows in the next section.

Site 541

Site 541 is a large mound that sits near a seasonal pool slightly over 200 meters from the current banks of the Koabu drainage. It rises at least 4 meters above the

	Analytical Units	AU5	AU4	AU3	AU2	AU1	Surface
	Depth	105-25 cm	50-105 cm	40-50 cm	20-40 cm	0-20 cm	NA
	Volume (m^3)	0.22	0.84	0.2	0.4	0.4	NA
CERAMICS	N	4	149	56	97	260	142
	N/m^3	18	177	280	355	650	NA
	Weight (g)	107	1174	339	838	3185	
	g/m^3	486	1398	1695	2095	7963	NA
	grog temper	75.0%	62.4%	62.5%	73.1%	61.9%	62.2%
	quartz temper	25.0%	35.6%	28.6%	23.7%	34.2%	31.7%
	grog & quartz temper	0.0%	2.0%	7.1%	3.1%	3.8%	2.8%
	mica temper	0.0%	0.0%	1.8%	0.0%	3.8%	1.4%
	polished, no slip	75.0%	49.7	41.1%	54.6%	51.5%	3.5%
	red slip	0.0%	4.7%	7.1%	6.1%	5.8%	2.1%
	decorated	0.0%	14.8%	12.5%	16.5%	13.8%	29.6%
	N decoration techniques	0	11	3	7	12	10
	N decoration techniques per 100	0	7.4	5.3	7.2	4.6	7.0
	mean sherd thickness (mm)	15.2	9.3	9.6	9.4	9.8	11.7
	diameters (cm)	NA	15	NA	24	24, 13, 10	28. 15

Table 5.2: Characteristics of the Unit E ceramic assemblage

surrounding landscape, and is over 1300 m^2. The surface of the site is covered with a dense layer of laterite pebbles mixed with pottery and fragmented animal bone.

In 2004, a small shovel test was dug into the surface at the peak of the mound to determine whether the archaeological deposits were superficial. Although few artifacts were recovered, an intact ash lens over 4 cm thick was identified from ca. 20-25 cm depth. A sample of this lens was taken from the profile to ensure its integrity, and resulted in an AMS date of cal AD 890-1020.[4]

In 2006, a slightly larger excavation, Unit E (1 x 2 m) was opened at the site (for detailed description, see Appendix B), the deposits of which can be divided into five analytical units (AU) (Figure 5.5). The site was originally founded on a natural rise

4 Unless stated otherwise, all radiocarbon dates are gven at the 2-sigma range.

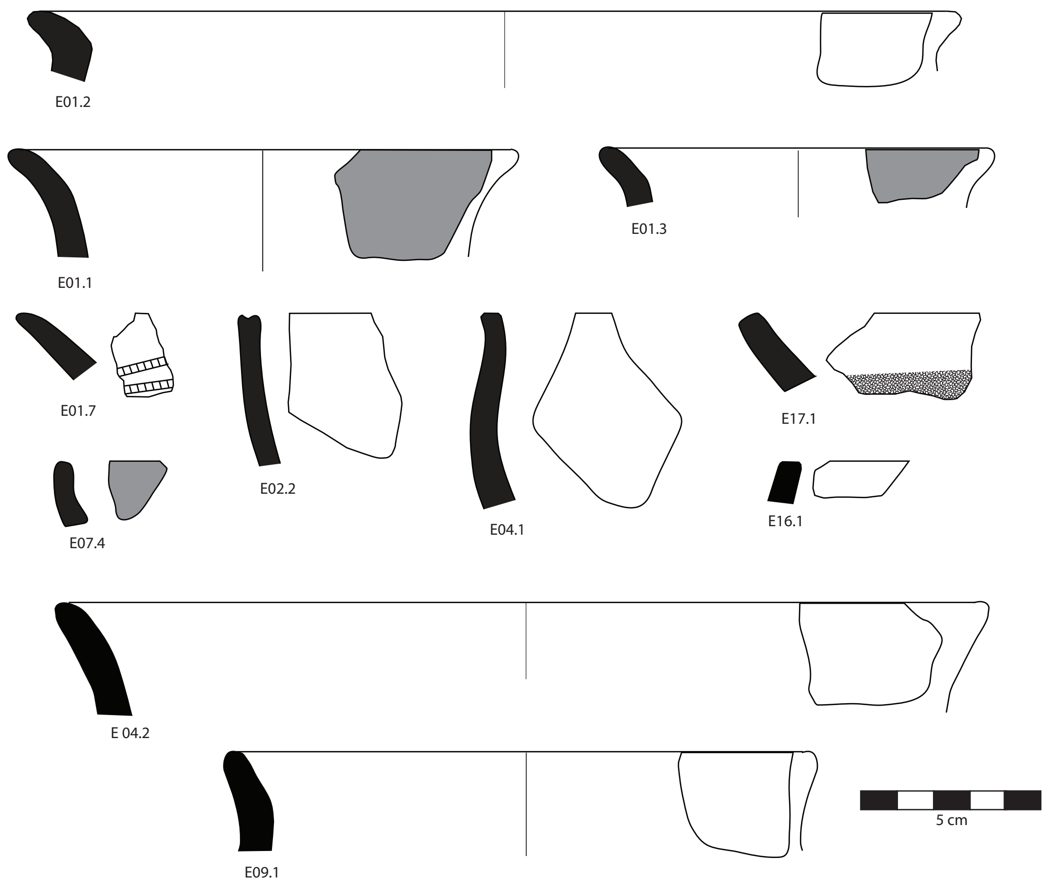

Figure 5.6: Unit E Ceramics

composed of sticky, heavy, and homogenous gray clay (AU5). Above this base was a series of three stratified structures with orange pebble and clay floors (AU4), the first of which had been dug into the natural clay. Most of the floors were composed of several laminae, and in the most recent instance, a 10 cm deep fill layer had been placed between reflooring episodes. No walls survived, and a puddled mud building technique is assumed from the texture of the fill. A radiocarbon sample from a burned feature above the oldest floor yielded a date of cal AD 680-990. The upper layers of the unit were divided into three strata. The first (AU3), is located directly above the most recent floor, but is heavily disturbed by rodent activity and an intrusive burial. AU2 is a fill layer with no discernable features that has also been significantly impacted by rodent activity. Finally, the topsoil (AU1) has a coarser texture and denser artifacts: this is likely evidence of significant deflation.

Unit E yielded 566 ceramics (an additional 142 sherds were collected from the surface of the site outside the boundaries of the unit) (Figure 5.6, Table 5.2).[5] The

5 An overview of the ceramic recording methodologies and assemblage characteristics for the study region is provided in Appendix A.

	Site 541 Unit E		Site 541	Site 502.3 Unit A		Site 502.3	Site 902
	AU 3,4,5	**AU 2,1**	**Surface**	**AU 2,3**	**AU 1**	**Surface**	**Surface**
Number	209	357	142	103	309	69	77
CC						*1*	
CH	**1**	**4**	**1**	**5**	**2**		**1**
CI				**2**			
COI		1					
CT						*2*	
DC		**2**	**2**	**3**			**1**
DI					1		
FCI	**1**			**2**			
FI							*1*
G							*2*
IB	**1**					**1**	
IC		1					2
LIPCH		**1**		**1**			**2**
MAC			*1*				*4*
MCT			*1*			*1*	
MLI	**1**						
PB				**1**			**1**
PC	**1**	**2**		**7**	**4**	**2**	**3**
R1	**2**			**1**			
R4							*1*
SC		2				1	
SCOR	**3**	**1**					**1**
XC						*1*	
Cord 1		1	1		3		
Cord 2	**7**	**22**	**26**	**22**	**16**	**8**	**19**
Cord 3	**2**		**2**	**2**	**2**	**1**	**4**
Cord 4		**4**		**1**	**1**		**1**
Cord 5					1		
Cord 6			**3**	**1**		**3**	
Cord 7				**1**		**1**	
Cord 9	**5**	**2**		**6**	**2**		
Cord 14							*1*
Cord 15			**2**	**1**			
Cord 16		4					

Table 5.3: Decorations from the Pwoli Ceramic Assemblage

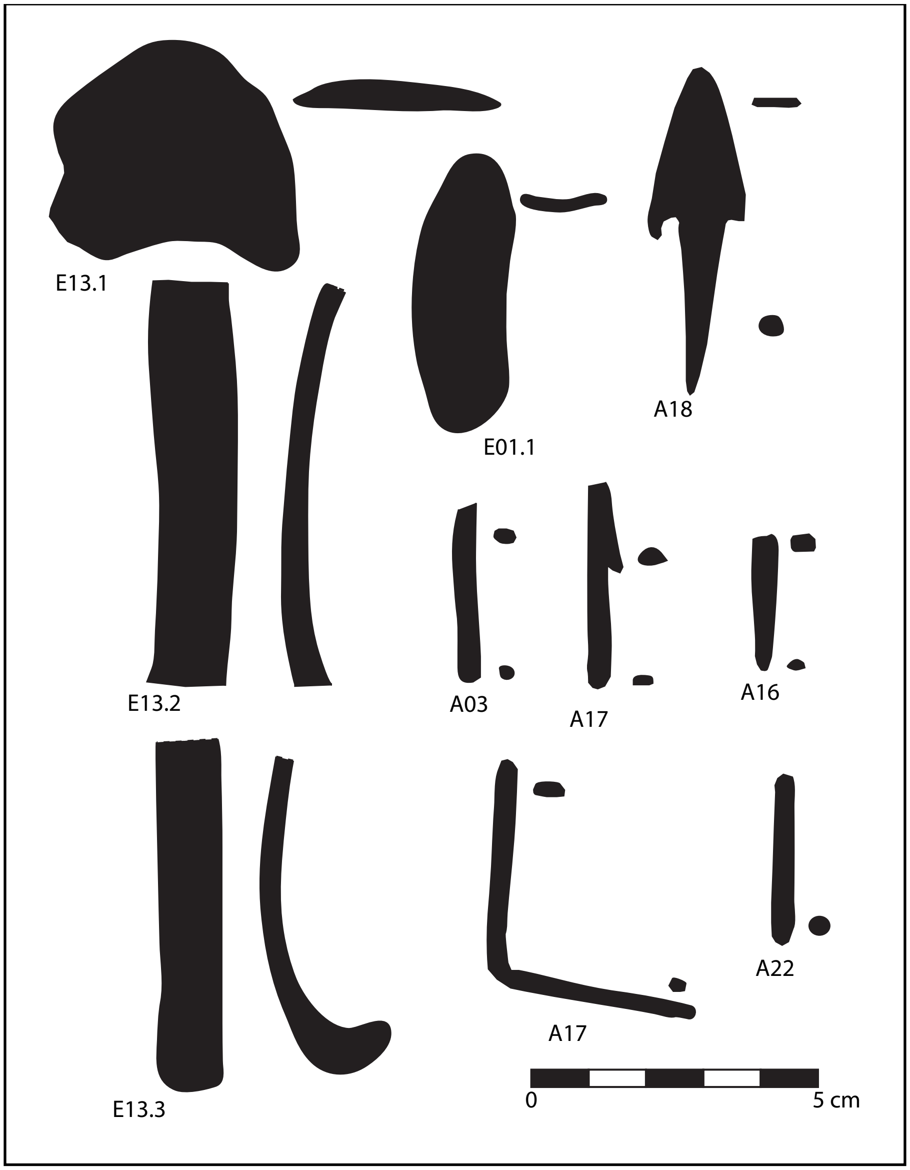

Figure 5.7: Iron objects from Unit E and Unit A

Unit E assemblage was characterized by grog and quartz tempers (occasionally used in combination)[6], polished vessel surfaces, infrequent use of red slip, and diverse, lightly impressed decorations that were either zoned or only applied to a limited set of vessels. Cord 2 was by far the most frequent decoration (36% of decorated sherds), with the remaining sherds represented 17 different techniques (Table 5.3). Of these 17, Cord 16 was the only technique confined to Unit E: the four examples come from a single stratigraphic level, and may be from the same vessel. Even though all other techniques were also used in subsequent phases, the versions in Unit E tended to be smaller and more gently impressed or rouletted on the vessel, creating a distinct visual appearance.

6 There are elements of the Siga occupation ceramic assemblage on the surface: consequently, the isolated micaceous sherds are likely intrusive.

Species	Common Name	AU1	AU2	AU3	AU4	Total
Wild Ungulates						
Hippotragus equinus	Roan Antelope		2			2
Alcelaphus/Damaliscus	Hartebeest/Topi	4	1			5
Cephalophus sylvicultor	Yellow Backed Duiker	1				1
Sylvicapra grimmia	Bush Duiker	1				1
Primate						
Cercopithecus patas	Patas Monkey	1				1
Rodent						
Thryonomys swinderianus	Marsh Cane-Rat	5	2		1	8
Tatera sp.	Gerbil		5			5
Fish and Aquatic Resources						
Auchenoglanis sp.	Catfish	1				1
Clariidae	Catfish	3	3		1	7
Lates niloticus	Nile Perch				2	2
Synodontis sp.	Catfish		1		3	4
Tilapia	Tilapia	1	2		1	4
Unknown Silure	Catfish	1			1	2
Freshwater Mollusc fragments (f)		12f				12f
Size Classed						
Small		2		1		3
Small/Medium		5				5
Medium/Large		6	4	2	2	14
Large		5				5
Total Number		36 + 12f	20	3	11	70 + 12f

Table 5.4: Animal Bone from Unit E, after Stephen Dueppen

Most of the sherds recovered were very fragmented (67% of sherds were less than 4 cm^2), making it difficult to address vessel form, although when diameters could be taken they were generally under 25 cm. The thin walls (mean 9.6 mm) also could be an indicator of smaller vessels. A polished piece of red ochre, recovered from AU4, could indicate that ceramics were made on site, although given the general lack of red slip, it may have been used for other purposes. Other than a few surface sherds associated with the Siga occupation, no stratigraphic patterns could be identified within the ceramic assemblage. The high level of fragmentation suggests that most of the sherds are from secondary contexts: it is possible that they were included in the puddled mud likely used to build structure walls, which could indicate an even older occupation near the site.

			Fish Size (cm)					
			0-10	10-20	20-30	30-40	40-50	50-60
UNIT E	AU1	*Auchenoglanis* sp.						
		Clariidae	1		1	1		
		Tilapia		1				
		Unknown Silure						
	AU3	Clariidae						1
		Tilapia			2			
		Synodontis sp.	1					
	AU4	Clariidae						1
		Tilapia				1		
		Lates niloticus				2		
		Synodontis sp.				2		
		Unknown Silure						
UNIT A	AU2	Tilapia		1				
	AU3	Clariidae				1		
		Tilapia			1			

Table 5.5: Size of fish from Pwoli occupation excavations, after Stephen Dueppen

In addition to ceramics, groundstone, flint, slag, and iron objects were recovered from Unit E. A white sandstone groundstone fragment, visible in the profile, was resting on the lower floor of the uppermost structure: while probably originally used for grinding foods (see discussion in Chapter 6), this particular fragment was only 6 cm wide, and clearly a discarded remnant. Its position between floors could indicate a period of abandonment between reflooring episodes. A gray flint flake and a small piece of quartz debitage were recovered in AU4 as well. Three large pieces of iron (two shaft fragments and a flat point, likely from the same object) were recovered from trash deposit outside the second structure (Figure 5.7). Finally, two small pieces of smithing slag were recovered from surface deposits.

Unit E contained over 40 identifiable animal bone fragments, all from wild species (Table 5.4).[7] Interestingly, while the material culture shows little variation over the course of the occupation, there is a significant transition in the fauna from an early assemblage dominated by fish to one including a broad range of species. Most of the fish species recovered from AU4 could not have been caught in the area of the site (Table 5.5). Several favor deep channels with high oxygen levels and even those species that could survive the oxygen depleted water common in floodplains and seasonal channels

7 The animal bone analysis was performed by Stephen Dueppen

Excavation Unit		SITE 541, UNIT E			SITE 502.3, UNIT A	
Analytical Unit		AU4	AU3	AU2	AU3	AU2
Samples (N)		9	2	2	5	4
Total Liters		17	4	4	9	8
Identified Seeds (N)						
Family	**Scientific Name**					
Domesticated Crop Plants						
GRAMINAE	*Pennisetum glaucum*	x				
Tree Fruits						
BOMBACACEAE	*Adansonia digitata*	x	x	x	x	x
Weeds and Other Identified Plants						
AIZOACEAE	*Trianthema portulacastrum*					x
AMARANTHACEAE	Unknown	x				
CYPERACEAE	*Scleria* sp.				x	
GRAMINAE	Tribe Paniceae	x				
GRAMINAE	Unknown		x		x	x
LEGUMINOSAE	PAPILLIONOIDEAE, A Type				x	x
LEGUMINOSAE	Unknown					x
MALVACEAE	*Sida* sp.	x				
MOLLUGINACEAE	*Glinus* sp.					x

Table 5.6: Identified Carbonized Seeds and Fruits from Pwoli Occupation Excavations

are represented by abnormally large specimens that would usually favor major rivers (*Lates niloticus*, large *Synodontis* sp.). The Kourtiagou River, which flows most of the year, is 13 km from Site 541, and the Pendjari River is 25 km: these rivers are a more likely source for this fish assemblage than the Koabu and its feeder drainages.[8] The few mammal bones in AU4, which included cane rats, represented species that could easily have been found near the site. Cane rats favor the margins of marshy areas and frequently raid fields. With their large size (up to 9 kg), they were commonly consumed historically.

The faunal assemblage from AU2 and AU1 is very diverse and suggests a wide range of hunting techniques employed in the exploitation of multiple ecological niches: the animals represented favor gallery forests, swamps, and grasslands. Cane rats, bush duiker, and patas monkey could all be found near the site and in fields. Significantly

8 While the first millennium AD is widely considered wetter than the second millennium AD, an assertion supported by the presence of species like the yellow-backed duiker, the likely difference is not sufficient to make the Koabu drainage a river suitable for the fish identified in AU4. As described above, the charcoal assemblage at Pentenga suggests a mixture of savanna and dry forest vegetation, and as will be seen below, baobab (*Adansonia digitata*) and pearl millet (*Pennisetum glaucum*), which favor savanna environments, were recovered from the Unit E botanical samples.

larger animals such as roan antelope and hartebeest/topi may also have lived near the site, although they would have been more difficult to hunt or trap opportunistically. The yellow-backed duiker is a particularly interesting find, as they are solitary animals that favor dense forests in significantly wetter environments (although they may move into drier areas along riverine strips); they are not known in Burkina Faso in the historic era. Fish remain a common element of the diet, but the species and size distribution changes dramatically to indicate fishing in the seasonal drainages, pools, and inundated areas near the site in the later part of the occupation. While the transition in fishing strategy is unambiguous, the absence of many of the mammal species from the early levels of Unit E could be simply a question of context: AU4 samples are mostly from interior locations, and the bones recovered were universally small (thus favoring the identification of fish and cane rats).

In contrast to the rich animal bone assemblage, botanical samples from Unit E yielded few identifiable remains (Table 5.6)[9]. The most common were seed coat fragments of baobab *(Adansonia digitata*), which were present in every level. A single domestic pearl millet grain was recovered from the lowest levels of the unit.

Site 502.3

Site 502.3 is a large mound perched on the edge of a broad, shallow seasonal drainage: the highest area (where the 2 x 2 m excavation unit, Unit A, was placed) is at least 4 meters above the agricultural plain to the south, while the drop off to the north is a steep 6-7 meters into the drainage. The site is part of a cluster of several mounds along this drainage, all of which have surface ceramic assemblages that are characteristic of the Siga occupation. In the case of Site 502.3, the Siga elements of the assemblage were in general confined to the topsoil, although some may have intruded into the lower layers of the unit through the numerous burial pits and rodent dens.

Due to these numerous sources of disturbance, Unit A could only be divided into three analytical units, not including the soft laterite of the rocky outcrop on which the site was founded (Figure 5.8). The rock base was rough and uneven, with numerous small pockets of cultural deposits. In the eastern half of Unit A, this surface was encountered at only 65 cm depth, although it dropped off sharply to ca. 80 cm in the west. Directly above the bedrock (AU3) was a cultural layer, in which the only identifiable feature was a burned ring of soil in the east profile, from which almost no ash was recovered (see discussion below). At least two burial pits cut through this level: the burials appear have

9 Wood charcoal analysis has not yet been completed on the botanical samples. The results presented here are for seeds only.

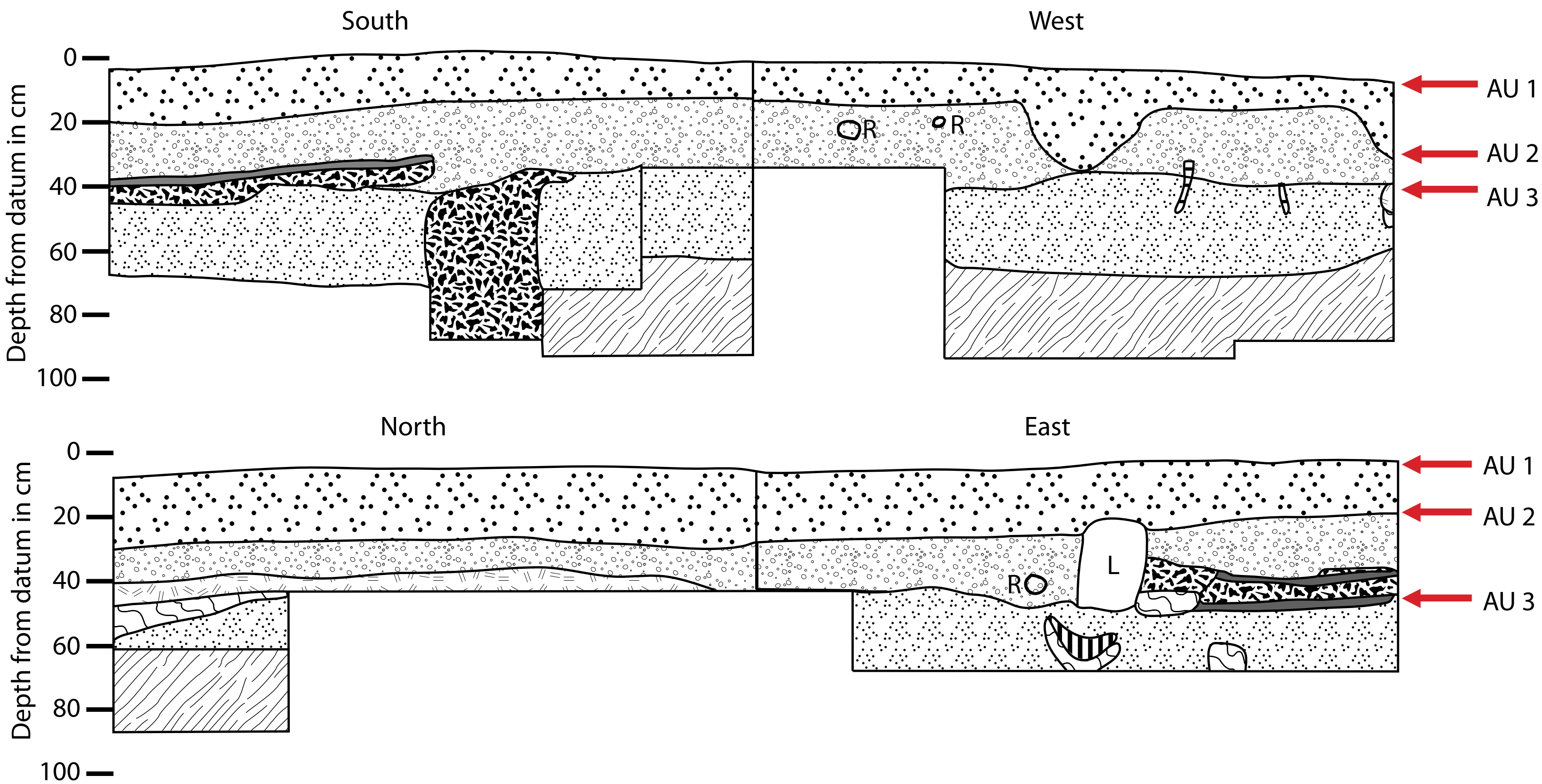

Figure 5.8: Unit A Profiles

	Analytical Units	AU3	AU2	AU1	Surface	Site 902
	Depth					NA
	Volume (m³)	1.15	0.87	0.8		NA
CERAMICS	N	116	193	103	69	77
	N/m³	100	221	128		
	Weight (g)					
	g/m³					
	grog temper	94.8%	89.1%	91.2%	81.2%	50.6%
	quartz temper	5.2%	7.3%	4.9%	17.4%	35.1%
	grog & quartz temper	0.0%	2.1%	1.0%	1.4%	14.2%
	mica temper	0.0%	1.6%	2.9%	0.0%	0.0%
	polished, no slip	40.5%	32.6%	7.8%	4.3%	12.9%
	red slip	3.4%	3.6%	8.7%	14.5%	10.4%
	decorated	21.6%	19.7%	36.9%	34.8%	31.9% in sys
	N decoration techniques	11	13	10	12	15
	N decoration techniques per 100	9.4	6.7	9.7	17.3	19.0
	mean sherd thickness (mm)	10.7	9.8	9.7	10.8	11.6
	diameters (cm)	17-30	11-34	NA	26, 19	25, 26

Table 5.7: Characteristics of the Unit A ceramic assemblage

been interred on the bedrock surface.[10] The only structure of the unit was identified at ca. 30-40 cm (AU2). It had two layers of orange clay and pebble floors that are clearly visible in the profile, although in practice they were patchy and degraded, making the exact structure boundaries difficult to identify. A charcoal sample from the edge of the floors was AMS dated to cal AD 890-1020. The rim of a pot was buried upside-down at the same level in the northwestern part of the unit, to the exterior of the structure: there was no evidence of the base, and it is uncertain whether the pot was intentionally placed here or simply discarded. Pots buried upside-down were identified in the profiles of borrow pits at multiple sites with Siga occupation ceramics, raising the possibility that this is an intrusive feature. Finally, the topsoil layer (AU1) was relatively undisturbed, with lower densities of ceramics than deeper levels.

10 The burials were pedestalled and left undisturbed.

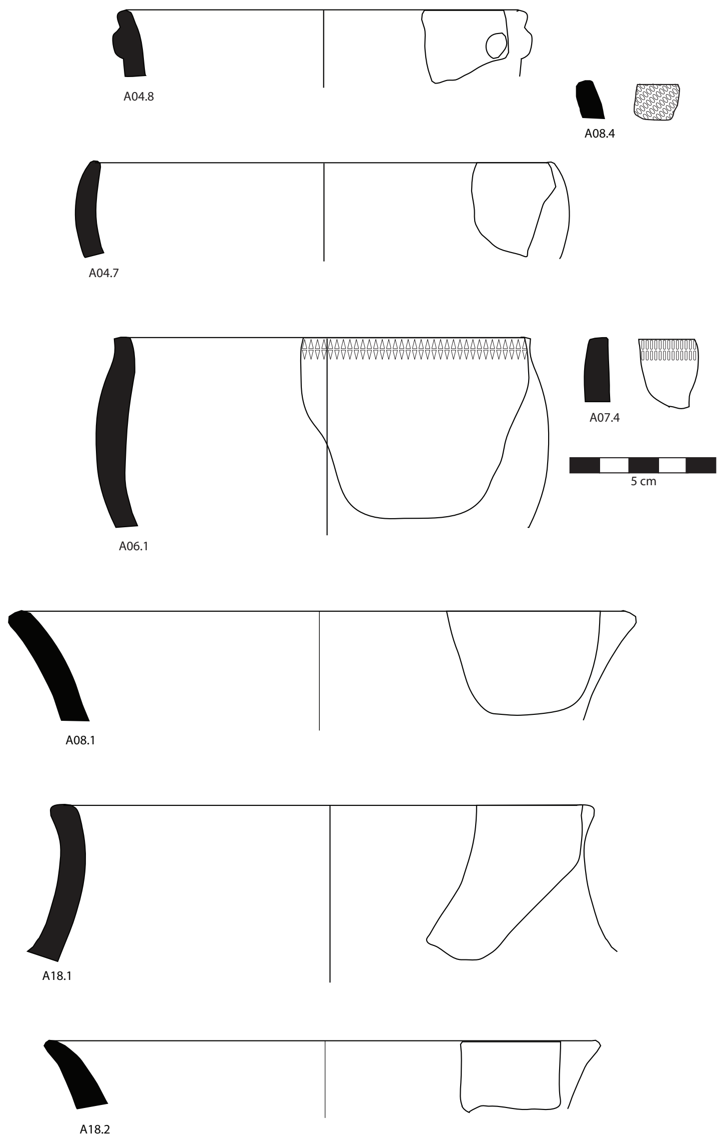

Figure 5.9: Unit A pottery

Unit A yielded 412 ceramics and an additional 69 sherds were collected from the site outside the boundaries of the unit (Figure 5.9-10, Table 5.7). This surface assemblage differed from the Unit A assemblage due to the higher representation of Siga occupation ceramics, which complicate interpretation, particularly given the intrusive burial pits that cut through the unit. Unit A ceramics had many similarities to Unit E: notably low incidence of red slip and high incidence of polish. Decorations were similarly diverse (18 techniques, 13 of which were also identified in Unit E) and in most cases lightly impressed, although decoration rates were higher and deep impressions more characteristic of the Siga occupation were not uncommon (Table 5.3). In contrast to

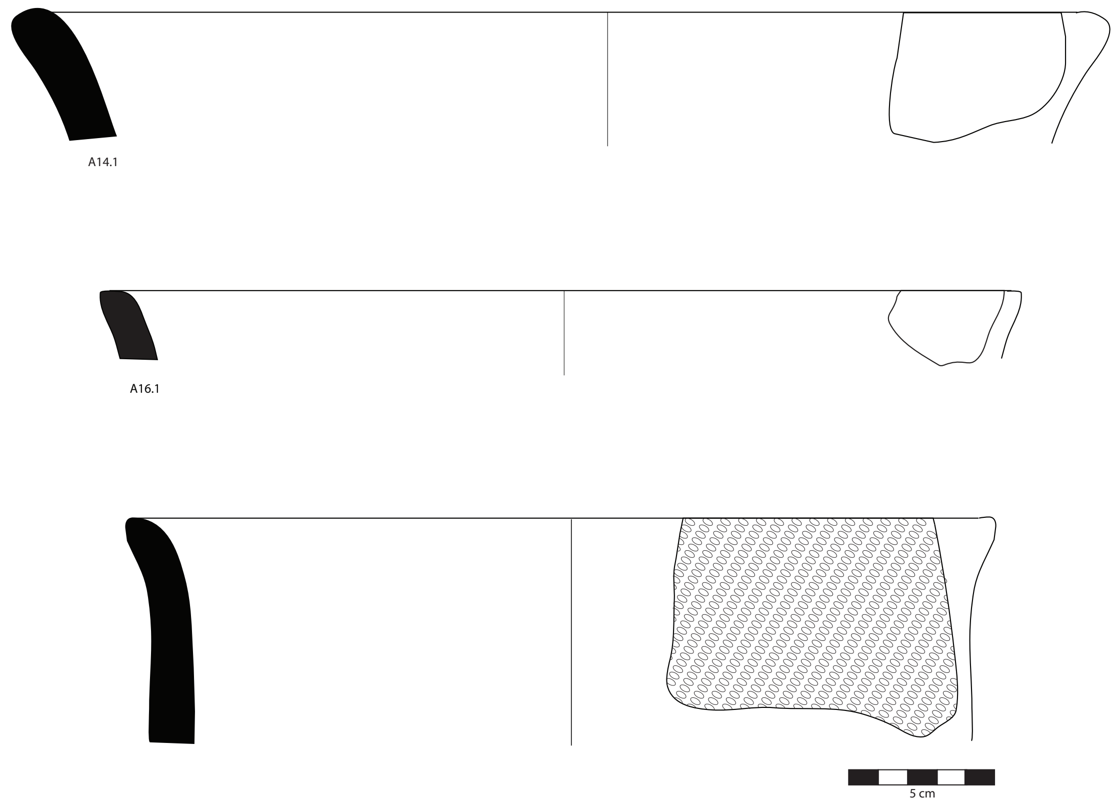

Figure 5.10: Unit A Pottery

Unit E, Unit A pottery was ca. 90% grog tempered, with quartz and quartz-grog mixtures represented in low numbers.

Unit A ceramics were less fragmented than those of Unit E, although 47% of sherds were less than 4 cm^2. Vessels were slightly larger, with diameters reaching 34 cm, and vessel wall thickness was similar or slightly higher than for Unit E, but the general trend of small, thin vessels essentially holds for Unit A as well. The upside-down rim mentioned above is the largest vessel recovered: an open, slightly flaring undecorated pot with grog temper, it has a rim diameter of 34 cm, and a neck diameter of 30 cm.

Like Unit E, groundstone, flint, iron objects, and possible slag were recovered from excavation. Groundstone fragments, made from white sandstone, were recovered from AU1 and AU3. All three pieces were from the basal portions of grinding stones, and were small discarded pieces. Flint debitage was recovered from throughout the unit, with the highest concentrations in the upper levels. Iron objects, mostly shaft fragments, were present in AU2 and AU3, although two arrowheads or spear points were found near the bedrock in the eastern half of the unit (Figure 5.7). The points and shafts were more similar stylistically to the delicate arrows identified during the Siga occupation (see Chapter 6), than the large, bulky point from Unit E.

Species	Common Name	AU1	AU2	AU3	Total
Domestic					
Bos Taurus	Cattle		1	1	2
Ovis/Capra	Sheep/Goat		1	2	3
Wild Ungulates					
Hippotragus equinus	Roan Antelope			1	1
Alcelaphus/Damaliscus/ Kobus	Hartebeest/Topi/Kob		1		1
Redunca redunca	Bohor Reedbuck		1		1
Sylvicapra grimmia/ Ourebia ourebi	Bush Duiker/ Oribi	1			1
Cephalophus maxwelli	Maxwell's Duiker		1	2	3
Carnivores					
Ichneumia albicauda	White Tailed Mongoose			1	1
Felis serval	Serval		2		2
Rodents					
Thryonomys swinderianus	Marsh Cane-Rat		3	1	4
Mastomys sp.	Multimammate Rats			4	4
Fish					
Clariidae	Catfish			3	3
Tilapia			2	2	3
Size Classed					
Very Small		1	1	1	3
Small			4	2	6
Small/Medium			6		6
Medium/Large			5	9	14
Large			1		1
Total Number		2	28	29	59

Table 5.8: Animal Bone from Unit A, after Stephen Dueppen

Finally, vitrified iron-rich soil was recovered from the burned feature described above. This feature initially appeared to be circular, but after cleaning the profile, it did not clearly continue into the wall at both ends, and may simply be an arc. The vitrification, localized in a very small area, suggests burning at a very high temperature (or possibly repeatedly through time), however, no charcoal was recovered during excavation, and even flotation of the feature contents yielded minimal carbonized material.

The animal bone data from Unit A indicate some significant changes in the domestic economy (Table 5.8). While in general, the wild fauna and fish assemblage suggest hunting and fishing strategies similar to those in the later phases of Unit E, domestic animals including dwarf cattle and sheep/goat are equally common in all analytical units. The wild fauna includes roan antelope and Maxwell's duiker, which, like the yellow-backed duiker described for Unit E, prefers a wetter, more forested environment than is found in the region today. Cane rats are once again among the most frequently recorded animals, although they are joined by a white-tailed mongoose, which is commonly found in cleared areas and former forests. Likewise, a serval cat, which favors forest and marsh margins, was also identified. The fish of Unit A tend to be species commonly found in floodplains and seasonal drainages: due to their small size, some could even inhabit remnant pools that last deep into the dry season (Table 5.5).

The botanical assemblage from unit A, while significantly more diverse than that of Unit E, is still very small and lacks any direct evidence of domesticated crops (Table 5.6). Most of the identified seeds are from weedy or ruderal species such as *Scleria* sp. (which is often found in young fields) and *Trianthema portulacastrum* (which favors inhabited areas). The most common seed was an unknown Leguminosae-Papillionoidae: their small size likely indicates that they are from a smaller herbaceous or woody plant. Like Unit E, baobab shell is present in every sample.

Site 902

Since the Pwoli ceramic assemblage was largely absent from surface deposits, it was difficult to identify other potential Pwoli sites in the region. Site 902 has numerous similarities to Pwoli occupation sites. The site is mounded, with fairly dense ceramics and pebbles on the surface. The ceramics have a superficial similarity to those of Sites 541 and 502.3: they have high rates of polish for a surface assortment, low rates of red slip, and a mixture of grog and quartz tempers, although they differ in important ways as well, e.g., increased decoration diversity and significantly higher average sherd thickness (Table 5.7). Site 902 was also particularly notable for the high density of animal bone on the surface: a phenomenon only observed here and at Site 541.

Building in Place: Architecture, Material Culture, and Economy of the Pwoli Occupation

Architecture

Residents of Sites 541 and 502.3 utilized similar construction techniques. The architectural fill of these mounds was composed of mud mixed with laterite pebbles (typical of the material used to build structures in the region today). No bricks could be identified, which suggests the use of a puddled mud or wet wall technique, in which hand formed moist mud balls are used to build up walls in a spiraling manner (Prussin 1969, Geis-Tronich 1991)[11]. Floors were composed of orange clay, mixed with a low density of laterite pebbles. This mixture was applied in thin strata (ca. 1-2 cm thick), and pounded to create a durable surface. In some cases, new floor surfaces were applied directly over other ones, while in other cases, a 7-10 cm layer of fill was present between floor surfaces. With small excavation units, degrading floor surfaces, and poor wall preservation, it was not possible to determine the shape or size of structures.

Curved burnt features, neither of which could be associated with floors, were excavated at both Sites 541 and 502.3. In Unit E, the feature was charcoal rich, with the burned surface along the convex side of the arc. In contrast, the Unit A burn feature lacked carbonized material and was burned along the concave side of the arc. Interestingly, both sites were used for burials following abandonment. However, since these were not excavated, it is not currently possible to assess whether the burials are evidence of continued links to the sites, or simply convenient locations on high ground: Sites 541 and 502.3 are adjacent to both Siga occupation sites and currently occupied residences.

Given the lack of surface evidence for the Pwoli occupation, even at sites like 502.3, where it was the primary subsurface component, it is difficult to assess the distribution of habitation in space. However, the presence of multiple flooring sequences at Site 541, and at least one instance of reflooring at Site 502.3 suggest repeated or continuous use of these sites through multiple construction episodes. As will be seen in Chapters 6 and 7, this is in sharp contrast to subsequent occupations.

Ceramics

Ceramics in the savanna zone of West Africa are common from the first millennium BC onward, and are present at archaeological sites in the study region at

---

11 Formed and dried bricks often preserve in archaeological deposits, particularly along the bases of walls (e.g., Dueppen 2008, McIntosh 1995).

an even earlier date. However, the Pwoli occupation is the first occupation in which ceramics are the dominant artifact class.

In attempting to define the Pwoli ceramic assemblage, it is easier to identify what is absent or rare (red slip, micaceous or lateritic tempers, large diameter vessels, sherds over 15 mm thick) than features that can be used to characterize the assemblage. The relative frequency of paste formulas differs significantly between Sites 541 and 502.3, and while there are strong similarities in the range of decoration techniques in use between the two sites, notably the dominance of Cord 2, and the use of Cord 3, Cord 9, Cord 15, Roulette 1, and dragged comb or parallel channels (Table 5.3), each site has unique decorations as well.

Archaeologists have often assumed links between ceramics and mobility, and for many years, ceramics were particularly associated with sedentary, agricultural lifeways. While ceramic manufacture and transport poses certain challenges in a mobile environment (e.g., weight, durability, production scale, etc., Arnold 1985), there are numerous exceptions and mobile groups often employ creative strategies such a caching at locations with predictable seasonal resources to facilitate ceramic use (Eerkens 2003). Pwoli occupation ceramics are thin and vessels tend to be small, qualities that could make them easier to transport. At Site 541, where the fauna assemblage implies significant seasonal mobility, these trends are more pronounced and quartz temper could have added durability to transported vessels.

Many researchers argue that the primary factor in the adoption of pottery is not mobility or logistics, but rather functional aspects of diet and food preparation driven by environmental constraints or cultural preferences in cuisine (Rice 1999, Harry and Frink 2009). Ceramic vessels are strongly associated with the consumption of foods that are best processed by boiling or simmering for an extended period of time: these include grains, shellfish, and nuts (Arnold 1985, Stahl 1993, Rice 1999).[12] In the study region, pottery could have been important for cooking pearl millet and sorghum, and for rendering the vegetable fat from shea butter nuts.[13] The grains both have low gluten content and consequently are rarely baked into breads, while processing shea

12 Haaland (1995) has argued that in this sense pottery can encourage sedentism, since it increases the exploitability of resources in a given location, although this link has not been established for the West African savanna. Specifically, pottery technology was available in the study region for hundreds of years before becoming the predominant artifact class during the Pwoli occupation.

13 In northern Ghana during the 1st millennium BC, a significant increase in pottery quantities between the Punpun and Kintampo phases is associated with more intensive exploitation of oil palm and, potentially, the introduction of pearl millet to the region (Stahl 1993, D'Andrea and Casey 2002). Stahl (1993) suggests that there may have been an accompanying shift in cuisine from "dry" cooking to "wet" cooking of foods available during both phases. Stahl (1993) also ties the accumulation of pottery during the Kintampo to a decrease in mobility.

nuts requires a length boiling process that is impractical without ceramic vessels. The increased use of ceramics during the Pwoli occupation could indicate a greater reliance on one or all of these resources.

Iron

During the Pwoli occupation, residents had access to forged iron objects. Although iron smelting technology was widespread in West Africa by the Pwoli occupation and, as discussed in detail in Chapter 6, all the raw materials necessary for smelting iron were present in the study region, we have no direct evidence that the recovered iron objects were locally produced.

While the organization of iron production cannot be addressed with the available data, a comparison of recovered iron artifacts from Sites 541 and 502.3 suggests a possible refinement in smithing techniques. The arrow or spear point from Unit E is significantly thicker and heavier than those from Unit A, and lacks the delicate tangs of the latter arrowheads. This difference could also be a question of function, particularly if the larger point from Unit E was meant for use with a spear while the smaller points from Unit A were intended for projectiles.

Economy

As described above, the botanical data for the Pwoli occupation is very limited. The single domestic pearl millet grain, from the earliest levels of occupation, could indicate cereal cultivation, although one grain cannot be considered conclusive. Given the evidence for a slightly wetter environment during the Pwoli occupation, pearl millet cultivation would likely have been on a small scale, supplemented with a wide assortment of other domesticates and wild plants. A moist climate could have favored more yam cultivation, which is very limited in the region today. The limited sample of grinding stones offers little further insight into the role of cereals, particularly since they can also be used for dried yams, sauce ingredients, and other materials (see Chapter 6). It is very possible that pearl millet was initially grown as a bridging crop since some varieties can produce grain in as little as 70 days, providing an important food source early in the rainy season when many wild plants have not yet matured (Swanson 1979).

A common feature in both units is the presence of carbonized shell from baobab seeds. Baobab fruits are widely consumed, and Duvall (2007) describes a common method of removing the pulp in which pods are soaked in hot water, and then discarded. Burkhill (1985:274) notes that pods are frequently burned to make a potash appropriate for soap manufacture. Baobab prefers drier climates and rarely occurs naturally in Guinean forests, although they are an anthropogenic species that is often found near settlements outside their usual distribution. The remaining identified seeds are common weeds, none of which are specific in their preferred environment, although many have ruderal tendencies.

The faunal data from Unit E and Unit A suggest increasingly localized exploitation of wild animal resources and a late adoption of domestic animals. Hunting patterns are fairly consistent between the two sites: residents appear to have employed a mixed strategy of big game hunting, possibly on organized expeditions, and small game hunting near the site. While ungulates are common targets, the potential importance of garden hunting, particularly of cane rat, to the diet should not be underestimated (Dueppen 2008). The increase in species favoring the margins of forests at Site 502.3 could indicate the clearing of land, possibly for cultivation.

The identification of fish from at least a day's walk distance is somewhat of an anomaly, given that the fish recovered both earlier, at Pentenga rockshelter, and later in the Pwoli occupation are all locally obtained. Freshwater fish are easily preserved through drying or smoking and traditionally smoked or dried fish can last for up to nine months, provided they are re-smoked or sun-dried every 4-6 weeks to maintain low moisture content (FAO 1989). Most likely, these fish would have been caught and preserved at specialized fishing camps during the dry season. At these times of year, major channels are easier to access and fish are confined to a smaller area. Additionally, the smoking of fish is more difficult (and sun-drying virtually impossible) during the rainy season due to high humidity, which further supports deep channel fishing as a dry season activity.

In contrast, fishing in floodplains and seasonal drainages is a more common activity**.** Fish in these areas are on average smaller, but require significantly less labor to catch and process. Because they are locally obtained, they could have been consumed fresh, although they may also have been preserved. This type of fishing is more common during the rainy season, when there is flowing water in the drainage and at the beginning of the dry season when fish are stranded in seasonal pools as the water recedes.

The faunal evidence from Unit A suggests that domestic animals have become a major component of the domestic economy. As these are dwarf varieties, they could have resided in the study region throughout the year: as described in Chapter 3, these animals are often penned in the rainy season to protect crops, then allowed to graze on fields during the dry season. The adoption of livestock in the savanna-forest margin is often associated with the intensification of local resource exploitation, notably farming. Since animals are generally consumed infrequently for meat, one of their primary economic roles is as producers of manure. The manure provides an essential fertilizer (especially when accumulated in pens) particularly for gardens cultivated directly outside the residence (and in some cases, even year-round). Dwarf livestock also inhibit mobility, as they require supervision and do not travel well over long distances, preferring to remain near their residence. Finally, livestock are commonly associated with the accumulation of wealth.

The Pwoli Occuption in Regional Context

Many of the changes from the LSA to the Pwoli occupation (i.e., increased use of ceramics, cultivation of pearl millet, herding of dwarf livestock, and iron smelting) are documented at much earlier dates in other parts of the West African savanna-forest margin. Given our very small sample size for the LSA and Pwoli occupations, it is difficult to make the argument that these resources were not in use prior to the Pwoli occupation, especially given the light footprint of low level cultivation. The charcoal sequence from Pentenga indicates increased levels of burning from the early 1st millennium BC, which could be indicative of clearing land for cultivation, or of attempts to encourage fodder growth to attract wild animals (Frank et al. 2001). Perhaps the strongest argument can be made for a late adoption of livestock, since domestic animals are not present at either Pentenga or Unit E.

The Pwoli occupation has numerous similarities to the sequence described by Petit (2005) for northern Benin ca. 100 km to the southeast. In both cases, the first mounded settlement sites date to the mid-late 1st millennium AD, and preserved architecture consists predominantly of occasional orange plaster floors. While the pottery has some visual similarity to sites in the north of the Atakora mountains (Petit, personal communication), it differs in its specifics, notable temper, vessel thickness, and decoration techniques. String roulettes are not used in northern Benin, while the twisted Cord 2 is the dominant decoration in the study region. Like the Pwoli occupation, iron objects, usually points or shafts, are found at all sites, but there is little evidence for smelting. Sites in northern Benin are substantially larger, however, than Pwoli occupation sites, with many reaching over 2 ha.

In northern Benin, domesticated sheep, goat, and large (not dwarf) cattle are present in the first millennium AD. Although the complete animal bone assemblage was not presented, preliminary analysis indicates that hunting was focused on smaller wild animals, like hares and small ungulates, and fishing was predominantly confined to shallow water. The botanical data indicate the use of pearl millet and sorghum, in addition to tree fruits. Like the study region, baobab shell was one of the most frequently recovered carbonized remains.

Discussion

Events leading up to the Pwoli occupation in the Gobnangou region generally indicate a fairly mobile foraging adaptation, employing a diverse broad spectrum economic strategies that produce only a limited archaeological signature. By the beginning of the Pwoli occupation a gradual adoption of domesticated crops had likely already begun, and the Pwoli occupation is marked by increasing localization and the first evidence for sedentary occupations (at least on a regular, seasonal basis). Data from Unit E suggest the incorporation of pearl millet into a still fairly extensive broad spectrum strategy. Architectural remains indicate an increasing investment in place, probably derived from the seasonal attachment to crop fields, yet the fauna spectrum suggests wide-ranging use of the landscape in the procurement of wild resources, notably fish.

Data from Unit A suggest the emergence of a domestic economy that could be considered typical of the West African savanna by the end of the first millennium AD. Farming begins to expand (as predicted by the Pentenga charcoal sequence), and domestic animals are incorporated. However, a strong commitment to wild plant and animal resource persists. In general, the sequence indicates that, as in other parts of the world, the incorporation of domestic resources occurred on local terms in the context of local processes.

CHAPTER 6
SHIFTING SETTLEMENT AND HOUSEHOLD NETWORKS: THE SIGA OCCUPATION

The Siga occupation (ca. AD 1100-1650) is the second of the temporal divisions I defined for the study region, and represents a significant transition from the Pwoli occupation. The relatively rare settlement mounds with multiple flooring sequences are replaced by literally hundreds of small, shallow sites produced by generations of shifting settlement, during which households were widely spaced and probably fairly autonomous in their daily activities. At the same time, the increased complexity of the ceramic tradition and the appearance of a few specialized sites for activities such as iron working suggest a new level of regional integration and the possible development of larger social and economic networks.

Unfortunately, as excavations of Siga sites yielded relatively little information (see below and Appendix B), my characterization of this phase is drawn primarily from the analysis of surface artifacts and the nature of the sites themselves. While this reliance on surface deposits significantly impacts chronological control and creates difficulties in comparing the artifact assemblages of individual sites in a meaningful and reliable manner, the breadth of data available allows (and requires) a truly regional approach to analysis.

The Siga Occupation: Farming the Drainage Catchment

Siga occupation sites are by far the most numerous in the study region, as the occupation encompasses 344 of the 521 sites identified. Sites were assigned to the Siga occupation at two levels of confidence using methods described in detail in Appendix A. Low confidence sites (n=89) had an almost identical distribution to high confidence sites (n=255), and are only discussed when they differ significantly. Additionally, a number of sites (n=52) were identified as having multi-component ceramic assemblages. While these sites are included in all discussions of spatial distribution, analyses of

Table 6.1: Spatial Distribution of Siga Sites by Zone

	1	2	3	4	5	6	7	Total
A	17 (7)	62 (47)	54 (41)	46 (30)	27 (17)	24 (16)		230 (158)
B			9 (7)	14 (9)	12 (10)			35 (26)
C				7 (5)	26 (19)	15 (10)	31 (20)	79 (54)
Total	17 (7)	62 (47)	63 (48)	67 (44)	65 (46)	39 (26)	31 (20)	

Numbers outside parentheses are total Siga sites.
Numbers in parentheses are single component, high confidence Siga sites only.

artifact frequency and other characteristics of the sites themselves are confined to single component sites.[1]

Given the problems calculating site densities within the study region (palimpsest, constantly evolving drainage location, etc.), the study region was divided into two overlapping sets of zones in order to assess the relative locations of sites. Zones 1-7 track increasing distance from the escarpment, while Zones A-C chart distance from the central Koabu drainage (Figure 6.1). While the absolute number of sites within individual zones is highly contingent, it is possible to use the zones to compare settlement across and within occupations.

Siga occupation sites are distributed throughout the study region (Figure 6.2, Table 6.1). Major and minor drainages (including many too ephemeral to be included on the map), seasonal and permanent pools, and seasonally inundated and/or marshy areas are very common in the study region, and it is consequently unsurprising that most sites occur near a water source (Table 6.2). Given the likely historical changes in the hydrology (see Chapter 3), it is very possible that Siga occupation sites not currently near water sources may have been close to them in the past.

1 While there are a few exceptions, most multi-component sites do not seem to be re-occupations. Most frequently, they have been used as trash dumps for currently occupied compounds, resulting in significant mixing of their ceramic assemblages. In some cases, the sites had been destroyed, resulting in the potential mixing of multiple distinct sites while in other cases, older sites may have been used as borrow pits for constructing a new residence. The only examples of stratified multi-component sites are those discussed in the previous chapter for the Pwoli occupation, both of which have evidence of Siga occupation on their surfaces. Thus, while it may seem intuitive that multi-component sites would be the most informative, their complex post-depositional processes make them among the most difficult to interpret, and consequently, as a group they were among the least useful sites for understanding the nature of the Siga occupation.

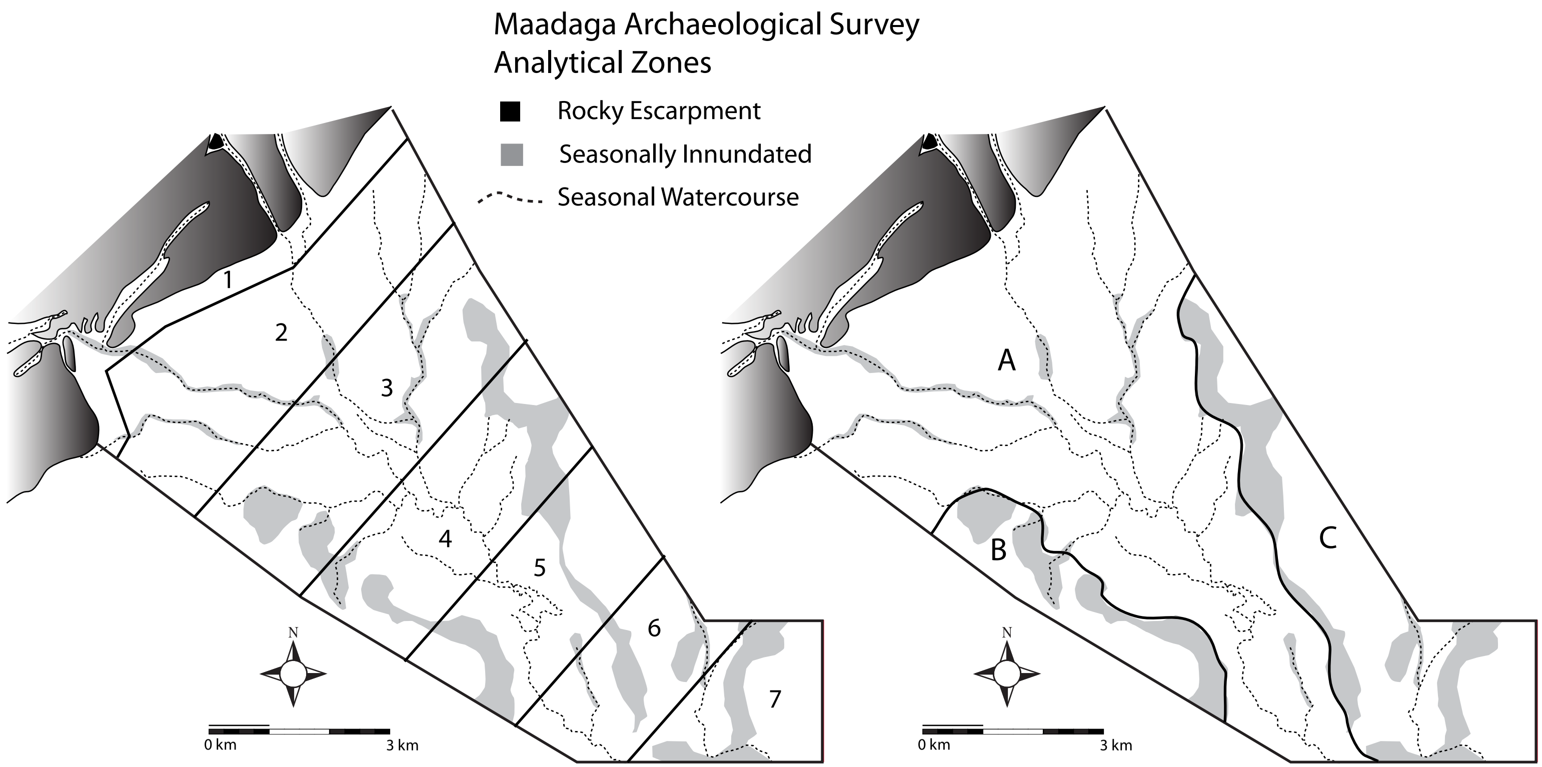

Figure 6.1: Study Region Analytical Zones

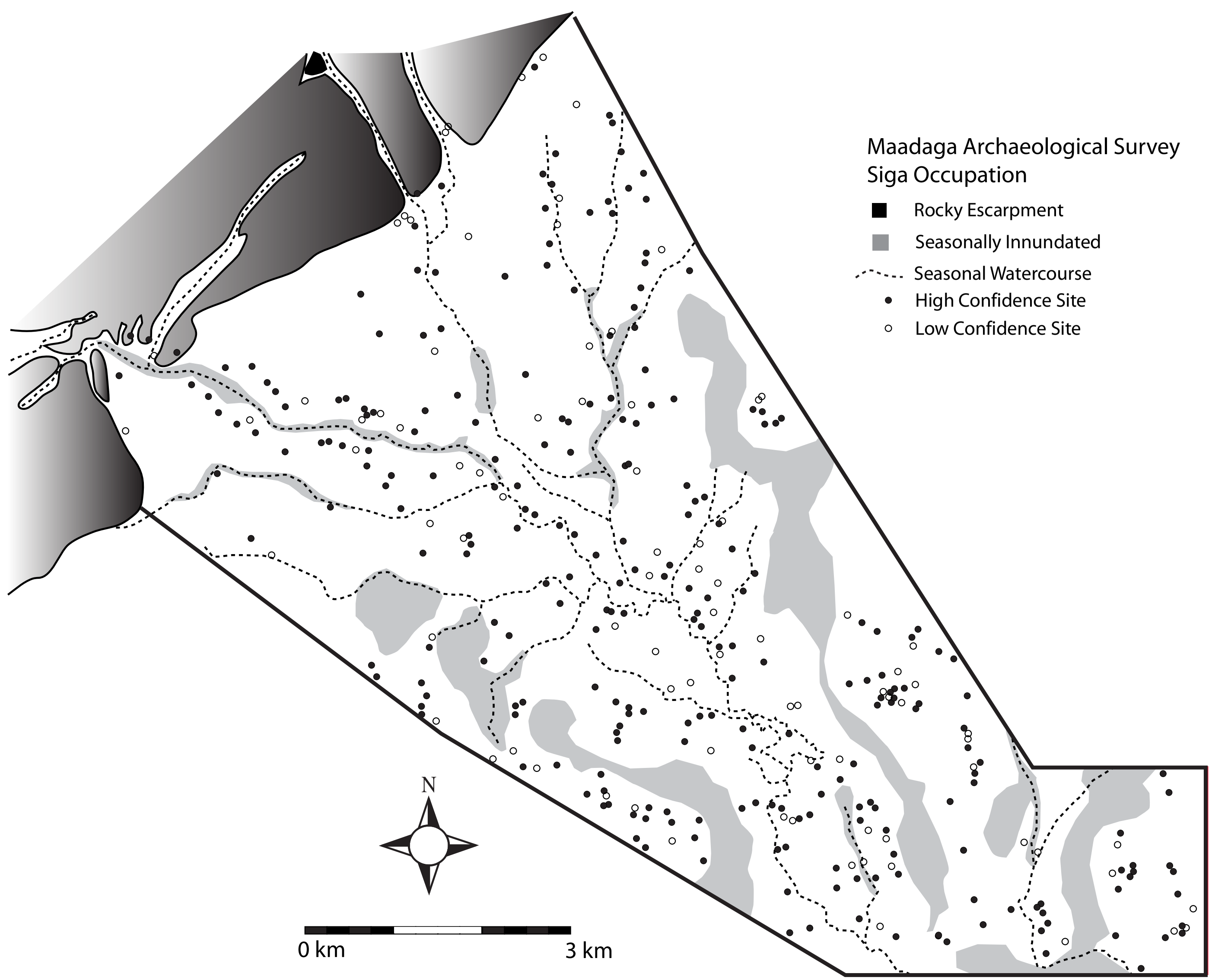

Figure 6.2: Distribution of Siga Occupation Sites

Site Features	High Confidence Single Occupation	Low Confidence Single Occupation	All Sites
#Sites	238	54	344
Baobabs	29	8	47
Near Seasonal Drainage	115	22	163
Near Seasonal Pool	12	6	52
Near Seasonal Innundation or Marsh	40	6	23
Total Near Water	167	34	238
Plowing	209	40	296
Borrow Pits	26	4	46
Chipped Stone	113	27	165
Groundstone	158	28	219
Iron Smelting (small)	9	0	10
Iron Smelting (multiple)	5	1	7
Iron Smelting (large)	1	0	1
Smithing Slag	37	12	41

Table 6.2: Surface Features of Siga Occupation Sites

Potential changes in the regional hydrology also have significant implications for possible site locations, site preservation, and site density measurements. Since the location of drainages and the availability of arable land could have differed substantially in the past, sections of the study region with what appears to be a lower density of sites could have been either subjected to differential preservation or even classified as unfavorable site locations in the past. Any discussion of inter-site relationships is further complicated by the issue of palimpsest. As will be discussed below, almost all sites were occupied for a relatively short period of time, and consequently the contemporaneity of particular sites cannot be established.

Despite these issues, three conclusions can be safely drawn regarding site distribution during the Siga occupation. First, virtually all arable land in the study region was likely farmed at some point during this phase; the distribution of sites is such that even close fields extending only a few hundred meters from each site would cover most of the survey area. Second, although evidence suggests that the reoccupation of sites was relatively rare, incidences of close spacing could suggest occasional repeated use of the same field system (although budding or clustering of multiple households is also a possible explanation). Different sites within clusters[2] often dated to both the Siga and Tuali occupations, and modern residential compounds are frequently positioned near archaeological sites such that, if abandoned, they would appear as another site in the cluster. For modern farmers, archaeological sites tend to be near good farmland, and are an excellent source of building material.[3] It is possible that similar processes occurred within the period covered the Siga occupation.

Finally, the Siga occupation represents an increase in the local population. While there may be more sites per household due to the shifting nature of the occupation (discussed below), the explosion in the number of identified sites from 3 in the Pwoli occupation to 344 in the Siga occupation is clear evidence for a higher population, despite the longer duration of the latter. Due to the palimpcest issues described above, it is impossible at this stage to assess the degree of population increase. The transformation in the pottery assemblage between the two occupations (discussed below) could indicate migration into the region by a at least a subset of the population. However, the possibility of the local evolution of this more complex pottery tradition in a region with high rates of population growth cannot be elimiated. Most likely, the population increase is results from a combination of the two.

Shifting Residences: Short Occupations of Small Sites

Individual sites within the Siga occupation are for the most part small, shallow, poorly preserved, and relatively homogenous in their physical characteristics and their surface densities. The poor preservation is due not only to their ephemeral nature, but also the heavy impact of plowing and borrow pits (see Table 6.2).

Siga occupation sites are characterized as shallow based on visual estimates of their depths made during the survey, and test excavations at a few sites. Over 75% of sites from the Siga group had an estimated depth of less than 0.50 m, although a several

---

2 Clusters are groups of distinct settlement locations (sites) that were tightly spaced such that they were given the same primary number during survey (e.g., 572.1, 572.2, etc.). . Of the nine identified clusters, at least five included sites dating to multiple occupations. Once this became apparent, sites within clusters were considered as independent entities in the analysis.

3These modern farmers do not necessarily have kinship claims to the land; often they are “borrowing” as described in Chapter 4. In discussing land ownership, locals invariably used useful trees as markers rather than previous residences. Locust bean (*Parkia biglobosa)* was the most frequently mentioned, but also the only tree in harvest during the survey. Duvall (2006) notes that among the Maninka, the preference is to choose residence sites in previously unoccupied areas, as the trees near formerly inhabited sites may be claimed by the original residents.

	Small	Medium	Large
Size (m^2)	1-60	75-625	700-3320
N	26	171	30
Zone 1	1	3	3
Zone 2	7	37	0
Zone 3	2	36	6
Zone 4	5	33	4
Zone 5	3	33	8
Zone 6	4	18	4
Zone 7	4	11	5
Zone A	19	116	12
Zone B	0	20	6
Zone C	7	35	12
Mean ceramic density (g/m^3)	27.3	28.5	28.0
Median ceramic density (g/m^3)	17.3	21.6	20.2
Mean # decoration techniques in use	3.0	3.8	5.9
Mean # decoration techniques in use per 100 sherds	17.8	15.0	13.8

Table 6.3: Characteristics of Siga Occupation Sites by Size Class

examples has estimated depths of over 1.0 m. However, excavations generally indicated that these figures are often too high. For example, sites 572.1 and 573 were estimated at 2.0 m and 1.25 m in depth respectively, but in actuality had less than 0.3 m of cultural deposits. Likewise, Siga occupations at Sites 541 and 502.3 proved to be entirely superficial, and no characteristic pottery from this period was recovered below the plow zone. Site 780 is a less extreme case (1.5 m estimated, 1.1 m actual) but, as will be seen below, no living surfaces were identified and evidence suggests that this site may be an atypical mortuary location. Finally, cursory examination of cuts from borrow pits also suggested very superficial occupation layers at Siga occupation sites.

More valuable and difficult to interpret are the data on site area. Sites from this phase can be roughly divided into three size categories (Table 6.2). The majority of sites are roughly circular with diameters ranging from 10 to 30 m (ca. 75-625 m^2). These sites are likely individual household compounds with a relatively small range of sizes;

the distribution shows minor peaks around 100 and 200 m^2 (11 and 15 m diameter), which could indicate two size classes within this group, following which the sharply diminishing area distribution suggests either very few larger residences or the effects of plow smearing. A few sites (n=30) are significantly larger, and often sprawl along ridgetops over an area that could include multiple households (ca. 700-3320 m^2). These sites are not consistent in size, and could be composed of either contemporary residences or sequential, slightly overlapping occupations. Finally, several smaller sites are either non-residential (e.g., small iron smelting locations such as Site 939) or poorly preserved, i.e., a few sherds pushed to the surface by tree roots or termite mounds. For the most part, the sites of different sizes are proportionately distributed in the landscape, with large sites slightly over-represented in Zones 1 and 7.

Interestingly, the mean and median ceramic densities (in g/m^2) are very similar across site size categories (see Table 6.3), and differ by less than 2 g. However, if the upper outliers are removed from the averages, the density of small sites in particular drops significantly from 30.2 g/ m^2 to 11.3 g/m^2, while medium and large sites experience significantly smaller declines (to 24.4 and 19.2 g/m^2 respectively). These densities support the assertion above that small sites (with one exception) are more ephemeral occupations, while large sites are simply more extensive, rather than more intensive occupations.[4]

Further differentiation of sites based on surface appearance is not possible, as many of the additional recorded variables are largely determined by local environmental conditions. Soils are those of the surrounding matrix, and their color variation reflects the differences between the highly leached sand near the escarpment, the grey clays of the lower Koabu floodplains, and the light brown of the plateaus. Laterite pebble density, while visually striking, is also likely a result of local conditions. Almost always higher than the surrounding matrix, in large part because the mud brick melt which forms the sites is usually derived from sub-surface contexts, dense pebbles are essentially an indicator that lateritic bedrock is closer to the surface. Thus, sites with dense pebbles are concentrated in Zones B and C, away from the central drainage valley. Finally, while useful trees were often identified on or near archaeological sites, they were equally common off-site. Most sites were probably not occupied long enough to raise trees: more

4 Additional measures of density including sherds/ m^2, and an index that combined both sherds and grams/ m^2 to identify the highest and lowest density sites yielded similar results. Likewise, no spatial patterns could be identified using any of the density measures.

likely, locations were chosen near existing trees or the fruits of trees were exploited after the sites themselves had been abandoned.[5]

Overall, the morphology of Siga occupation sites is remarkably similar across the study region. With the exception of a few poorly preserved smaller sites, some larger sites with no evidence of occupation qualitatively different from the smaller sites, and some specialist iron working sites that will be discussed below, almost all sites leave a circular or oval footprint between 10 and 30 m diameter. While household compounds vary significantly in physical size, structure density and population, these areas are consistent with modern residences occupied by an extended or nuclear polygamous family (Remy 1967, Prussin 1969).[6] Sites also tend to be shallow, with no evidence of multiple rebuilding or reflooring episodes. While a puddled mud structure can last up to five years with no maintenance (Prussin 1969), simple tasks such as annual plastering and thatching can extend the lifespan significantly. As mentioned previously, longitudinal studies of house life are rare: however, the figure of 30-40 years before rebuilding is required occurs regularly in the literature (e.g., Blier 1987, Duvall 2006). While the occupation length of any given residence was likely driven by historically particular factors, this figure is the best outside estimate for occupation length that can be made with the available data. This combination of single family sites with short occupations is characteristic of shifting cultivators: a theme that will be explored in more detail below.

The Siga Ceramic Assemblage: A Socio-Functional Approach

The Siga ceramic assemblage is characterized by incredible diversity along every axis of analysis, notably temper, decoration, and vessel form. While part of this diversity can be attributed to a long temporal span and large sample size in comparison to other phases of occupation (n=12,281, 74% of recorded sherds), high levels of variability are also present at the scale of individual sites. This discussion focuses on the multiple

5 Duvall (2006, 2007) tested the relationship between settlements and baobabs in southern Mali. He found that human activity, notably the soaking of fruits (and consequently the seeds) to remove the pulp, encouraged germination, and that saplings in settlements were more protected than those in the wild due to both intentional management practices and unintended factors such as fire protection. As a result, baobabs are in much higher frequencies near settlements, both modern and abandoned.

6 Remy (1967) recorded residential compound populations at Yobri, and compound size could be measured on the detailed maps he provided. Of the 54 compounds documented, 40 were between 12 and 30 m in diameter, and each had up to 70 residents. The 14 compounds with diameters between 32 and 52 m were home to 30-100 residents. Yobri is an excellent illustration of the challenges of estimating population size from site size: compounds with 30 residents ranged from 12-35 m diameter. Prussin(1969:43-44) notes that while the Dagomba and Konkomba both live in circular compounds, the latter have smaller rooms and closer spacing, creating a more compact residence. The majority of compounds she depicts for the Konkomba, Dagomba, and Tallensi also fall within the 10-30 m diameter range.

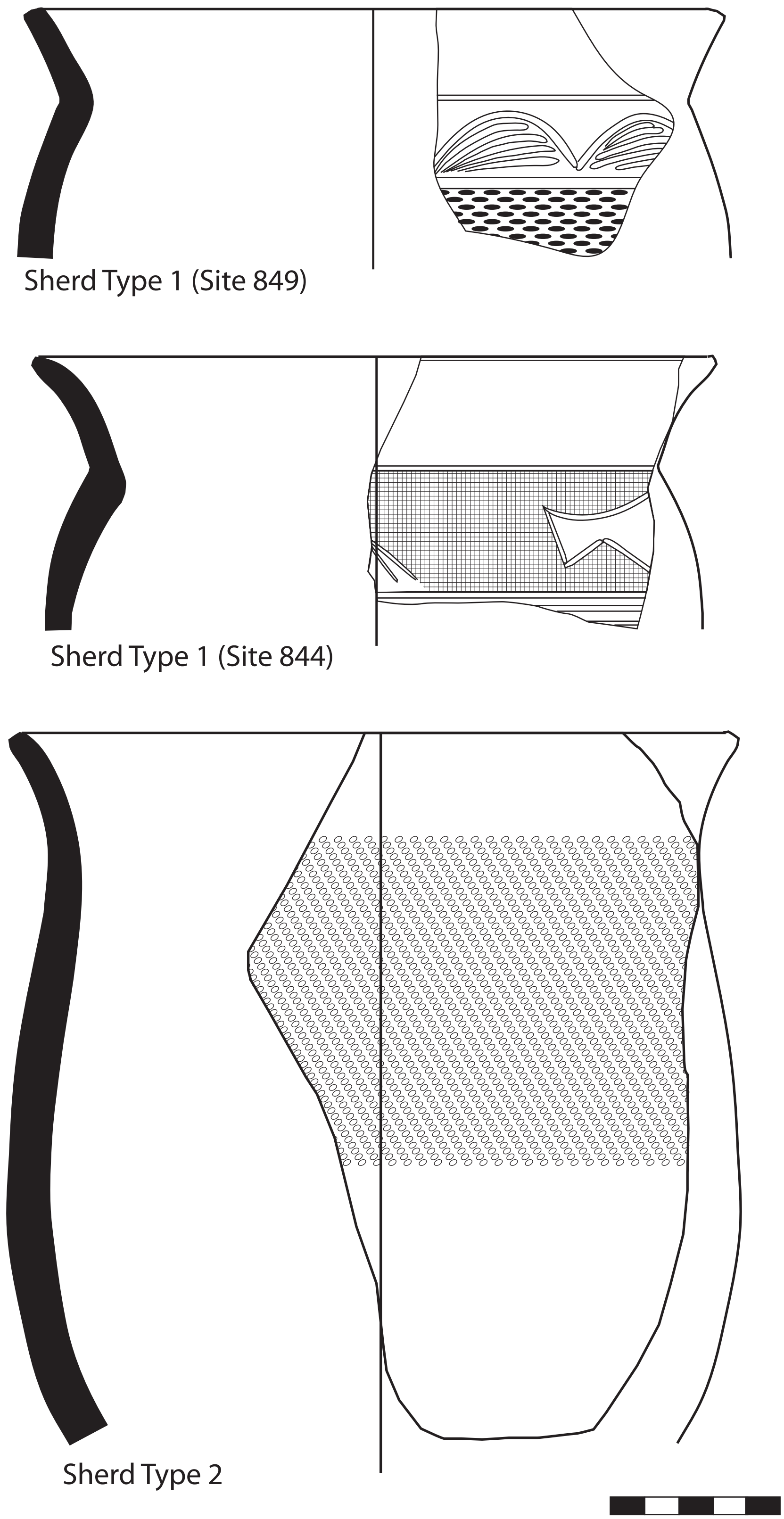

Figure 6.3: Siga Occupation Ceramics, Sherd Types 1-2

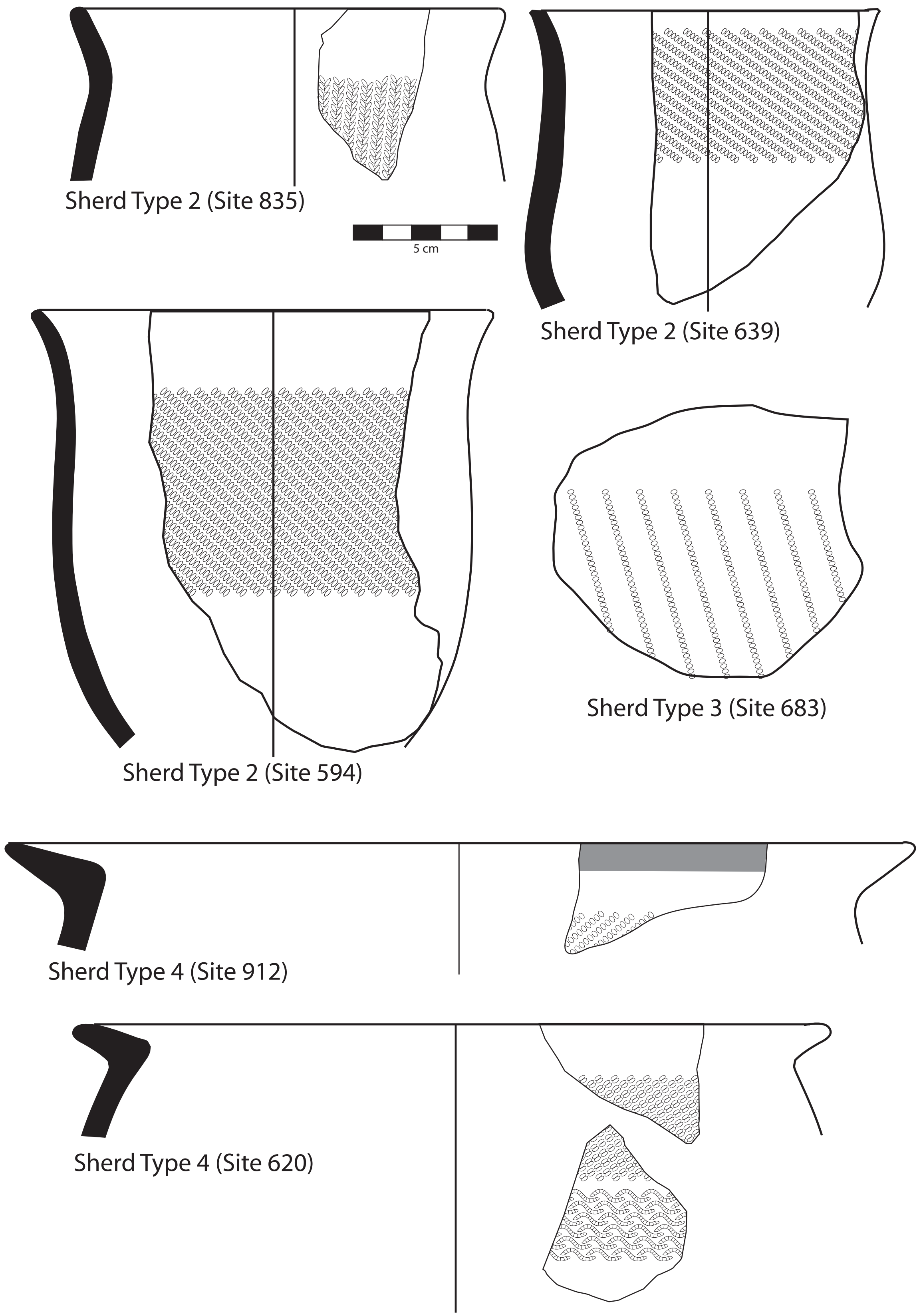

Figure 6.4: Siga Occupation Ceramics, Sherd Types 2, 3, and 4

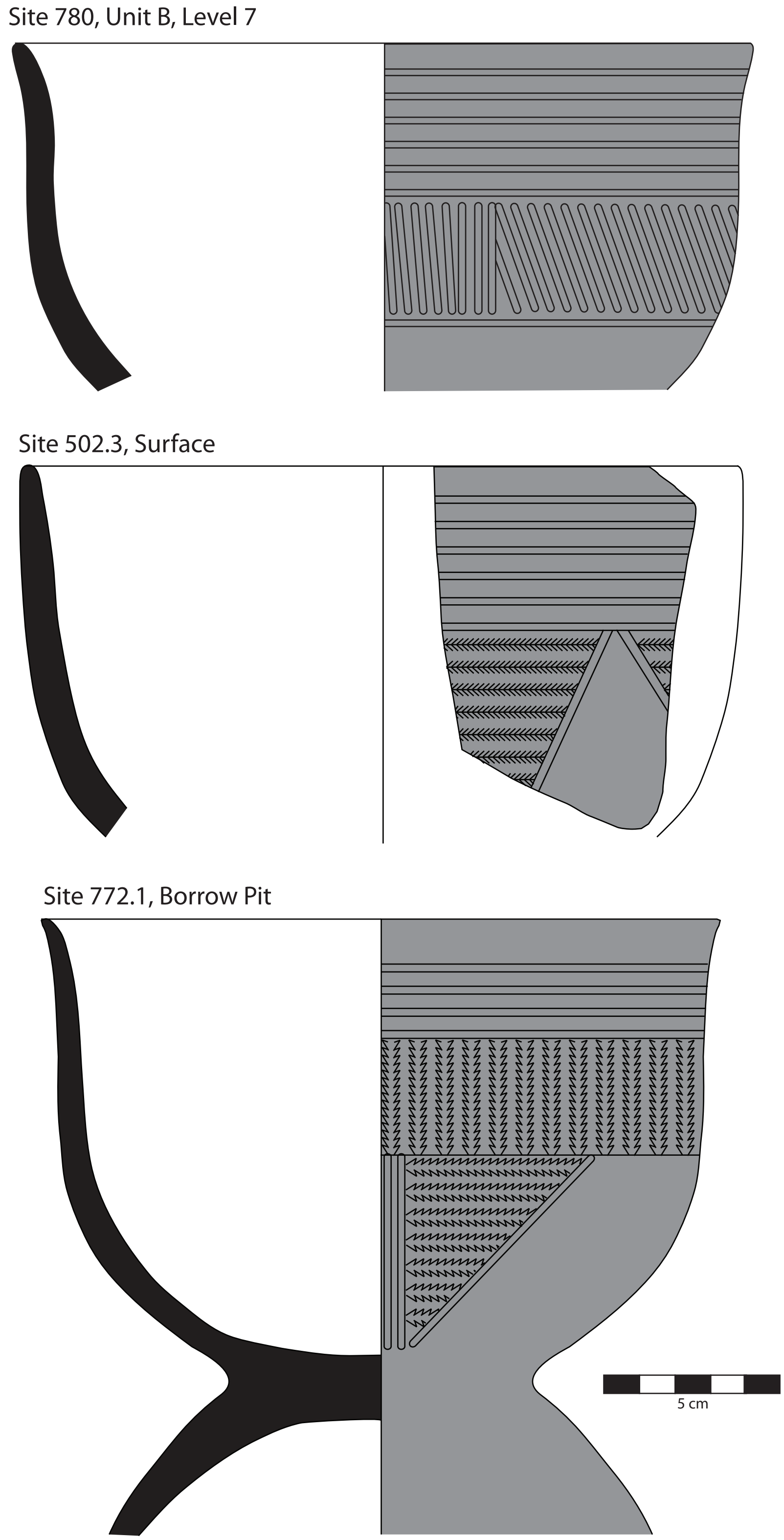

Figure 6.5: Siga Occupation Ceramics, Sherd Type 5

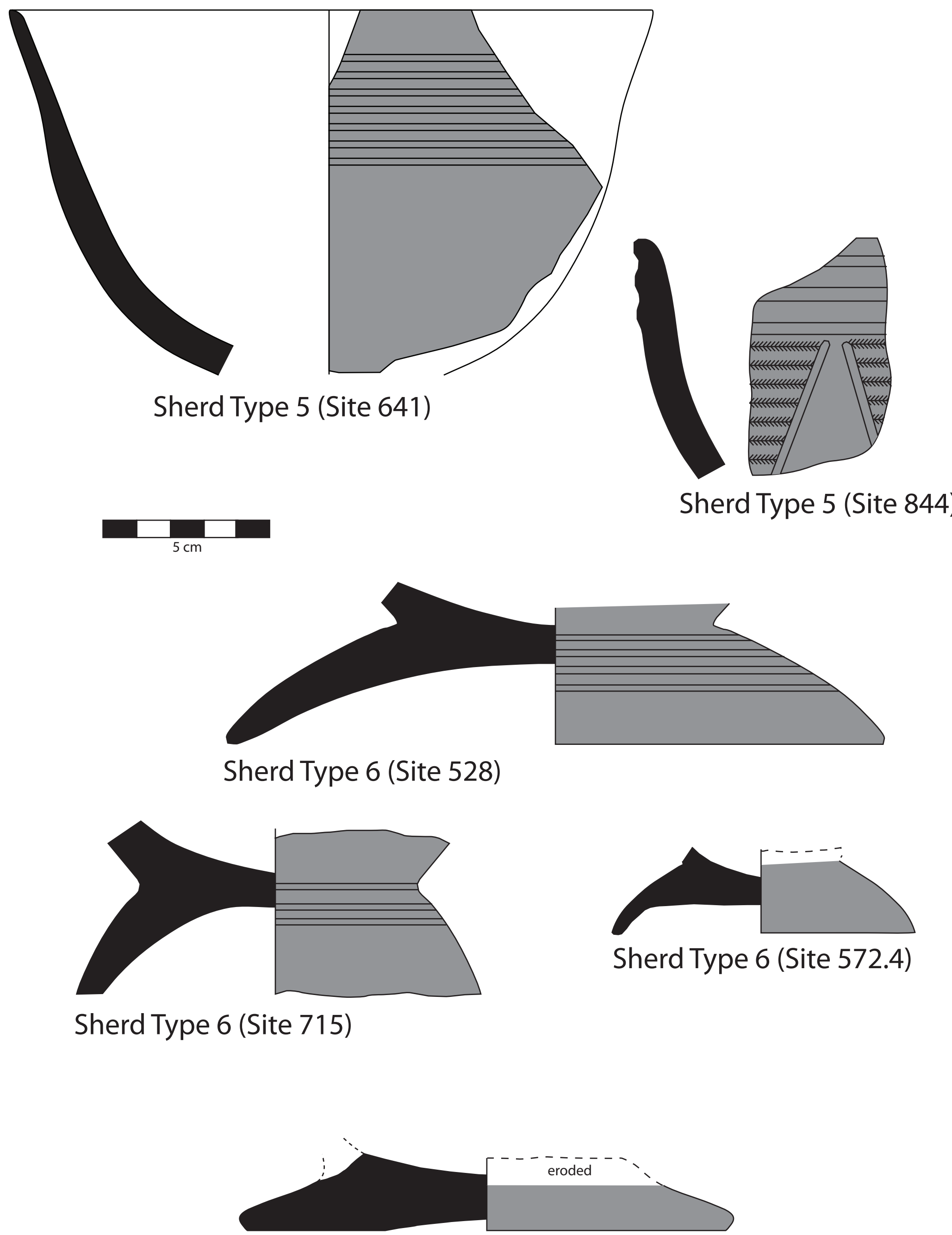

Figure 6.6: Siga Occupation Ceramics, Sherd Types 5, 6, and 7

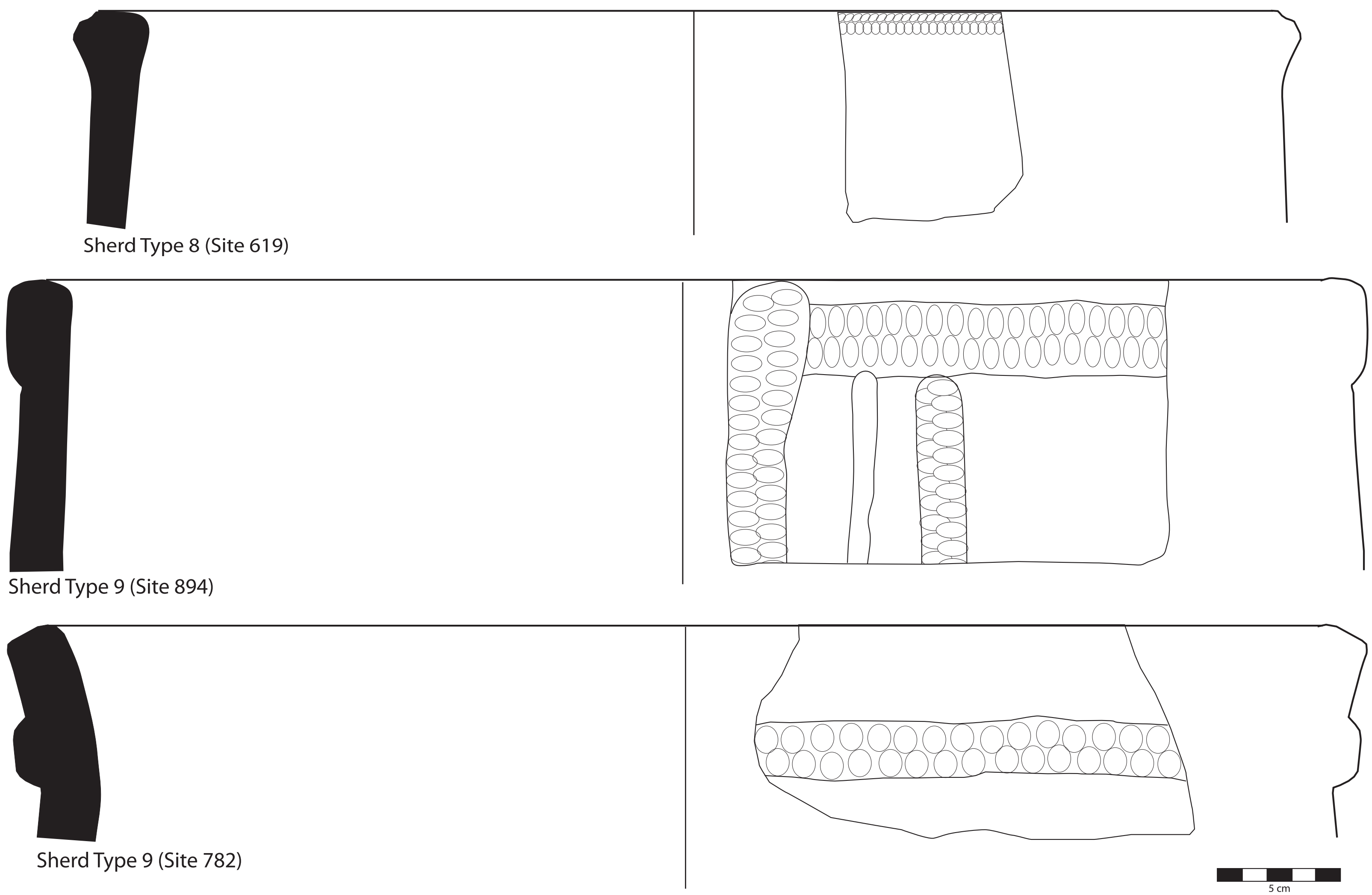

Figure 6.7: Siga Occupation Ceramics: Sherd Types 8 and 9

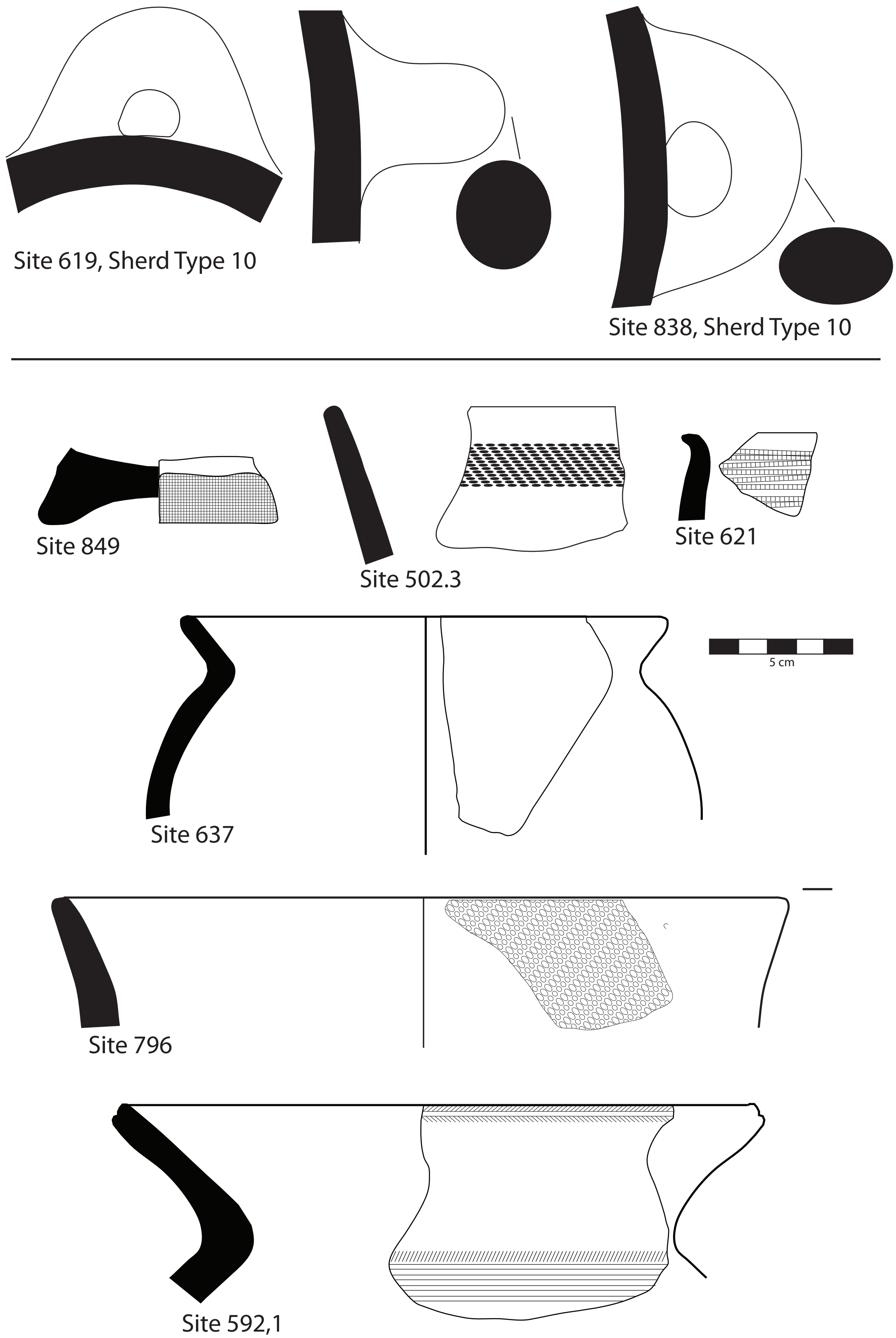

Figure 6.8: Siga Occupation Ceramics, Sherd Type 10 and Untyped

possible sources and implications of this diversity (for more detailed descriptions of formal characteristics in the assemblage see Appendix A).

Siga occupation ceramics can be divided into two primary categories: Typed sherds and untyped sherds (for detailed descriptions of Sherd Types and how they were identified, see Appendix A). Typed sherds are of particular interest because they are consistent across numerous sites. This suggests that the vessels they represent were widely available, employed in common tasks, and may have had more standardized sets of uses than the numerous idiosyncratic vessels present at many sites. Without minimizing the importance of individual household diversity, these vessels may be more informative at a broad, societal level of analysis. Ten Types were identified as associated with the Siga occupation (Figures 6.3-6.8). Each Type is striking in its coherence, and there is relatively little cross-over between Types in terms of temper, decoration techniques or vessel forms. In contrast, untyped sherds are often very unique; their decoration techniques generally occur at only a handful of sites, and single instances are not uncommon (Figure 6.8).

In the following sections, the ceramic assemblage is approached from two directions. First, a functional perspective focuses on daily activities at the Siga occupation sites, i.e., what were the ceramics used for. In contrast, the social perspective emphasizes the cultural context of production and use of the assemblage.

Variability in Pots: Functional Sources of Ceramic Diversity

In traditional West African societies, ceramic vessels are one of the primary types of containers, and the only ones that regularly survive in the archaeological record.[7] Although most vessels are multifunctional, intended primary uses of individual pots can impact potters' choices regarding raw materials, vessel form, and surface treatments including decoration.

Multiple paste formulas are in use at every site from this phase, the most common of which are coarse and fine grog tempered paste, quartz tempered paste, and a micaceous paste with quartz and possibly additional mica temper (see Table 6.4). The use of diverse tempers is often a functional choice, as they impart different qualities to the ceramic vessels. For example, the coarse grog and stone temper in use in large jars creates a very porous fabric, which aids evaporative cooling of stored liquids. Mica content, whether natural or added, is helpful for blocking crack propagation, and micaceous vessels are often used for cooking due to their excellent thermal stress properties. The association of different vessel types with different tempers further supports a functional assessment. However, despite these advantages, most tempers are adequate for a normal range of

7 Other common containers include gourds, baskets, and animal skins.

	High Confidence Single Occupation	Low Confidence Single Occupation	All Sites
N Sherds	7508	1368	12281
Grog Temper	76.2%	69.3%	71.7%
Quartz Temper	16.3%	26.6%	21.6%
Mica & Quartz Temper	5.6%	2.1%	4.4%
Sherds Decorated	35.3%	28.9%	32.0%
N Decoration Techniques in Use	58	34	65
Mean # Decoration Techniques in Use per 100 Sherds	4.0	3.3	4.2
N Sherd Type 1	26	0	32
N Sherd Type 2	60	3	78
N Sherd Type 3	69	1	83
N Sherd Type 4	123	2	157
N Sherd Type 5	101	2	141
N Sherd Type 6	72	3	84
N Sherd Type 7	6	0	9
N Sherd Type 8	11	2	16
N Sherd Type 9	95	14	125
N Sherd Type 10	31	4	45
N Sherd Type 11	9	6	24
N Sherd Type 12	-	1	2
N Sherd Type 13	-	-	7
N Sherd Type 14	-	-	21
N Sherd Type 15	1	-	14

Table 6.4: Characteristics of the Siga Occupation Ceramic Assemblage

vessel functions, as evidenced by the frequent minor variations on and exceptions to the usual tempers for particular Sherd Types. Many modern and prehistoric potters in West Africa and beyond use a fairly standardized paste for all vessels, regardless of size or intended purpose.

Just as vessel temper is an imperfect measure of intended vessel function so is vessel form. While certain conventions often hold true, multiple forms may be used for the same purpose, or, even more common, a single form or even a single vessel can be used for multiple purposes. Additionally, the best data on vessel function is often derived from excavation context or use residues such as fire blackening: data that is generally unavailable for the study assemblage. Bearing this in mind, McIntosh (1995:158) has created a basic functional typology for African domestic pottery based on relative vessel

			VESSEL SIZE		
			Small	**Medium**	**Large**
RELATIVE ORIFICE SIZE	**Small**	Uses	ablutions	water transport beer storage and fermentation	water transport beer storage and fermentation
		Sherd Types		Type 1, Type 4	
	Large	Uses	cooking sauce serving sauce drinking frying beignets oil storage ablutions	cooking sauce or grain serving grain washing storage tanning salt production beer fermentation and storage	water storage other storage bathing washing and dyeing cloth
		Sherd Types	Type 2, Type 5	Type 1, Type 2, Type 3, Type 4	Type 8, Type 9

Adapted from McIntosh 1995: 158

Table 6.5: Potential Functions of Siga Occupation Ceramic Vessels

and orifice size that illustrates the poly-functional possibilities of many vessels . While McIntosh's classification scheme was developed primarily from data on ethnic groups in modern day Mali, the similarities to the study region in diet, food preparation, and other daily activities are such that it is easily adapted to southeastern Burkina Faso (Table 6.5).

Also informative, though rare in the assemblage, are certain additional elements: notably handles, bases, and perforations. The handles generally have the form of lug handles (Type 10). In most cases, these are not very useful for carrying, as they cannot support the weight of a filled, large vessel. Instead, lug handles provide a grip for shifting, leaning, or rotating the vessel, and/or a point of attachment for tying down a cover or lid. Bases are often found on serving or drinking vessels, as they provide stability such that the pot can be set on a variety of surfaces. The base types present in the assemblage -pedestal (Type 6), flared (Type 7), ring, and feet- are all plastic additions to the pot, and consequently inappropriate for use on cooking pots as the thermal stress would affect the joints. Finally, several perforated fragments were recovered (n=38 at 24 sites). Generally undecorated and grog tempered, but in a range of thicknesses (8-24 mm), these sherds had uniform, evenly spaced punctures that ranged in diameter from 0.6-1.3 cm, with two outlying examples at 2.3 cm and 2.8 cm. Perforations of this sort are generally identified with "coucousieres" used to steam pounded millet or sorghum to make a couscous (e.g., Gallay and Huysecom 1989), although perforated vessels may also be used for activities like draining freshly dyed cloth or leaching vegetable salts.

The functionality of surface treatment and decoration is particularly complex, as both can be a means of communicating a wealth of information. While this information may be difficult to interpret, vessels with more elaborate decorations are often for use in more public or social settings. However, these treatments may also be functional at a more practical level. Slips can be used to decrease permeability, and decorative features such as plastic ridges or the roughness resulting from many space-filling decoration treatments may make pots easier to grip.

Using the above criteria, the vessels represented by typed sherds form a functionally diverse group and cover most of the major vessel use categories identified by McIntosh 1995 (see Table 6.5). Type 5 sherds, along with their likely associated bases (Types 6 and 7), are probably from serving vessels, either for sauce or beer. Their thick, polished slip is one of the most time-intensive techniques among all surface treatments and decorations, and they are the most likely of any vessel to have been used in ritual contexts. The open vessels of Types 3 and 4, with their smooth curves and simple decoration, are excellent candidates for cooking, particularly since the former come in a range of sizes, with the caveat that many of them lack the lipped rims that can aid in lifting the pots from the top (for this reason Type 2 may also have been a good cooking vessel). The vessels of Type 9 sherds are among the most ubiquitous. With their open mouths and large diameters, they are candidates for either grain or drinking water storage: large constricted neck vessels are absent from the assemblage, and open vessels are used for water storage in northern Benin (Petit 2005). At two sites, adjacent horizontal cross-sections of vessels were identified in undisturbed deposits; in both cases, the vessels in question were likely a Type 4 and a Type 9. Large and small pots can occur together in numerous contexts, although the most frequent are cooking installations, and water or dry goods storage (daily or weekly grain allotments may be transferred from granaries to these vessels for easier access).

Like the typed sherds, the more unique elements of the ceramic assemblage cover a range of pastes, vessel forms, and decorations (Figure 6.8). Among vessels identified at numerous sites are large open, thick-sided bowls with cord impressions on the sides, small bowls with narrow strips of decoration at or near the lip (notably Cord 3). Ring bases and small legs are not uncommon and generally of an appropriate size for smaller vessels: this could indicate a broad assortment of serving vessels. With few exceptions, these vessels fall into the same functional categories as many of the typed sherds.

Few differences could be detected between sites in terms of functional variation, particularly since the sample size for any given site is relatively low (on average ca. 31 recorded sherds/site). While the absolute number of decoration techniques in use at each site decreases with size and density, likely due to smaller samples, the mean index value (techniques/100 sherds) remains fairly constant, suggesting that the ceramics at all sites are drawn from the same assemblage, an assertion further supported by the presence of the full range of Sherd Types at all sizes and densities of sites (Table 6.3). Likewise, no spatial patterns in ceramic distribution could be identified in the study region, a fact that will be explored in more detail below. Overall, the functional analysis further supports the generalized nature of most Siga occupation sites.

Variability in Potters: Social Sources of Ceramic Diversity

Since, as described above, there are multiple functional options for pottery vessels regardless of intended use, the technological choices are often a result of social factors including organization of production and distribution; identity of the potter or intended user of the vessel; and cultural mores, preferences, and restrictions on vessel form and decoration. The comparative literature on these topics is immense (e.g., Costin 1991, David et al. 1998, Hegmon 1992, Gosselain 2000), but with the available data, the discussion at this stage must remain limited.

The Siga assemblage has significant elements of homogeneity and diversity. The typed sherds are from distinctive vessels that have many of the classical hallmarks of specialized producers (i.e., standardized vessel types): minor differences in the paste or decoration could be simply the result of small-batch production or temporal drift. However, each Sherd Type is distinctive, and employs different techniques, begging the question of whether they were produced by the same potters. Although the raw materials used to manufacture typed vessels are widely available in the greater region, few similar sherds have been identified outside the Gobnangou escarpment and its immediate surroundings. While long distance import cannot be ruled out, given the paucity of research, at this time there is no positive evidence that the diversity of typed assemblage is a crossroads phenomenon.

Within the greater Gobnangou region, the distribution of typed sherds is poorly understood; particularly since the northern and southern extents of the escarpment have not been explored. Only three of the Sherd Types were also identified by the Frankfurt team, and only two of these were collected on both the north and south sides of the escarpment (Type 1 was confined to the study region). Within the study region itself, no production centers could be identified, and all types were evenly distributed. Spatial

	Typed Rims		Untyped Rims	
N rims with diameter data	112	100%	135	100%
N rims over 35 cm	28	25%	10	7%
N rims over 50 cm	6	5%	0	0%

Table 6.6: Comparison of Diameters of Types and Untyped Rims

mappings of Sherd Types and the minor variations within them all yielded dispersed patterns of sites that were neither bounded nor linked through other commonalities.

Given the problems of palimpsest, it is possible that stylistic boundaries are obscured by the presence of non-contemporaneous sites in the sample. However, it is more likely that there were no significant differences resulting from location in access to particular types of pottery by particular households. Consequently, while it is not yet possible to determine whether individual potters produce the entire range of typed ceramics[8], nor whether all typed sherds were produced within boundaries of the study region, the currently available data suggest that all sites from this period were ultimately part a unified ceramic tradition practiced by potter(s) who supplied the entire study region.

At the same time the diversity of decorations and vessel types present in the assemblage is overwhelming; at least 20 decorative techniques or groups occurring at less than 10 sites have been documented. This aspect of the assemblage, if produced locally, is more typical of idiosyncratic household production. However, if these vessels originate outside the study region, it is possible that households use a set of standardized, locally produced ceramics supplemented with non-local vessels.

It is possible to get a sense of the frequency of rare vessels at sites by looking at the distribution of sherds with decorations other than those found on typed sherds.[9] Of the 238 sites with the Siga assemblage, only about one third (n=73) have sherds with rare decorations. The vast majority (n=68) of these have only one or two sherds that likely represent different vessels. The most diverse site, 696.2, has only 6 techniques represented, although they may originate from a slightly higher number of vessels. Interestingly, this site is across a minor drainage from Site 780 where, as will be seen

8 Although the diversity of paste formulas and decoration techniques could suggest multiple potters, use of multiple tempers and decorations by the same potter is not unknown (Rice 1987)

9 As discussed in Appendix A, the number of sherds actually assigned to Sherd Types under-represents the frequency of sherds from these vessels in the assemblage. By eliminating all sherds with decorations found on types regardless of whether the individual sherd was assigned, "noise" from typed vessels is eliminated. Unfortunately, rare vessels with the same decoration techniques as sherd types are eliminated as well, as are undecorated rare vessels.

below large quantities of iron were recovered. In general, however the presence of sherds with rare decorations did not correlate with any other site features, including the presence of iron-working debris.[10] Ceramic production is a skilled task: if households were producing their own unique pottery, one would expect to find these vessels in higher frequencies.

Given the available regional data, the importation of rare vessels cannot be firmly established, although a few lines of evidence provide some tentative support. First, the overall functional redundancy of rare vessel forms with the forms of typed vessels suggests that the latter are supplemental rather than essential. Second, the vast majority of rare vessels fall into small or medium size classes that would be fairly easy to transport (see Table 6.6). Finally, the only two sets of vessel decoration with strong similarities to pottery documented in other regions[11] could be considered rare in the assemblage: MAC vessels were found near Kantchari by the Frankfurt Project (Wotzka and Goedicke 2001), and Petit (2005, personal communication) noted designs similar to those represented by BDC, DI, and LC in northern Benin. No Typed sherds have been conclusively identified in either of these regions. If rare sherds are from imported vessels, they could indicate site residents had extra-regional trading networks, or the wealth to buy exotic goods.

Discussion

In conclusion, the ceramic assemblage from the region is composed of a diverse functional set of household ceramics that is commonly available, supplemented by numerous, often unique vessels that may be manufactured outside of the Gobnangou region. The possible reasons for and implications of this pattern are manifold.

The consistency of vessels represented by the Sherd Types suggests that they may be manufactured by specialist potters. We know little about these potters: whether they make only one or two types of vessels or the full range, whether they reside within the study region, or whether they are full or part-time specialists. We do know that they serve the entire study region, and that there is currently no evidence for restricted access to their products. Ethnographic studies of pottery style in West Africa have demonstrated that ceramic traditions may be in common within political, social, or linguistic boundaries (or any combination thereof) depending upon the particular local circumstances

10 Large sites were more likely to have sherds with rare decorations than medium or small sites. However, the difference was small enough that it could be a function of sample size, particularly since large sites tended to have larger opportunistic surface collections.

11 Some of the decoration techniques used in the assemblage (e.g., Cord 2) are ubiquitous in West Africa and thus not useful for tracing the movement of ceramic vessels. In comparing decoration techniques across regions, the emphasis was on identical use of a given technique (e.g., while rocker comb (COR) is frequently observed, it was often applied at a different density and in different locations on the vessel).

(Gosselain 2000). Thus the common use of Typed vessels could be indicative of some form of social cohesion across the study region.

The more unique vessels add significant variability to the Siga ceramic assemblage, and may be evidence of long distance trade networks or increased differentiation in wealth. Unfortunately, these vessels were relatively rare in the assemblage, and their individuality makes interpretation difficult, especially given the lack of archaeological research in the greater region.

In regards to settlement and mobility, a few key data points can be gleaned from the ceramic assemblage. It is difficult to use the ceramic data to interpret the length of occupation at any given site: only a single systematic collection was taken at each site, and ca. 90% of sites fell within one standard deviation of the mean density.[12] However, relocation of households does not seem to have affected access to different types of ceramics, implying maintenance of economic networks (both local and long-distance) during moves. Finally, if residents were restricted in their ability to relocate within the study region, those boundaries are not marked in the ceramic assemblage.

Spatial Distribution of Iron Working

While the Siga occupation is not the earliest instance of iron-working in the region, it is the first phase for which there is direct evidence of iron production, in the form of numerous slags and tuyeres. There are two main stages of iron production: smelting and smithing, each of which leaves a distinct archaeological signature. Iron smelting is the process by which raw iron is extracted from ore, in this case likely the iron rich laterite found throughout the region, while smithing involves the processing of both blooms from smelting furnaces and scrap iron to create metal objects. While the smithing of scrap metal is still a common activity, traditional smelting all but vanished during the colonial period (if not before) as local iron was replaced by imported, higher quality industrial alloys. Consequently, much of our knowledge of traditional forms of iron production in West Africa comes from secondary sources (e.g., de Barros 2000), archaeological reconstructions (e.g., Killick 2004, Coulibaly 2006, Kiethega 2009), and the ethnography of iron workers whose profession has been dramatically transformed (e.g., Childs 2000, Saltman 1986).

12 Surface ceramic density is significantly impacted by site preservation (recently plowed sites almost universally had higher densities than undisturbed sites), as well as the nature and intensity of site use (Cameron and Tomka 1993, Varien 1999). Additionally, the difficulties of comparing ceramic density at different sites is complicated by such factors as what pottery was left behind when the site was abandoned, whether archaeological deposits were used in house construction such that pottery is an element of mud brick melt, etc.

Smelting

The smelting process requires access to two primary resources: ore and fuel. In the study region, the most commonly available ore is laterite, a soft, coarse, iron rich stone. Lateritic outcrops are found throughout the study region, and there are veins of laterite in the escarpment itself. No ore mines were located in the study region, although prehistoric mines can be difficult to identify as laterite is often stripped off the surface.[13] While ore is readily accessible, fuel requirements are time-consuming and potentially difficult to meet. Since the high, sustained temperatures required by iron furnaces can only be achieved with charcoal, the wood must be gathered, dried, and processed before smelting can take place. Depending on the scale of iron production and local population density, smelting has the potential to strain local fuel supplies. While precise numbers are impossible to calculate without access to variables such as furnace design, ore quality, and fuelwood type, the ratio of charcoal to ore required for a bowl or natural draft furnace can be slightly above 1:1 but may reach as high as 20:1 (Gordon and Killick 1993). Studies of traditional charcoal production in the West African savanna have found that yields by weight are at most about 15-20% of the original biomass (Girard 2002), suggesting that at minimum ca. 8-10 kg of wood was likely needed to smelt 1 kg of ore.

Evidence of smelting in the study region during the Siga occupation consists almost entirely of slag heaps mixed with tuyere fragments (Figure 6.9). No furnaces with intact walls have been identified, and none were excavated, making it impossible at this stage to assess the furnace technology. The measured intact tuyeres have internal diameters ranging from 3.2-4.5 cm, and a single site may have tuyere diameters from throughout this range.

The quantities of slag present at sites were both difficult to measure and to interpret. Differences in slag pile density from site to site were visually apparent, and many areas had been plowed, distributing the slag across a large area. Even if accurate slag volumes could be calculated, they cannot be linked to the number or size of smelting events with the available data. However, if the techniques, ore, and fuel are assumed to be fairly constant from site to site, it is possible to compare the relative productivity of different smelting locations. Given the difficulty of producing precise numbers, smelting sites were divided into three categories of increasing production scale. The first group (n=9) consists of sites with small, isolated slag concentrations that are no more than 5 m in diameter and often of negligible height; the second group (n=5) includes those sites with multiple small slag concentrations or larger slag piles of up to 10 m in diameter;

13 An exception is the gallery style mines found in western Burkina Faso, which are often visible as sinks in the landscape (Coulibaly 2006, Dueppen 2008).

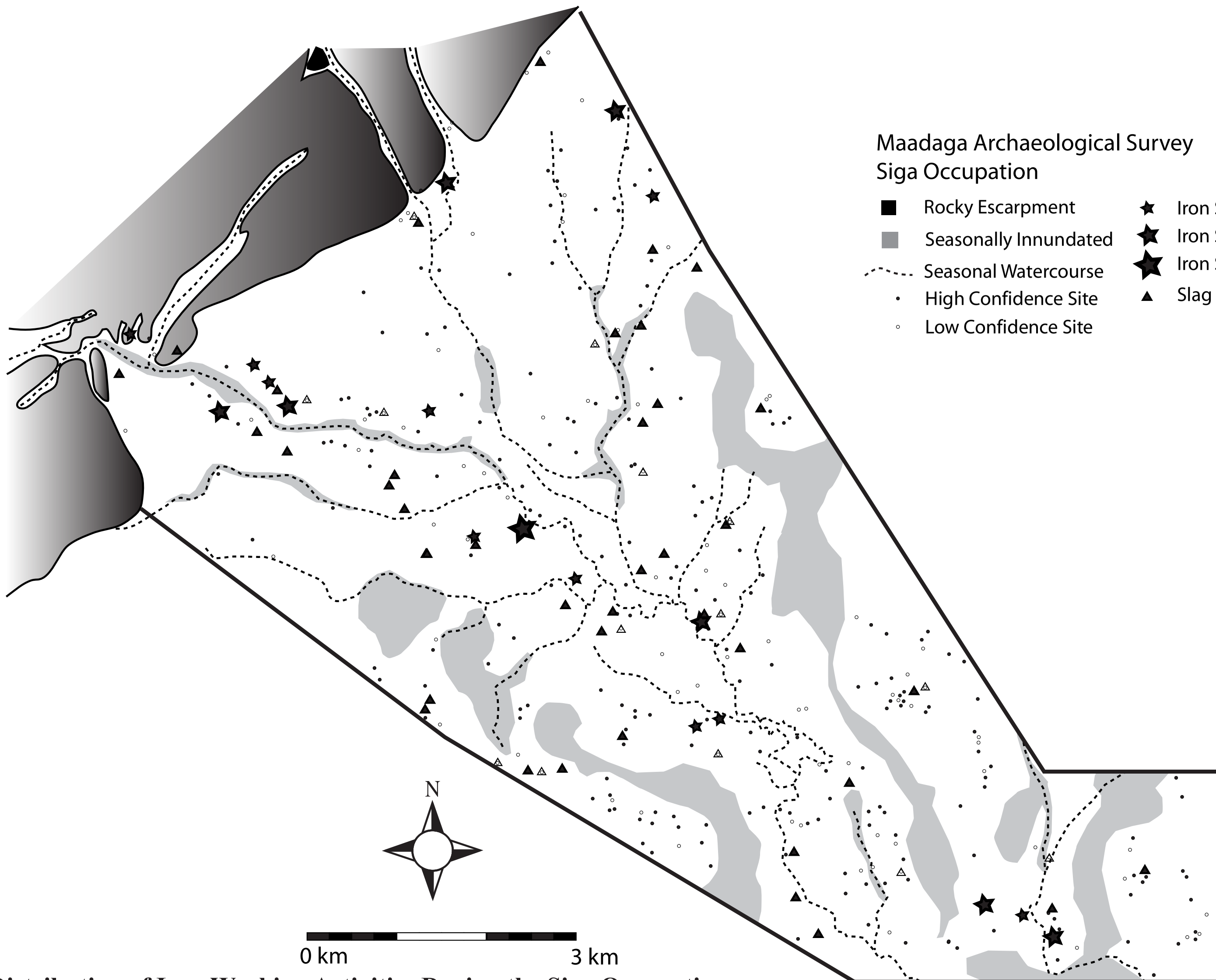

Figure 6.9: Distribution of Iron Working Activities During the Siga Occupation

and finally, the third group is a single site (Site 849) that had multiple very large slag concentrations including one that covered ca. 300 m^2.

Sites from the two groups with higher productivity are dispersed throughout the landscape. Site 849 is centrally located on the banks of the Koabu. Five of the seven sites in the second group are in three clusters along the Koabu, spaced ca. 2 to 4 km apart. The remaining two sites are at the heads of major tributaries near the escarpment in the northern section of the study region. The small furnace locations (likely single smelting events) are also scattered along the major drainages (particularly the Koabu) and tend to cluster near the larger sites. Smelting is notably absent from large sections of the study region, in particular in the higher elevation areas at the fringes of the drainage catchment (Zone B and the upper portion of Zone C). These regions do not lack lateritic outcrops; however, they often have deeper water tables and may have fewer or smaller of the preferred fuelwoods, many of which favor slightly moister conditions (see Table 3.5).

Interpretation of this spatial pattern is complicated by the coarse chronology available. However, the preponderance of smelting locations, their distribution, and their infrequent long term use suggests that iron-smelters during this period were, like the general population, fairly mobile. Site 849 may have been a center where multiple iron-smelters came together or a location that was repeatedly revisited for smelting activity. While it could have been in continuous use by a single iron-worker and his family, its status as a specialized location is supported by the minimal residential debris (although the site is located in a high erosion area). Of the other sites, those that appear to be single furnace locations (regardless of size) tend to be located near or as part of extensive residential sites and those with multiple furnaces tend to lack the residential debris, although again the lack of chronological control hampers interpretation.

Smithing

Smithing, or the production of iron objects such as hoes, bracelets, or arrowheads, takes place at a small hearth, often augmented with bellows to achieve the necessary heat. The raw iron is heated until softened, then pounded on an anvil. If the iron is from a newly made bloom, it will often contain impurities and the smithing process will produce small slag fragments that are usually lighter and less dense than smelting slags.

Small slag fragments were noted at numerous sites from this phase (n=37). Isolated surface pieces, they tended to have the qualities of smithing slag, although without context or microscopic study their origin is uncertain. However, if even half of the sites at which these slags were observed had smithing activity, then smithing was far more widespread and perhaps more broadly accessible than smelting. Particularly notable is the distribution of sites with smithing slag: they are located throughout the study region, and their spatial pattern has little relationship to the pattern of smelting sites. Even if iron-workers carried out smelting activities at specialized locations and smithing activities in the home, many of the sites with smithing slags are located several kilometers from the nearest smelting location. It is possible that iron-workers' residences could move more frequently than their smelting locations, but the rarity of multi-furnace sites is evidence against that hypothesis. It is not uncommon for smithing and smelting to be practiced by different individuals. However, smelting, which is often imbedded with mysticism due to its transformative nature, is more likely to be restricted knowledge possessed by a closed specialist group, while smithing may be practiced more opportunistically.

Iron Objects

Discarded iron objects rarely find their way into archaeological deposits, since they are normally refashioned into new objects. Their densities at most archaeological sites are low, although specific numbers are available for only a few sites: at Jenne-jeno iron densities are on average 10-20 g/m^3, with the highest densities reaching 65 g/m^3 and at Kirikongo iron densities averages 10 g/m^3 (McIntosh 1995, Dueppen 2008). In this context, the quantity of iron recovered from excavations at Site 780 is very high. Seven pieces of metal weighing a total of 42 g and including at least four metal arrow or spear points were recovered from a 35 cm deposit in Unit B, resulting in a density for this deposit of 84 g/m^3. The arrows vary in size and shape (see Figure 6.10), and at least one arrow had been bent twice, possibly intentionally.

The only excavated locations with similarly high numbers of metal objects in West Africa tend to be mortuary sites (e.g., Magnavita et al. 2002, Shinnie and Kense 1989, Thilmans at al. 1980), and this may in fact be the case at Site 780. About 30 m distant from the project excavations, a local farmer, Amilidi Tindambiga, had dug a large borrow pit a few years previously (ca. 15 x 15 x 1.5 m). During this venture, he uncovered the burial of an individual wearing numerous heavy iron bracelets, seventeen of which he still had in his possession and donated to the project (Figure 6.11).[14] Given the spatial dislocation and lack of context information, it is unknown whether this burial is contemporaneous with the trash deposits in Unit B. However, the possibility remains open that the iron objects from excavation were disturbed from a mortuary context at some time in the past.

14 These bracelets are stored with the archaeological materials recovered by the project in the Laboratory of Archaeology at the University of Ouagadougou.

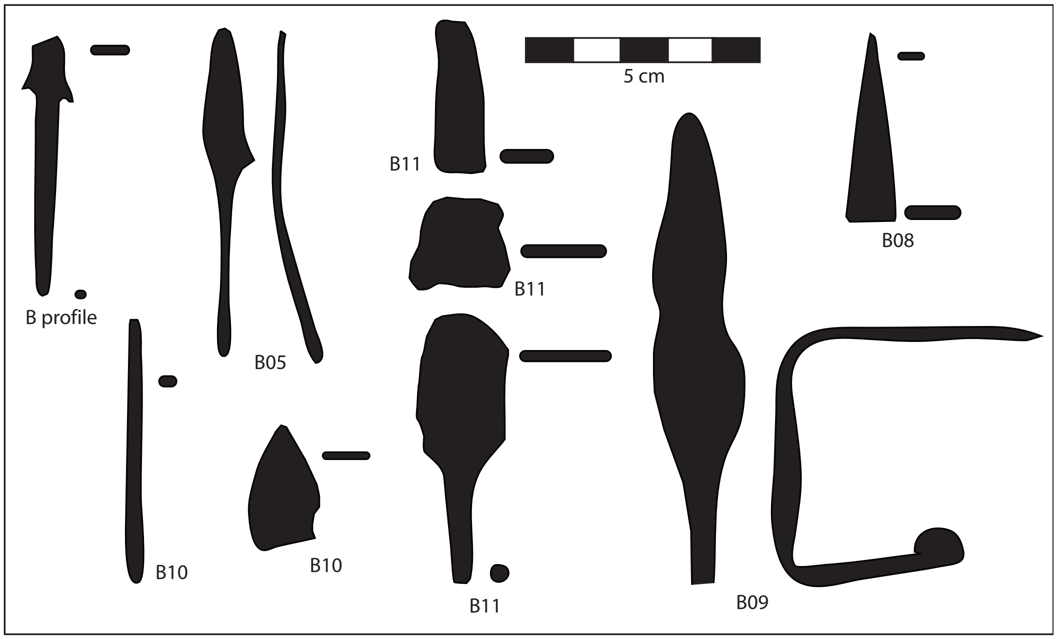

Figure 6.10: Iron Artifacts from Unit B

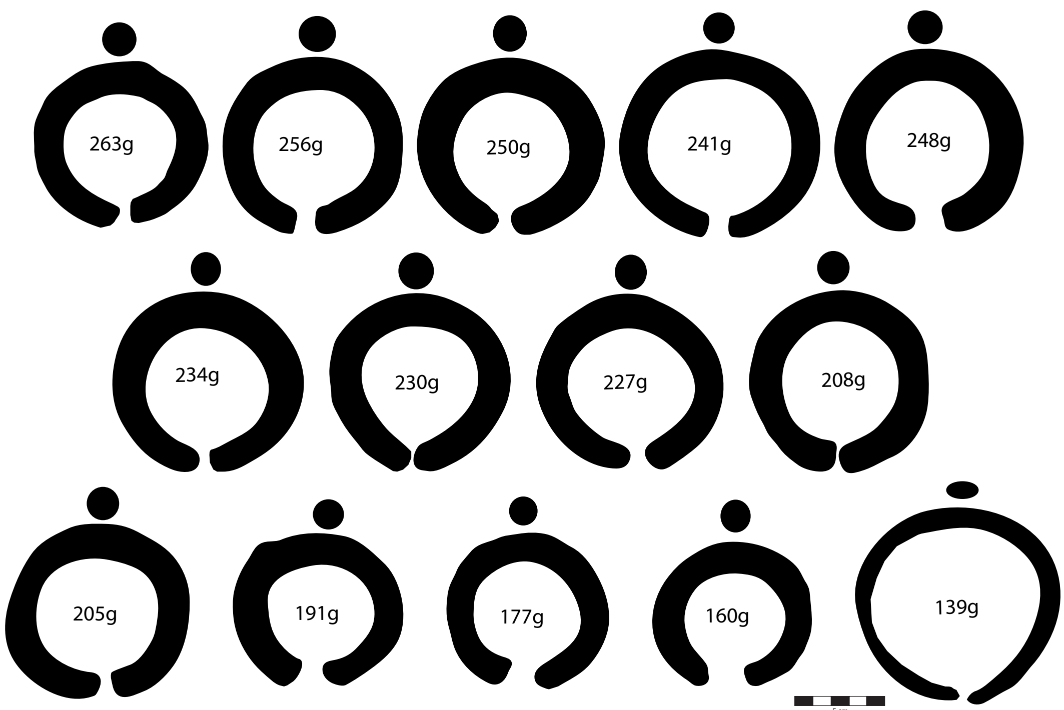

Figure 6.11: Iron Bracelets from Site 780

Daily Activities: Groundstone, Chipped Stone, and other Small Finds

Unlike ceramics and iron-working debris, where it was possible to be fairly comprehensive in documentation, the following categories of material culture are known only from judgemental samples from surface scatters. While groundstone objects were nearly as ubiquitous as ceramics, and certainly more so than iron, load restrictions prevented the collection of most broken and large examples, particularly if they fell outside the systematic collection area. The presence of chipped flint debris was also widely documented, but most debris could be categorized as debitage and was generally collected only within the systematic collection area. In contrast, objects such as formal chipped flint tools, hachets, and pipes may have been rare items only present at a few sites, but they also could simply have occurred in lower quantities within all households, reducing the chances of recovering them from the surface.

Grinding Stones

Grinding stones are present at most sites in this phase. These smoothed pieces of sandstone are used to crush or grind substances; food is the most frequent, but the stones are also used to process medications, crush tempers or ochre for pottery (decoration), and perform other similar tasks. To process the most common staple grains, millet (*Pennisetum glaucum)* and sorghum (*Sorghum bicolor*) stalks are first pounded in wooden mortars and pestles to loosen the grain prior to winnowing. The cleaned seeds can then be pounded or ground to make flours. In the former case, the resulting flour is usually steamed to make a couscous. In contrast, ground flour is mixed with water and boiled to make the thick paste commonly used as a staple in the region. Since yams are usually pounded[15], the widespread presence of grinding stones can be interpreted as a possible proxy indicator for significant reliance on cereals.[16] Households will often have multiple stones, and their use may be specialized. For example the Tallensi keep a rough and a fine stone for grinding grain, and reserve a third stone for other foods (Fortes and Fortes 1936). Given their essential function, it is not surprising that grinding stones are distributed evenly throughout the study region; although weight/number of stones per site was not quantified, sites in zone 1 were no more likely to have them on the surface than sites in zone 7.

15 Dried yam chips may be ground into flour, but this preparation is normally used only when fresh yams are not available and is generally not preferred. However, grinding stones may be used for the preparation of sauces or other dishes within yam based cuisines (e.g., Bascom 1951).

16 The wild plants most frequently exploited in bulk (shea butter and locust bean) are usually initially processed by pounding, after which they are boiled or fermented.

The grinding stones documented during survey and in excavation can be divided into two primary categories: *li naali* (the basal stones on which grinding takes place) and *u bindu* (the handheld stones used to grind).[17] The hand stones collected on the survey come in several shapes and sizes; most can be classified as trigonal, patellar, or discoid, but there are several other forms. The *u bindu* are generally small enough to be held with one hand, although they were likely pushed by both.

Unlike *u bindu*, which were frequently recovered intact, almost all *li naali* were fragmented. *Li naali* require significantly more labor to prepare than *u bindu*, as an appropriate piece of sandstone must be ground down to create both a smooth grinding surface and a stable base. Some of the recovered stones with two flat sides and no grinding depression could be preforms for these, although Geis-Tronich (1991: 394) depicts a small flat groundstone as a base on which to separate cotton seeds from their fibers. While no descriptions of groundstone use-life could be located for West Africa, numerous studies in the American Southwest suggest that they are used for grain until they break (Schlanger 1991). At this point, the fragments are maintained as grinding tools for smaller tasks such as crushing sauce ingredients, medications, or pottery tempers. Eventually, those fragments that can no longer be used for grinding are incorporated into building foundations, hearths, lintels, etc.

Unfortunately, few conclusions regarding mobility can be drawn from the groundstone data. Grinding stones are sufficiently labor intensive so that they may have been moved rather than left behind when a site was abandoned, and the inhabitants of more recent sites in the region may have scavenged stone from older occupations when possible, rather than obtaining new stone from the escarpment. More significant than the stones themselves is the implication of widespread cereal processing.

Chipped Stone

Chipped flint is found at slightly less than half of the sites associated with this phase, and generally occurs in small quantities. Flint was recovered from the systematic surface collections at 83 of the sites with only a Siga component, and generally occurred in very small quantities. In over 50% of cases, only one piece was recovered in the 25 m^2 collection area, and 90% of sites had fewer than six pieces (the maximum collected was 10). Weight was strongly affected by the presence or absence of cores in the collection, but again over 50% of sites had less than 5 g of flint in the systematic sample (maximum collected 120 g). Sites with chipped flint were distributed evenly throughout the study region, although sites with particularly high weights or numbers of chipped flint objects

17 These Gourmantche terms are used to distinguish these two categories of grinding stone in the discussion.

(n=10) are distributed throughout the upper half of the drainage catchment (zones 1-4) nearer the flint sources. However, only one of these sites occurs in Zone 1 near the escarpment where most presumed Late Stone Age sites (i.e., those with dense chipped stone assemblages) have been identified.

Chipped flint is locally considered a firestarter,[18] and the majority of recovered flint –multi-directional cores, flakes, and debitage—could be flaked debris from this activity. Flint on flint fire starting is unreliable, and usually flint is sparked with an iron striker[19]; Geis-Tronich (1991) documents the use of this technology in modern Gourmantche, albeit with a piece of quartz rather than flint. While no recovered iron objects have been identified as strikers (see above), a specific form is not necessary. If chipped flint was in use as a fire starter, it is possible that some sites consisting only of flint debris could be activity sites for fire intensive activities, e.g., fish smoking, that otherwise leave few surface remains.

Formal chipped flint tools are largely unknown from this phase. Only a few backed microliths were identified, and most of those occurred at sites near the escarpment and/or known LSA occupations (where backed microliths are common). While the possibility of a continued formalized chipped flint industry cannot be excluded, particularly since the continued use of stone tools despite the availability of iron is well-documented in West Africa (MacDonald and Allsworth-Jones 1994), the currently available data do not support this theory in the Gobnangou region. Regardless, the use of chipped stone as expedient tools should be considered likely, as even unmodified flakes made on this fine-grained flint have very sharp cutting edges. Since flakes were recovered almost exclusively from surface contexts, post-depositional effects such as trampling, plowing, and weathering obscured easily identifiable evidence of use-wear.

The flint likely comes from local sources (see Chapter 5), and based on the collected pieces of unflaked stone, it is transported in small rectangular blocks. These blocks are fairly standardized (averaging 4.2 x 3.0 x 1.6 cm with standard deviations of less than 1.0cm), which could be a result of natural fracture patterns at the source. Regardless of the origin, this size would make flint blocks an easy item to transport.

In contrast to flint, quartz is very rare at sites from this phase. Chipped quartz is present in the systematic collection at only 8 sites, and the number only increases to 11 when opportunistic collections are included. Larger pieces reach a maximum of

18 In Maadaga this technique is no longer used as affordable matches are widely available.

19 Certain types of stone, notably iron pyrite, can be used in place of iron. None of these are known to occur in deposits near the study region.

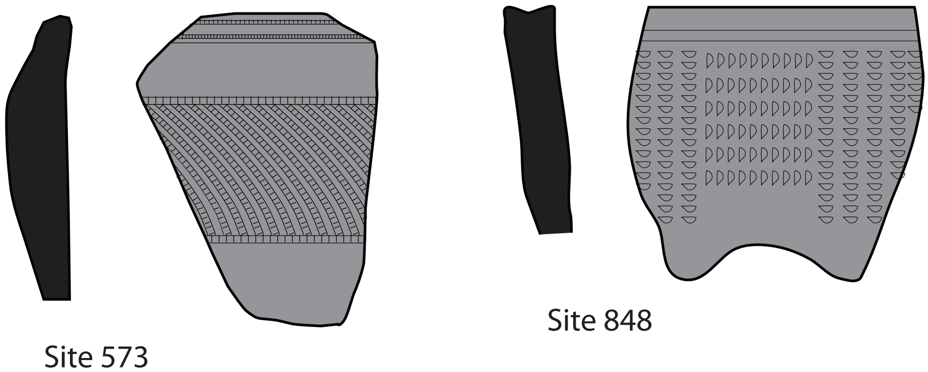

Figure 6.12: Pipe Bowls from Siga Occupation Sites

38 g. Since quartz is a common pottery temper, it is possible that quartz was largely consumed, i.e., flakes produced by other activities such as fire-starting may have been collected and repurposed. However, sites with chipped quartz actually have significantly lower percentages of quartz tempered pottery than are present in the complete phase assemblage. In contrast, of the three sites where unworked pieces of quartz were recovered, two have significantly higher percentages of quartz tempered pottery.

Hachets

Four small groundstone hachets were recovered on survey. Three of the four are from high confidence sites (502.2, 572.2, and 731), and one is from a low confidence site (643). These hachets range in length from 4.8 to greater than 10 cm, and are variable in their width, height, and features, although they are all made of a similar hard stone with a greenish tint, possibly granite (see Figure 6.9). There is no residue from hafting, although that is not unexpected in a surface find. At least one hachet has visible wear along cutting edge, suggesting that these may have been functional rather than ceremonial or symbolic tools. These types of axes, though rare, are not unusual, and their presence is noted by Geis-Tronich (1991) and Breunig and Wotzka (1991).

Pipes

Pipe fragments are very rare in the Siga occupation: only three fragments were recovered (each from a different site), and only one of these fragments was from a site classified as high confidence (Figure 6.12). Of the three fragments, two are from the pipe bowl. They have been treated with red slip, and elaborately decorated. In contrast, the stem fragment is only tentatively classed as a pipe: it is made of rough, unsmoothed clay, and is undecorated. These types of clay pipes are almost universally associated with smoking tobacco: the dating implications are discussed below.

Farming, Herding, Gathering, Hunting: Siga Occupation Subsistence

As described above, there is strong evidence that the majority of sites from the Siga occupation are the remnants of generalized households that moved frequently, likely as part of a program of shifting cultivation. In this section, I will present what little direct evidence we have for prehistoric subsistence, in the form of carbonized plant remains and animal bones from excavation. This data will then be integrated with the various indirect conclusions regarding subsistence described above in order to reconstruct the Siga occupation subsistence economy.

Seeds and Bones: Direct Evidence of Siga Occupation Subsistence Strategies

Very little direct botanical evidence is available for the Siga occupation. Of the three excavation units, Unit C (Site 572.1) and Unit D (Site 573) were too shallow to obtain reliable flotation samples. In Unit B (Site 780), rodent disturbance was so pervasive in the upper layers that flotation samples were only taken from the most intact cultural deposits (B09-B12, 55-110 cm below the surface, see Appendix B). Each of these five 2L samples exhibited significant evidence of post-depositional intrusion including uncharred seeds, rootlets, shells, and insect parts.[20] Only one sample (B09) yielded identifiable carbonized remains: a seed of *Eleusine indica* (Graminae), and a fragment of shell from *Adansonia digitata* (Bombacaceae). The former is a common ruderal grass that colonizes disturbed areas: it can be found in aging crop fields, abandoned areas, and other low nutrient locations. The latter, baobab, is one of the more prominent useful trees in the region (see Chapter 3). Interestingly, while shell fragments of *A. digitata* were common in almost every level of excavations at the Pwoli occupation sites, they were very rare in Unit B.

Likewise, only four identifiable animal bones were recovered from Unit B: bushbuck (*Tragalaphus scriptus*), bush duiker (*Sylvicapra grimmia*), cattle (*Bos taurus*), and catfish (Siluriforme).[21] Unfortunately, since different species of catfish live in a wide

20 Identified uncharred seeds include *Commelina* sp., *Kyllinga* sp., *Pennisetum* sp. (wild), and members of the Amaranthaceae and Leguminosae-Papillionoideae families. All are common weeds consistent with the site's current use as a crop field.

21 The faunal analysis was performed by Stephen Dueppen. The three mammals are each represented by a single first phalanx. However, phalanxes preserve well and are frequently discarded intact. Fragmented, unidentifiable bone including ribs, long bones, and other body parts consistent with the size classes of these animals was also recovered from Unit B. The catfish is represented by a vertebra.

range of habitats, it is unknown whether this particular fish was caught locally during the wet season, or transported (likely in dried/smoked form) from a larger river.

The three mammals are evidence of three different strategies. As described in Chapter 3 (see Table 3.13), bushbucks are moderately sized animals that are often found away from human settlements since they prefer areas of thick cover. They are usually killed during hunting expeditions, particularly during the dry season when they tend to cluster near water sources. In contrast, bush duikers live in a variety of habitats and can be common even in fairly populated areas as they breed twice yearly (Spinage 1986). They are known to raid fields and are consequently prime targets for opportunistic hunting. Finally, measurements of the cattle bone indicate a dwarf breed common in the southern savanna. Dwarf livestock are village animals, and generally fare poorly in transhumant or mobile husbandry strategies. They usually are kept near the village and their manure is used to fertilize fields.

Farming and Gathering During the Siga Occupation

With so little direct evidence, determining the crops under cultivation is challenging. As described in Chapters 3 and 4, the study region is at the northern limits of yam cultivation, and cereals (millet and sorghum) are generally the dominant crop. While the ubiquity of grinding stones and the identification of cereal agriculture during the Pwoli occupation suggest a reliance on millet and/or sorghum as the primary staple, the potential importance of yams cannot be ruled out. Likewise, numerous varieties of fruits, vegetables, and legumes were likely also cultivated, although again, there is no direct evidence.

The settlement pattern outlined above suggests a farming practice that requires (or allows for) the frequent relocation of the primary residence. Most likely, residents farmed a ring of fields directly around their homes, as described in Chapter 4. While the manure from the dwarf livestock may have been used to fertilize those fields, or more likely vegetable gardens closest to the homes, the majority of the cultivated area would have been farmed “as is,” with few added inputs. The usual length of cultivation for a millet or sorghum field is seven years, even with the inclusion of a crop of legumes, after which they usually require a fallow period of 15-20 years (see Chapter 4): the decision as to how long a farmer would reside in any given location would depend on the quality and extent of easily accessible land from the residence.

It is presumed that numerous wild plants played a significant role in Siga occupation diets, although direct evidence is limited. While the presence of important herbaceous species (e.g., *Corchorus* ssp.) may have been important for choosing residence sites, these plants are easily encouraged, occur widely, and reach harvest within a growing season. More important is access to the crucial useful trees, notably shea butter, locust bean, and baobab: these orchard crops take years to reach their first harvest, making it unlikely that farmers would see fruit from protected saplings during a short term occupation.[22] As discussed above and in Chapter 4, access to trees is often distinct from access to land. In a landscape of shifting cultivation, one of the benefits to clearing virgin territory is often the establishment of tree rights that may be continually exploited. Thus, even if a particular patch of land is not farmed, the trees will be visited and harvested, resulting in an ongoing link to the sites of previous residences and a possible incentive to return to the same general area once the fields have recovered.

Hunting and Herding During the Siga Occupation

Our data on hunting and herding is also significantly limited, as we can only rely on the very small animal bone sample. Additionally, as discussed below, Site 780 is fairly unique in the region and may not be representative. Both bushbuck and bush duiker could easily have been hunted in thickets near watercourses. Cattle are high investment animal, particularly in the tsetse zone, where even dwarf breeds must be specially cared for. Since cattle are almost universally considered a form of storable wealth, their presence could be an indicator of wealth differentials between households. Overall, there is nothing to suggest any significant changes in hunting or herding strategies from those described for the Pwoli occupation.

Dating the Siga Occupation: Absolute Dates, Occupation Length, and Palimpsest

Providing an absolute date for the Siga occupation is challenging due to the ephemeral nature of the majority of sites and the lack of a strong regional chronology. Consequently, several dating sources are used, including radiocarbon dates, direct thermoluminescence (TL) dates on ceramics, and dated artifacts from surrounding regions (Table 6.7, Figure 6.13). The Siga occupation was initially placed after the Pwoli occupation due to the presence of Siga ceramics on the surfaces of Site 502.3 (Unit A) and, to a lesser extent, Site 541 (Unit E). Thus, the Pwoli occupation dates, described in Chapter 5, act as a *terminus post quem*. An AMS radiocarbon sample from the most intact

22 Shea butter trees bear fruit from ca. 50 to 250-300 years of age. Locust bean bears fruit from ca. 15 to 100 years of age (Timmer et al. 1996). The data on baobab are less clear, particularly since intensive harvest of the leaves for sauce on young trees can significantly delay fruiting (Duvall 2007).

Datable Item	Date Type	Date Source	Date
Charcoal (B12)	AMS Radiocarbon	Site 780, B12	cal AD 1210-1290
Sherd Type 1 (ST1)	Thermoluminescence	Six sherds from surface and near-surface contexts in study region (WG)	AD 320-544
Sherd Type 1 (ST1’)	Thermoluminescence	One sherd from near surface context in study region (WG)	AD 1055-1267
MAC Decoration (MAC)	Thermoluminescence	Three sherds from surface contexts in Kantchari (WG)	AD 1122-1222
LC, BDC Decoration (LC)	Associated Radiocarbon	Excavation unit: charcoal is from lowest levels and may pre-date pottery (P)	cal AD 891-1023 and after
Smoking Pipes (SP)	Associated Radiocarbon	Sites throughout West Africa (see text)	AD 1600-??

P=Petit 2005, WG= Wotzka and Goedicke 2001

Table 6.7: Absolute Dates for the Siga Occupation

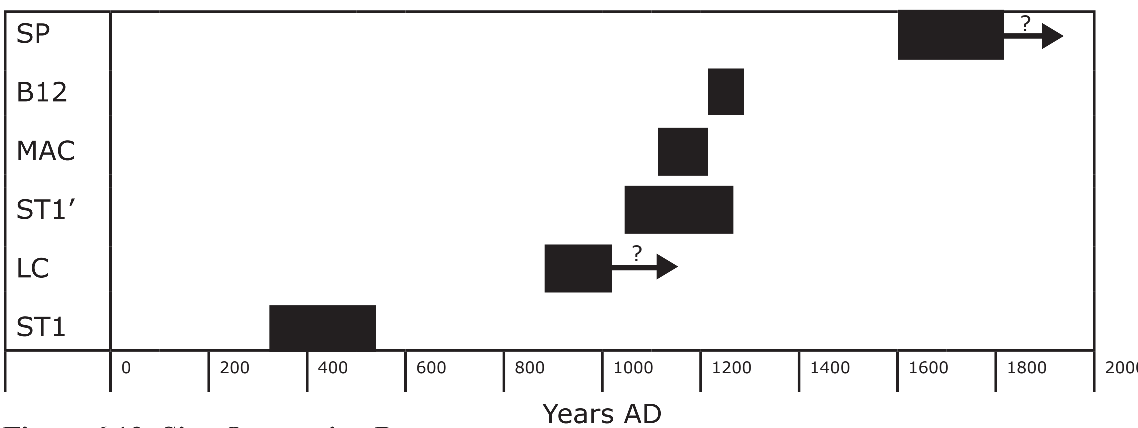

Figure 6.13: Siga Occupation Dates

cultural deposits of Unit B (Site 780)[23] yielded a date of cal AD 1210 to 1290[24] for the Siga occupation, confirming this seriation.

Further support for an early second millennium AD date for the Siga occupation is provided by the dates available for the LC/BDC and MAC decorated pottery found at Tchikandou-I and Kantchari, respectively (discussed above). Petit identified several sherds with LC/BDC decoration at the site of Tchikandou-I in northern Benin. The available radiocarbon date for the site (cal AD 891-1023) is from the bottom of the 130

23 Units C (Site 572.1) and D (Site 573) were very shallow and yielded no datable samples. Unit B had significant rodent disturbance, and most samples collected were not *in situ*. See Appendix B for more details.

24 Unless stated otherwise, all dates are given at the 2-sigma range.

cm deep excavation unit in which the relevant pottery was recovered (Petit, personal communication). According to Petit (2005:108), the site was abandoned in the 12th century AD. Sherds with MAC, collected from several surface sites by the Frankfurt project, were TL dated to AD 1122-1222 (Wotzka and Goedicke 2001).

The Frankfurt project also ran TL dates on seven Sherd Type 1 ceramics collected from surface and near-surface contexts in the study region, predominately at Maadaga rockshelter (Wotzka and Goedicke 2001, see Appendix A for more details). Six had similar TL ages that were combined to create a context date of AD 320-544 for the pottery group, earlier even than any dates for the Pwoli occupation. However, the single outlying date, AD 1055-1267, is consistent with the proposed dates for the Siga occupation. There are several possible explanations for this discontinuity (return to a legacy ceramic style, errors in dating, etc.) that cannot be distinguished with the present data. However, given the total available evidence, it is presumed that Type I sherds recovered for this project in association with other Siga occupation ceramics date to the early second millennium AD.

An upper end for the Siga occupation is suggested by the presence of smoking pipes at a few sites. While some arguments have been made to the contrary (e.g., Mvondo 1994), the widespread use of smoking pipes generally coincides with the availability of tobacco in the region, usually ca. A.D. 1600 (e.g., Shinnie and Kense 1989, McIntosh et al. 2003). Unfortunately, the decorated pipe fragments are bowls, which show the least temporal variation (Shinnie and Kense 1989). However, as will be seen in Chapter 7, pipes were also recovered from Tuali occupation sites, and these pipes likely date from the 17th to the early 18th centuries AD. While on the surface, this suggests a transition between the Siga and Tuali occupations sometime shortly after A.D. 1600, it is important to bear in mind that smoking pipes are a very rare class of artifact that could easily be deposited after the sites were abandoned, particularly since we know little about the context of smoking: i.e., whether smoking was a social activity confined to residences, or a habit indulged when convenient, regardless of the location.

In summary, as can be clearly seen in Figure 6.11, the majority of Siga occupation dates cluster in the early second millennium AD. While smoking pipes may indicate the temporal extent of the Siga occupation, no dates were obtained for the 14th to the 16th century AD. Given this unresolvable gap, the end dates for the Siga occupation must remain tentative.

The Siga Occupation in Regional Context

Archaeological Perspectives

Drawing links between the results of archaeological projects over 100 km apart is a speculative endeavor at best, particularly when both projects are hampered by low chronological resolution. However, there are certain similarities between the sequence described in northern Benin by Petit (2005) and that of the study region that suggest possible regional scale patterns. As noted above and in Chapter 5, northern Benin is characterized by fairly sedentary people who created settlement mounds throughout the mid first through early second millennium AD. In the 11th-12th century AD, locations to the north of the Atakora mountains were abandoned: abandonment of southern mound sites followed approximately 300 years later.[25] Sites dating to the middle and late second millennium AD (Petit's "Historical Period") are few and ephemeral; Petit was not able to subdivide the occupation, and most of the described sites have more similarities with the Tuali occupation than the Siga occupation. Petit attributes the changes in settlement strategy to either the effects of the early second millennium AD dry spell and/or increased insecurity in the region.

There are two ways to interpret this transformation in light of the evidence from the study region. First, residents of northern Benin may have become more mobile, resulting in more ephemeral sites that are difficult to identify, particularly if the survey area was not extensively plowed. Second, there may in fact have been a depopulation of the region to the north of the Atakora mountains. In the former case, the basic sequence mirrors that of the study region, where the more sedentary Pwoli occupation gives way to the more mobile Siga occupation. This could point to regional level trends that encourage mobility. In the latter case, a depopulation along the banks of the Pendjari is intriguing given its traditional role as the southern boundary of the Gourmantche kingdom. As will be described below, the Siga occupation covers the period during which, according to oral histories, the Gourmantche kingdom was founded and consolidated: raiding and conflict with peoples to the south is a central part of those narratives. Unfortunately, it is not possible at this time to further explore these very speculative hypotheses, particularly given the lack of archaeological data on the areas directly to the north of the Pendjari River.

---

25 Despite the noted coincidence that northern Benin was possibly depopulated contemporary with or slightly after the beginning of the Siga occupation and its attendant possible increase in population, there is virtually no evidence that suggests a migration to the study region. If anything, the lack of similarities in the ceramic assemblages is evidence against this hypothesis.

The Origins of Gourmantche: Perspectives from Oral History of the Early Second Millennium AD.

The Siga phase is the first for which substantial oral histories are available, as this period covers the range of generally cited dates for the foundation and establishment of the Gourmantche kingdom.[26] There are two primary sources for Gourmantche oral history. The most commonly cited sequence can be traced to the seminal master narrative complied by Chantoux (1966) from various oral accounts collected in Fada n'Gourma, over 200 km from the study region. His *Histoire du Pays Gourma* ("History of the Gourma Land") suffers from many of the problems common to oral accounts gathered and assembled during the colonial era. In contrast, Madiega (1982, Madiega et al. 1983), embarked on an ambitious project that incorporated modern methodologies and systematic techniques in a close examination of the northern areas of the Gourmantche kingdom. His results often directly contradict those of Chantoux (see Appendix C for a detailed presentation and critical discussion of both Chantoux and Madiega's narratives).

Chantoux's narrative begins with the founding of the Gourma kingdom at Pama by Diaba Lompo in AD 1204. Over the next 200 years, Lompo and his successors expanded the territory of the Gourmantche kingdom to include the Gobnangou region to the east in addition to numerous territories to the north. Chantoux suggests that the Gobnangou of the early second millennium AD was an area in which egalitarian peoples, whom he identifies as Bariba, lived along the escarpment and in the marshes of the Pendjari due to fears of Fulbe and Hausa raiders. The conquering Gourmantche leaders allied themselves with locals, drove back the raiders to beyond the Pendjari and Niger Rivers, and reorganized the region under a chief drawn from the local population. After ca. AD 1400, the Gourmantche kingdom entered a period of decentralization, during which the sixteen member chiefdoms, including the Gobnangou, maintained greater autonomy (and frequently fought amongst themselves).

In contrast, Madiega (1982, Madiega et al. 1983) places the founding of the Gourmantche kingdom significantly later, in the 15th-17th century AD, and suggests that the founders were the Buricemba or Bemba, arriving from the east. He emphasizes the autonomy of the member chiefdoms, and argues that the Gobnangou chiefdom was actually founded by a Hausa dynasty at an even later date. Like Chantoux, Madiega characterizes the Gobnangou region of the early first millennium AD as populated by egalitarian peoples (whom he identifies as Tankanba and Ouoba) who for the most

26 There is a contentious debate as to what extent the Gourmantche kingdom was one unified polity, or a collection of independent polities (see Appendix C for details). For the purposes of this thesis, the term "kingdom" is used to refer to the entire collection of culturally cohesive Gourmantche polities, regardless of whether they were political linked. The term should not be read as an endorsement of a hierarchical, unified Gourmantche state.

part stayed close to the escarpment. He attributes the granaries found in caves in the escarpment to these peoples (e.g., Millogo 1993a, 1993b).

The details from both narratives are difficult to align with the archaeological record, particularly given the low reliability of the dates provided in the oral histories, which make it impossible to determine whether the Siga occupation predates, postdates or transcends incorporation of the region into a greater Gourmantche polity. In addition, projecting specific ethnicities and their relationships into the past is problematic, and there are elements of a classic civilizing narrative in the creation of the Gourmantche political hierarchy. (It is interesting to note that both Chantoux and Madiega trace the origins of that hierarchy to invaders, from the west and the east respectively).

The diversification of the ceramic assemblage could be indicative of increased multi-culturalism and/or contact with surrounding regions. Without the resolution to track the development of the Siga ceramic tradition (or comparative ceramic data from regions to the west and north), it is not possible at this time to determine whether any or all or aspects of the ceramic assemblage were locally developed, imported, or are evidence of an in-migration (Gourmantche or otherwise). As will be discussed below, some of the archaeological data may suggest a greater political organization that may have had a hierarchical organization. At the least, the assumption that pre-Gourmantche peoples were confined to the base of the escarpment is clearly false.

Discussion

The Siga occupation represents a significant transition from the Pwoli occupation. While the basic elements of the subsistence economy in terms of resource exploitation appear to have remained fairly stable, the associated farming practices changed dramatically. Residents of the study region during the Siga occupation lived in household compounds that were widely spaced on the landscape; while occasionally a few may have been constructed adjacent to each other, the minimum distance between sites was usually over one hundred meters, and often significantly higher, particularly when the effects of palimpsest are considered. During the rainy season, the network of drainages bisecting the landscape would have increased the travel times between sites. Combined with the data suggesting that these sites were not occupied for long periods of time, residents were likely practicing a form of shifting cultivation that involved regular relocation of the primary residence.

Given the problems of chronology, it is almost impossible to untangle the complex settlement pattern of the Siga occupation at the regional level: the “snapshot” view is unattainable. As described in Chapter 4, it is likely that no more than 200 of these residences could have been occupied simultaneously. Hypothetically, if inhabitants moved their primary residences and field systems every 30-40 years, and population remained constant in the region, only 30-35 sites would have been occupied at any given time. More likely, population in the region over the lengthy period covered by the Siga occupation fluctuated significantly: the study region boundaries are to a certain extent arbitrary, and residents may have been moving within a significantly larger territory. While the pattern and coordination of moves is unknown, individual households in shifting settlement systems usually have significant autonomy and flexibility in determining when and where they will move, provided they remain within territory controlled by a group (kin-based, political, or ethnic) with whom they are identified. In this case, the ceramic data suggest that the entire study region was within one such territory.

In making their decisions as to where to locate their residences, and consequently farm (or vice versa), Siga occupation households likely balanced multiple tensions, the foremost of which may have been whether to return to an earlier residence location or move to a previously unoccupied area. The currently available data suggest that re-occupation of sites was rare based on the small number of clusters and large sites, although since decayed former residences (and the areas directly surrounding them where trash was deposited) often produce very rich soils, it would not abnormal to return to the same field system, but locate the residence several hundred meters distant.

The data suggest that households during the Siga occupation were fairly generalized: for the most part, they have similar ceramic assemblages, fall within a small range of sizes, and their distribution suggests that each household controlled its own field system. There are a few exceptions: iron smelting appears to have been carried out at specialized locations, some of which (notably site 849) may have been used for extended or high volume smelting. Additionally, Site 780 and its environs (including Site 696.2 less than 100 m distant across a small drainage) have a richer material culture other sites in the study region. As described above, the densities of iron objects were very high at Site 780, and Site 696.2 had by far the highest diversity of ceramics in the study region. The burial at Site 780, with its iron bracelets, is the only known burial in the study region with grave goods.[27] While it seems as though residents of Sites 780/696.2 were wealthier than other households, there is not yet sufficient data to address whether this translated to political power.

27 This project did not excavate burials. However, they are frequently encountered by farmers when digging borrow pits, preparing fields, etc. Locally, this find was considered very unusual.

Several lines of evidence suggest that regardless of political organization, residents of the study region during the Siga occupation were not subject to significant raiding. Households were able to move freely within the landscape, and there is no evidence of settlement concentration near the escarpment. Ceramics, groundstone, flint, and iron objects were exchanged throughout the study region, and access to these resources does not seem to have been disrupted. Likewise, the hypothesized small but steady stream of imported ceramics from outside the region could indicate positive trading relationships with neighboring groups.[28]

28 Pottery is not commonly cited as a spoil collected during raiding expeditions, in part because transport of earthenware requires very careful packing.

CHAPTER 7
INDIGO AND THE ESCARPMENT: THE TUALI OCCUPATION

The Tuali occupation (ca. AD 1650-1900), the last of the temporal divisions I defined, is in many ways similar to the Siga occupation; it consists almost entirely of the small, short occupation sites consistent with shifting cultivation, and if anything, many of the larger sites and/or clusters that suggested aggregated communities in the Siga occupation have disappeared. This continuity in the basic mode of settlement is accompanied by significant changes in the material culture, as the diversity of the ceramic assemblage decreases dramatically throughout the Tuali occupation. Finally, the most significant development of the Tuali occupation is the construction towards the end of the period of a series of plastered indigo dye pits; the presence of these pits has numerous implications for understanding how the Gobnangou region interacted with surrounding territories, and allows us to critically assess common historical narratives that describe Gobnangou populations as changing their spatial pattern of occupation in response to external security threats. I suggest that these moves may have been motivated more by economic considerations.

Tuali occupation sites can be divided into two groups, designated Tuali-A and Tuali-B. This division is fundamentally based on characteristics of the ceramic assemblage, but, as will be described below, is substantiated in other classes of data. Unfortunately, no excavation data is available for the Tuali occupation, and the Tuali ceramics assemblage was not identified at any stratified sites. For this reason, while there are strong indications that the Tuali-A occupation (ca. AD 1650-1850?) predates the Tuali-B occupation (ca. AD 1850-1900?), the possibility must remain open that the differences between them are functional rather than temporal. This chapter begins with a review of the Tuali A occupation. This is followed by a discussion of Tuali B, with an emphasis on the role of indigo dyeing. Finally, after a brief discussion of recently abandoned "ring" sites (ca. AD 1900-present?), the transformations in the Gobnangou region over the past several hundred years are synthesized.

	1	2	3	4	5	6	7	Total
A	16 (10)	9 (5)	19 (8)	17 (9)	8 (6)	0 (0)		69 (38)
B			2 (2)	6 (4)	2 (2)			10 (8)
C				0 (0)	4 (2)	1 (0)	1 (0)	6 (2)
Total	16 (10)	9 (5)	21 (10)	23 (13)	14 (10)	1 (0)	1 (0)	85 (48)

Numbers outside parentheses are total Tuali A sites.
Numbers in parentheses are single component, high confidence Tuali A sites only.

Table 7.1: Distribution of Tuali-A Sites

Tuali-A

The Tuali-A occupation is characterized by small sites and shifting settlement. However, it is notable for the beginnings of a settlement shift towards the escarpment and for significant transformations in the ceramic assemblage.

Spatial Distribution of the Tuali-A Occupation

The Tuali occupation accounts for significantly fewer sites than the Siga occupation: only 85 Tuali-A sites were identified, and of these only 48 were high confidence single occupation sites (Figure 7.1). Multi-component sites are common, although given the already established phenomenon of using older residences as a mudbrick source for new residences, it is hardly unsurprising that Tuali-A occupation sites are more likely to have significant elements of the Siga occupation's ceramic assemblage than vice-versa.

With one notable exception, Tuali-A sites are located throughout the study region, occurring on the banks of major and minor seasonal drainages, on the highlands near inundated regions, and along the foot of the escarpment (Table 7.1, 7.2). That exception is the almost complete lack of sites in Zones 6 and 7. While these areas were commonly occupied during the Siga occupation (accounting for ca. 20% of identified sites), they are essentially abandoned. More interestingly, the transition from occupied to unoccupied territory is abrupt; there is no evidence of gradually declining site occurrence further from the escarpment, and Zone 5 is as likely to have a Tuali-A site as Zone 1. There is no obvious environmental reason for this transition as the soils and topography of Zones 4-5 and Zones 6-7 are similar. While in general the Tuali-A occupation sites are broadly

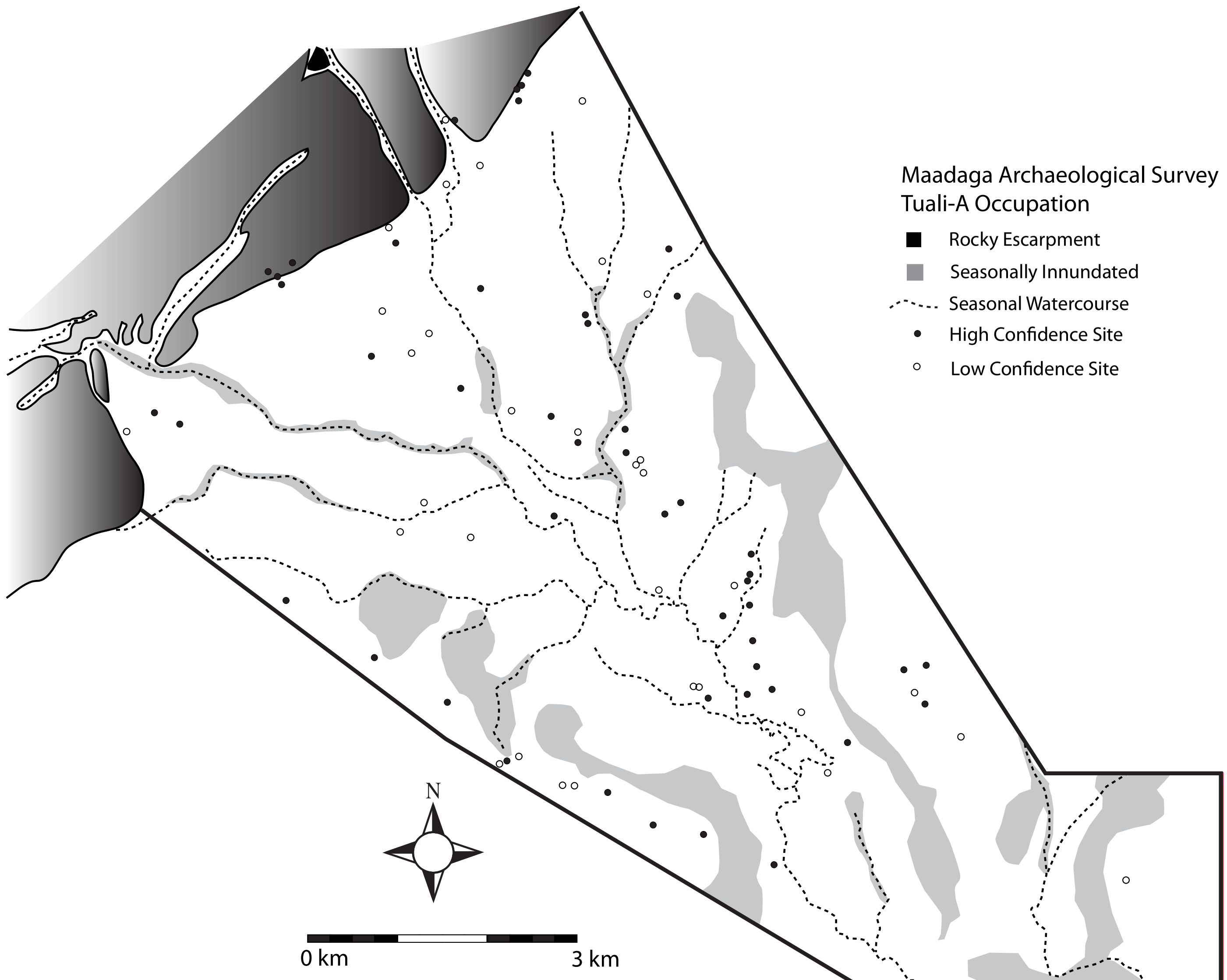

Figure 7.1: Distribution of Tuali-A Sites

Site Features	High Confidence Single Occupation	Low Confidence Single Occupation	All Sites
#Sites	48	18	85
Baobabs	8	3	13
Near Seasonal Drainage	17	12	39
Near Seasonal Pool	-	-	2
Near Seasonal Innundation or Marsh	7	1	9
Total Near Water	24	13	50
Plowing	46	16	79
Borrow Pits	4	-	8
Chipped Stone	24	7	41
Groundstone	29	11	51
Iron Smelting (small)	1	-	1
Iron Smelting (multiple)	-	-	1
Iron Smelting (large)	-	-	-
Smithing Slag	7	2	13

Table 7.2: Characteristics of Tuali-A Sites

distributed, there are two noticeable clusters of sites near the foot of the escarpment. Bearing in mind the issues of palimpsest, these sites are the only evidence for aggregation during the Tuali-A occupation, and constitute a minority of documented sites.

Since the Tuali-A occupation is probably significantly shorter than the Siga Occupation, it is possible that this change in settlement pattern is simply an artifact of the particular group of sites included, i.e. it is a snapshot of a continuing trend of motion towards and away from the escarpment that is obscured in the Siga site distribution. However, as will be seen below, the Tuali-B occupation is even more strongly oriented around the base of the escarpment. If this is indeed a real pattern, the question then becomes whether the movement was towards the escarpment or away from a cultural boundary in the southeast. The latter case seems unlikely, as the boundary would have been oddly positioned a few kilometers on the near side of the Kourtiagou River.[1] In the former case, movement towards escarpments and other hilly features is a commonly

1 It is possible that a boundary was being formed with a community residing along the Kourtiagou River. While it is not possible to draw any conclusions given the lack of research in that area, it seems unlikely given the prevalence of onchoceriasis (river blindness) along permanent/near-permanent waterways.

	Small	Medium	Large
Size (m^2)	1-60	75-625	350-840
N	3	35	10
Zone 1	0	7	3
Zone 2	0	5	0
Zone 3	1	7	2
Zone 4	1	10	2
Zone 5	1	6	3
Zone 6	0	0	0
Zone 7	0	0	0
Zone A	3	27	8
Zone B	0	6	2
Zone C	0	2	0
Mean ceramic density (g/m^3)	16.2	28.6	70.3
Median ceramic density (g/m^3)	16.5	20.2	32.0
Mean # decoration techniques in use	1.3	1.8	3.1
Mean # decoration techniques in use per 100 sherds	6.8	7.1	6.0

Table 7.3: Size Distribution of Tuali-A Sites

documented phenomenon in the latter part of the second millennium AD (e.g., Petit 2005). While often attributed to security afforded by the escarpment in the event of raiding or other forms of unrest, the sites in Zones 3, 4, and 5 are not even within sight of the escarpment. Instead, it is more likely that other features, such as political coordination or the establishment of trade routes favored residence locations closer to the escarpment.

Occupation Length and Type

Despite the changes in site distribution, individual Tuali-A sites share many physical characteristics with Siga sites. The average estimated height of Tuali-A sites is a shallow 0.33 m, with the majority of sites falling below that average. While we have no excavation data with which to verify these figures, data gathered from the few sites with borrow pits indicate that the surface impression of thin, single occupation sites is accurate.

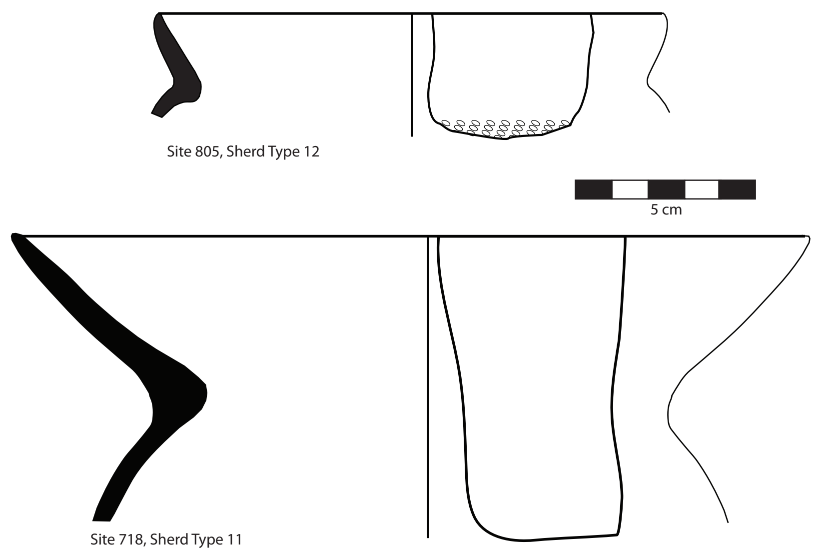

Figure 7.2: Tuali-A Ceramic Assemblage

The vast majority of Tuali-A sites fit within the medium size class defined for the Siga occupation (Table 7.3), with only a few very small sites less than 60 m^2. The site size histogram demonstrates even more strongly the dual peaks at ca. 11 and 15 m diameter (100 and 200 m^2) identified during the Siga occupation, perhaps due to lower impact of plow smear at these more recent sites.[2] If the sites are representative of individual family compounds, this jump could be related to the number of structures in the compound, whether they are additional huts around the edge of the ring or are extra features in the center of the ring that require wider spacing.[3] The most notable feature of the Tuali-A occupation was the absence of large sites: the largest example was 850 m^2, and only 25% of sites were over 350 m^2. This pattern suggests lower incidence of the multiple compound/close re-occupation phenomenon documented during the Siga occupation (although three of the multiphase sites are significantly larger). The size differences within the Tuali-A occupation did not seem to affect site placement: large sites are as likely to occur near the escarpment as in Zone 5. Likewise, there are only minor differences in artifact density, and diversity.

2 There were no identifiable distinctions in site location or material culture based on these two size categories.

3 Estimating the number of structures in a compound from its size is challenging, due to the vastly different potential structure densities (Prussin 1969). Documented hut size in Burkina Faso usually ranges between 3 and 4 m diameter. At this size, an 11 m diameter compound would comfortably fit ca. 3-4 huts, although in the study region it was noted that small compounds usually had more open space along the edges to compensate for the lack of central courtyard space. In contrast, a 15 m diameter compound would comfortably fit 5-6 huts along the outer ring.

	High Confidence Single Occupation	Low Confidence Single Occupation	All Sites
N Sherds	1708	558	2720
Grog Temper	31.2%	46.1%	36.2%
Quartz Temper	65.5%	50.2%	60.4%
Grog & Quartz Temper	4.7%	4.8%	4.4%
Mica & Quartz Temper	0.8%	1.0%	0.8%
Red-Slipped	10.2%	13.2%	11.6%
Sherds Decorated	12.2%	25.8%	17.0%
N Decoration Techniques in Use	16	19	31
Mean # Decoration Techniques in Use per 100 Sherds	6.8	9.9	9.0
N Sherd Type 1	-	-	1
N Sherd Type 2	2	1	3
N Sherd Type 3	3	-	3
N Sherd Type 4	-	3	4
N Sherd Type 5	-	-	7
N Sherd Type 6	-	-	-
N Sherd Type 7	-	1	1
N Sherd Type 8	-	-	2
N Sherd Type 9	26	14	50
N Sherd Type 10	-	3	4
N Sherd Type 11	34	3	43
N Sherd Type 12	13	2	15
N Sherd Type 13	-	1	1
N Sherd Type 14	57	3	81
N Sherd Type 15	-	-	-

Table 7.4: Characteristics of Tuali-A Ceramic Assemblage

In conclusion, despite the significant transformations in material culture described below, residents of the study region during the Tuali-A occupation maintained a mobility program similar to that with that described for the Siga occupation.

The Tuali-A Ceramic Assemblage

The Tuali-A ceramic assemblage is less than 20% the size of the Siga assemblage, with only 1708 sherds from high confidence single occupation sites (Table 7.4, Figure 7.2). Even with this smaller sample, there are dramatic changes in the nature of the assemblage. One of the most notable is the increased importance of quartz-tempered vessels, which now constitute the majority of recovered sherds. Grog tempered vessels are still common, particularly the large grog and laterite tempered vessels associated with Sherd Type 9 (see below), however mica tempered sherds virtually disappear from the assemblage. Functionally, grog and quartz temper have very different properties. Quartz temper creates a very strong paste which can be used to create large, thin-walled vessels, a property that was clearly favored by the potters of the Tuali-A occupation since over 50% of quartz tempered sherds are less than 8 mm thick.

The Tuali-A ceramic assemblage is also marked by a significant decrease in the diversity of vessel forms. The slightly restricted jar with a large flaring neck (usually quartz tempered) emerges as the dominant vessel shape, and accounts for a large percentage of both typed and untyped sherds (Figure 7.2). Sherd Type 11 is the archetypical example of these vessels, and these quartz-tempered rims occur in a wide range of sizes (vessel diameters are evenly distributed from 16 to 40 cm). Many of the untyped rims appear to be from the upper sections of these quartz flares, but they were not assigned to the sherd type since the inflection point was not present. Sherd Type 12 is very similar to Sherd Type 1; the rim is identical, but Sherd Type 12 is marked by the presence of a strip roulette decoration (usually Cord 6) on the shoulder of the vessel. Type 12 sherds also have particularly thin vessel bodies, onto which a slightly thicker rim has been applied. Finally, the roughing treatment that distinguished Sherd Type 14 is universally found on quartz tempered sherds. It is a common feature of the bases of the similar jars made in the region today. The only other Sherd Type common in the Tuali-A ceramic assemblage is Type 9, the very large, open grog and laterite tempered vessels with coarse ridges that were also present in the Siga assemblage. The persistence of this vessel type could indicate that it had a specialized function.

In comparing the transformations in the assemblage between the Siga and Tuali-A occupations, a particularly interesting development is the elimination of all vessels that would likely be used for serving. While the Sherd Type 11 and 12 vessels could easily take on the roles performed by Sherd Types 2, 3, and 4 during the Siga occupation, there are no equivalents for Sherd Types 5, 6, and 7. Indeed, bases of all kinds (pedestals, rings, feet) are largely absent from the Tuali-A assemblage: only 3 were identified. While it is tempting to interpret this pattern as an indication of a transformation in the context of food and beverage consumption, it is important to bear in mind that the lack of ceramic serving vessels may tell us more about the changing importance of ceramics. Preferred serving vessels could have simply been manufactured using mediums that do not preserve in the archaeological record, e.g., carved wooden bowls or decorated calabashes (gourds), a possibility explored further below.

The decline in the diversity and complexity of ceramic decoration during the Tuali-A occupation may also be indicative of the lessening importance of ceramics as loci of social signaling. The total number of decoration techniques in use declines to only 16, and a few decorations (Cord 2, Cord 6, and the plastic ridges associated with Sherd Type 9) account for the vast majority of decorated sherds. Standardized complex design grammars, such as those of used on Sherd Types 1 and 5 during the Siga occupation, are completely absent. Even the surface treatments indicate less investment in ceramic production. Red slip decreases in frequency, although this may be in part due to effects of weathering: effects which are more pronounced when slip is applied in a thin layer and only lightly burnished. Polishing is almost completely absent in the Tuali-A assemblage.

These trends are not confined to the Gobnangou; the simplification of pottery traditions during the latter half of the second millennium AD has been noted at archaeological sites throughout the savanna region (e.g., McIntosh et al. 2003, Petit 2005). As mentioned above, the apparent decline in social investment in ceramics likely corresponds with increasing importance of another class of vessel, probably the bottle gourd or calabash (*Lagenaria siceraria*). As a serving vessel, the calabash has several advantages over ceramic vessels: it is lighter, less breakable, easily repaired, and can be decorated by individuals other than the potter. Although the calabash has great antiquity in the African subcontinent, we have relatively little knowledge of the development of the diverse varieties in use today.[4] The sweeping change in ceramics could be easily related to the spread of a new calabash varietal, either indigenously developed or introduced from the Americas, that was perhaps stronger, larger, or easier to grow than extant varieties.[5]

As for ceramic production, this move towards standardization in the ceramics could be indicative of increasingly specialized pottery production. Like the Siga occupation, there is no direct evidence for pottery production at any sites (with the possible exception of a broken polishing stone recovered from Site 957), and the lack of ceramic data for the greater region complicates assessments of the organization of production. However, the lower per pot investment in finishing and decoration, as well as the standardization of form could suggest an increase in the scale of production and/or a reduction in the number of active potters/pottery workshops.

While the Tuali-A ceramic assemblage differs in many respects from the Siga ceramic assemblage, there is no evidence of an abrupt transition. The current chronology

4 The only archaeological evidence for *Lagenaria* sp. is from the 13th century AD at the site of Oursi (Kahlheber 2004)

5 The correspondence between the simplification of pottery traditions and the introduction of tobacco (as evidenced by the spread of tobacco pipes) could suggest a pure or hybrid New World varietal.

is very coarse, and the higher rates of grog tempers in low confidence sites could point to a transitional period. In addition, it is very possible that the Sherd Type 11/12 pots are derived from Sherd Type 3 vessels. The pots are of similar sizes, and differ primarily in the temper used and the degree of inflection at the neck.

Iron Working

Since the processes of iron smelting and smithing were treated in detail in the previous chapter, the brief discussion here will focus exclusively on the archaeological data. Only one iron furnace was identified in association with the Tuali-A occupation, and it is a moderately sized furnace located near the escarpment (Figure 7.3). While smelting is seemingly concentrated at one or two locations near the base of the escarpment (although not adjacent to the clustered sites in the same area), possible smithing slag is present at sites throughout the study region. This distribution suggests some continuity in the organization of iron production from the Siga to the Tuali-A occupation. However, the isolation of smelting towards the escarpment could be the first step towards the movement of all smelting activity to this area during the Tuali-B occupation (see below).

Daily Activities

Like the Siga occupation sites, groundstone and chipped stone are the most common classes of artifacts besides ceramics. Groundstone continues to be an essential item, as evidenced by its even distribution throughout the study region: sites in Zone 5 were only slightly less likely than those in Zone 1 or 2 to have groundstone present, and given the small number of sites, the differences may be insignificant. The grinding stones recovered from Tuali-A sites were essentially similar to those recovered from Siga sites, and exhibit the same range of variability in their handstones (*li naali*).

Chipped flint likewise is frequent throughout the study region during the Tuali-A occupation. As in the Siga occupation, the few formal microliths are from sites near the escarpment base and may be in secondary contexts; at most sites flint is only represented by debitage that could derive from firestarting activities.

Although still a rare class of artifact, clay pipes become relatively more common during the Tuali occupation (Figure 7.4). West African pipes are generally designed to be used with a reed, and are associated with tobacco smoking. Pipes are particularly interesting because despite being pottery, they use different production techniques and decoration than contemporary pottery (and even different clay sources (Stahl et al. 2008)). Morphologically, the pipe from Site 603 has a double angle base which is widely considered as among the earliest pipe forms in stratified deposits from northern Ghana

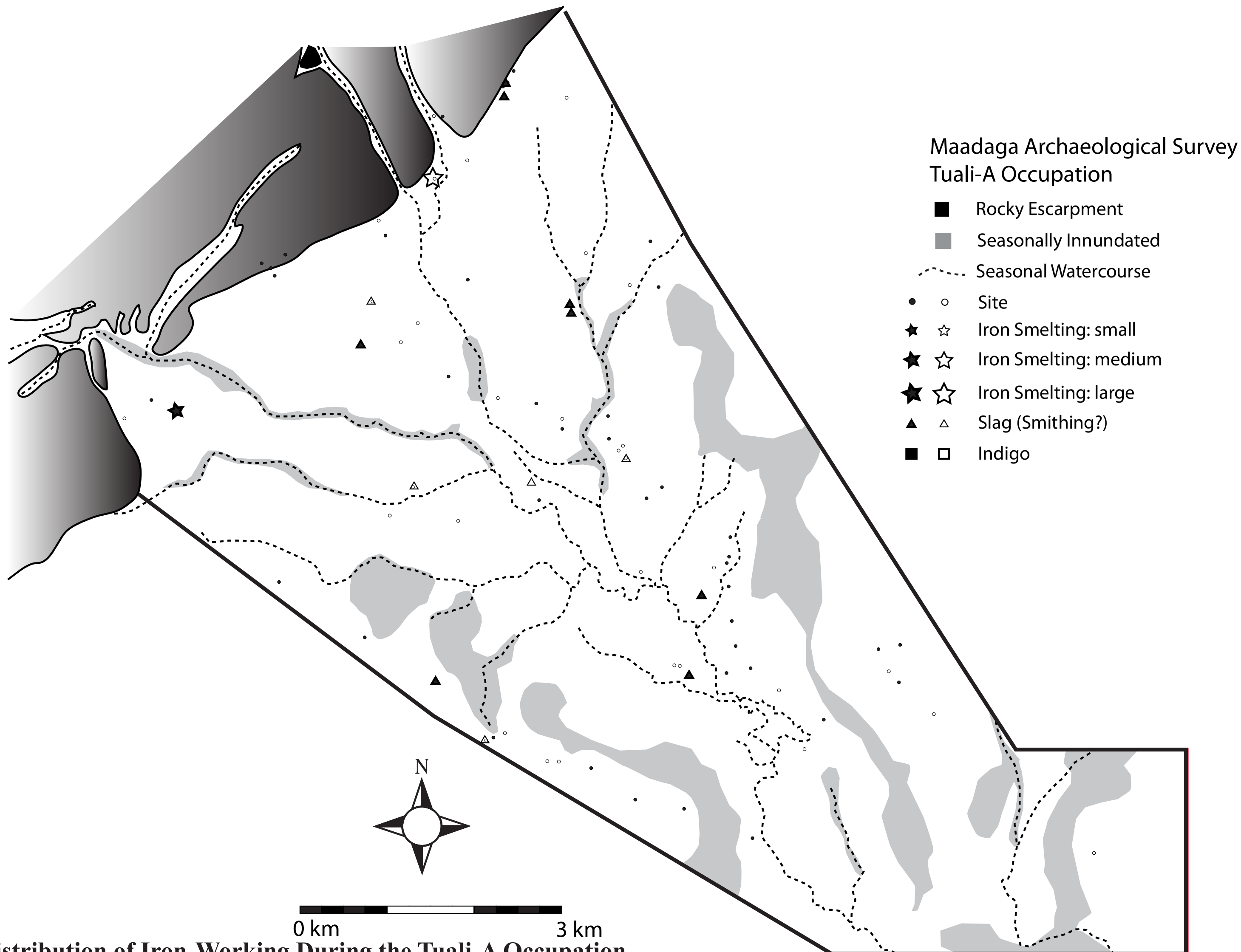

Figure 7.3: Distribution of Iron-Working During the Tuali-A Occupation

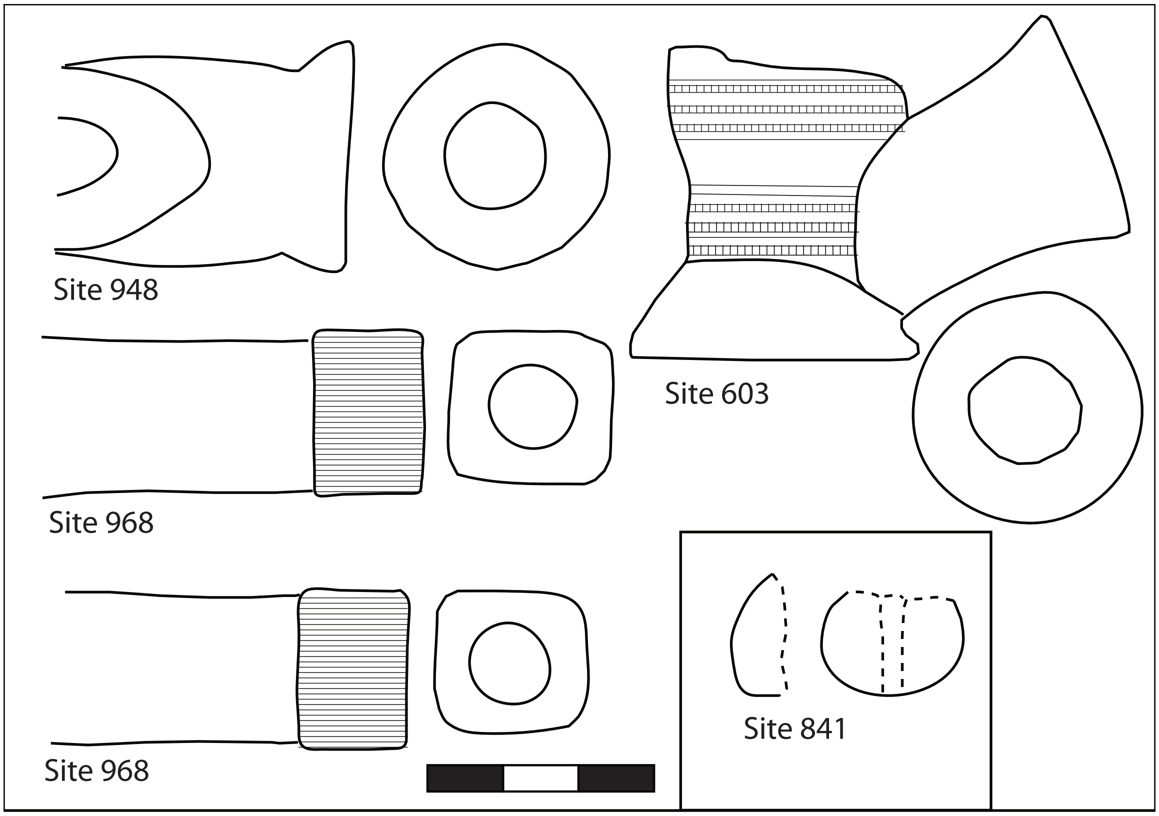

Figure 7.4: Pipes and Spindle Whorl from the Tuali-A Occupation

(Shinnie and Kense 1989) and is also found among the earliest pipes in Mali (McIntosh et al. 2003). If pipes in the study region follow the same temporal trends, these pipes may date to the 17th-18th centuries AD.

Finally, a partial spindle whorl was recovered from the surface of Site 541. These whorls are a common artifact in West Africa, and are used as weights on the end of spindles for making cotton thread.[6] This time consuming method is still practiced today, and the resulting thread is usually woven into narrow strips on a treadle loom (Geis-Tronich 1991, Kriger 2006). Cotton, while very hard on the soil, grows well in the study region, and may have been produced locally; its inclusion in the farming economy could have decreased the length of occupation for individual residences by both expanding the area under cultivation during a particular growing season and more rapidly draining nutrients from the soil. This artifact is the first direct evidence for the manufacture of cloth in the region; as will be seen below, the dyeing of cloth becomes a significant specialist enterprise during the Tuali-B occupation.

6 Cotton is by far the most commonly spun material in West Africa. While wool cloths have been documented, they were usually traded from north of the Sahara and later imported by European traders as were linens and brocades (Bolland 1981, Kriger 2006).

Subsistence Economy

With no direct evidence, it is difficult to assess changes in farming, gathering, hunting, and herding practices during the Tuali occupation. The distribution of sites suggests that the basic practices of farming remain the same; there is no evidence for intensification of production or increasing length of residence at individual sites. The tight distribution of site size and lack of differentiation in the ceramic assemblage seems to suggest generalized site purpose; there is no evidence for the use of field huts or other seasonal occupation strategies. It is possible that the increased cultivation of cotton favored occupation in areas closer to the escarpment (as cotton plants prefer well-drained soils), resulting in the slight shift in site distribution, but today cotton is grown throughout the study region.

Likewise, it is necessary to consider the potential impact of the adoption of new crop plants originating in the Americas (Table 3.12). While it is unquestionable that introduced foods --including maize, peanuts, tomatos, and peppers-- have become essential parts of local diet, the process, speed, timing of their incorporation is still largely unknown. This is particularly true for inland areas like the study region, as prior to the 20th century documentation is available primarily for the coast (a limitation apparent in McCann's (2005) comprehensive study on the adoption of maize in sub-Saharan Africa). Early varieties of these plants probably favored moister climates (since they were introduced on the coast), and may have been grown primarily near drainages.

Although it is presumed that residents continued their gathering and hunting activities, herding of domestic animals, particularly cattle, is rarely documented among Gourmantche populations of the study region during the historical era (Remy 1967, Swanson 1979). Instead, the local residents obtain access to these animals through trade with Fulani herders who move into the region during the dry season. This represents a significant change from the Pwoli and Siga occupations, when dwarf cattle were raised locally. While the project collected no evidence that could be used to assess the timing of this transition, the Fulani are thought to have migrated into the southern savanna zones of West Africa during the 16th-17th centuries AD (Skinner 1989), raising the possibility that these arrangements were first negotiated during the Tuali-A occupation.

Tuali-B Occupation

During the Tuali-B occupation, the use of landscape in the study region changes dramatically. Settlement shifts strongly towards the escarpment base, a trend that is even more pronounced in the distribution of iron smelting. The simplification of the pottery assemblage continues, with the range of variability and vessel forms decreasing further.

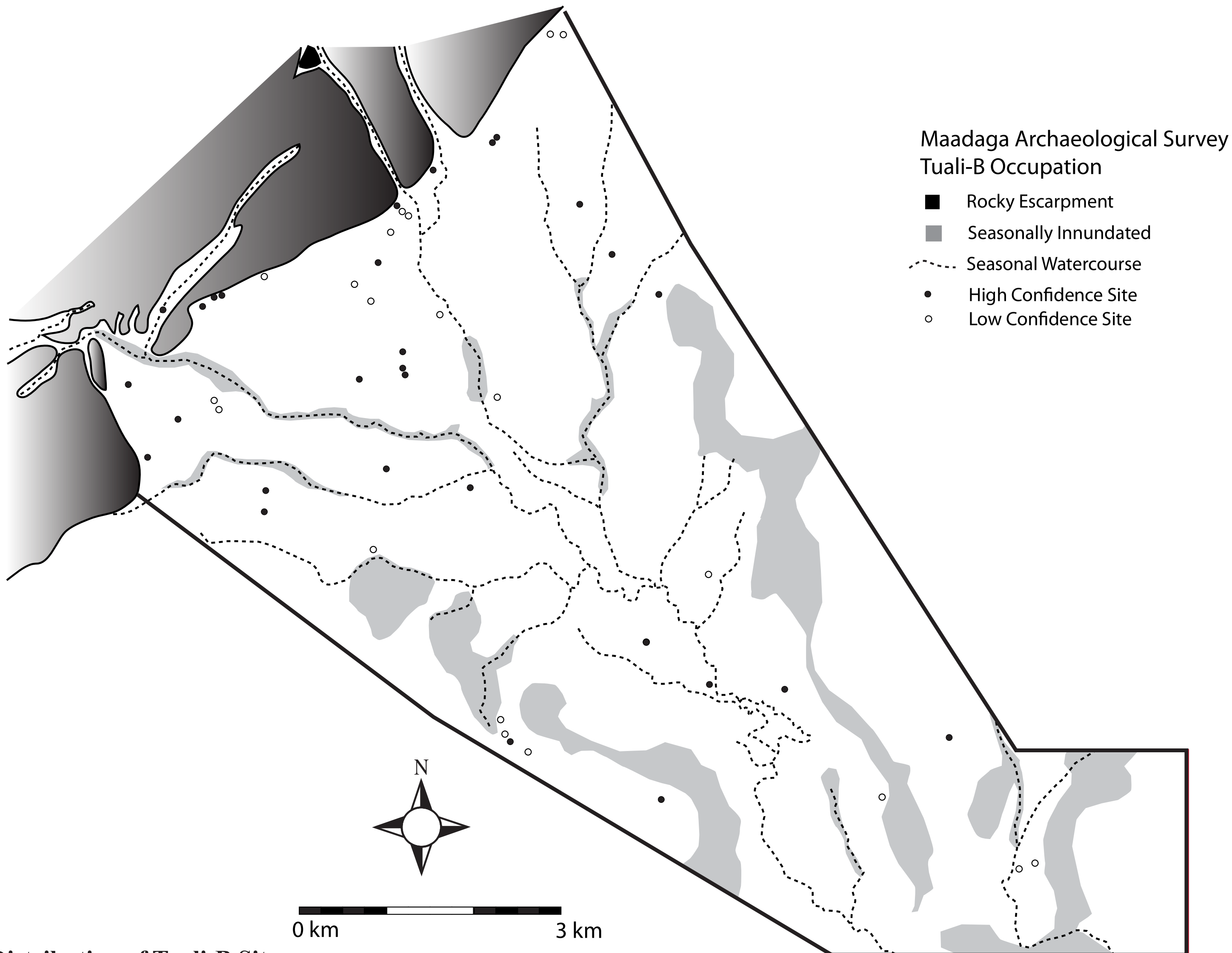

Figure 7.5: Distribution of Tuali-B Sites

	1	2	3	4	5	6	7	Total
A	17 (10)	13 (9)	6 (6)	2 (1)	2 (1)	2 (1)		42 (28)
B			0 (0)	4 (2)	1 (1)			5 (3)
C				0 (0)	0 (0)	1 (1)	2 (0)	3 (1)
Total	17 (10)	13 (9)	6 (6)	6 (3)	3 (2)	3 (2)	2 (0)	50 (32)

Numbers outside parentheses are total Tuali B sites.
Numbers in parentheses are single component, high confidence Tuali B sites only.

Table 7.5: Distribution of Tuali-B Sites

Perhaps most significantly, the Tuali-B occupation is associated with the construction of specialized pits used for indigo dye; these pit complexes require significant labor investment and are likely associated with participation in inter-regional trading networks. Despite these transformations, basic farming practices as indicated by settlement remain remarkably stable.

Site Distribution

The site distribution during the Tuali-B occupation shows a clear shift towards the base of the escarpment (Figure 7.5, Table 7.5-7.6). While the entire study region is still occupied, site occurrence decreases dramatically with distance, and for the first time in the sequence sites are significantly more likely to be located in Zone 1 than any other location. This pattern has some similarity to that described by Remy (1967) for the village of Yobri on the north side of the escarpment. According to local oral histories, the village residents lived in dispersed households at some distance from the escarpment until the mid-nineteenth century, when raiding in the region forced them to move into nucleated villages against the edge of the escarpment (see Appendix C for details). However, there is little evidence for an increase in site size south of the escarpment, and if anything, the incidence of site clustering is even lower than in the Tuali-A occupation. It is possible that many of the Tuali-B sites were occupied simultaneously, creating a relatively densely populated settlement near the base of the escarpment, although that hypothesis cannot be confirmed with the currently available data.

Site size is even more tightly clustered than in the Tuali-A occupation, and of the three “large” sites (over 350 m^2), two are indigo dyeing installations. These sites are also incidentally among the deepest, as the average estimated site depth drops further to less

Site Features	High Confidence Single Occupation	Low Confidence Single Occupation	All Sites
#Sites	32	5	50
Baobabs	1	1	6
Near Seasonal Drainage	10	2	15
Near Seasonal Pool	1	0	2
Near Seasonal Innundation or Marsh	3	0	5
Total Near Water	14	2	22
Plowing	24	4	38
Borrow Pits	2	0	4
Chipped Stone	7	1	14
Groundstone	18	3	25
Iron Smelting (small)	-	-	-
Iron Smelting (multiple)	3	-	4
Iron Smelting (large)	1	1	2
Smithing Slag	6	-	16
Indigo Dye Pits	3	-	3

Table 7.6: Characteristics of Tuali-B Sites

than 0.3 m. A series of shovel tests at Site 937 in 2004 identified no subsurface deposits, even in areas with dense surface pottery. The maintenance of the small site size and short period lengths of residence in the Tuali-B occupation is particularly interesting since, as will be discussed below, there are dramatic changes in the regional economy.

Tuali-B Ceramics

Like Tuali-A, the Tuali-B ceramic assemblage is relatively small in comparison to the Siga assemblage (only 767 sherds from high confidence single occupation sites) (Figure 7.6, Table 7.7). In general, Tuali-B continues the trend towards greater homogeneity in the pottery; the assemblage is almost entirely quartz tempered, and the range of vessel forms narrows even further, with the elimination of large Sherd Type 9 vessels from the assemblage.

Over 80% of Tuali-B ceramics are quartz-tempered, with the majority of the remaining grog tempered sherds from medium or small vessels. Although decoration

	High Confidence Single Occupation	Low Confidence Single Occupation	All Sites
N Sherds	767	80	1207
Grog Temper	15.8%	37.5%	20.2%
Quartz Temper	83.3%	58.8%	76.2%
Grog & Quartz Temper	3.4%	5.0%	3.2%
Mica & Quartz Temper	0.5%	2.5%	1.2%
Red-Slipped	19.6%	8.8%	20.4%
Sherds Decorated	8.7%	25%	11.5%
N Decoration Techniques in Use	13	11	25
Mean # Decoration Techniques in Use per 100 Sherds	5.9	22.9	10.1
N Sherd Type 1	-	1	2
N Sherd Type 2	-	1	3
N Sherd Type 3	-	1	3
N Sherd Type 4	2	-	4
N Sherd Type 5	-	-	3
N Sherd Type 6	-	-	-
N Sherd Type 7	-	-	-
N Sherd Type 8	-	-	1
N Sherd Type 9	-	-	-
N Sherd Type 10	-	-	2
N Sherd Type 11	16	-	19
N Sherd Type 12	1	-	2
N Sherd Type 13	15	2	23
N Sherd Type 14	60	-	81
N Sherd Type 15	-	-	-

Table 7.7: Characteristics of the Tuali-B Ceramic Assemblage

rates drop even further, the incidence of red-slipping increases, possibly in part due to better preservation of more recently produced vessels. Vessel form, as characterized by Sherd Type 11 remains consistent with the Tuali-A ceramics, and the incidence of basal roughing almost doubles. Particularly notable in the Tuali-B assemblage is the introduction of wooden roulette decoration on the shoulders of vessels. This decoration is in the same location as the cord roulettes on Sherd Type 12, and seems to supplant the cords as a preferred decoration.

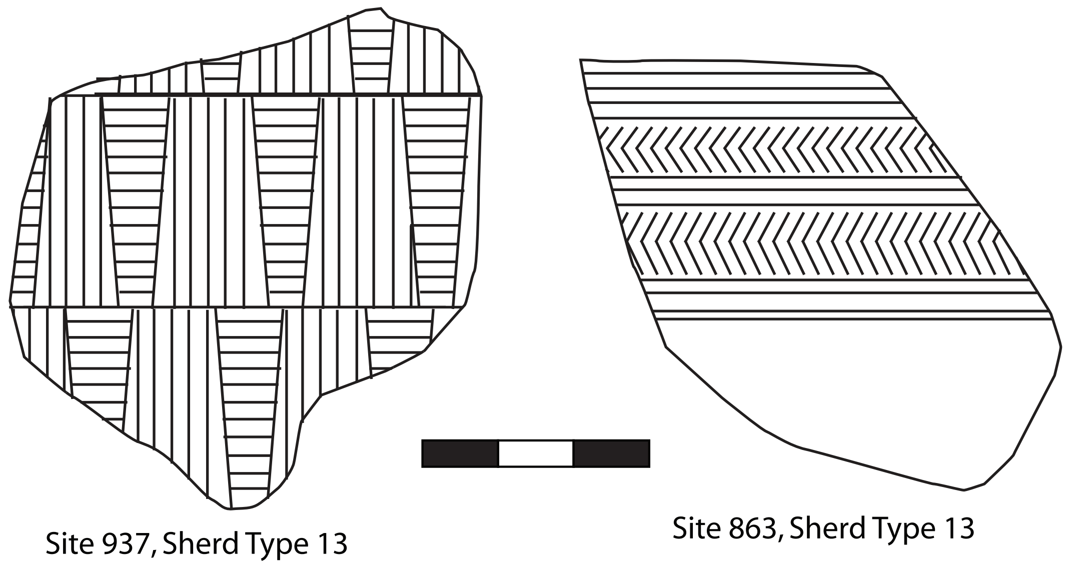

Figure 7.6: Tuali-B Occupation Ceramics

In general the Tuali-B ceramic assemblage can be interpreted in much the same manner as the Tuali A assemblage, with a narrow set of vessels in use for a diverse set of functions. The elimination of Sherd Type 9 could be either due to replacement by vessels in another medium (unlikely given their size), or a phasing out of their particular task. It is possible that these pots were used for indigo dyeing activities; they may have become unnecessary once dyers in the region began using the pit technology.

Iron

The evidence for iron working during the Tuali-B occupation consists of several large smelting sites (dense slag piles often over 1 m tall with broken vitrified tuyeres) (Figure 7.7). As during the Tuali-A occupation, the furnaces are all clustered near the foot of the escarpment. The Tuali-B occupation has the highest ratio of smelting sites to non-smelting sites of any occupation in the study region, and almost all are large. It is possible that the rate of iron smelting increased during the Tuali-B occupation.

Interestingly, the position of smelting installations near the base of the escarpment could be indicative of widespread cultivation. As described in the previous chapter, smelting requires large quantities of wood charcoal. In general, the rocky slopes and proximal portions of the escarpment plateau within the study region have relatively little woody vegetation; it is necessary to travel several hundred meters or more into the escarpment to gather fuel. However, the escarpment also has shallow soils, which are rarely cultivated. If areas near settlements are completely denuded of woody vegetation, a position near the escarpment where you have access to this relatively stable wood source could be favored for a charcoal intensive task like iron smelting.

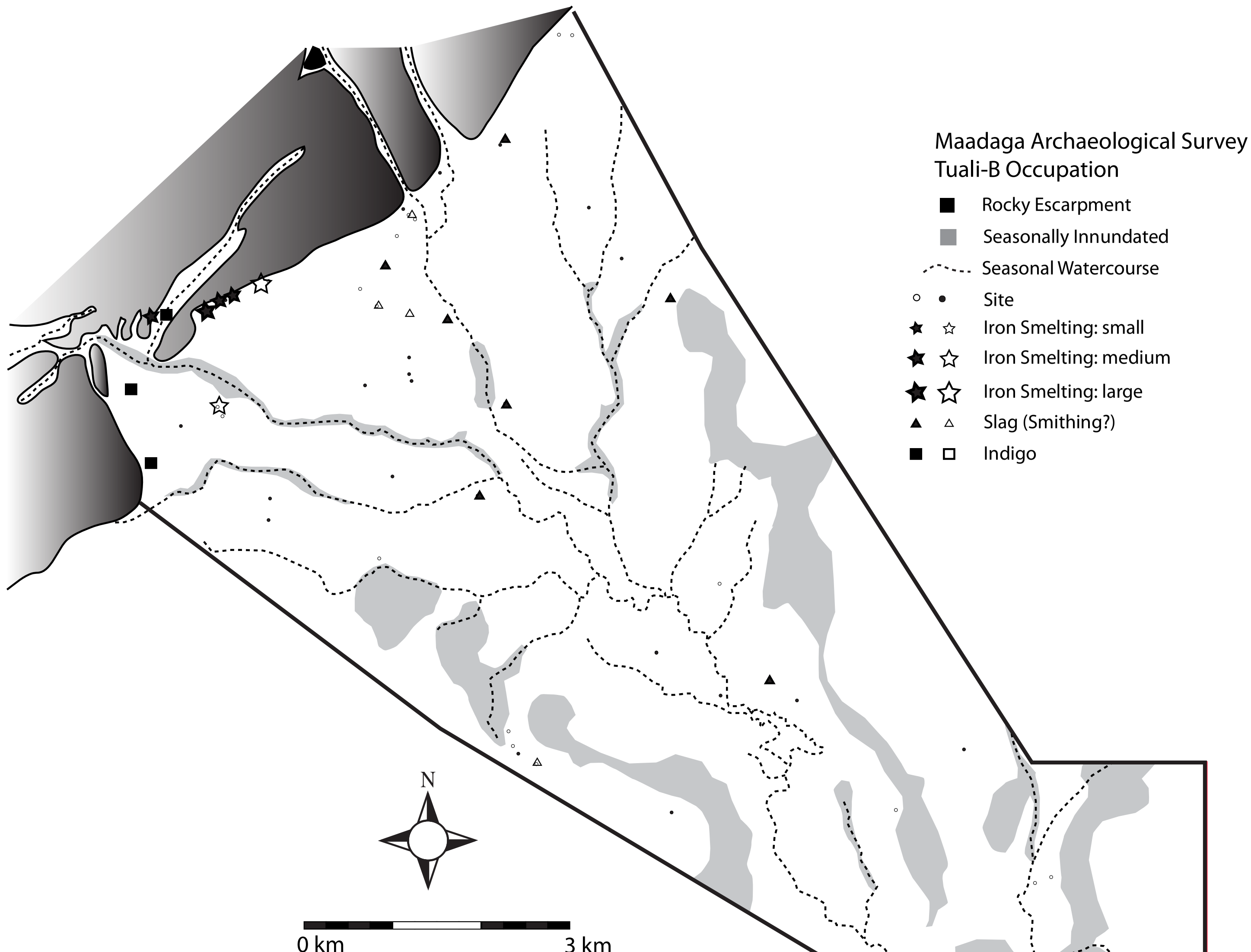

Figure 7.7: Distribution of Iron-Working Sites During the Tuali-B Occupation

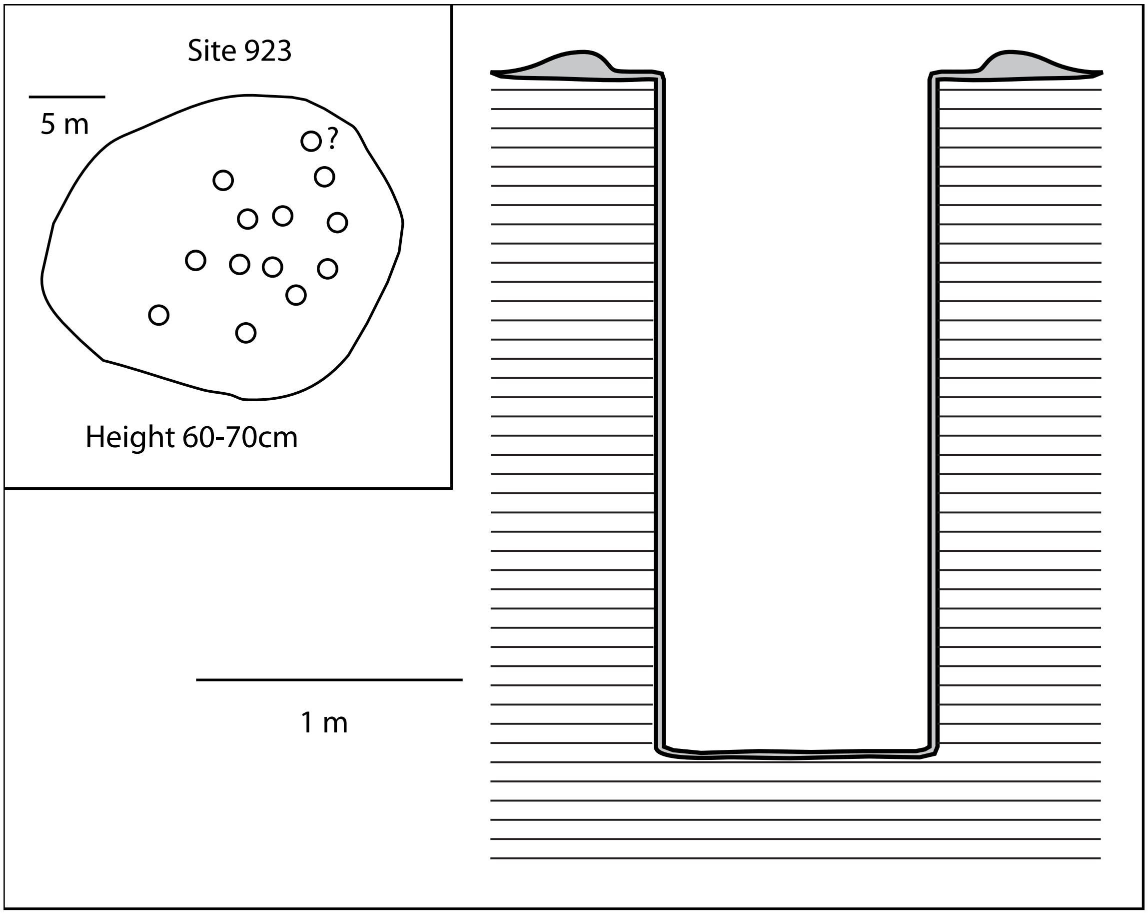

Figure 7.8: Indigo Dyeing During the Tuali-B Occupation

Groundstone

Despite most sites being located closer to the escarpment, the frequency of observed groundstone remains very consistent with both the Siga and Tuali-A occupations. Stones have a similar morphology and there are no indications of either an increase or a decrease in frequency. This stability from throughout the sequence could suggest a relatively stable economic role for grinding, and therefore potentially for the role of cereals in the local economy.

Chipped Stone

Interestingly, the frequency of chipped stone decreases dramatically during the Tuali-B occupation; it is present at less than 25% of sites in spite of the fact the chipped stone is generally more common near the escarpment. If, as has been hypothesized in previous chapters, the role of chipped stone was as a fire starter or as an expedient sharp tool, it is possible that the decrease in chipped stone use could point to the availability of other tools: possibly imported European products such as steel blades and matches. Although we have very little evidence for the dates of penetration for European trade

Site Features	High Confidence Single Occupation
#Sites	11
Neem	2
Near Seasonal Drainage	3
Near Seasonal Pool	0
Near Seasonal Innundation or Marsh	0
Total Near Water	3
Plowing	6
Borrow Pits	0
Chipped Stone	3
Groundstone	3

	High Confidence Single Occupation
N Sherds	112
Grog Temper	6.3%
Quartz Temper	93.7%
Grog & Quartz Temper	-
Mica & Quartz Temper	-
Red-Slipped	70.5%
Sherds Decorated	8.9%
N Decoration Techniques in Use	6
Mean # Decoration Techniques in Use per 100 Sherds	13.5
N Sherd Type 6	
N Sherd Type 11	1
N Sherd Type 13	
N Sherd Type 14	1
N Sherd Type 15	3

Table 7.8: Characteristics of Ring Sites and Their Ceramics

goods into the interior, matches became very popular in Europe in the 1800s and they were observed in Mossi markets by the early twentieth century.

Indigo

Three large indigo dyeing complexes consisting of plastered pits in mounds of ash were associated with the Tuali-B occupation. The typical pits are ca. 1m in diameter and at least 2.5 meters deep, if not more (Figure 7.8). The walls have been finished using multiple layers of plaster, described by Geis-Tronich (1991) as mixture of sediment drawn primarily from termite mounds, and in all cases the pits were surrounded by mounds of discarded potash from cleaning. Of the three sites identified, Site 937 was overgrown with trees and brush, Site 920 was surrounded by very large ash piles over 2.0 m tall which may obscure many of the dye pits (only 4 were visible), and Site 923 was deflated such that the rims of at least 14 pits could be mapped (Figure 7.8). At the edge of Site 923, a plastered, shallow depression may have been used for crushing indigo. An additional example with 22 dye pits was noted just outside the study region, at the north end of the current village of Maadaga. The identified pit installations tended to

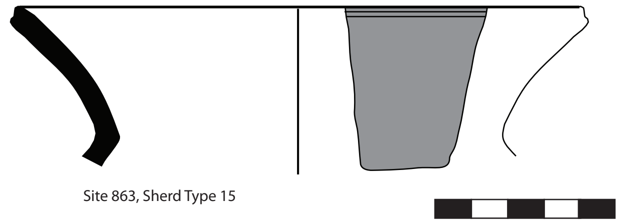

Figure 7.9: Ring Site Ceramics

be somewhat isolated from habitation, which is unsurprising given the pungent smell of the dyes. Indigo dye pits are generally considered a mid-nineteenth century innovation, although their precise origin is unknown, and are associated with intensive cloth production (Shea 1975a, 1975b). The practical and social implications of these features are discussed in detail below.

Ring Sites

In surveying a landscape in which traditional architecture is still in use, and residents move frequently, it is inevitable that some identified sites will date to the very recent past (within the last 50 years), particularly since the project documented every location with evidence of human occupation that lacked standing architecture. Some of these recently abandoned sites were easily identifiable: artifacts included glass and plastics, wooden bases of granaries were still in place, and individual hut locations were visible (thus the moniker "Ring"). The material culture of these sites was used as a baseline to identify other very recent sites that were less well preserved.

In general the Ring sites had very few artifacts, and in particular very few ceramics (in several cases none could be located). This paucity of ceramic artifacts is likely the result of several factors. First, ceramics have been replaced in many daily tasks by metal and plastic containers (Geis-Tronich 1991). Second, the increased availability of donkeys and donkey carts would make moving ceramic vessels, particularly large ones, a much more manageable task (Swanson 1979). Finally, the significant increase in cotton cultivation over the past 15 years has dramatically transformed the landscape. Farmers are cultivating significantly larger areas, and soil is more quickly exhausted with this nutrient-demanding crop. More rapid soil exhaustion combined with increases in the area cultivated around the household compound in a given year could easily result in shorter average occupation length.

Ring sites had a significantly more constrained ceramic assemblage than the Tuali occupation (Table 7.8, Figure 7.9). Over 95% of sherds are quartz tempered and rates of red slipping were significantly higher (over 50%), although the latter could be simply a function of a shorter period of exposure to the elements. Other than slip, sherds are generally undecorated, with the exception of an occasional cord roulette or incised triangular channels. Sherd Type 15 is common, and in one case, Sherd Type 14 is also present.

These sites are very limited in their interpretive value as they are a small, transitional sample towards current occupation patterns. With their multiple structures, they are fairly substantial for seasonal occupations, and were likely inhabited as the primary residence. Over the past 30 years, as population has expanded in the study region, more and more farmers have moved from villages to more distant areas, an effect clearly seen in comparisons of satellite images from the early 1970s and early 2000. In the earlier images, the boundaries of the national parks and other protected areas could not be distinguished, and most intensive cultivation was concentrated in the areas near villages (UNEP 2008). In contrast, the images from 2000 show evidence of extensive cultivation, and park boundaries are visible as crisp transitions. The increase in land under cultivation could even be seen in the study region between 2004 and 2006. While in the first season, several parts of the survey area were uncultivated, by 2006 cotton farming had increased to the point where no arable land was left fallow.

Cloth Weaving and Dyeing During the Tuali Occupation: Techniques and Social Implications

Cotton cloth has a long history in West Africa; the earliest confirmed examples are those recovered from caves in the Dogon region of Mali, which date to the 11th-12th centuries AD (Bedaux et al. 2005), although the cotton textiles probably have greater antiquity in sub-Saharan Africa since they are commonly referenced in Arabic texts, and spindle whorls (used for weaving) are widespread at archaeological sites. In the savanna region of West Africa, cotton is often locally raised, carded, and hand spun. The thread is then woven into narrow strips on a traditional treadle loom, and often dyed dark blue using indigo (Kriger 2006, Geis-Tronich 1989, 1991). In the study region, the first definitive evidence for weaving and dyeing of cotton cloth is associated with the Tuali occupation. A single, partial spindle whorl was recovered from a Tuali-A site. More importantly, three major indigo dyeing installations dating to the Tuali-B occupation were identified, each consisting of multiple plastered dye pits surrounded by mounds of ash. Given the sparse evidence for weaving, the discussion here will focus primarily on the indigo dye process.[7]

7 For a general review of West African weaving techniques, see Kriger 2006. For a more specific discussion of weaving among the Gourmantche, see Geis-Tronich 1989, 1991.

Indigo Dye: The Technical Process

Indigo dye comes from the leaves of many species of *Indigofera*, which vary widely in their indigotin content.[8] According to Geis-Tronich (1991), *Indigofera tinctoria*, a domesticated species originating in India but possibly with great antiquity in West Africa was the only indigo cultivated in the study region in the 1980s.[9] Leaves are collected at the end of the rainy season in November, pounded, mixed with ash, and formed into balls or logs that are left to dry for over a year. These balls may be traded, and Kriger (2006) has suggested that in some cases their standardization may have contributed to an increase in the scale of production for indigo cloth by facilitating the consistent production of effective dyes.

Since indigo is not water soluble, its preparation requires an alkaline solution, usually accomplished through the use of salts, particularly potash (Kriger 2006). Potash production begins by carbonizing a carefully chosen wood: Geis-Tronich records the use of *Sclerocarya birrea*, but numerous species have been documented in other regions of West Africa. The resulting ash is leached once using a filtration process, which can involve double pot strainers, baskets, or simply pouring ash mixed with water through a layer of fibers (Kriger 2006, Geis-Tronich 1991, Porteres 1951). Depending on its strength, the soda solution may be used as a sauce base or evaporated and cooked with oil to make soap (Geis-Tronich 1991, Folorunso 2002). The ash, however, is mixed with water, formed into balls, and baked, often for several hours. Like the prepared indigo, these ash balls may be sold at markets.

To mix the dye, indigo and potash are mixed with water to form a clear solution, then allowed to rest, covered for approximately one week to ten days (Shea 1975a, Geis-Tronich 1991). The cloth is dipped or soaked in the dye, sometimes transferred to a second pit for rinsing, then left to dry in the sun. It is only at this stage that the dye oxidizes and the cloth takes on its characteristic dark blue color. There is significant room for error throughout the process, as deepness and permanence of the color depends on the species and preparation of the indigo, the types of potashes or salts added to the dye, and the timing of the dye process (Kriger 2006). Geis-Tronich (1991) and Shea (1975a) both describe dyers tasting the indigo solution to test the alkalinity.

---

8 *Lonchocarpus laxiflorus,* a wild plant found in the study region, can also be used for indigo, although its quality is considered inferior. *Lonchocarpus cyanescens*, or Yoruba indigo, which produces a much stronger dye on a par with many *Indigofera* sp., is not recorded in the study region, although it is commonly used in northern Nigeria (Burkhill 1995, Küppers 1996, Kriger 2006).

9 *Indigofera tinctoria* has naturalized in West Africa, and may grow spontaneously in the wild (Burkhill 1995, Folorunso 2002). This has not been documented in the study region, where indigo is generally referred to exclusively as a cultigen (Swanson 1979, Geis-Tronich 1991).

The indigo dye solution is usually prepared in large clay pots or in plastered pits. Although the basic process is the same in both cases, pits are usually associated with larger scale production. Monteil (1927:85) goes even further, suggesting that dye pits are used by "professionals," i.e., full or part time specialists. While some specialists use pots (e.g., Folorunso 2002), no examples could be found of occasional dyers constructing pit complexes. Descriptions of dye pits suggest that they are remarkably standardized across the savanna zone of West Africa, with those identified in the study region falling well within the normal range of variation (Monteil 1927, Shea 1975a, Geis-Tronich 1991, Kriger 2006).

Social and Historical Implications of Weaving and Dyeing

While it is possible, even likely, that cotton cloth was woven and dyed during the Siga occupation (possible in the large Sherd Type 9 vessels), the dye pit installations in the Tuali occupation indicate a significant expansion of the economic role of cloth production. The scale of production suggests involvement in trading relationships, as well as the availability of wealth (and possibly capital) within the study region.

Due to the labor required in the indigo dye process, the dark blue cloths were traditionally considered a higher status fabric than natural white cotton cloth, or cloth stained with vegetable dyes (Kriger 2006). Johnson (1977, 1980) has argued for the use of cloth strips as a currency, as they were a standardized unit that could be easily traded. She suggests that different widths of cloth may have denoted different zones of exchange, in which they were used as a standard.

The West African cloth trade is thought to have expanded throughout the latter half of the second millennium AD; historical records from the coast clearly demonstrate the importance of cloth for export by European traders to markets outside West Africa, as well as among indigenous coastal polities throughout the 17th and 18th centuries AD (Kriger 2006). While most of this cloth was produced on vertical looms in the south, the cotton thread may have been drawn from areas further to the north.[10] In the nineteenth century, the price of cloth produced in Europe and the Americas decreased dramatically due to the innovations of the industrial revolution, and the export market for cloth largely disappeared. However, it was replaced by a robust internal market for traditionally produced cloth. The demand was sufficiently great that numerous colonial attempts throughout the latter half of the 19th into the 20th century to funnel African cotton production into European markets met with almost total failure (Roberts 1996).

10 According to Shea (1975a) cotton was an easily traded item: it had high value relative to its transport costs, particularly if already processed into thread or woven cloth.

According to Shea (1975a) in his definitive history of cloth production in the Kano Emirate (northern Nigeria) during the nineteenth century, the shift to the use of plastered dye pits is strongly associated with increased production volume of dyed cloth. Shea (1975a: 163) estimates that construction of an individual pit took ca. 20 days, but once completed an individual dyer could dye more cloth with significantly less effort. While there were thousands of pits within the Kano Emirate at its peak, "prosperous dyers" within the city itself generally controlled only 5-10 pits at the most (Shea 1975a: 165). By this measure, the fourteen pits from Site 923 alone, which would have required more than eight months of labor to build, are indicative of a very large dye center, particularly for a rural area.

Since, as described above, cotton is cost-efficient to transport, dye pits in rural areas were generally located in areas where indigo could be locally grown and water plentiful during the dry season. Shea notes that a single batch of dye uses over 65 kg of indigo, a quantity that made the transport of this low cost resource impractical.[11] In this sense, the Gobnangou region would have been ideal for indigo cloth production: water is available year-round, and the low-lying swampy areas favored by indigo are common. Cotton could easily have been grown in the region as well.

Given the necessary capital investment (dye pit production, indigo farming, and the weaving or purchase of cotton cloth) and the scale of indigo cloth production suggested by the archaeological sites in the study region, it is reasonable to assume that dyers were serving markets outside the local community whether through direct trade or the use of middle-men. The demand for indigo cloth was high in both the Sokoto caliphate to the east and the political centers of the Gourmantche and Mossi polities to the north and west (Shea 1975a, Skinner 1989)

The Tuali Occupation in the Context of the Greater Gourmantche Region

As described in Chapter 6 (and more fully in Appendix C), the Gobnangou region is largely peripheral to documented oral histories of the Gourmantche. However, by focusing on societal trends rather than specific political events, it is possible to draw some possible connections between the two data sources. Tuali-A roughly corresponds with Chantoux's "Golden Age," described as a period of consolidation and expansion of centralized authority within Gourmantche land as previously powerful neighboring polities weakened. While the archaeological data provide few insights into political

11 This figure could be high for dye pits in the study region. Shea does not specify the size of pit (pits in Kano could reach 6 m deep, although most were 2.5-3.5 m), or whether this is the quantity of indigo required for "black" cloth, a particularly intense color favored in the Sokoto caliphate.

processes in the Gobnangou, given the lack of regional context, the changes that took place during Tuali-A and Tuali-B are directly relevant to modern characterizations of Gourmantche land (including the Gobnangou) as a homogenous ethnic zone that is in many ways unique in the greater region. In general, both Chantoux and Madiega's narratives describe diverse indigenous peoples either pushed out or forced into subservient relationships in the face of Gourmantche conquerors. According to the oral histories, it was not until the latter half of the second millennium AD that the Gourmantche began to intermarry with local populations including the Ouaba (today a family name associated with hunters in the study region). It is possible that the homogenization of the ceramic assemblage observed in the Tuali occupation could be associated with the development of a more unified cultural or political identity, although more research is necessary particularly if links are to be drawn with the greater Gourmantche region.

As described above, during the Tuali-B occupation the increase in production of dyed cloth and possibly iron suggest greater participation of the study region within regional trading networks. Chantoux's narrative suggests that the first half of the 19th century was a period of general political disintegration in the greater Gourmantche region/polity as individual chiefs asserted their autonomy, following which there was a period of general peace between fairly autonomous Gourmantche chiefs during the reign of Yempadigou from 1856-1883. The Tuali-B evidence suggests that Gobnangou elites may have taken advantage of this independence by increasing their involvement in the trade of high value crafts. In the local area, entrepreneurial elites or non-elites may have transformed themselves economically, while maintaining their shifting agricultural subsistence base.

While it is unknown with whom trade relations were developed and maintained, given the supposed local autonomy, it would seem possible that the new commerce was focused towards the east, where Hausa merchants ultimately connected to the large cloth trade of the Sokoto polity. Sokoto traded extensively, particularly in indigo-dyed cloth, and many markets in the Gobnangou region today are heavily influenced by Hausa merchants (to the extent that Madiega argues for a Hausa origin of Gourmantche chiefs in the Gobnangou). Only additional research will clarify whether this trade was indeed oriented towards the east rather than the west, where the Mossi kingdom also engaged in a thriving cloth trade (Skinner 1989).

In conclusion, the clustering of dispersed, shifting settlements at the base of the escarpment was the combined result of multiple settlement influences. Involvement in regional trade networks may have pushed residents of the study region towards the escarpment, where they could exploit the year-round water sources for indigo-dyeing and more easily access trade routes, and encouraged the construction of high investment production centers (dye pits) which would have tied residents to a location. However, the local inhabitants maintained essentially the same agricultural practice of shifting cultivation documented in the Siga occupation, albet within a more limited area, illustrating the continued importance of mobility to Gobnangou society.

CHAPTER 8
DISCUSSION

Transformation and Continuity in Subsistence Practices

Throughout this thesis, an argument has been made for the role of cultural choice in subsistence practices. As described in Chapter 4, even when specific yields are desired, there is still a wide range of effective agricultural strategies from which farmers can choose. There is very little direct evidence of prehistoric subsistence from the study region, and the interpretation of that data is complicated by the coarse chronology. However, the long term perspective on landscape use provides essential insights into the operation of subsistence systems within the study region.

The Gobnangou region is notable for its relatively late adoption of an agricultural economy. Plant and animal domesticates, including pearl millet and livestock, have been identified throughout the savanna by ca. 1000 BCE, however, their use in the study region appears to have been very limited until the late first millennium AD. During the LSA, residence near the escarpment may have been seasonal, and the qualities of the documented microlithic tool industry suggest a rich micro-environment. Starting ca. 1000 BCE, the frequency of burning increased dramatically, possibly due to a gradual shift towards savanna vegetation and possibly as a result of clearing fields. If domesticated crops were being cultivated, it was on a very small scale, as flora characteristic of fallow fields does not appear in the charcoal sequence.

By the beginning of the Pwoli occupation, residents of the study region were constructing mud architecture, and probably farming millet. At Site 541, pearl millet is incorporated into an economy in which wild plant and animal resources remain a major element of the diet. If anything, the extraction of wild animal and vegetal fats including shea butter may be intensified as indicated by the increase in ceramics. The gradual incorporation of domesticated millet into an economy that maintained extensive resource extraction strategies (i.e., fishing the main river channel) is an expected process, as is the eventual transition to a more localized commitment to domestic resources by the end of the first millennium AD. What is more intriguing is the timing; most other studied areas of the West African savanna were heavily reliant on domesticates hundreds, if not over a thousand years earlier. Despite, or perhaps because of the relatively high quality soils and available water, residents of the Gobnangou incorporated domestic crops and animals only when it became locally advantageous.

During the subsequent Siga occupation, archaeological data for the first time indicate the emergence of a settlement pattern resembling that of the modern Gourmantche, with small dispersed compounds distributed throughout the landscape, and ephemeral remains suggest short-term residence. There is limited evidence for re-occupation at any given spot, matching ethnographic examples for extensive agricultural techniques. These data provide important context for the German charcoal data from Pentenga, which indicated the presence of fallow field flora in the region concomitant with the increase in residential and field plot mobility. The Siga occupation comprises several hundred years of successful shifting cultivation practices.

The resilience and persistence of this subsistence system are further illustrated during the Tuali occupation, when significant changes in the local economy, including highly specialized craft production, only minimally impact subsistence farming strategies. Even with potentially increased cultivation of cotton and indigo, there is currently no evidence for intensification of agricultural strategies. Instead people remain mobile, even if residential priorities maintain proximity to the specialist dyeing and iron smelting installations, possibly also targeting soils for cotton or ensuring proximity to trade routes.

Economic and Social Integration: Concepts of Community

Within the context of the stable shifting agricultural system described above, there is significant evidence for increased social and economic integration accompanied by changing concepts of community.

During the Pwoli occupation, the few identified sites are widely distributed and have a diverse material culture. While there is some limited evidence of craft specialization (i.e., the availability of iron- although it could be simply intrahousehold specialization), the data generally suggest self-sufficient, economically generalized households.

In comparison, the Siga occupation is distinguished by a diversified, yet standardized pottery assemblage, which could indicate greater social cohesion within the study region. However, households remain largely self-sufficient in their subsistence economies and choices regarding household mobility were likely made independently. There are few indications of significant differences in wealth accumulation as most households would appear to be of similar size, and had similar material contents including equal access to possible trade ceramics. An increase in furnaces and smelting debris attest to an expansion in iron production, however widespread distribution of smithing slag could indicate a more generalized practice of this stage.

The Tuali occupation, most notably the Tuali-B, is characterized by a residential shift towards the escarpment, increasing the scale of craft production (including high value trade items), and a loss of diversity in pottery assemblages that may suggest even greater social integration in the region. The presence of cloth dyeing installations (that are the product of large amounts of labor and thus expense), may indicate wealthy households within the community. However, other indicators such as relative settlement size and material contents provide little direct evidence to clarify the nature and organization of production. What is clear is that the economy and maybe even concepts of community, are no longer as locally oriented.

On the surface, Gourmantche land is considered remarkably homogenous in ethnicity and cultural practice. However, upon investigation the region's oral histories and current social categories within villages present a strong thread of a multiethnic past, as certain old family names are associated with ethnic groups considered indigenous to parts of Gourmantche land (Madiega 1982). In some regards, but more subtly, this resembles Mossi settlements, where the Mossi culture and language is dominant, but various localized practices and social roles in certain families are remnants of a more diverse history. Indeed, in most areas of Burkina Faso and neighboring countries, linguistic diversity at the local level is very high, and concepts of ethnic identity are sufficiently complex to make boundary drawing an exercise in futility (e.g., Mercier 1968). In this context, the modern Gourmantche region is striking in its linguistic and cultural uniformity. In general, the origins and development of Gourmantche culture are a difficult subject to address with the available data, but processes like the increased homogenization of pottery over the sequence may be related to the formation of this common identity. Additional research in the region is needed to address this fascinating question.

The Gobnangou Escarpment: Rethinking Colonial and Post-Colonial Narratives

In West Africa, where colonialism has shaped not only the present, but also the construction of historical narratives and the definition of "traditional" lifeways and practices, archaeological research has proven transformative in our understandings of both colonial and pre-colonial history. This project is no exception, as its results directly address three common narratives of the Burkinabe past and present: environmental degradation, insecurity in the precolonial era, and the peripheral political and economic status of the study region. As will be seen below, all have their roots in the colonial era, and all require re-evaluation in the context of the data presented in this thesis.

Environmental Degradation

Throughout the latter half of the twentieth century, environmental degradation has been a significant concern of anthropologists, ecologists, and development workers in West Africa. Based in very real concerns about increased population density and exacerbated by the Sahel drought in the 1970s, this narrative suggests that traditional agricultural practices in the savanna region are systematically destroying the natural environment. Even today, deforestation and desertification remain major foci in the development literature (e.g., UNEP 2008). Over the past fifteen years, a series of innovative studies by geographers, historians, and ecologists have systematically deconstructed this narrative (e.g., Leach and Mearns 1996, Fairhead and Leach 1996, Mortimore 1998, Baker 2000, Bassett and Crummy ed. 2003). Armed with new concepts of savanna ecology and a long-term perspective that recognizes colonial bias, they have found that traditional agricultural practices are remarkably robust in the context of the unpredictable yet resilient savanna environment.

In the study region, the archaeological data indicate that residents have been practicing a form of shifting cultivation for nearly a millennium, during which populations likely rose and fell, agricultural production expanded and decreased, and various cash and subsistence crops came in and out of favor. During the Tuali occupation, it is likely that farming activities increased, as the region became more engaged in regional networks, and possibly paid a grain tribute to a more centralized Gourmantche polity. While the specifics of farming practices remain unknown, the mobile strategy could not have persisted if it was not effective within the local environment.

This is not to minimize the potentially detrimental effects of the recent dramatic increases in both population and cotton cultivation; during the archaeological survey in 2006, no fallow fields were identified in the study region. Every piece of arable land was under simultaneous cultivation, a strategy that appeared inherently unsustainable. (The response of a local farmer when asked what he planned to do once the soil was exhausted is telling -he plans to move). However, the long term effectiveness of mobile strategies suggests potential for further research in the tradition described above.

Insecurity in the Precolonial Era

During the latter half of the second millennium AD, the effects of a multitude of interregional social and political processes were ubiquitous in West Africa, including the spread of Islam, internal and externally focused slave trades, and relations between numerous large and small-scale social formations. The variety of local situations resulting from these are poorly understood, although there are some common threads. It is likely that there were parts of Burkina Faso that were highly unstable, in particular regions of the West and Center were deeply affected by Jihadic states and the continuing expansion of the Mossi. Some areas, including large parts of Mossi and Gourmantche lands, were likely less extensively affected owing to the protections derived from their political systems. However, the narrative is taken as a general phenomenon rather than an analytical question, likely because it was encouraged by colonial governments, who often justified their enterprise as bringing peace to a dysfunctional region. One common element within the narrative—based upon real case studies within West Africa (i.e., Netting 1968)-- is the presumption that regions where defensive locations are found in the landscape served as refugia from slave-raiding. The archaeological data for the Gobnangou region illustrate the importance of understanding experiences within local sequences and provides a cautionary tale against broad generalizations of a perceived "West African" experience.

In the Gobnangou region, researchers have long noted the settlement trend of movement towards the escarpment during the past several hundred years. This move has been almost universally attributed to the need to seek refuge from slave raiders: Remy (1967) describes previously dispersed households aggregating near the escarpment for security, Millogo (1993) notes the appearance of "hidden" granaries built into caves and Frank et al. (2001) report local oral traditions to this effect. However, the archaeological data from the study region do not indicate increasing regional insecurity accompanied this shift in settlement pattern, rather, they suggest that economic or political processes may have influenced a new focus near the escarpment.

First, the move towards the escarpment, while noticeable, is not absolute and many sites are still several hundred if not thousands of meters from the shelter of its canyons and ravines. If the Gobnangou was a place of refuge, one would expect more residences near the base of the escarpment itself. Second, the settlement shift was accompanied by a significant expansion in craft production, and likely greater participation in regional trade, a trade that was probably relatively stable given the high levels of investment in indigo dye pits. If security was the primary concern driving settlement decisions, the development of a potential trading depot near a permanent water source along an easily identifiable landmark seems an unlikely strategy.

Peripheralization

The diverse, often negative impacts of colonially drawn boundaries on modern West Africa are a well established topic in the scholarly and popular literature. However, these boundaries do not only shape interaction in the present, they can also impact understanding of the past. As mentioned previously, the study region is isolated within the context of modern Burkina Faso. It is one of the furthest points from the capital, Ouagadougou, and is separated from the political and economic centers of the country by the sparsely populated provinces of the Eastern Region. Even within Tapoa province, "beyond the escarpment" is often considered a backwards region by those living in larger communities to the north of the Gobnangou. Although these attitudes are belied by present realities (aid coordinated by Christian missions and disposable income from cotton farming have resulted in the construction of well stocked dispensaries, widespread access to solar power, Gourmantche language schools, etc.), the focus here is on the development of these attitudes and their inaccuracy as evidenced by the archaeological data.

The Gourmantche region of Burkina Faso has been largely invisible in historical accounts since the precolonial period. Arabic descriptions of West African societies over the course of the second millennium AD tend to focus upon Islamic peoples and/or large trading entrepôts. The Gourmantche region had neither (although Islamization of some northern villages has increased over the course of the 20th century). The situation did not improve much during the colonial period, when the region became a perpetual border zone that despite multiple administrative redistrictings, always ended up on the periphery. Moreover, the problem may have actually been exacerbated, both within Burkina Faso and perhaps regionally by the designation of national and international parks and wildlife preserves, as these have made the Gobnangou in particular an island within a series of parks, likely redirecting former trade routes and communication corridors.

The archaeological data suggest that views based upon biases in the historical record and political processes of the last hundred years in the Gobnangou obscure our ability to understand West Africa's local and regional traditions. The Gobnangou, owing to its rich environment and comparatively high carrying capacity, attests to a long history of settlement, the development of complex material culture traditions, active participation in exchange networks, and provides us with one of the first long term views of societal developments within a shifting agricultural strategy common in modern Burkina Faso. The Gobnangou and the other escarpments in the same formation also stand out in a fairly flat landscape, and early European visitors like von Karnap followed these to the Niger River from Togo, passing by the study region. The data presented here indicate that this may not have been an unique trajectory.

Mobility: Stability and Flexibility

Over the past millenium, the inhabitants of the Gobnangou region have utilized shifting cultivation as their primary agricultural strategy, resulting in a consistant and archaeologically visible pattern of shifting settlement despite dynamic changes in their social, economic, and possibly political circumstances and practices. While various scholars have postulated that these strategies are determined by a given environmental incentive or particular political milieu, the data presented in this thesis suggest that the strategies developed and maintained by prehistoric inhabitants of the Gobnangou region (almost certainly ancestral to the modern Gourmantche population) are stable, yet flexible structures that can easily adapt to historical circumstances and changing times. Continuity of practice inidicates a strong embedding of mobility in Gourmantche society, and further reinforces one of my main themes; that shifting cultivation and its associated mobility are as much cultural processes as shaped by environmental variables. As is clear in the archaeological record, the Gobnangou is not an isolated region, and residents have been consistantly exposed to other possibilities. Even during the colonial period, the Gourmantche found ways to maintain mobility through the development of their bush field system (*kwadiegu*) and today, with the dramatic expansion in cotton farming, residents of the study region are increasing their mobility as they increase household agricultural production.

In conclusion, this project demonstrates the importance of archaeological research to understanding long term trajectories of landscape use. In doing so, it is possible to gain perspective on debates that may be based on fundamentally inaccurate conceptions of the nature of human interaction with their natural environment, particularly in cases such as West Africa where formerly explicit political agendas have been formalized in the academic and popular canon as accepted narratives. Hopefully, this research has taken a small step towards recasting the Gobnangou region as a center rather than a periphery.

APPENDIX A
THE CERAMIC ASSEMBLAGE

Ceramics are the primary class of material data collected on the survey, and are the main data source for determining the regional chronology. In this appendix, the methodologies for recording and analyzing the ceramics, and the resulting types are described in detail. The types are placed in a comparative perspective with the pottery of the greater region and a seriation of the types is presented.

The Analysis in Context: Developing a Methodology

In developing the recording and analytical methods for this particular assemblage, several factors were considered. The primary goal in data recording was to document the sherds in such a way as to facilitate the creation of chronological and functional typologies. McIntosh (1995) has argued persuasively for the use of individual attribute recording such that multiple typologies can be created from the same data set. This methodology is particularly effective when there is not an established typology in place, such that chronologically significant variables are not yet known (e.g., McIntosh 1995, Lawson 2003, Bedaux et al. 2006, Dueppen 2008). The second major factor was the need to evaluate the project ceramics in the context of assemblages recorded by other scholars. Previous work in southeastern Burkina Faso and northern Benin has resulted in several ceramic typologies with little comparability between them.[1] The University of Frankfurt's research in the Gobnangou region itself employed an intuitive typology that took into account numerous factors including archaeological context in addition to formal characteristics of the ceramics themselves (Breunig and Wotzka 1991, Frank et al. 2001, Wotzka and Goedicke 2001). The resulting groups were published with short descriptions, in some cases accompanied by drawings, and subsume a great deal of variability within each group. In the Atakora mountains and northern Gourma Plains of

1 Vernet has also published basic descriptions of pottery from southeastern Niger, accompanied primarily by illustrations of rim profiles (Vernet 1996). In general, these ceramics were very different from those of the study region and no points of similarity were identified. Recent work in the Niger section of Park W may result in a comparative ceramic assemblage, but as of this writing only preliminary reports have been published (Haour et al. 2006)

Benin, Petit used vessel form as the primary basis for ceramic description, and provided summary discussions of the assemblages from different phases (Petit 2005).[2]
Since the existing data on ceramics in the greater region is fragmented, it was determined that an individual attribute analysis would provide the best opportunity for integration with the German typology, as well as the identification of previously unknown vessel types and comparison across regions.

Ceramic Recording

During the 2006 field season 26,506 ceramic sherds were collected, 1,875 of which are from the five small excavation units. All ceramics from both survey and excavation were washed and individually recorded, with the exception of undecorated sherds smaller than $4cm^2$ from surface collections, which were counted, weighed, and set aside (n=9,959). For each of the remaining sherds (the primary study assemblage, n=16,547), the following data points were taken: interior surface treatment; interior slip color and position; interior decoration; exterior surface treatment; exterior slip color and position; exterior decorations and positions; thickness; paste color; and temper inclusion types, their relative proportions and their sizes. For rims, bases, and handles firing conditions and interior/exterior diameters were also recorded when possible. All rims, bases and handles were drawn (rim angle data was taken from drawings when needed), as were selected body sherds. Representative sherds from all classes were photographed. The small 2004 pilot assemblage (n=481), was recorded in a similar fashion to that described in detail above for 2006. However, due to inconsistencies in the coding between the two seasons, these sherds could not be fully integrated into the significantly larger 2006 assemblage. Therefore, while these data were taken into account when assessing the chronology of particular sites, they are not included in the discussion below.

Paste

Potting clay is widely available in the Gobnangou region. Clay deposits are found along the banks of seasonal streams, and high quality clays are often available at a depth of one meter or less (Geis-Tronich 1991: 411). Modern Gourmantche potters differentiate clays according to their colors; according to Geis-Tronich, most of the clay available in the Gobnangou region is considered black clay, *u yoagboanu.* Dark gray in color due to a high proportion of magnesium oxide, black clay is often naturally interspersed with mica particles. Red clay, *u yoagpienu*, is also available in the region to the north of the escarpment; this clay is derived from Birrimean deposits and can range from yellow-

2 Petit was kind enough to provide comments on photographs of the study assemblage which greatly aided comparisons with the northern Benin material (Petit, personal communication).

Temper Size	Frequency	% of Assemblage	Mean Vessel Thickness (mm)
small	1364	8.3%	8.9
medium	14121	86.3%	11.0
large	863	5.4%	21.7

Table A.1 Temper Size: At the assemblage level, temper size is linked to statistically significant variability in vessel thickness.

red to brown-red, depending on the proportion of iron oxide (Geis-Tronich 1991: 412). However, both red and black clay produce fired vessels of a similar pale orange-red color (Geis-Tronich 1991: 412), and are consequently difficult to distinguish archaeologically.

Temper

Although some clays in the Gobnangou region are naturally tempered with sand or mica, these are usually supplemented with added tempers such as grog (crushed pottery), crushed quartz, and mica. The archaeological assemblage exhibited extraordinary diversity in temper composition.

Each sherd was assessed along a fresh break and most included multiple types of temper. In recording, a distinction was made between dominant temper(s), regularly present temper(s), and sparse temper(s). The latter, usually isolated occurrences, were likely not intentionally added, but rather small pieces accidentally mixed in with other temper or naturally occurring in the clay. Average size of each temper type was recorded using the following categories: Small (< 1 mm^2), Medium (<2 mm^2), and Large (>2 mm^2).

Six major classes of temper were identified in the archaeological ceramics:

Grog: Crushed pottery is the most frequently occurring temper in the archaeological ceramics.

Quartz: This category refers to crushed pieces of quartz, rather than silicate sand. Quartz veins are common in the escarpment, and are used locally to temper modern pottery. Frank et al. (2001) and Wotzka and Goedicke (2001) note the presence of feldspar as well as quartz as a common temper. Since the two are visually similar, it is possible that some tempers recorded as quartz were actually feldspar.

Mica: Although mica occurs naturally in some of the local clay sources, additional mica is frequently added by modern potters to create a particularly glittery effect (Geis-Tronich 1991). In comparing modern local pottery with archaeological pottery, the mica content in mica-dominant prehistoric pots is much higher than naturally occurs in currently utilized clay sources.

Code	Dominant Tempers	Frequency	% of Assemblage
2	grog	10193	61.6%
3	quartz	5406	32.7%
14	quartz-mica	563	3.4%
8	grog-quartz	221	1.3%
4	mica	82	0.5%
1	organics	23	0.1%
7	grog-laterite	14	0.1%
5	laterite	7	<0.1%
6	slag	1	<0.1%
9	grog-organic	4	<0.1%
10	grog-mica	8	<0.1%
11	grog-slag	1	<0.1%
12	grog-quartz-mica	4	<0.1%
13	grog-quartz-laterite	2	<0.1%
15	quartz-mica-slag	5	<0.1%
16	quartz-organic	1	<0.1%
17	mica-laterite	1	<0.1%
18	no dominant temper	8	<0.1%

Table A.2 Dominant Tempers and their Frequencies

Laterite: Small laterite pebbles are also found almost exclusively in large vessels. These may be intentionally added as temper or evidence of the use of less finely processed clays for these vessels.

Organics: Organics are only present in some large vessels: this suggests a degree of prehistoric consistency with Geis-Tronich's (1991) observation that organic temper is most commonly used for large constructions such as clay granaries.

Slag: Crushed pieces of slag are known as a temper from areas on the forest margin (e.g., Stahl et al. 2008), but less frequent in savanna areas to the northeast (e.g., McIntosh 1995, Dueppen 2008). Slag is an infrequently used temper locally.

Fine sand was not recorded as its presence could not be reliably identified using the available hand lens, although Geis-Tronich (1991) found its use to be virtually ubiquitous throughout modern Gourmantche. Additionally, a few examples of bone or shell tempered sherds were recorded. These sherds tended to be heavily weathered, and are insignificant in the regional assemblage.

The study assemblage included 184 unique type/size/frequency temper combinations. In order to streamline analysis, temper size was separated from the type/frequency designations (Table A.1) and two summary codes were given to each sherd on a presence/absence basis. The first included only those tempers designated as dominant (18 categories) and the second those designated as dominant or regularly present (32 categories) (Tables A.2 and A.3).

As can be seen in these tables, grog is by far the most dominant temper, followed by quartz. Additional combinations of temper, notably those with mica, are used in specialized circumstances. Despite Geis-Tronich's (1991) identification of naturally micaceous clay as the predominant potting clay of the Gobnangou region, only about 5% of sherds have mica as a regularly occurring or dominant temper (the percentage goes up insignificantly if sherds with sparse mica are included). Consequently, the micaceous deposits were likely less frequently exploited in the past: the micaceous clay may have been reserved for specific uses, or there may have simply been other, more convenient clay sources. A further attempt to identify clay sources in use was made by comparing the paste color of oxidized vessels within temper groups, however all recorded paste colors (light brown, brown, gray and orange) occurred in similar proportions irrespective of temper.

The preponderance of temper diversity, and in particular the number and diversity of rarely observed variations on common temper formulas is most likely a result of numerous potters manufacturing their clays in small, hand-mixed batches. None of the most infrequent temper categories correlated with any particular vessel form or decorative scheme.

Vessel Form

Today, most ceramics in the Gobnangou region are hand built using different combinations of drawing, molding, and coiling techniques. Two typical examples of Gourmantche vessel construction are provided by Geis-Tronich (1989). In the first case, the building of a water jar in Tanbaga on the north side of the Gobnangou escarpment, the potter uses a shallow concave mold made of fired clay or termite loam, into which a thick lump of clay is pressed using a pestle. The potter then draws the clay up to form the sides while rotating the pot in the mold to smooth the sides and maintain a rounded shape. After drying, a donut of clay is applied around the small mouth then drawn upward to create an elongated, slightly flared neck. In the second case, the building of a cooking pot in Kantchari, 90 km north of the study region, the potter begins by molding a flat piece of clay over the convex base of a fired pot. The clay is cut to make a hemisphere, removed from the mold, and left to dry. The dried hemispheres are placed in a sand pile to steady them and the upper portion of the pot is added using a coil technique. The coils are smoothed and shaped by the potter using their hand and/or a hard seedpod from

Code	Dominant and Regular Tempers						Frequency	% of Assemblage
	organic	grog	quartz	mica	laterite	slag		
16		x					7423	44.9%
28			x				5088	30.8%
2		x			x		1405	8.5%
1	x	x			x		920	5.6%
21			x	x			614	3.7%
5		x	x				582	3.5%
15	x	x					172	1.0%
10		x		x			63	0.4%
24			x	x		x	38	0.2%
4		x	x	x			36	0.2%
3		x	x		x		31	0.2%
32				x			28	0.2%
20			x	x	x		27	0.2%
30	x						22	0.1%
25			x		x		20	0.1%
22	x		x				16	0.1%
14	x	x	x				15	0.1%
19		x				x	9	0.1%
6		x	x	x	x		4	<0.1%
7		x	x			x	2	<0.1%
9	x	x		x			2	<0.1%
11		x		x	x		8	<0.1%
12	x	x			x	x	1	<0.1%
13	x	x	x		x		3	<0.1%
18	x	x	x	x			2	<0.1%
23	x		x	x			1	<0.1%
26			x		x	x	1	<0.1%
27			x			x	7	<0.1%
29	x				x		1	<0.1%
31				x	x		3	<0.1%
33						x	1	<0.1%

Table A.3: Frequency of Dominant and Regular Temper Combinations

a *Piliostigma* sp. The neck of the vessel may be built in the same manner, or drawn as described above. There is no record of modern Gourmantche potters using the slow wheel techniques favored to the west (e.g., Frank 1998, LaViolette 2000, Mayor et al. 2005), although this does not exclude their use in the past. Little conclusive evidence for vessel formation techniques was recovered from the archaeological assemblage. While a few of the thicker sherds from larger pots had evidence of coils, in most cases, their presence or absence could not be determined. Many of the flaring rims on jars have seams indicating that they were later additions to the body of the pot, as described above.

Geis-Tronich (1991:139-60) also describes the modern ceramic assemblage, dividing vessels into four local categories: *cancanli, sanli, bobli,* and *cuali.* Although she does not provide a detailed functional analysis, *cancanli* (open sub-hemispherical bowls) and *sanli* (open hemispherical bowls) are generally used for serving while *bobli* (open jars) and *cuali* (restricted jars) are used for cooking, water transport/storage, and fermentation. In the past, vessels' forms and functions were likely significantly more varied as commercially manufactured plastic and metal vessels have become commonplace and usurped many of the roles previously fulfilled by ceramics and gourds.

Only a few archaeological vessels with complete profiles were located on survey, and much of the vessel form information from the assemblage is derived from dissociated rim and base sherds. In general, there was significant variability in the rim assemblage, and while there were trends in vessel form, attempts to create clean distinctions between types were largely unsuccessful: individual sherds often had characteristics of more than one category. The numerous small rims (<4 cm^2) -approximately 1/3 of the total rim sample- further complicated efforts, as did the similarities between the upper portions of jars with long flared necks and slightly flared open bowls and beakers. For this reason, vessel form is presented only in general terms.

Jars with Flared Necks: Spheroid or ovoid jars with slightly constricted throats and flaring necks (as described above). These jars are present in a variety of shapes and sizes. Flares can vary from 1.5 cm to 15 cm depending on the type and size of jar. An analysis of flare length and exterior rim angle found a fairly continuous distribution of flare length, and a concentration of rim angles from 90°-145°.

Jars or Bowls with Everted Necks: These vessels have short, strongly everted necks. The neck length ranges from 1.5-5.5 cm, and exterior rim angles are concentrated between 155°-170°. No large vessel fragments with these rims were recovered, and these may be associated with jars, slightly restricted bowls, or both.

Large Open Vessels with Vertical Sides: These vessels, likely large storage bowls or jars, have large diameters (mostly between 35-50 cm), and thick walls that descend almost vertically. While these vessels often have square rims, they sometimes have a thickened, pinched rim.

Simple Open Bowls: Open bowls, fragments are usually small enough that hemispherical and sub-hemispherical examples cannot be differentiated.

Double Simple Open Bowls: Hourglass-shaped vessels. All have at least one hemispherical or hemi-ovoid bowl. The basal bowl may be a functional and size equivalent, or it may be a smaller, less finished pedestal base. There is no stem or similar feature in the middle. These vessels can be difficult to distinguish from simple open bowls when only a small fragment is present.

Open Beakers: Open ovoid vessels with gently flaring sides. These are in a range of sizes, with diameters from 10-44 cm.

Small Jars with Out-Turned Lip: Vessels with out-turned lips. These occur exclusively on smaller vessels with most diameters under 35 cm.

Bases are predominantly rounded, but may include the pedestal bases mentioned above, ring bases, and cylindrical or button feet. With the exception of the pedestal bases, none of the other base techniques have been associated with any vessel form.

Surface Treatment

Identification of patterning in surface treatment posed particular problems. Over 40% of recorded sherds were weathered such that their original surface treatment could not be determined, an unsurprising figure given that 88.9% of the study assemblage was collected from the surface. An additional ca. 25% had space-filling decorations that obscured any surface treatment applied prior to decoration.

There are three stages in the construction of a vessel at which different surface treatments are usually applied. Self-slipping (smoothing with a slurry of particularly fine clay) and burnishing of either the self slip or the primary fabric often occurs immediately following vessel construction. In contrast, red-slipping with a slurry of ground hematite and burnishing of that surface usually occurs after any decoration has been applied and the vessel has been dried. Finally, a thin external layer of clay mixed with crushed gravel (referred to here as "roughing") may be applied, usually to the base. According to Geis-Tronich (1989), this step follows the application of slip. The latter two conditions seem to hold true archaeologically, as there were no cases in the study assemblage of decoration cut through slip or of slip over roughing. Slips are generally applied with fingers or a piece of cloth, and polishing can be done with a piece of wood, the hard seedpod of the *Piliostigma* sp., or a smooth quartz stone similar to those recorded by Geis-Tronich (1991) and collected at sites 552, 582, and 957. Polishing serves a dual

Surface Treatment	Frequency	% of Assemblage	% Preserved Surface (n=5596)
N/A - Weathered	6913	41.9%	
N/A - Decorated	3997	24.2%	
Self-Slipped	2035	12.3%	36.4%
Self-Slipped & Polished	997	6.0%	17.8%
Red-Slipped	631	3.8%	11.3%
Red-Slipped & Polished	1759	10.7%	31.4%
Roughing Applied	174	1.1%	3.1%

Table A.4 Frequency of Surface Treatments

function; not only is it aesthetic, but it also helps the slip bind to the dried clay body (Rice 1989: 150-1). The function of roughing is unknown, but given that it is confined to the base of the vessel, it likely adds stability and/or reduces wear.

Among those sherds not recorded as weathered or decorated, self-slipping is the most common surface treatment (Table A.4). Only 32% of self-slipped sherds are polished, however they may be under-represented as 59% of the polished sherds are from excavation (which make up only 11% of the assemblage). In contrast 74% of red-slipped sherds are polished, and polish is not disproportionately found on sherds from excavation. The application of roughing is likely a recent innovation: in use by modern potters, archaeological examples of the technique are only from the latest period sites.

Decoration

The archaeological assemblage exhibited a particularly diverse set of decoration techniques, despite the fact that only 28% of assemblage sherds were decorated. Recording of decoration involved noting each individual technique (defined as use of a specific tool in a specific manner) utilized on the sherd. Relationships between decoration techniques were noted, as was the position of the decoration on the sherd. All rim sherds as well as examples of each technique and particularly complex composite decorations were drawn.

Sixty-seven individual decoration techniques were documented in the assemblage. These can be divided into numerous groups based on the tool used (cord, wood, finger, etc.), the appearance on the vessel (space-filling, lines, etc.) or, as in Table A.5, on the basis of the technique used to make the impression. *Roulette* decorations are the patterns produced by rolling an object, in this case a carved wooden cylinder or a twisted and/or knotted cord, across the surface of the vessel to produce a zone of decoration. *Dragged* decorations are those where an object, most frequently a wooden stylus or carved comb

Type	Code	Description	N	% Dec. Sherds (n=4569)	Notes
	PC	Evenly spaced parallel channels, may or may not be made with a comb	311	6.81%	
	CH	Single straight channel of any direction or width; usually made with a stylus and ca. 1-3 mm wide.	275	6.02%	
	LIPCH	Channel on the lip of the pot, likely made using the central rib of a leaf.	55	*rims only*	GT describes this technique for modern Gourmantche potters
	CC	Use of a comb to create short (<5 mm) parallel incisions within a channel. Usually occurs in parallel rows	47	1.03%	See Type 5 discussion
	SC	Semi-circular channels	30	0.66%	
	DC	Comb dragged lightly across the vessel surface resulting in shallow, slightly messy channels.	27	0.59%	
	MCT	Nested groups of channels in a triangle or chevron motif	21	0.46%	
	IC	A specific arrangement of channels that does not fall into a different category. Individually drawn.	17	0.37%	
	TC	Similar to CC, except two sets of short channels are made in opposing directions.	15	0.33%	See Type 5 discussion
	CT	Single channel in a triangle or chevron motif.	11	0.24%	
	XI	Incisions in a regular, space-filling cross-hatch pattern	10	0.22%	
	DI	Rows of short diagonal incisions, generally less than 10 mm high	9	0.20%	P identified this technique at Tchikandou-I (early 2nd millenium AD
	I	Incisions made with a sharp instrument that slices the clay	9	0.20%	
	G	Short, deep, wide channels, usually in rows.	7	0.15%	
	MAC	Sets of roughly parallel, fairly wide arcing channels that have a close origin point and expand outward.	7	0.15%	WG Group 10 has several sherds with this technique, all of which have quartz, feldspar, or laterite tempers. WG identified this decoration only at open air sites near Kantchari.
	MI	Multiple incisions with no consistent pattern	7	0.15%	
	LC	Two closely spaced parallel channels with evenly spaced vertical lines running between them	4	0.09%	P identified this technique at Tchikandou-I (early 2nd millenium AD)
	XC	Channels in a regular, space-filling cross-hatch pattern	4	0.09%	

Table A.5: Decoration Techniques

Type	Code	Description	N	% Dec. Sherds (n=4569)	Notes
	MCH	Multiple channels with no consistent pattern	3	0.07%	
	Cord 11	Dragged twisted cord	2	0.04%	
DRAGGED DECORATIONS	BDC	Comb dragged a very short distance between channels	2	0.04%	P identified this technique at Tchikandou-I (early 2nd millenium AD)
	SDC	Comb with 4-5 teeth dragged lightly in an open swirling pattern	2	0.04%	
	VF	Fill pattern made of short (5-10 mm) vertical channels. Although all have the same orientation, they are not horizontally aligned.	1	0.02%	
IMRPESSED DECORATIONS	Cord 4	Impressed twisted cord in parallel rows. Rarely applied in two directions to create diamond pattern	134	2.93%	See Type 3 discussion
	FCI	Fill of dense comb impressions in a generally rectilinear pattern.	52	1.14%	See Type 1 discussion
	RP	Rim treatment in which the edge is extruded and formed by pinching between two fingers, resulting in a series of adjoining facets	22	*rims only*	See Type 8 discussion
	IB	Impressed braided cord	20	0.44%	
	SCOR	Dense, unevenly applied rocker comb which creates a space-filling pattern	11	0.24%	WG Groups 1 and 2 have dense rocker comb on quartz tempered sherds.
	TB	Triangular impressions, possibly created using the end of a stylus	6	0.13%	
	CI	Solid impressed circles	5	0.11%	
	COR	Rocker comb (impressed design made by pivoting the comb across the surface of the vessel)	5	0.11%	
	CCI	Impressed semi-circular comb	4	0.09%	
	COI	Impressed comb	3	0.07%	
	FI	Impressed fingernail	3	0.07%	
	HC	Angular,"L" shaped impressions, like made with a wedge-shaped stylus	3	0.07%	
	TH	Impressed thumb or fingers	3	0.07%	
	Cord 12	Impressed cord wrapped stick	2	0.04%	
	MLI	Fill of small pointed ovate impressions in a random pattern but with similar alignment	2	0.04%	
	Cord 14	Impressed cord in a zig-zag pattern	1	0.02%	
	IHC	Impressed comb with H-shaped teeth	1	0.02%	

Table A.5: Decoration Techniques, continued

Type	Code	Description	N	% Dec. Sherds (n=4569)	Notes
APPLIED DECORATION	R2T	Plastic ridge with two parallel rows of deep thumb or finger impressions (pinching?) running along it.	139	3.04%	See Type 9 discussion
	PR	Plastic ridge, often with a square profile.	27	0.59%	See Type 9 discussion
	PRT	Plastic ridge with a row of deep thumb impressions running along it	14	0.31%	See Type 9 discussion
	PRG	Plastic ridge with evenly spaced vertical gouges	12	0.26%	See Type 9 discussion
	PB	Applied circular plastic button	11	0.24%	
	MR	Small plastic ridge with triangular cross-section	6	0.13%	
	MRG	Small plastic ridge with evenly spaced gouges	2	0.04%	
CORD AND STRIP ROULETTES	Cord 2	Twisted cord roulette	2566	56.16%	M Twine 6
	Cord 1	Plaited cord roulette	235	5.14%	M Twine 10
	Cord 3	Accordian pleated strip roulette	158	3.46%	M Twine 4, P common in northern Benin throughout Iron Age
	Cord 5	Knotted cord roulette	94	2.06%	See Type 4 discussion
	Cord 6	Twisted looped cord roulette ("chevron")	79	1.73%	M Twine 12
	Cord 9	Accordian pleated strip roulette	47	1.03%	M Twine 5
	Cord 8		27	0.59%	
	Cord 7	Loosely twisted cord roulette	23	0.50%	M Twine 7
	Cord 15	Pleated strip roulette (end-to-end ovals)	11	0.24%	
	Cord 10	Pleated strip roulette (double ovals)	4	0.09%	
	Cord 16	Stick wrapped with untwisted fiber?	4	0.09%	M Twine 14?
CARVED WOODEN ROULETTES	R1	Closely spaced ovals or hexagons in low relief	30	0.66%	
	TDC	Angular patterns made from parallel lines	19	0.42%	See Type 13 discussion
	VC	Horizontal rows of "V" staped impressions	10	0.22%	See Type 13 discussion
	R2	Raised boxes in offset parallel rows	1	0.02%	
	R3	Large impressed squares	1	0.02%	
	R4	Toothed line in parallel rows	1	0.02%	
	R5	Double-toothed, almost wavy lines in parallel rows	1	0.02%	

GT= Geis-Tronich 1991, M= McIntosh 1995, P= Petit 2005

Table A.5: Decoration Techniques, continued

Dec. Group	N	% Dec. Sherds (n=4569)	Description	Comments
A	196	4.29%	Plastic ridges (including R2T, PR, PRG, PRT, MR, MRG). These ridges usually occur in a band near the neck, but may also occur in vertical or circular motifs. The ridges may or may not have Cord 2 on the body below the ridge. Straw impressions are frequent	Tend to be thick sherds (mean 17.9 mm) with large, coarse grog and laterite temper. Undecorated surface is usually roughly smoothed and self-slipped.
B	144	3.15%	CC or TC in co-occurrence with PC or PC in two diferen directions. May have CT or CH separationg zones of decoration. PC are made with dragged comb and have distinctive depth and spacing.	Tend to be thin sherds (mean 8.7 mm) with grog temper. Interior and exterior surfaces usually to be red slipped and often polished.
C	38	0.83%	Zoned decoration consisting of upper bounding CH or PC at the neck, below which is a band of incised shapes (CT, I, MI, or SC) the space around which is often FCI. These are then separated from a zone of Cord 3 or 9 that covers the base of the vessel by additional PC.	Tend to be thin sherds (mean 10.1 cm) with quartz temper.
D	94	2.06%	Cord 5. May occur in a single band, or in a block and is often in conjunction with Cord 2.	Tend to be thin sherds (mean 9.0 mm) with grog temper
E	26	0.57%	TDC or VC. May have occaisional decorative motifs like CI, MCT, PC. TDC and VC can co-occur	Sherds are thin (mean 10.1 mm) and all have quartz temper.
F	14	0.31%	MCT or CT with PC or CH.	This is a highly variable group: while a few sherds are red-slipped with a coarse quartz temper, there are no consistent patterns
G	230	5.03%	Cord 1	This is a highly variable group with a wide range of thicknesses, tempers, and surface treatments.
H	2443	53.47%	Cord 2, occasionally with CH	This is a highly variable group with a wide range of thicknesses, tempers, and surface treatments.

Table A.6: Common Decorative Groups

Dec. Group	N	% Dec. Sherds (n=4569)	Description	Comments
I	132	2.89%	Cord 3	This is a highly variable group with a wide range of thicknesses, tempers, and surface treatments.
J	127	2.78%	Cord 4 alone or with bounding channel	60% of these sherds are mica tempered with weathered surfaces (thickness mean 11.3 mm). The remainder have significant variability in temper, thickness, and surface treatment.
K	79	1.73%	Cord 6	55% of these sherds are a very thin (mean 8.9 mm) with quartz temper. The remainder have significant variability in temper, thickness, and surface treatment. A few examples with mica temper have cord spacing more consistent with Group J.
L	17	0.37%	Cord 7	This is a highly variable group with a wide range of thicknesses, tempers, and surface treatments.
M	26	0.57%	Cord 8	All sherds are grog tempered. 12 of these sherds were excavated from 572.3 and are likely from the same pot.
N	41	0.90%	Cord 9	This is a fairly variable group: 14 sherds are from excavation at site 541 and 572.3. The former are likewise variable, while the latter are all grog tempered.
P	20	0.44%	IB	This is a highly variable group with a wide range of thicknesses, tempers, and surface treatments.
Q	26	0.57%	R1	Predominantly grog tempered with weathered surfaces. The sherds are concentrated at only 13 sites.
U	34	0.74%	LIPCH	Those sherds which are not weathered are all red slipped and polished. While the majority are quartz tempered, about 30% are grog tempered.

Table A.6: Common Decorative Groups, continued

are impressed in the wet clay and dragged to create lines. *Impressed* decorations are those where an object is pressed into the surface of the clay, then lifted without lateral movement. *Applied* decorations are those where a piece of clay is shaped and joined to the vessel surface, creating a protruding decoration. Most decoration techniques occurred on fewer than 20 sherds (less than 0.5% of the decorated assemblage).

In order to facilitate analysis of the decorations, seventeen decorative groups were created, which encompass over 80% of decorated sherds (Table A.6).[3] These groups serve two purposes. First, they isolate the most frequent decorative techniques (e.g., Group D) and lump together minor variations on the same technique (e.g., Group A). Second, and more importantly, they allow for the analytical combination of sherds representing different parts of common complex combinations of decorations (notably Groups B and C). As will be seen below, the decoration groups that clustered most tightly around specific tempers and thicknesses proved most significant when developing a typology. In contrast, highly variable groups, primarily the cord roulettes, consist of decoration techniques that can be used in a variety of settings.

While the most common decorations are important for comparing sherd assemblages across all recorded sites, rare decorations can be equally significant. Those that occur at more than one site are presented in Table A.7. Interestingly, despite the very small sample size, these groups had more diversity in temper than several of the primary decorative groups, and certainly more than most of the Vessel Types presented below. There are multiple potential explanations for this diversity: vessels with these decorations could be less codified; they could be produced in the home while more standardized vessels are produced by specialists; they could be produced outside the region, possibly in multiple locations, thus accounting for their low numbers; or they could have normal ranges of diversity that are obscured by small sample size.

Firing

Modern Gourmantche potters fire using an open-air technique (Geis-Tronich 1989). Pots are piled on a pallet of dried branches, then covered with wood and more branches. The pile is lit and allowed to burn through the night. The fired pots are removed the next morning. This technique is consistent with those frequently used in neighboring regions, and there is no evidence, modern or prehistoric, of construction of the simple mud-brick kilns occasionally found in the Voltaic region to the west (Manessy 1960, Frank 1998, Dueppen 2008).

This type of bonfire firing is known for its variability in atmosphere. The vast

3 Originally, twenty-one groups were created. However, during analysis several (O, R, S, T) were eliminated.

Table A.7: Rare decoration techniques found at multiple sites

Decor.	N	Sites	Comments
Cord 3 in a thin band near the rim	5	502.3 592.2 621 794 844	Mostly grog tempered with a self-slipped surface
Cord 10	4	696.2 753 900	Three grog and laterite tempered, one quartz tempered
Cord 11	2	664 730	One quartz tempered and one grog and slag tempered
Cord 12	2	531.5 847	Grog tempered. One is red slipped and one is weathered
Cord 13	5	562 701 796 834 928	Three grog and two quartz tempered. All are weathered.
Cord 15	11	502.2 502.3 541 550 731 795 900 931	Six quartz tempered and five mica tempered
CCI	4	526 625 844 972	Three grog tempered and one mica and quartz tempered
COI	3	541 774 780	All grog tempered
COR	5	502.2 522 649 686 922?	Three grog tempered and two quartz tempered
DI with Cord 3	2	502.3 797	One grog tempered, one quartz and grog tempered
HC	3	524 550 903	One slipped and polished. All different tempers.
LC	4	592.1 784 815?	Two grog and two quartz tempered
MAC	7	513 541 856 902	Four grog and three quartz tempered: both tempers occur at the same site
MLI	2	541 704	One grog and one quartz and mica tempered
SCOR	11	541 550 694.1 696.2 902	Variability in size and shape of comb teeth. Mix of grog and quartz tempered.
SDC	2	775 900	Grog tempered
XC	4	502.3 696.2 780 868	Three grog and one quartz tempered. Variable decor.
XI	10	573 752 780	Seven quartz and three grog tempered
White Paint	6	569 573 689 963	Five quartz and one grog tempered: both tempers at same site

majority of sherds (66%) had oxidized exteriors and interiors with a blackened core. According to Rice (1987:334), this phenomenon is caused by a charring of organic matter in the clay. (The organic matter is not necessarily a temper, but rather the humus, rootlets and fibers common in surface and shallow sedimentary clays such as those found in the study region). In high temperatures or particularly porous clays, the carbonaceous material may completely oxidize, leaving no black residue. Cases of full oxidization in the assemblage (23%) were no more common amongst coarse tempered sherds than fine tempered sherds, and are likely from firings, or even sections of vessels, where higher temperatures were achieved. Likewise, fully reduced sherds (11%) may be from lower temperature areas of a firing. However, complete blackening may also be the result of an intentional strategy known as smudging in which "the open fire or bonfire is smothered with a dense layer of fine organic matter . . . so that no oxygen reaches the pots and carbon is deposited on the surface and in the pores" (Rice 1987:335). There are only a few cases where a similar technique may have been employed, primarily with some of the older ceramic types.

Sherd Types

The creation of typologies has long been the subject of fierce archaeological debate (see reviews/discussions in Whallon and Brown 1982, Adams and Adams 1991, Wylie 2002). What has emerged is a consensus that the definition of a set of types must be accompanied by an explicit accounting of both the methods used to create the types and their intended purpose.

The goal of the study typology is to identify sherds from similar vessels in order to facilitate the chronological control of the superficial, short occupation sites that dominate the region. For this reason, the emphasis was on creating very tight typological definitions in order to minimize the inevitable temporal drift and avoid as much as possible conflating similar ceramics from different phases of occupation. This policy was not without its drawbacks, however, as it limited both the number of types to 15 and the number of sherds assigned to types. Consequently, it was only possible to assign 1149 sherds (7% of the study assemblage, 25% of decorated sherds), i.e., slightly more than two typed sherds per recorded site (Table A.8).

While the absolute number of typed sherds is low, a clear correlation cannot be drawn between the percentage of sherds in the assemblage that are typed and the percentage that come from typed vessels. Often only specific parts of a vessel provided the necessary information to assign a sherd to a category. For example, Type 3 designations were only made when the rim and the decoration zone were present; however, based on an almost

Table A.8: Sherd Types

Type	N	Sites (N)	Description	Primary Temper	Vessel Form	Mean Thickness (mm)	Mean Ext. Diameter (cm)	Surface Treatment	Decoration	Sampling
1	38	29	Incised Impressed Comb	quartz	round jars with flaring necks	10.0	20.5	self-slip	Group C (all sherds)	rim, body
2	83	75	Open Cord Roulette	grog	gently flared beakers	10.3	22.4	mixed, often polished	Groups G and H (sherds with correct rim only)	rim
3	88	70	Micaceous Impressed Cord	mica and quartz	NA	11.3	NA	NA	Group J (all sherds with correct temper)	body
4	154	107	Everted with Knotted Cord	grog	open bowls or jars	9.6	28.3	self-slip or lightly applied red slip	Group D (all sherds) Group H (sherds with correct rim only)	rim, neck, body
5	144	98	Red Dragged Comb	grog	open, possibly double bowls	8.6	20.2	red slip	Group B (all sherds)	rim, body
6	86	69	Red Pedestal Base	grog	cup-like pedestal base	NA	15.6	red-slipped	channels, parallel channels	base
7	11	11	Red Flared Base	grog	squat pedestal base	NA	13.1	red-slipped	none	base
8	17	17	Open Thickened Rim	grog	large open jars or basins	17.8	43.9	mixed, often polished	RP (all sherds)	rim
9	176	118	Coarse Thumb Impressed Ridge	grog, laterite	large open jars or basins	18.9	42.6+	self-slip	Group A (excluding mini-ridges)	rim, body
10	49	45	Lug Handle	grog	NA	NA	NA	mixed	none	handle

Table A.8: Sherd Types, continued

Type	N	Sites (N)	Description	Primary Temper	Vessel Form	Mean Thickness (mm)	Mean Ext. Diameter (cm)	Surface Treatment	Decoration	Sampling
11	93	78	Quartz Flared Neck	quartz	jars with flaring necks	11.8	27.3	self-slip or red slip	none	rim, neck
12	18	16	Thin Walled Chevron Roulette	quartz	jars with flaring necks	9.5	NA	NA	Group K (sherds with correct rim or neck only)	rim, neck
13	26	18	Triangular Wooden Roulette	quartz	NA	10.2	NA	red slip	Group E (all sherds)	body
14	166	54	Basal Roughing	quartz	NA	13.0	NA	roughing	none	body
15	19	15	Red Channeled Flared Neck	quartz	vessels with flaring necks	11.1	29.6	red slip	lip channels	rim

complete example, as much as 75% of the vessel surface area falls below the decoration line. The effect is even more extreme on vessels such as those represented by Types 8 and 9.

The methodology used in creating these types was essentially a cluster analysis: the variables of temper, rim form, surface treatment, and decoration were found to vary significantly. Types were identified by looking for cases of concordance amongst at least three of the four groups. For this reason, the resulting types cannot be equated on a one-to-one basis with vessels (thus their designation as *Sherd* Types). As an example, Type 13 sherds are likely shoulder portions of some Type 11 sherds, based on illustrations in Geis-Tronich (1989, 1991). However, since no actual examples of this were identified and not all Type 11 sherds would necessarily be associated with Type 13, these two groups remain separate.

Type 1: Incised Impressed Comb, n=38

<u>Temper:</u> The majority of these sherds (87%) have quartz dominant temper, while 13% have grog dominant temper. Additional temper inclusions are rare.

<u>Vessel Form:</u> These vessels are spheroids with slightly constricted throats and flaring necks. Diameters could be obtained from only four vessels: three are almost exactly the same size (neck/rim: 14/18 cm, 15/19 cm, /19 cm), while one is slightly larger (22/26 cm). As is apparent from the neck/rim diameter differential, the angle and length of the neck flare is also very consistent, resulting in a standard 4 cm diameter differential. The walls have a fairly tight thickness distribution (range 5-14 mm, mean 10.0 mm, s.d. 2.3 mm)

<u>Surface Treatment:</u> Of the few vessels that are not weathered, all are self-slipped. One example has polished red slip on the interior of the rim, but this is the only case of red slip in this group.

<u>Decoration:</u> These vessels have a fairly standardized complex design grammar, described as Group C above (see Table A.6). The representation of the different decoration techniques in the assemblage is purely representative of the parts of the vessel, not of their relative prominence. The only pattern noted in the design variability is in the use of semicircular channels rather than angular incisions. The former are used exclusively on the grog tempered sherds, although they are also present on the quartz tempered sherds. Angular incisions are found only on quartz tempered versions of these vessels.

<u>Firing:</u> These vessels have exceptionally high levels of complete reduction (33%). It is possible that smudging techniques were in use by some producers or at certain points in time.

Regional Similarities: Wotzka and Goedicke (2001) classify very similar vessels as Group 13. The vessels have identical form and design grammar. The only significant difference is that their group consists entirely of examples with semi-circular channels: the variations with angular incisions are absent. Wotzka and Goedicke describe the temper of their Group 13 as feldspar, rather than quartz. Since their analysis of temper was made in a laboratory setting, and the two minerals are visually very similar, it is possible that Type 8 ceramics are likewise feldspar tempered. If so, this would have some interesting implications for the temper sourcing as feldspars are volcanic in origin and more likely found in Birrimean deposits rather than the Voltaic sandstones of the escarpment. Thermoluminesence dates on 6 sherds from Group 13 yielded a two sigma date range of AD 320-544.

Type 2: Open Cord Roulette, n=83

Temper: The bulk of sherds (85%) have grog temper. There are 7 quartz tempered sherds and three tempered primarily with mica. The latter might be a better fit with Type 11 despite lacking a Cord 4 decoration.

Vessel Form: These sherds are from ovoid vessels with open orifices and slightly flaring walls. The vessels are spread evenly across a wide range of diameters, with no evidence of size classes (interior- range 8-34 cm, mean 19.2 cm, s.d. 7.3 cm; exterior range 10-44 cm, mean 22.4 cm, s.d. 7.8 cm). The vessels have a moderate wall thickness, although there are significant fluctuations in the vessel wall due to the curvature (range 6-17 mm, mean 10.3 mm, s.d. 2.4 mm).

Surface Treatment: While the bulk of sherds (60%) are weathered, the remainder is divided equally between slipped and self-slipped sherds. About half the sherds in each category are polished.

Decoration: The majority (60%) of sherds have a cord roulette in a wide band on the body of the vessel. While most vessels have Cord 2, Cord 1 is also on multiple sherds. Cords 3, 7, and 8 and IB (which has a similar visual impression as a cord) are present on 1-2 sherds each. Analysis of other vessel characteristics suggests that these cords were used interchangeably. Sherds in this group with Cord 1 and sherds with Cord 2 co-occur at Site 885.

Firing: Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage.

Regional Similarities: Some similar vessels are included in Frank et al. (2001)'s extremely diverse Group 3. Petit found vessels with this form throughout the Iron Age in northern Benin, although cord roulette decoration was limited to the latter part of the sequence.

Type 3: Micaceous Impressed Cord 4, n=88

Temper: These sherds are all made with clay containing dense particles of mica. It is unknown to what extent additional mica may have been added to any naturally occurring. 92% of sherds have quartz temper, usually recorded as co-dominant with the mica. In 8% of cases, small quantities of crushed slag were added to the standard quartz-mica mix.

Vessel Form: Based on the curvature of the larger sherds, the vessels seem to have essentially the same open, flaring jar shape as Type 7. No rim data is available for this group, primarily due to the friable nature of these sherds: all edges, including lips are heavily eroded. Vessel thickness is relatively standardized (range 7-15 mm, mean 11.3 mm, s.d. 1.7 mm)

Surface Treatment: All sherds (including those from excavation) were weathered on both the interior and exterior. It is possible that these vessels were neither polished nor slipped.

Decoration: All sherds have cord decoration, usually in a horizontal band on the neck and/or body of the vessel. The majority (93%) are decorated with Cord 4. In eight cases, the cord impressions were made in two directions to create a diamond cross-hatch pattern. Six sherds were recorded as Cord 6, however, it is not certain that these were the usual roulette Cord 6 and not impressed cord in a chevron pattern. In some cases there is a bounding channel demarcating the zone of decoration.

Firing: Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage.

Regional Similarities: Micaceous clay is common in the area south of the Atakora mountains. Similar vessels (with strip rather than cord roulette) are found throughout northwestern Benin (Petit, personal communication).

Type 4: Everted with Knotted Cord, n=155 + 9 necks[4]

Temper: Grog is the primary temper in this group, as it is dominant in 146 (94%) of sherds. Only 21 of these include additional tempers (mica, quartz, grog, or laterite). The remaining nine sherds have a diverse assortment of tempers, among them quartz dominant and mica dominant sherds. 89% of sherds have medium temper, while the remainder has primarily small temper.

Vessel Form: These sherds are from open vessels with only very slightly restricted rims

4 The significance of neck form was recognized in the field after the completion of primary coding, and necks were retrieved and recorded by site. However, it was not always possible to match neck data with the primary coding information as most were undecorated. Consequently, necks are not included in discussions of other variables.

(the fragments are too small to determine whether they are bowls or jars). The rims are very sharply everted with short necks, and consequently diameters were taken at both the edge of the lip and at the throat. Rim diameters (n=32, range 18-36 cm; mean 28.3 cm, s.d. 4.9 cm) were 4-8 cm larger than the throat diameters, although the throats are not more consistent than the rims (n=26, range 13-32 cm, mean 22.3 cm, s.d. 5.0 cm). In both cases, the diameters are distributed across the range, rather than clustered. Vessel walls are fairly thin, especially considering that the thickness is likely skewed by the large number of rim sherds (range 5-16 mm, mean 9.6 mm, s.d. 2.2 mm).

Surface Treatment: As with the assemblage, a large percentage of the sherd interiors (40%) are weathered. Of the remaining sherds 69 are self-slipped, 27 of which have been polished. 23 are slipped with a lightly applied, often streaky orange-red color. The exteriors are mostly decorated, and only 12% have a slip, all of which are similar in nature to the interior slip. Due to the superficial nature of this slip, it may be under-represented.

Decoration: The majority of sherds are decorated with cord roulettes on the exterior. Almost all decorated sherds have a variation on Cord 5 (61%), either in multiple rows (cord with multiple knots) or in single rows (single knot). In some cases, rows of Cord 5 are over a Cord 2 background. Cord 2 rarely occurs without Cord 5, and when it does it is often from near the neck, and may have had Cord 5 below on the vessel body. Three examples have Cord 2 on the interior of the neck, such that it would be visible from above.

Firing: These sherds are more oxidized than the general assemblage. There are no examples of fully reduced sherds, and only 60% have black coring. While the vessels from which these sherds derive may have been fired at a higher temperature or in a more open atmosphere, it also possible this result could be due to thin body walls, more porous textures, or a less organic clay source.

Regional Similarities: These sherds are similar to those described as Group 7 by Frank et al. (2001). The vessel forms and decorative techniques in use are essentially identical. However, grog is not mentioned as a temper.

Type 5: Red Dragged Comb, n=144

Temper: The temper for this group is particularly homogenous as 142 sherds are grog dominant, and only one of these has a regularly occurring temper other than grog. The remaining sherds are both quartz dominant: one is an unambiguous example of the definitive TC decoration, while the other has only PC. 85% of sherds have medium-sized temper, while the remainder have small-sized temper.

Vessel Form: These sherds are from simple open bowls. However, the only nearly complete vessel profile is of a double, hour-glassed shaped open bowl. It is not certain whether this shape is typical or an anomaly, although the frequency of similar pedestal bases (see Type 17) would seem to suggest that Type 1 sherds are often from double bowl vessels. Diameters could be obtained on 17 sherds and are distributed evenly (range 16-26cm, mean 20.2 cm, s.d. 2.8 cm),. The vessels have thin walls (range 5-12 mm, mean 8.6 mm, s.d. 1.6 mm).
Surface Treatment: Sherds of this type are usually completely covered with a thick, highly polished layer of red slip. 75% of sherds have slip on the interior surface, and an additional 20% are weathered. Only 7 examples have a self-slipped interior, and only two of these are polished. On the exterior, only 68% were recorded with red slip. The remaining 32% were recorded as weathered or decorated and weathered. There are no confirmed examples of exterior self-slipping.
Decoration: These sherds generally have a zone of decoration comprised of variations on dragged comb that extends from the rim to the mid-lower body (see Group B above, Table A.6). PC are almost always present (often in two directions), and CC is present on 32% of vessels. In contrast, TC occurs on only 10% of sherds, and never co-occurs with CC, although otherwise the sherds are very similar. This minor variation does not pattern spatially, and could be the result of production by multiple potters/workshops or a temporal shift in technique. At Site 780, TC sherds occur in the deep levels of excavation, while CC occurs in the plow zone, which could suggest a temporal relationship. However, the CC example is a very small, trampled sherd that may have been dug up from the deep borrow pit near-by. TC and CC co-occur on the surface at one site (502.7).
Firing: Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage, although the latter are at slightly higher levels than normal.
Regional Similarities: A vessel with a similar hourglass shape was recovered by Petit in Northern Benin at the site of Yohongou-I, however, this vessel was decorated with a strip roulette (Petit 2005, personal communication). Petit also identified similar decorative techniques, never in combination.

Type 6: Red Pedestal Base, n=86

Temper: All but one example has grog dominant temper, and of these only 6 sherds contain additional temper. There is a single example of a mica tempered sherd, but while clearly a base of a similar sort, it is heavily eroded and cannot be considered unambiguous.[5]

Vessel Form: These sherds are high, arching pedestal bases. Joined directly to the rounded base of a vessel, these sherds have the form of small, shallow, upside-down bowls. The base maintains an even or slightly narrowing wall thickness and usually has a clear point of contact with the ground (as opposed to the gradual slope of the underside in Type 7). The interior arch is at least 1.5 cm, but is often significantly more, possibly 4-5 cm or greater. The association of Type 5 with these bases is presumed due to the single example that combines both Types. However, it is neither certain that all Type 5 vessels have a pedestal base nor can it be assumed that all Type 6 pedestal bases are associated with Type 1 vessel forms and decoration. The bases range in diameter from 8.5 cm to 22 cm, with no clear peaks (mean 15.6 cm, s.d. 4.4 cm). When the diameter could also be taken at the attachment point with the pot, it was generally 50-60% of the diameter of the base.

Surface Treatment: These sherds have three distinct zones of surface treatment: the exterior of the vessel (including the visible portion of the base), the interior of the vessel, and the underside of the base. All except for two of the vessel exteriors are slipped and polished. The vessel interiors likewise are usually slipped and polished, although a few sherds are self-slipped or weathered. In contrast, the undersides of the bases are only slipped and polished on 21% of the sherds. Instead, self-slipping is the usual treatment, present on 70% of sherds. The remaining base undersides are weathered, or in one case polished. While it is possible that cases with slipping on the underside may actually be lid handles (such that this area would be visible), the one intact Type 5/6 vessel has slipping on the underside of the base.

Decoration: Channel(s) occur on about one third of these sherds, and are usually located about 2-4 cm from the base of the sherd. While some intact examples do not have channels, many sherds are missing the areas where channels would usually occur.

Firing: Black coring, complete oxidation, and full reduction proportions are generally line with those of the complete assemblage.

Regional Similarities: The most frequently cited pedestal bases in West Africa are those of the tripod bowls common archaeologically throughout the modern Mande region (e.g., Mayor et al. 2005). This is mentioned here only to emphasize that these bases lack the characteristic twisted three pillar stem of those vessels and should not be considered similar to them. Geis-Tronich 1991 depicts pedestal bases on some modern vessels.

---

5 This group is represented by multiple sherds at this site, so the inclusion of the mica-tempered example does not affect analysis.

Type 7: Red Flared Base, n=11

Temper: Over 90% of sherds are grog tempered, and only one example is quartz tempered.

Vessel Form: These sherds are flat, flaring pedestal bases. Joined directly to the rounded base of a pot, they flare outward to create a stable foundation for the pot. The edges of the pedestal are rounded, and at the edge, the underside lies nearly flat against the ground. There may be a slight depression in the center of the base, but it will reach no more than 1 cm above the ground. Although these are likely the bases of open bowls, no sherds of this type were recovered with the upper vessel intact. Since the edges of the pedestals are frequently highly eroded, diameters could be taken on only a few bases: these ranged from 6-17.5 cm with a tendency towards the larger bases. These figures are in concordance with the diameters taken at the pedestal-body junction (range 9-13 cm, mean 10.1 cm, s.d. 1.9 cm).

Surface Treatment: These sherds have three distinct zones of surface treatment: the exterior of the vessel (including the visible portion of the base), the interior of the vessel, and the underside of the base. In all cases, the exterior of the vessel is slipped and polished, and the same is true of the interior in most cases (although unlike the exterior, the interiors are frequently weathered). The underside of the base is left un-slipped or self-slipped.

Decoration: Not present on either the base or the few basal portions of the vessel body present.

Firing: Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage.

Type 8: Open Thickened Rim, n=17

Temper: The majority of sherds (88%, n=15) are grog dominant. Of these, 13 have only grog and/or organics. Laterite inclusions are more rare. Two sherds are quartz dominant.

Vessel Form: These vessels are open (jars or bowls) with a somewhat similar shape to Type 5 vessels, although the rims are extruded and pinched to create a faceted appearance. They have a comparable range of diameters (interior range 31-48 cm, mean 38.1 cm, s.d. 5.9 cm; exterior range 34-52 cm, mean 43.9 cm, s.d. 5.9 cm), but they are neither as large nor as small as Type 5. The vessels are fairly thick, but thin out as you move away from the rim, leading to a relatively flat thickness distribution (range 12-25 mm, mean 17.8 mm, s.d. 4.1 mm)

Surface Treatment: This group of sherds has exceptionally diverse surface treatment: on both the interior and exterior approximately half are self slipped, with the remainder equally divided between polished, slipped, slipped and polished, and weathered. Particularly notable is the high instance of polishing on both red-slipped and self-slipped vessels (25% of the sherds in this group). Approximately 60% of vessels have straw impressions on the interior and/or exterior.

Decoration: RP is present on all sherds.

Firing: No sherds are completely oxidized.

Regional Similarities: Vessels of similar size are common throughout the greater region, although they lack the characteristic rim treatments.

Type 9: Coarse Thumb-Impressed Ridge, n=175

Temper: 161 (92%) of these sherds have dominant grog temper. Of these, 128 also contain laterite and 94 also contain organics. Only 12 sherds are quartz dominant, and several of them co-occur at sites with grog dominant versions of this type. The remaining sherds have variations on grog, laterite, and organic temper. The majority of sherds (59%) have large temper, while the remainder have medium temper.

Vessel Form: These vessels have very thick walls and relatively straight sides. According to a similar vessel drawn by Geis-Tronich (1991), they may be elongated jars with rounded bases, although since no large fragments were recovered from which to reconstruct vessel profile, they could also be large open basins. There may be two size classes: the first a minor group (3 vessels) with interior diameters of 19-25 cm, and the second the dominant class (33 vessels) with interior diameters from 30-50+ cm. These vessels have very thick walls (range 9-37 mm, mean 18.9 mm, s.d. 4.6 mm). Several horizontal cross-sections of vessels, likely of this type were visible on the surface of unplowed sites. While they were too deeply inset to determine partial vessel height or base morphology without excavation, it was possible in a few cases to measure their cross-sections.

Surface Treatment: These sherds are predominantly weathered or self-slipped. Only 5% of sherds have interior slip and a mere 2% have exterior slip. Isolated straw impressions are common: 25% of interiors and 21% of exteriors have them. These impressions are not regular, and seem accidental. It is not apparent whether they are the result of large organic fragments in the clay or from surface impressions made during manufacture (e.g., rotating the pot on a surface during construction).

Decoration: All of these vessels have a large plastic ridge, usually in a horizontal band either directly on or just below the square rims (ridge placement does not pattern spatially). Occasionally vertical columns or other patterns may be made with the ridge. R2T is the most common ridge form, present on 77% of sherds. The remainder is split

fairly evenly between PRG, PRT, and PR. The only other decoration on these vessels is Cord 2, a large version of which occurs below the ridge on 13% of sherds. Given the size of these vessels, the bulk of sherds from a given pot are undecorated or have a cord 2. While these sherds are not specifically assigned, thick grog and laterite tempered sherds were considered in context when seriating site assemblages.
Firing: All sherds are mixed or oxidized. The lack of fully reduced sherds in this case may be due to the particularly coarse temper.
Regional Similarities: Vessels of similar size are common throughout the greater region, although they lack the characteristic rim treatments.

Type 10: Lug Handle, n=49
Temper: The largest temper group is grog dominant sherds (85%), a quarter of which also have laterite temper. The remaining examples are quartz dominant.
Vessel Form: The intact handles are hemispherical loops that attach to the vessel 1-3 cm apart. Many have a central core that extends into the vessel body, while the outer layer of the handle is smoothed to create a seamless bond with the vessel surface. In a few cases, the handle was recovered with a fragment of the vessel body. In one instance the handle is perpendicular to the attachment surface, while in the other three cases they are at a 45° angle. The handles are roughly round in cross-section (vertical and horizontal dimensions are usually within 0.5 cm), and are within a fairly small range of diameters (range 1.5-4.5 cm, mean 3.2 cm, s.d. 0.5 cm). Decoration and temper cross cut the diameter spread. We have no information on the type of vessel to which these handles may have been attached, although two handles are associated with perforated vessel walls: a feature that is generally associated with steamers or "couscousieres." (McIntosh 1995). Geis-Tronich (1991) only depicts handles on vessels in a pitcher style. These handles extend in a gentle arc from the middle of the vessel body to the rim or throat. Some of the handle fragments may be of this variety.
Surface Treatment: Approximately 40% of all lug handles are red-slipped, about half of which are also polished. The remainder is weathered, with the exception of five examples of self-slip.
Decoration: Only three handles are decorated. One is covered with a Cord 2, while in two cases there are gouges in a "V" pattern along the handle exterior.
Firing: Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage.

Type 11: Quartz Flared Neck, n=86 + 7 necks
Temper: All sherds have quartz as a dominant temper. Only 7 (8%) have another temper

regularly occurring: in six cases grog is present and in one there is mica. 97% of sherds have medium temper.

Vessel Form: These sherds are from jars with large flaring necks, similar (although not necessarily identical) to the jars whose construction by modern potters is described above. For a small number of jars (n=15) it was possible to take a diameter at the throat (range 9-36 cm, mean 11.8 cm, s.d. 2.9 cm). The throat diameters clustered into two size classes: 9-18 cm and 26-36 cm. Given the long and variable necks, diameter at the rim varied widely (n=31, range 15-50+ cm, mean 27.3 cm, s.d. 8.8 cm). The size classes present in the throat diameter data were obscured in the rim diameter data by the variability in neck length. Since all of these sherds are rims with strong inflection points and only rare body data, thickness is an inconsistent measure (range 7-23 mm, mean 11.8 mm, s.d. 2.9 mm).

Surface Treatment: These sherds have particularly high instance of weathering (61%) on both the interior and exterior. Of those that are not weathered, approximately half are red-slipped and the other half are self-slipped. On those sherds that are red-slipped, the pigment covers both the interior and exterior surfaces completely.

Decoration: No decorations were recorded for any sherd in this group. However, the sherds rarely extend past the throat, and there is no data available on shoulders and body decoration or lack thereof.

Firing: Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage.

Regional Similarities: Frank et al. (2001) include a rim similar to these in their Group 5. Group 5 also contains Type 9 sherds (see discussion below). While large flared rims of this sort are common in northern Burkina Faso, they are not known to the south in northern Benin (Petit, personal communication)

Type 12: Thin-Walled Chevron Roulette. n= 6 + 12 necks

Temper: All sherds have exclusively quartz temper. Temper size is predominantly medium.

Vessel Form: Jars with large flaring necks, similar to those from which Type 3 sherds are drawn. The two vessels on which rim diameters could be taken both fall within the small diameter category of Type 3 (10/15.5 cm, 20/27 cm). The primary distinguishing vessel form characteristic between the two was the extremely thin body walls. Since the sample is very small, and these sherds are primarily located near the rim, the difference between the two types is not as clear in the data as it was visually (range 7-12, mean 9.5, s.d. 2.2).

Surface Treatment: These sherds are generally weathered. A gray colored surface

treatment (possibly the result of under-firing red slip?) is present on some sherds of this group, but it was not consistently recorded.
<u>Decoration:</u> The sherds are from vessels with a crisp, deeply impressed version of Cord 6 on their shoulder (in some cases, where not enough of the decoration was present to see the full motif, it was recorded as a Cord 2). While some quartz tempered Cord 6 body sherds should almost certainly be included here, it is clear from the assemblage that these sherds are also associated with other types of vessels. Consequently, only sherds associated with the appropriate vessel form are assigned, although all quartz-tempered Cord 6 sherds were considered in context when seriating the site assemblages.
<u>Firing:</u> No completely reduced sherds, however the sample size is small.

Type 13: Triangular Wooden Roulette, n=26
<u>Temper:</u> All of the sherds in this group are tempered exclusively with quartz.
<u>Vessel Form:</u> As this type is represented only by body sherds, there is no archaeological vessel form data available. Geis-Tronich (1989, 1991) depicts numerous vessels decorated with very similar roulettes. In all cases, these vessels are ovoid jars with constricted throats (*cuali*) and flaring necks. The roulette is applied to the shoulder and/or upper body of the vessel. The vessel walls have relatively standardized thickness, perhaps in part because all sherds may be from the same part of the vessel (range 8-13 mm, mean 10.2 mm, s.d. 1.3 mm).
<u>Surface Treatment:</u> Of the two sherds that are not weathered on the interior, one is self-slipped and one is red slipped and polished (which could indicate a more open vessel orifice if the decoration is on the shoulder. Slipping and polishing rarely occur beyond the neck on the interiors of highly constricted vessels). On the exterior, ca. 25% of sherds are red slipped. In many cases, the red slip is primarily in undecorated areas, possibly due to zonal application or possibly because these areas retain slip during weathering since they can be burnished for better adhesion (see above). In either case, the incidence of red slip may depend on whether the decoration fills the sherd.
<u>Decoration:</u> These vessels all have carved wooden roulette decoration (see Group E, Table A.6). These roulettes fall into two categories: those with closely spaced parallel channels in overlapping triangular arrangements, and those with raised “V” motifs in nested or linear patterns. In two cases, both types of roulettes occur on the same sherd. Other decorative techniques may be applied over or around these roulettes, including small circular impressions or channels in parallel or triangular designs.
<u>Firing:</u> Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage.

Regional Similarities: Frank et al (2001) classify this type of wooden rouletted, quartz or feldspar tempered sherd as Group 5, and note the similarity of these sherds to the modern Gourmantche pottery described by Geis-Tronich (1989, 1991). Many of the examples they describe are also red-slipped. These vessels are presumed to date to the latter second millennium AD (Wotzka and Goedicke 2001). According to Petit, wooden roulettes, some of which appear similar to those described here, are found north of the Atakora mountains throughout his historical period (14^{th}-18^{th} century AD). They are often associated with iron production (Petit 2005, personal communication).

Type 14: Basal Roughing, n=166

Temper: All sherds have quartz dominant temper, and only four examples contain any additional type of temper.

Vessel Form: Since this treatment is normally applied to the rounded base of the vessel, virtually no vessel form information can be derived from the archaeological sherd assemblage. Geis-Tronich's (1991) illustrations suggest that this treatment is used primarily on large constricted neck storage jars or water jars, although it is present on a range of vessels. The example of interior red slip (see below) indicates that at least some open vessels have this treatment. Sherds are fairly thick as they likely come from the basal portion of the pot (range 8-20 mm, mean 13.0 mm, s.d. 2.5 mm).

Surface Treatment: 90% of vessels are weathered on the interior. Of the remaining 10%, approximately half are self-slipped and half are red-slipped. All vessels have a roughing layer applied to the exterior, and none have red slip.

Decoration: None

Firing: Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage.

Regional Similarities: Geis-Tronich (1989, 1991) describes the use of this technique by modern Gourmantche potters (see discussion above).

Type 15: Red Channeled Flared Neck, n=19

Temper: All sherds have exclusively quartz temper.

Vessel Form: In general only small rim segments are available for this group, however most of them appear to be the flaring necks of constricted jars. It was possible to measure rim diameter on only five vessels, and these ranged evenly from 14 to 44 cm, suggesting that this type may cover a whole class of vessels. Sherd thickness is moderate (range 7-15 mm, mean 11.1 mm, s.d. 2.1 mm).

Surface Treatment: All sherds are completely red-slipped on both the interior and the exterior. While polishing is ubiquitous on the exterior, only 63% of sherds have polishing

on the interior.
Decoration: All vessels have a channel along the top of the lip (LIPCH). This channel is possibly made using a technique documented by Geis-Tronich (1989, 1991) in which a leaf of *Ficus gnaphalocarpa* is wrapped around the rim of the pot, with its prominent midrib aligned along the top of the lip, and dragged in a circle to smooth, channel, and otherwise finish the rim.
Firing: Black coring, complete oxidation, and full reduction proportions are generally in line with those of the complete assemblage.

Seriation of the Site Ceramic Assemblages

Although created to aid in developing a ceramic chronology, seriating the types described above presented numerous challenges. First, only 13 typed sherds were recovered from below the plow zone in excavation contexts. While many of these sherds were very small (raising concerns that they may have originated in earlier occupations, particularly since archaeological sites are often used as a source of pre-mixed fabric for mud bricks), these deposits had been subject to less mixing than those from the surface and provided a starting point for identifying elements of a contemporary assemblage. At Site 780, Types 1, 2, 3, 4, and 5 were represented in the subsurface deposits. Notably, excavations at Sites 502.3 and 541 yielded no typed sherds below the plow zone.
For the surface collections, despite the large overall size of the assemblage, the sample from any given site tended to be small (average 32 individually recorded sherds), and consequently, many site assemblages either lacked typed sherds completely (n=100) or had only one typed sherd present (n=170). Only 242 sites had multiple types present, and a mere 100 of these had more than two types occurring simultaneously. A simple chi-square analysis was used to determine those types which co-occurred significantly (Table A.9).

These data were then used to develop clusters of roughly contemporary ceramics. It is important to note that these clusters are not perfectly sequenced phases, but rather points of commonality that can overlap and include many spatial and temporal variations. It is expected that these clusters will be significantly refined as more research is completed in southeast Burkina Faso and surrounding regions. In general, Types 1, 2, 3, 4, 5, and 6 are more commonly found together, and Types 11, 12, 13, 14, and 15 are more commonly found together. Types 7, 8, 9, and 10 are more difficult to place, but notably only correlate with the Type 15 among the second group, which is also the Type that most resembles ceramics in the marketplace today. Temporal localization of these clusters is discussed in more detail in their respective Chapter discussions, but the first group,

2	y													
3	y	y												
4	y	xy	xy											
5	xy	xy	xy	xy										
6			x	x	x									
7				x										
8														
9								x						
10		x			x									
11														
12											x			
13											a			
14											ax	x	a	
15							x				a		a	a
Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**

x = co-occurence in surface collections significant at p<0.01 using both pearson and fisher tests of chi square values
y = co-occurence in sub-surface deposits at Site 780 (Unit B)
a = co-occurence in Gourmantche ethnographic pottery assemblages (Geis-Tronich 1991)

Table A.9: Co-occurrence of Sherd Types

designated as the Siga occupation likely dates to the early-middle second millennium AD, while the latter cluster, the Tuali occupation, becomes common in the late 2nd millennium AD and extends to the present.

The temporal ceramic clusters provided a crucial starting point for seriating the site assemblages, however these clusters have only a limited utility for typing those sites with few or rare examples of typed sherds. Although most of the sites recorded are nominally single occupation, they are subject to intrusive ceramics that both predate and postdate the primary occupation. In the former case, ceramics can drift from earlier sites to later sites through a variety of means including erosion, tossing by farmers plowing fields, use of sherds as slingshot ammunition, and not to mention the mud brick problem described above. Later ceramics are often the result of near-by contemporary or more recent occupation. New residences are often located near archaeological sites. Residents exploit the same water sources, use the archaeological deposits as building material, take advantage of the rich soils that often occur around sites due to trash decomposition, and may even have ancestral rights to established useful trees and/or rejuvenated agricultural fields. Even if an archaeological site is not the primary trash disposal zone for a more recent residence, it is always possible for a ceramic vessel to be broken while walking to visit a neighbor, resting under a tree, etc.

Consequently, in seriating the site assemblages, a holistic approach was used. The notes and maps for each site were referenced to identify possible sources of disturbance, particularly the presence of currently occupied compounds, as well as factors which could skew composite site data, such as clear evidence of a fragmented large jar on the surface. The ceramic assemblage was examined in detail, with attention paid not only to typed sherds, but also the distribution of individual attributes including temper and decoration techniques. While these latter aspects did not pattern categorically, some trends were noticed at sites with little evidence of disturbance and high concentrations of sherds typed to one of the two primary clusters. The Siga occupation tended to have very diverse decoration techniques and mixed temper profiles that included grog, quartz, and mica dominant sherds. In contrast, the Tuali occupation tended towards high proportions of quartz temper, and few decorated sherds with a limited set of techniques. Even with this attention to detail, uncertainty in the assignment of any individual site to temporal group(s) was inevitable given the available data, and site classifications were made at two levels of confidence.

APPENDIX B: METHODOLOGIES AND STRATIGRAPHIES

This appendix presents a brief overview of the survey and excavation methodologies used for the Maadaga Archaeological Survey. It then summarizes the stratigraphic sequences for excavated units.

Survey Methodology

Sites in the study region were identified primarily through full coverage survey. The survey team consisted of a group of 3-5 individuals spaced ca. 20 m apart walking transects. All sites with artifacts or cultural remains were recorded unless the materials clearly derived from a current or recently abandoned structures (i.e. walls were still standing). At each site, notes were taken, a map was drawn, and surface collections were made.

Each site was assigned a consecutive site number beginning with 500 (so as not to overlap with the numbering system used by the Frankfurt Project). GPS coordinates were plotted, and the following information was systematically recorded: soil color; soil texture; laterite pebble density; water sources within 200 m; the number and species of trees on or near the site; sources of disturbance including plowing, borrow pits, modern trash, and termite mounds; types and densities of cultural artifacts including ceramics, groundstone, slag, and chipped stone; and position relative to other sites and/or significant natural features. The sites were individually mapped, and the depth of deposit (height above the natural surface) was estimated for each. Maps included not only site dimensions, but also the locations of significant features like in situ pots, artifacts concentrations, useful trees, and borrow pits.

Two surface collections were taken at each site. A systematic collection of all surface artifacts within an arbitrary 5 x 5 m square was made at each site: locations with average density were selected and unusually dense or sparse areas avoided. Since load restrictions made multiple systematic collections at each site impractical, a second opportunistic collection of any sherds on the surface of the site that were potentially diagnostic (i.e., rims, decorated sherds, etc.) was also made. All survey artifacts were documented in the field. Artifacts are stored in the Laboratory of Archaeology at the University of Ouagadougou.

Excavation Methodology

The primary goal of project excavations was to develop a regional chronology. Consequently, sites selected for excavation were those that appeared to have the greatest potential depth of deposit. Given the chronological focus, excavation sizes were kept small in order to maximize the number of sites that could be tested. Sites were excavated in natural subdivisions within 10cm arbitrary levels. A map was drawn every 10 cm, and each identified cultural deposit assigned an individual lot number. All sediment was screened using a 2 mm mesh, with the exception of flotation and radiocarbon samples, which were collected directly from the unit. Animal bone, floated botanicals, and radiocarbon samples were exported for analysis: all other materials were recorded in the field and are stored in the Laboratory of Archaeology at the University of Ouagadougou.

Stratigraphies

Mound 502C: Unit A (2x2 meter unit excavated to ca. 90cm)

Natural Base
Laterite Duricrust

Pre-Occupation
Event 1 (90cm): Burial: Pit oriented NE/SW in the east-center of the unit set into degraded laterite deposit that rests atop harder duricrust. Burial was not excavated.

Analytical Unit 3: Occupation
Event 2 (50-70cm): Domestic Space: A burned orange hearth ring that appeared to be set into natural degraded laterite deposit. The hearth was located in the center of the eastern wall, had an 8 cm thick orange wall and its ashy contents were very dark gray. To the north and northwest of this feature there was a thin layer of pure ash, resting below a larger deposit of ashy material contained high densities of animal bone.

Analytical Unit 2: Structure
Event 3 (35-50cm): Domestic Space: The most extensive evidence for occupation at the site was found in this level. The first floor was indicated by a small (40 cm diameter) burned patch (42cm deep) in the east central unit adjacent to the profile, and associated with a large block of laterite. This was likely a hearth with some preserved burned surrounding floor. The rest of the unit was composed of ashy deposits --perhaps related to the hearth-- within which there were a variety of animal bones and ceramics. A new floor surface was laid 5 cm atop the hearth, although the laterite block remained in place, suggesting a continuation of the spatial organization of the first floor. The second floor was better preserved, and was composed of orange colored clay with laterite pebbles 1.5 cm thick. The floor extended from the southeast corner to the unit center, where

trash deposits with a high ash content continued to be placed, yielding animal bones and artifacts.

Analytical Unit 1: Topsoil
Event 4 (0-20cm): Topsoil- This deposit was fairly compacted and unplowed. It was composed of decayed mud architecture that dissolved into a shell atop the mound. The high density of fragmented artifacts suggests at least some degree of trampling in the past, however. A large grinding stone fragment was recovered.
Event 5: Burial: An individual was interred in a 50-60 deep pit of unknown size in the center and east of the north wall of the unit. The burial was not excavated.

Mound 780, Unit B (2 x 1.5 m unit excavated to ca. 110 cm)

Archaeological deposits excavated at Unit B differed from those elsewhere in the study region. Rather than clear architectural or activity spaces, the highly compacted deposits had low density archaeological remains. Strata were also not horizontal, as is evidenced by the West profile showing a rise of 20 cm over the small distance of 1 m in all deposits below 30 cm. With such a small sample, it is not possible to assess whether this slope is the result of a natural rise, an intentional construction, or a side effect of an activity such as trash dumping. The modern surface has been affected by construction at a currently occupied compound directly adjacent to the site, with the result that the usual topsoil is actually overlain by a 10-15 cm stratum of pure clay. Overall, there were no indicators of domestic activity at this site, other than the presence of artifacts in the fill. It is possible that this site (or this particular area of the site) was not residential, particularly given the unique nature of the finds, notably the high densities of iron objects (see Chapter 6).

Site 572.1, Unit C (2 x 1.5 meter unit excavated to ca. 30cm)

Natural Base
Laterite Duricrust

Event 1 (10-25 cm): Domestic Courtyard: This site essentially had one occupation layer-- typical for the period. A domestic context is demonstrated throughout the unit by artifacts that appeared to be left in situ. Three large groundstone artifacts were found dispersed over the unit, one in the southwest center, another along the center of the eastern profile, and finally one in the northwestern profile. A laterite block was associated with the occupation level in the northeastern corner.
A dense concentration of ceramics (including fairly complete vessels) was also uncovered along the western profile and extending into the unit ca. 50 cm, set between the two groundstone implements located along the western profile.

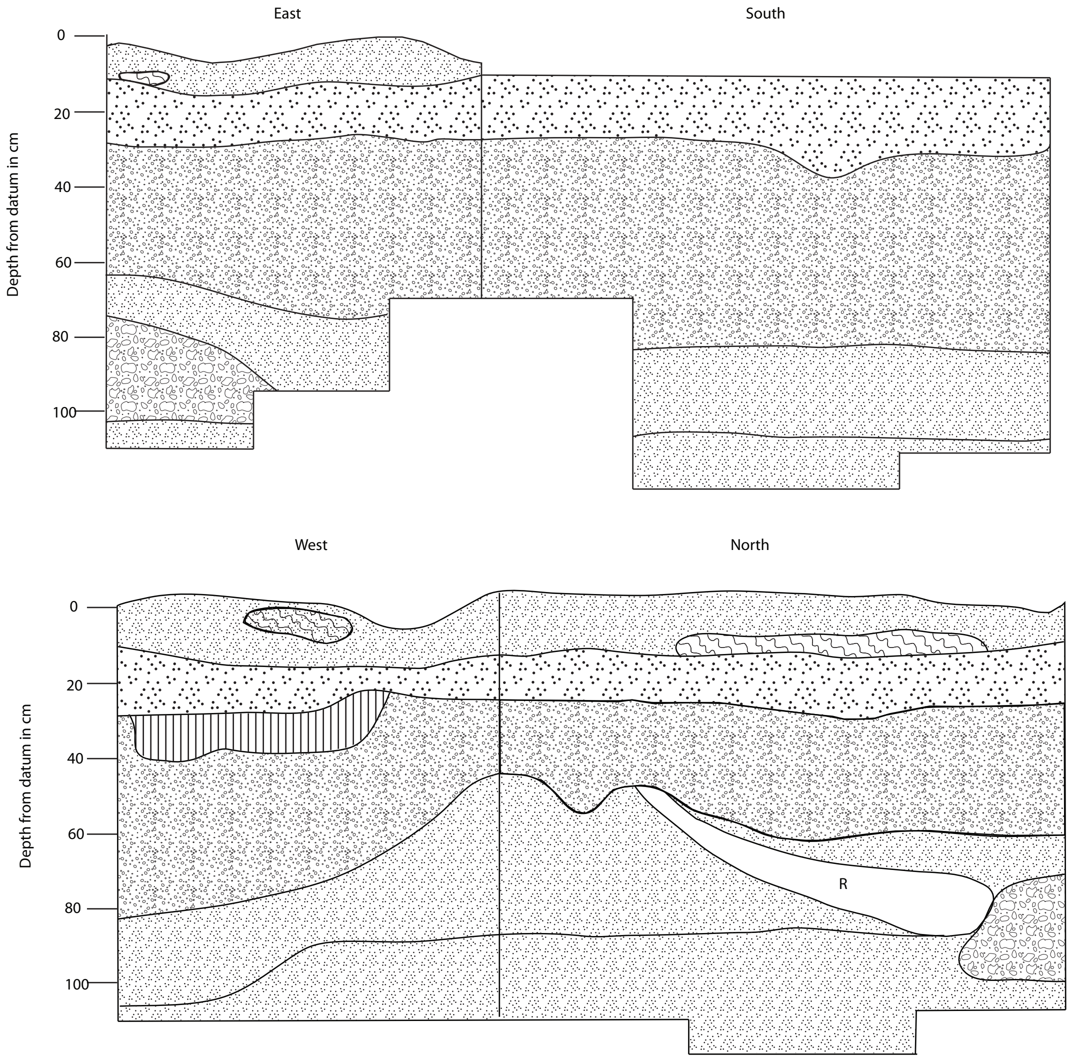

Figure B.1: Unit B Profiles

Event 2 (0-10 cm): Topsoil: The high degree of preservation in such a thin site was likely ensured by the fact that the top-layer was largely composed of pebbles, and lacked soil. While there were slight furrows, it didn't appear that the site has been frequently plowed in the past.

Site 573, Unit D (1 x 1.5 meter unit excavated to ca. 45 cm)

Natural Base
Laterite Duricrust.

Event 1 (25-40cm): Possible Domestic Space: The only evidence for a cultural feature is located along the west central section of the unit, extending into the western profile. The roughly elliptical patch(100 x 50 cm, oriented NW/SE) of burned earth 3-4 cm thick

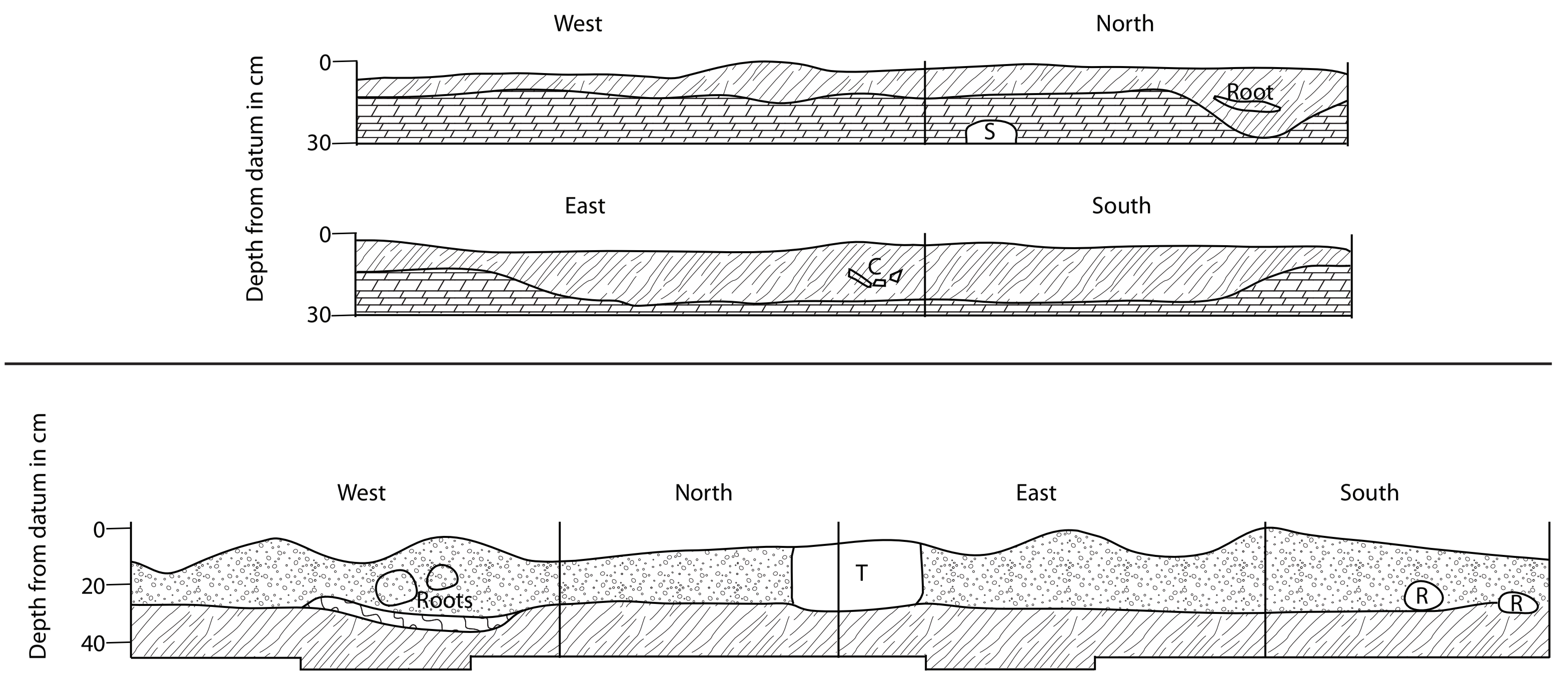

Figure B.2: Profiles from Unit C (top) and Unit D (bottom) likely represents the tossing of hot ash, or a low-temperature hearth. There were some ceramic sherds and ash atop the feature that could substantiate either case.

Event 2 (0-25cm): Topsoil: The deposit was highly churned and loose, set in a deeply plowed millet field with 10-15 cm furrows.   A fragment of tobacco pipe was found on the surface.

Site 541, Unit E (2 x 1 m unit excavated to ca. 110 cm)

Analytical Unit 5: Natural Base
Pre-Occupation: Thick, heavy, pure gray clay.   Some evidence of insect disturbance, but nothing that could be construed as cultural. No laterite pebbles and no charcoal flecks as in the next couple layers 10YR 6/2. NB- the two sherds from E26 are intrusive- remnants from the level above.

Analytical Unit 4: Series of Intact Floors
Event 1 (110-100cm): Structure. Thick flooring sequence covering most of the unit. The floor is made of orange clay with laterite pebbles, applied in even 0.5-1.0 cm thick laminae (each laminae is thickest in the center and thins towards the end). The floor, which has a maximal thickness of 4cm, has been dug into the natural clay by as much as 10cm, and lips up at the edges.   Based on the curve of the edge of the structure in the southern edge of the unit, the structure would be a large 3.4m diameter. However, floor lipping in the northern profile suggests that the structure may not be round. No materials on the floor.   There is a vertical burned surface sloping up from this floor, which could be related. However, no clear relationship between the floor and the burn feature could be from something different. It was in the corner of the unit.

Event 2 (90-100cm): Burn Feature: Semicircular burned feature ca. 60 cm in diameter. The feature has loose sediment, ash, and charcoal on the convex side (south), while the concave side (north) is a 6 cm vertical flat burned edge. The feature also continues into the west profile. The nature of this feature is as yet undetermined, but it is floating ca. 10 cm above the floor surface and thus postdates the use of the structure

Event 3 (72-75cm): Structure: Flooring sequence in the northwestern portion of the unit. Structure has the same orange clay and pebble laminae, however, the most recent layer does not cover the entire surface (3 laminae vs. 1 lamina).   The area outside the floor is a general clayey fill with ashy spots and blobs of burned earth mixed in.   There was a concentration of metal objects in the southern part of the unit at approximately the same level.

Event 4 (55 cm/42-45 cm): Structure: Corner of a circular structure in the southeastern part of the unit. The floor lips up at the edges and is the standard orange clay and pebble laminate. There is a grinding stone fragment lying on the surface, but it could also have been part of the inter-floor fill. There is a second flooring episode 10cm above this initial floor which clearly is a reflooring of the same structure since it follows precisely the same boundaries.   Each floor has multiple laminae, and there seems to be a purposeful interfloor fill between the two. However, the nature of the fill is no different than the surrounding matrix. Even with the lower floor, there is a yellow clay and pebble surface in the northern part of the unit. Unlike the structure floors, this surface is uneven thickness and does not have smooth top surface. This may be an exterior or expedient surface rather than an intentional flooring.

Analytical Units 2 and 3: Intact Cultural Fill with Significant Intrusive Disturbance (Rodent, Burial)
Event 5 (ca 20-55+ cm): Burial: Dug in from the topsoil layer (and possibly above). The top of the burial is at 55cm, but area was pedestaled, burial was not disturbed.

Analytical Unit 1: Disturbed Topsoil
Higher artifact densities in the top soil are probably indicative of deflation, particularly since the site was cultivated.

APPENDIX C
CHARACTERIZING GOURMANTCHE: HISTORICAL APPROACHES

One challenge faced by most archaeologists studying West Africa in the second millennium AD is the integration of historical data into the archaeological research. While this information is invaluable to the research, it is often fragmented and from methodologically uncertain sources such as colonial archives, travelers' accounts, and, most notably for the Gobnangou region, oral traditions. Given the relative paucity of research, easy syntheses are often not available, and archaeologists find themselves tackling primary historical sources as a side project or even as a central part of the research (e.g., Schmidt 1978; Stahl 2001).

This appendix presents the available historical data for the study region (defined at different scales as the upper half of the Koabu Drainage, the Gobnangou Escarpment, the former Gourmantche kingdom(s), and modern southeastern Burkina Faso). While most of the available texts relevant to this study are oral histories, historical data from the colonial era is presented to provide the context within which both the collection of oral histories and the conceptualization of the study region took place. The data is then analyzed with an emphasis not on fact-finding, but rather on the elucidation of themes that can inform the archaeological analysis.

Loci of Analysis: An Integrative Challenge

Although often co-terminus, there is frequently a divide between the history of an ethnic or linguistic group (a socially cohesive group of people) and the history of place (a geographical locale). The nature of archaeological data inherently results in a narrative of transformation of place, while oral traditions are more commonly oriented around a social unit. As Andah (1995) has made explicit, ignoring ties between modern ethnic groups, the history of places, and the archaeological record results in what he calls "fragmentation syndrome" in which the past and the present are irrevocably split. Further, the issue cannot be sidestepped, since, as Trouillot (1995) has made clear, silences are as powerful as mentions. However, attempts to avoid this phenomenon almost inevitably run into problems the contrast between archaeological cultures and modern human ethnicities, and the implications of that divide for incorporating historical documents (Shennan 1989). The use of oral histories to bridge this gap is further complicated by the "hardening" of ethnic identity during the colonial period (a phenomenon which will be discussed

Figure C.1: Historical Boundaries of the Gourma Kingdom

in more detail below). Attempts have been made to study oral tradition in an "ethnic-blind" fashion by emphasizing geographical ties (Robertshaw 2000), but the concept of mentions and silences once again becomes relevant: can an ethnic blind analysis be an accurate one?

Regional approaches have proved fruitful for archaeologists attempting to integrate historical, archaeological, and ethnographic data. Studies such as Ogundiran's (2003) exploration of modern Yorubaland move smoothly from unattributed prehistoric settlement to historically known political entities to modern ethnic groups, but they are most effective when the oral histories and archaeological data share a geographical locus and most accurate when topics such as ethnicity are left blurred. Stahl (2001), in her work at Banda (central Ghana), explicitly dodges the question of ethnicity by framing her discussion around a geographical locale: the multi-ethnic nature of the region is thus at once central and peripheral to her understandings. Many of these regional projects implicitly use a Braudelian disciplinary division of labor: historically known sequences of events lie alongside the archaeological analyses of everyday life, i.e., structures and/or cycles (Devisse 1993, Vansina 1995, for critiques see Andrén 1997, Schmidt and Walz 2007).

Much of the oral historical data available for eastern Burkina Faso is oriented not around a place, but rather around a political structure: the Gourmantche kingdom (Figure C.1). Today, the study region is inhabited almost entirely by gulmancema speakers who consider themselves inhabitants of a pre-colonial Gourmantche kingdom centered at Nungou (Fada n'Gourma), the boundaries of which coincide almost perfectly with the extent of the language. In addition to the challenges of applying oral histories collected hundreds of kilometers from the study region, modern conceptions of the Gourmantche kingdom have been heavily shaped by both pre-colonial and colonial political considerations. In the process, much of the local diversity has been subsumed, a point that forms the basis for Madiega's (1982) critical assessment of the Gourmantche sequence. Thus this project takes a somewhat different approach to the historical data than the regional approach describe above. The locus of analysis for the oral historical data is not place, but rather themes and modes of behavior that can be identified in the archaeological record.

Oral Tradition: Background to Interpretation

Many discussions of historical data (particularly in an archaeological context) focus on the question of written text (e.g., Moreland 2001, Little 1992). However, for most places and times in sub-Saharan Africa (indeed, for much of the world including North America, Australia, and Oceania) the bulk of the historical data available takes the form of oral narratives. While written texts are products of their times, orally transmitted narratives are continuously impacted by cultural factors. Thus the proposition that archaeologists can treat texts as contemporaneous data sets to be read and integrated into archaeological analysis as simply another material class lacks utility in this context (Moreland 2006).

Vansina (1985: 27) defines oral tradition as " verbal messages which are reported statements from the past beyond the present generation." They can take many forms including memorized speech, accounts, epics, or tales. During the colonial era in West Africa, oral traditions were gathered primarily for administrative purposes. For example, British directives involved drawing administrative boundaries along indigenous political divisions, and oral histories were often collected to establish the antiquity of various linguistic, cultural, and ethnic groups within a region (Lentz 2000). In general, colonial administrators tended to rely on a few trusted informants and accept their narratives uncritically.

In the 1960s, due in large part to the pioneering work of Vansina and his students, oral tradition slowly became part of the historical lexicon. While many of the original approaches were heady with the potential offered by the narratives (Vansina 1965), steady research throughout the 1960s and 70s gradually exposed sources of bias in oral narratives. While some researchers emphasized the difficulties of dating (Henige 1974) and of determining the colonial impacts on narrative, by the 1980s solid methodologies had been developed, and in response Vansina completely rewrote his original monograph (Vansina 1985).

As oral historians have become more sophisticated in their approach, they have begun to more fully contextualize the narratives they study, and to use the changes in the narratives themselves as a source of information. Oral traditions are mutable, and are frequently altered to reflect the interests of the narrator. This type of transformation can be informative in and of itself, as in Law's (1988) analysis of changes in Dahomean narratives gathered from the early 1700s to the present. He found both unintentional drift and conscious alterations made to suit the convenience of Dahomean rulers. Modern oral historians use joint anthropological and historical approaches, examine sources critically, employ multiple perspectives, and look at the interests of actors along the way (Madiega 1982, Lentz 2000). Lentz, who found modern oral histories of the Dagara to be colored by village politics while colonial era versions were affected by rivalries among British administrators, collaborated with a vegetation geographer to incorporate landscape history. The results supported some of the versions she had collected but not others, and demonstrated the efficacy of the interdisciplinary approach (Lentz 2000; Lentz and Sturm 2001). Landscape history has also been suggested by several other researchers as a particularly productive avenue for archaeological and historical collaboration (DeCorse and Chouin 2003).

While inter-disciplinary approaches are imperative for understanding the African past, the difficulty of dating oral narratives often has a significant impact on the accuracy with which they can be integrated with other forms of temporally fixed data sets. In the case of archaeological data, the challenges of determining temporal relevance are complicated by the breadth of archaeological notions of time and contemporaneity (Robertshaw 2000). It is well established that time is easily telescoped or contracted within oral narrative, and local conceptions of time may be fundamentally different than those used by the researcher as a measuring device.

Alphonse Chantoux and the *Histoire du Pays Gourma*

The most familiar cited work on Gourmantche history is the *Histoire du Pays Gourma* by Alphonse Chantoux (Chantoux 1966). It is the basis of almost all historical work on the Gourmantche kingdom, and the dates it presents for the foundation of the kingdom and years of rule of prominent kings are widely quoted as standard. A mimeographed document of only 62 pages, it is an expansion of the seminal manuscript by P. Davy (1952) [A copy of the latter manuscript could not be located]. As with many colonial documents, the context surrounding its production is hazy at best, and only limited information is available.

Father Alphonse Albert Chantoux was born January 29, 1920 in Rennes, France (Volta 1962). While it was not possible to identify when he joined the priesthood nor even an approximate date of his arrival in French West Africa, by 1952 he had assembled a collection of 50 Gourmantche short stories in the local language (Chantoux 1952). This was shortly followed by several publications on the Gourmantche language including an essay on grammar (Chantoux 1954b) and a dictionary (Chantoux 1954a). (In 1968 this work was incorporated into a regional synthesis of Gourmantche grammar, but despite his authorship it is not clear how actively Chantoux was involved in the preparation of the volume (Chantoux, et al. 1968)).

In 1953 (Cheney (2007), working from church records, places this in 1959), Father Chantoux was elevated to the role of Apostolic Prefect of Fada n'Gourma, approximately three months following its establishment as a separate ecclesiastical administrative unit: it had previously been under the control of Niamey. He resigned from this position in June 1964 when Fada N'Gourma was elevated to a diocese (Cheney 2007). The *Histoire du Pays Gourma* was published two years later, although since Chantoux does not mention his emeritus status in the text, it may have been prepared a few years prior to publication.

In his introduction to the *Histoire du Pays Gourma*, Chantoux provides little detail on to his methodology. He states that he has drawn heavily from Davy's document (prepared while an administrator in Fada N'Gourma between 1951-52), and acknowledges a debt to the directors of the local school: Raphaël Lompo and Fidèle Lankoande. Although no biographical information has been located on these individuals, their names suggest that they may have been Christians and thus possibly not within the mainstream of traditional Gourmantche culture. Madiega et al. (1983:13) note in passing that Lompo traveled extensively, and consequently some of the narratives he recounted for Chantoux may have originated outside of Gourmantche territory.

Throughout the text, Chantoux attempts to verify accounts with oral histories gathered by colonial scholars working in neighboring countries, but it is clear that the available information is patchy. There is no discussion as to how dates were assigned to events, and it is possible that these were drawn from Davy. Overall, the document takes the form of what Lentz (2000:194) has termed the "as oral tradition has it" type report typical of the colonial era in which traditions from several informants were accepted uncritically and merged into a single master narrative. The necessary social context discussed above is absent.

Despite these methodological concerns, Chantoux's biography and publication record indicate that he had excellent command of the Gourmantche language, and, having spent at least 12 years in the region (and probably significantly more), some understanding of Gourmantche culture and society. He probably did not rely on interpreters when gathering information, and was likely as well qualified as any Frenchman of the time to assess the reliability of local narratives.

Histoire du Pays Gourma: A Gourmantche Narrative

Chantoux's monograph takes as its defining structure a kinglist (see Table C.1). The discussion is a catalogue of events during each individual's reign. The actions of other courtiers and nobles are only mentioned when they affect the actions of the king, and the lives of ordinary citizens are absent. General aspects of daily life, such as housing, diet, religion, and professional and leisure activities, even as practiced by the elite, are also absent from the narrative.

This monograph would thus at first seem to be the type of narrative which is best used in parallel to the archaeological record. However, a closer reading of the text reveals pronounced changes in political atmosphere, which could easily affect the organization of daily life in a peripheral region such as the Koabu drainage. For example, while there may be no actual evidence of Thiombiano and Ountani's military campaigns along the Gobnangou escarpment in the late 13th century, the subsequent political centralization of the region should be apparent in the archaeological record.

I have taken Chantoux's work as a baseline since it is foundational for all subsequent studies, however, I have added commentary from other sources, particularly Madiega (1982) and Madiega et al. (1983) where they supplement or contradict his interpretations.

Origins of the Gourma Kingdom

Chantoux begins with a discussion of the many stylized folktales describing the origins of the Gourma kingdom and the lineage of its founder, Diaba Lompo (Chantoux 1966). These sections are the most narrative of the book in that they discuss the emotions and motivations of the principles.

The "Gambaga Tradition" which traces the origins of the royal family to the Gambaga state and links them to the ruling families of the Mossi kingdoms is the most commonly cited. The king of Gambaga, Nedega, had a daughter, Na-Yalanga. After quarrelling with her father, she fled north until she came to the region of Yanga (Bitou). There, alone in the woods, she met a solitary hunter, Di-Yare. She and Di-Yare married and had a child, Ouedraogo. Soon, Nedega, who missed his daughter, located them and invited them to his court in Gambaga. After a successful visit, Nedega wished them to stay, but Di-Yare longed for the forest. Nedega allowed them to leave, but showered them with gifts including a troop of soldiers for Ouedraogo. Na-Yalanga and Di-Yare retired to Zambalga, where their tombs can be seen today, but Ouedraogo went north and founded the village of Tenkodogo. Ouedraogo was a charismatic leader, and drew thousands of Dagomba to his side. The neighboring peoples did not have chiefs and were very divided: they soon submitted to Ouedraogo. He married Pouinketa and they had many children, including several sons who became great warriors. These included Diaba Lompo who would found the Gourmantche kingdom, Raoua who would found Zandema (ultimately Yatenga), and Zoungrana who stayed near his parents and became the first Moro Naba of the Mossi kingdom.

There are numerous variations on this basic narrative: according to some scholars, Ouedraogo is a common name in the founding family, rather than a single individual. The precise relations between the Gourmantche and Mossi branches of the family vary depending on who is telling the story (some Gourmantche say that the Mossi are from the female line of the Gambaga chiefs, while the Gourmantche are from the male line; Mossi sources have Diaba Lompo as the youngest son or even a cousin rather than the oldest, etc.). Chantoux includes a version from Raphaël Lompo that suggests that Di-Yare was originally from Mali, but this version is not widely accepted. Madiega et al. (1983) argue that the Gambaga tradition is based in political attempts by lineages on the western borders of the kingdom to create kinship ties between themselves, the Mossi kingdom, and the ruling lineages of Gourmantche. However, this argument disregards the numerous cultural and linguistic similarities between the Gourmantche and Mossi (as well as other Gur speaking peoples).

Chantoux then summarizes the "Eastern Tradition" which he notes is not in direct contradiction to the Gambaga Tradition. According to this tradition, ancient Gur speakers were iron-workers who had been conquered and organized by people who had been evicted from Zounga (near Lake Chad) by Berbers in the 10th century AD. After a brief stop in Hausaland, they pushed on to Mali, where they gained local favor from the Malian rulers. In the process, their cavalry was able to defeat most of intermediate groups, and it was only in the mountains that local populations were able to maintain control. This matches with some Dagomba traditions that suggest that the ancestor of the King came from Chad to the region of Nungu, where he met his wife, then moved south to Dagomba. Again, Raphaël Lompo provides a unique variation, in which he suggests that the ruling families of Gourma originally came from Bornu, thus explaining the close ties between the kings of Bornu and Gourma, and the prohibition on young Gourmantche traveling east of the Niger River.

Madiega et al. (1983) believe an eastern origin for Gourmantche is more credible, pointing to oral histories collected from the banks of the Niger River and the importance of Hausa traders in Gourmantche. According to this narrative, Bemba or Baricemba warriors, originating on the left bank of the Niger River, crossed into Gourmantche territory ca. AD 1400-1600. They adopted the local customs and language, but imposed a hierarchical political structure on the indigenous inhabitants.

Finally, Chantoux gives the "Celestial Tradition" in which Diaba Lompo descended from the heaven dressed fully in white with his wife, his sons, and a pair of each animal. He came down the mountain of Koudiaboangu and appeared at Kankangou (near Pama). From 1204-48, he lived in a cave from which he imposed his authority and taught everyone to cultivate the earth. He easily gained the respect of everyone, even those as far north as Koalla.

Founding myths are notoriously political, and act as a method by which to legitimate the local power. Interestingly, the Gambaga Tradition creates ties to the other western powers of the 2nd millennium AD: Dagomba, Mossi, and even Mali, while the Eastern Tradition suggests additional ties to Bornu and Hausa. This phenomenon can even be seen on a local level: stories of Diaba Lompo collected in Maadaga describe him sailing up the Pendjari River. Notably absent from these narratives are mentions of political powers based in the forest belt.

The Expansion and Organization of the Gourmantche Kingdom

The next three kings of Gourmantche (Thiombiano, Ountani, and Banydoba) established the boundaries of the kingdom and organized its structure (Chantoux 1966:10-16). Throughout this period, brothers and younger sons frequently founded chiefdoms that were part of or would eventually come under the control of Gourmantche, thus creating familial links within the ruling infrastructure throughout most of the region. Thiombiano (AD 1248-1292) led the first expeditions outside the Pama region. The neighbors in the Gobnangou were restless, and Thiombiano campaigned along the escarpment to Diapaga. He imposed his authority and pushed the inhabitant south to Koubargo. Thiombiano then turned west and campaigned to Diabo, where he established a chief. Thiombiano returned to Pama, where he remained for the rest of his reign.

The first actions of his son Ountani as king (AD 1292-1336) were to consolidate the gains in the Gobnangou Region. At the time, the Gobnangou was populated by Baribas who lived in the marshes along the Pendjari River and along the escarpment for fear of Fulbe and Hausa hunters. They lived without chiefs and were easily attacked. Ountani was able to ally with a local leader Kouatoueme (who had been a captive in Kano). Together they drove the pillagers beyond the Pendjari and Niger Rivers and Ountani rewarded his ally by making him chief of the region. Kouatoueme reorganized the administration of villages, making his sons the chiefs of Yobri, Tambaga, and Tansarga, and set up a rotating system for succession among three lineages. However, he still struggled with internal conflict. Ountani also led campaigns to the north where he and his relatives established several other chiefdoms.

Ountani was succeeded by his son, Banydoba (1336-1380). Banydoba led numerous campaigns to the east and north founding several chiefdoms. He is also the first Gourmantche ruler to lead a campaign to the south against the Tomba. At the death of Banydoba, there were sixteen Gourmantche chiefdoms under centralized leadership.

Fluid Allegiances Within a Stable Kingdom

Following the death of Banydoba, the boundaries of the Gourmantche kingdom remained relatively stable for the next 300 years. During this period, however, local chiefs within the kingdom became more and more independent. Chiefdoms incorporated indigenous elements, and often ignored their obligations to the kings at Koudiaboangu. As a result, most rulers during this period spent their time either fighting (and often failing) to impose their authority or (more frequently) isolated in Pama dealing with palace intrigue and having seemingly little impact on the rest of their realm. The dynamism of succession in Gourmantche society is a topic explored in great deatail by Madiega (1982). Despite this internal conflict, the Gourmantche kingdom maintained its autonomy against increasing pressures from the outside. The information available on the kings from this period is minimal in comparison to the founders, and for the first time there are kings for which no information is available (Chantoux 1966: 17-24).

Labidiebo (1380-1395) traveled throughout his reign, and was unusual in that he brought his entire household with him. His successor, Tenintouodiba (1395-1439) returned to Pama, and supposedly did not leave his palace during his entire reign. Likewise, Toukoulmou (1439-1483) remained at Pama. He was known as a cruel leader who abused his subjects. There is no record of his successor Gnima (1483-1527). Golli (1527-1571) was forced to flee Pama when the local chief revolted: he was buried alive at Madjoari. He was the first king not succeeded by a son: instead his brother Kampadiboagli (1571-1615) murdered the heir and installed himself. The beginning of his reign was marked by a famine, which served as punishment for the murder of his nephew. There is virtually no information about Kambabi (1615-1659) other than the foundation of Yamba.

Tantiari (1659-1684) resumed hostilities with the Tomba to the south. Unfortunately, the Tomba were victorious, and Pama was sacked. During the battle, local inhabitants hid in the cliffs for protection. Ultimately, the population fled north to Nassouadou where the capital was reestablished. The death of Tantiari marked the end of rule from Pama and of reigns that each measured precisely forty-four years. His son Lissoagui (1684-1709) repelled yet another attack from the Tomba (this one reaches Nassouadou), and on his deathbed, he told Jendabri to move the capital to Nungou and make war against the Tomba.

"The Golden Age"

During the 18th century, the Gourmantche kingdom was at the height of its power and influence (Chantoux 1966: 25-30). While most of the Sahelian states and empires had been significantly weakened, the installation of Europeans on the coast and the increasing power of coastal kingdoms resulted in pressure on the southern border. New foods became available, as did guns. At the same time, the dissolution of Songhai and the weakening control of the Almoravids created a power vacuum in the north, where Gourmantche chiefdoms were able to expand their influence.

Jendabri (1709-1736) immediately followed his father's instructions, and took up the fight against the Tomba. His second expedition was successful and he was able to drive the Tomba as far south as Bassari (although there is no mention of this in Bassar oral traditions). Following his successful campaign, Jendabri moved the capital to Nungou where it remains today. During Jendabri's reign, Gourmantche influence in the north, particularly in Liptako, became more prevalent. Jendabri's reign is generally considered the peak of Gourmantche influence and power (Pilaszewicz 2000).

The identity of the Tomba who figure particularly strongly during this period, although they are a constant threat throughout Gourmantche history, is unclear. Chantoux suggests that they are either the Cotokoli or a group of diverse populations from northern Togo, Benin, and Ghana whose antiquity in the region predates Diaba Lompo.

Jendabri's successor, Yenbirima (1736-1761) gained the throne following a succession dispute with the aid of the chief at Koupela; as a reward, Koupela was allowed to expand east to Kantchari. The warriors of Koupela intermarry with locals in the east, particularly the Ouoba (hunters). The reign of Yenbirima was relatively peaceful, and that of his successor Baghama (1761-1791) was not marred by warfare. Under Baghama, the population around Nungou increased significantly and many strangers moved to the region. Baghama also supported a florescence of arts and culture.

Conflict and Decline

The period following Baghama's reign was filled with conflict as local chiefs attempted to assert their autonomy. The next four kings perished in conflict, and it was not until the French assumed control over the region that peace returned (Chantoux 1966: 31-39).

Although Yenghama's reign (1791-1820) began peacefully, increasing Fulbe presence in Liptako culminated in a major defeat at Dori. By 1817, the Gourmantche had retreated as far south as Koalla. Yenghama then became involved in a secession conflict amongst the chiefs at Matiacoali, and was thrown from his horse and killed during the battle.

Yenkirma (1820-1849) was forced to turn his attention to the neglected southern border. A member of the royal family of Kong had moved to northern Ghana and begun to organize the local population. They pushed towards Mango, then north to Pama, Borgou, and Kouniagou. Although Chantoux places this invasion during Yenkirma's reign, other scholars suggest it took place as early as AD 1700 (Hébert), and Chantoux acknowledges the existence of contradictory information. There were also continued skirmishes with the Tomba. Yenkirma was killed in a battle at Nungou over the refusal of the agricultural heartland Diapangou to pay tribute.

The reign of Yentiabri (1849-1853) was even more fraught with conflict. In only four years, he engaged in warfare with the chiefs of Yambi, Nagouli, Tigba, Bilanga, Coaré, and Pama, in addition to aiding the chief of Tenkodogo with an attack by the Boussancé. Yentiabri was killed during a battle at Pama. The reign of Yempabou (1853-56) is similar, and he was killed subduing the village of Diabo. After nearly 50 years of constant war, Gourmantche nobles hoped for a return to peace by choosing a direct line descendant, Yempadigou.

In fact, the reign of Yempadigou (1856-83) was relatively peaceful in comparison to his direct predecessors. Although there was fighting amongst numerous chiefs to the north and an attack by the Fulbe on Pama, Yempadigou seems to have avoided conflict, and there is little information regarding his reign. Yencoare (1883-1892) experienced renewed unrest amongst the chiefs, and was forced to aid Tenkodogo, reign in Bilanga, and deal with refugees fleeing an offensive by Matiacoali against Nabougou. Yencoare died in December 1892, just as the first European explorers crossed into Upper Volta.

European Conquest

Prior to the late 1800s, France, Great Britain, Germany, and other European nations had maintained a very light footprint in West Africa, relying instead on collaborative relationships with primarily coastal polities. By the 1880s, these relationships could no longer meet Europe's growing need for raw materials, and nations began to explore the possibility of political control (Hargreaves 1974, Hirshfeld 1979). Rulership of the interior regions of West Africa became particularly important both as a means by which to connect coastal enclaves and as a possible heartland for the production of commercial crops. For the French, ownership of modern Burkina Faso would allow them to connect their holdings in Dahomey to those in French Sudan, and ideally the banks of the Niger. Likewise, the Germans wished to connect their holdings in Togo to the upper Niger through modern Burkina Faso.

This period of European conquest and consolidation is, unsurprisingly, related in detail by Chantoux (1966: 40-50). Given his access to church records and local historical records, as well as Davy's position within the colonial government, this section is likely the most well-documented of Chantoux's monograph, although few citations are provided.

In July 1894, Ballot debarked at Porto Novo with express instructions from Delcasse to beat the Germans and English into the Gourma and Bornou regions. The Gourma commission was given to Decouer, and he departed Sansané-Mango on January 8, 1895. Decouer traveled with Lt. Baud (from whom he separated at Koande), Dr. Danjou, 25 tirailleurs, and 75 porters. At Pélélé he was overtaken by the German expedition led by von Karnap. With his smaller entourage, von Karnap made better time and arrived at Pama on January 14, 1895.

Von Karnap quickly signed a treaty with the chief at Pama, then proceeded to the northeast, arriving at Nando, near Kantchari. There, von Karnap negotiated treaties with the chiefs of Matiacoali and Kantchari, claiming the region for Germany.

Decouer reached Pama only a few hours after Karnap's departure, but finding that a treaty had already been signed, negotiated a new one. Decouer's treaty stated that the chief at Pama was a vassal of the king at Nungou and not authorized to sign treaties in the region. Decouer then proceeded north to Nungou in search of the king.
The king was not at Nungou: Yencoaré's successor, Yentougouri (1892) was killed almost immediately by his brother Bantchande (1892-1911). Bantchande was unable to hold the capital, and was forced to flee to Diabo in 1892. He had been in residence at Diabo for three years when Decouer located him, and had direct control only of the immediate region. In addition, his holdings were threatened by Cheikou Amadou, who had sought refuge in Liptako. Bantchande was easily persuaded to sign a treaty with France, and on January 20, 1895 placed all of Gourma under their control. Bantchande tried to convince Decouer to stay at Diabo and provide him with military support, but Decoeur refused and on January 23, 1895 he departed for the Niger River.

Decouer arrived in Kantchari on the same day von Karnap concluded his treaty negotiations. Decouer presented von Karnap with a formal objection based on his treaty with Bantchande, then continued to Say, and subsequently south to the coast, arriving there in mid-February. Decouer's treaty with Bantchande was ratified by the French government on August 18, 1895.[1]

The next expedition into Gourmantche territory did not take place until November 1896, when Lieutenant Baud set out to establish posts at Batilo, Pama, Fada N'Gourma, and Ouagadougou with the goal of cutting the English off from the Niger. Leaving Batilo on January 6, 1897, Baud arrived in Fada N'Gourma on February 1 and found Bantchande still in Diabo. Bantchande demanded Baud's aid in attacking Diapangou and re-establishing control. This was easily accomplished, and Bantchande returned to Fada N'Gourma for the first time since he was expelled in 1892.

Baud spent the next few months working to consolidate Bantchande's power base, and was confronted with numerous rebellions. The chiefs of Pama and Matiacoali fled to the German garrison at Mango and demanded protection. The Germans sent detachments to both towns, and Baud was forced to travel to Pama, where he convinced the chief of Pama to swear in front of the German officer that both Pama and Matiacoali were dependant chiefdoms of Bantchande, officially nullifying von Karnap's treaties. On July 23, 1897, the Paris Commission drew the boundaries between modern Burkina Faso, Togo, and Benin ending all German claims to the region.

---

1 Decouer's strategy of pursuing a treaty with the "king" of Gourmantche may have had roots in his previous expeditions to Borgu. In 1894, Decouer signed treaties with numerous village chiefs within the region on behalf of the French, while his counterpart, Lugard, signed a treaty with the weak "king" who didn't trust the British enough to use his real name (Hirshfeld 1979).

Baud remained in the capital until 1899, when he was replaced by a French civilian administrator. During that time he created a streamlined governance system of 18 Gourmantche provinces, each with autonomous provincial chiefs. Throughout the early 20th century, various chiefs jockeyed for power under the new administration. In particular, the chiefs of Matiacoali and Pama continued to cause problems, often from a base at Mango in German-controlled Togo. Bantchande himself was suspected of fomenting trouble in 1906, and in 1911 he was arrested for corruption and imprisoned. He died shortly thereafter, and Maubert, the colonial governor, eliminated the political position of king.

The social position remained but Simandari (1911-1952) seems to have had little power, and in 1952 was arrested for stealing Fulbe children. He was succeeded by Hamtiouri (1952-1962), and when Hamtiouri died the dynasty was ceded to modern popular representation.

While the study region was important early on as a means by which to cut off Germany from the Niger River, once it fell under firm French control it lay south of the major east-west trade routes from Ouagadougou to the Niger River, and west of the north-south trades routes from Benin. During the colonial era, the study region was shuffled between numerous administrative divisions (Dahomey, French Sudan, Niger, Upper Volta), but was almost always a border territory. Furthermore, the creation during colonial rule of numerous national parks and reserves on the borderlands created a buffer zone largely absent of population to the south and east (Table C.X). Today, the Gobnangou region seems firmly lodged in the general Burkinabe consciousness as a marginal zone. Large areas of Tapoa province have very low population densities, and the Gobnangou is considered an isolated outpost of population. It is difficult to reach from Ouagadougou (Niamey is significantly closer, and the locally preferred big city destination), and the most distant Gourmantche area from Fada n'Gourma (Nungou). However, as can be seen from the preceding discussion, the story of the region has been largely told from the perspective of the colonially designated center.

Discussion

As mentioned above, the oral historical data available suffer from many flaws that make it difficult to analyze. These flaws include a lack of information on the social context both of the providers of the narrative and of the scholars/administrators who parsed the data and no discussion regarding the development of the chronology. The precise 44 year reigns for the first 12 rulers suggests an oral mnemonic, although there is no way to determine whether the temporal scale is correct and terms of rulers have been added/omitted/modified to fit the template, or if the temporal scale has been stretched/condensed to fit an accurate kinglist (or both). Madiega et al. (1983) give a somewhat later date for the founding of Gourmantche, but do not suggest that it is significantly more reliable than that of Chantoux.

The detailed discussion of the colonial process of conquest is presented not because of the direct relevance for understanding the archaeological data, but rather because it provides important context for Chantoux and Davy's work. It is clear that French claims for the Gourmantche region were predicated on the existence of a centralized Gourmantche kingdom. The Germans had signed treaties with chiefs of major centers who seem to have actively controlled their territories. These chiefdoms, Pama, Madjoari, and Kantchari would have given the Germans control of the Pendjari drainage system within Gourmantche territory and cut the French off from the Niger River. In contrast, the French had signed a treaty with an expelled claimant to a Gourmantche throne, who controlled virtually no territory and was not located on a major drainage. It was in the interest of both colonial players and local residents of Fada n'Gourma to promote the idea of a Gourmantche state.

While it seems established that there was some sort of greater Gourmantche political organization, its centralization (or centralization in recent history) may have been overplayed. Madiega et al. (1983:35) expand on this theme:

"However, to observe the spirit of independence that prevailed at the level of certain dynasties, one can say that the idea of a *Nunbado*, supreme king of the Gourmantche in the image of the Mogho Naba, emperor of the Mossi, dates in practice to the colonial period. There existed prior to the age of colonial French intervention independent dynasties …. some of which even led bloody expeditions against the *diema* (kingdom) of the *Nunbado*."

In general, three strong themes emerge from the oral historical narrative. The first is of conflict with non-Gourmantche populations to the north and south, the second is of internal political fluidity, and the third is of cultural and linguistic assimilation. While it is difficult to assess the precise timing, relative veracity, and effects of most of the particular events, these general aspects of the political environment remain fairly consistent throughout the history of the Gourmantche kingdom.

Conflict with populations to the south (and north, though this is less relevant for the current project) is a common feature of almost every reign for which there is data. Descriptions of these incursions vary from organized campaigns (on both sides) to isolated raiding. In general, there were very few extended periods of minimal raiding, and most of these actually correspond to periods of lesser centralized control (which are perhaps not coincidentally the periods with less detailed descriptions). Overall, raiding from the south is portrayed as a constant concern or threat. This could affect settlement decisions in the Gobnangou, since it is located along the southern border.

Within the Gourmantche kingdom, absolute control from the king was rare according to the oral histories, and usually was limited to one or two consecutive reigns. Local chiefs seem to have had a fair amount of autonomy, even when the center was strong. During periods of weak central control, local chiefs generally responded by attacking their neighbors in attempts to expand their realms, and by refusing to pay tribute (described in Chantoux as grain).

It is difficult to assess the role of the center in the governing of local populations. The king is only documented as interfering in the internal affairs of chiefs in cases of succession, disputes with other chiefs, or failure to pay tribute. However, the mores of day to day governance are for the most part absent from the oral historical narratives. Ultimately, the question of interest for this study is whether relative centralization and autonomy within the kingdom affected daily life within member chiefdoms. Local people may have been insulated from these changes, however greater centralization could have brought benefits like larger-scale risk management and military support, as well as burdens such as increased agricultural production and military service.

The Gobnangou through the Oral Historical Lens

In this section, I will discuss what is known from oral history of the Gobnangou region. In addition to mentions in Chantoux's manuscript, oral histories collected in the region by Remy (1967), Frank et al. (2001), and by the author are included in the analysis. The narratives collected by Remy are the most reliable, as he was working in concert with an ethnologist, Cartry, and seems to have worked with multiple informants, although his work is focused exclusively on the community of Yobri to the north of the escarpment. The oral histories mentioned in passing by Frank et al. and those collected by the author were obtained informally, in translation and often without knowledge of local interests, and therefore have many of the same, if not more, reliability issues as Chantoux's work.[2]

2 In a note relating to reliability, several Maadaga residents claim the place name "Maadaga" (meaning market of the iron workers) is not a Gourmantche word. However, according to Chantoux, et al. (1968) and Swanson (1985), the prefix "ma" means "forger" while the suffix "-daaga" translates as market. However, it is possible that locals simply meant that it is not an appropriate place name for a community founded by Gourmantche, but rather a term generally applied to an existing settlement. Certainly there are no other prominent place names in Gourmantche territory with the "daaga" suffix, other than Mardaaga- a Fulbe camp.

The study region is for the most part peripheral to Chantoux's narrative, and when the Gobnangou is mentioned, all events take place to the north, rather than the south of the escarpment. According to Chantoux, the Gobnangou was originally inhabited by indigenous, non-Gourmantche populations whom he identifies as Bariba, and whom Madiega et al. (1983) identify as Tankanba.[3] These populations are described by Chantoux as egalitarian, and clustered in easily defensible locations such as swamps and along the escarpment. This is also supported by the oral histories collected informally in Maadaga, where locals said that the Gobnangou was already inhabited when the Gourmantche entered the region. Locals intermarried, and the indigenous groups became Gourmantche.

Chantoux's description of the initial conquest indicates minimal movement of populations into the Gobnangou region, and instead discusses an alignment of local elites with a greater Gourmantche political community. Internal conflict continues, and the Gobnangou continues to be portrayed as a multiethnic region. The Gobnangou disappears from Chantoux's narrative for 400 years, and reappears during the reign of Yembirima. However, the study region, given its location south of the escarpment, was likely particularly vulnerable to raiders from the south although the swamps of the Pendjari may have acted as a barrier. Frank et al. (2002:130) note that according to elders "in the past people used the caves of the range to hide away from slavehunters," although it is unknown whether the elders are referencing this period of insecurity or later periods discussed below.

During the reign of Yenbirima, there is discussion of increased intermarriage among Gourmantche and indigenous groups, particularly the hunters (Ouoba: a common surname in the Gobnangou today). This would suggest that despite nominal control, the Gobnangou remained a multiethnic region for a significant period of time, and the homogenous culturally Gourmantche population of today has subsumed significant variability.

By the mid-1800s, according to Remy, the region was fully Gourmantche. At that time, the village of Yobri was a loose collection of households located ca. 4 km from the base of the escarpment (Remy 1967:31-2). These households, under the control of a chief from the Yonli clan, moved frequently to fresh farmland, but generally chose locations at some distance from the escarpment (Remy describes this style of occupation as "normal"). Around 1840-45, this strategy changed. The village moved to the foot of the escarpment, as they felt this location provided some security from raiders, specifically

3 Today the Bariba are located mostly in Northern Benin, although according to McFarland (1978), there are some in southeastern Burkina Faso.

Peul horsemen from the north. Despite the restrictions of security, the ethos of mobility was maintained as the village moved four times over the next 30-40 years. Over this period, the community boundaries were hardened both spatially and socially in response to insecurity: inter-household spacing decreased and the movement of households and individuals between villages was restricted. Remy also briefly references increases in inter-village conflict, which may be a result of succession issues amongst the regional chiefs mentioned by Chantoux, although they are still described as coming from Tambaga, Tansarga, or Yobri, following if not the precise rotation, the same general qualifications set forth by Kouatoueme.

According to Remy, the arrival of the French in the early 1900s created peace in the region. While in theory this should have resulted in the dispersion of nucleated settlements near the escarpment, the colonial administration forbid the movement of villages. However, locals responded by increasing the distances between residences along the escarpment, and by significantly expanding the use of field huts, thus maintaining a regular access to new land as well as a degree of mobility.

In summary, there are a few threads to this incomplete narrative, which it may be possible to pick up and assess in the archaeological data. The first thread is the threat of raiding and instability. Throughout Chantoux's narrative, populations under attack (whether in the Gobnangou, Pama, or elsewhere) take refuge in escarpments and "collines" when available. Changes in settlement patterns within the study region can be interpreted with this in mind, and the shifts in the settlement distribution from dispersed to concentrated may indicate periods of instability. Unfortunately, the relationship between dispersal and insecurity is not constant: in some cases dispersed households are a defensive arrangement as they creates smaller, isolated targets, while in others it is a reflection that the safety of numbers is not needed.

The second is the assimilation of local populations into a greater Gourmantche. Linguistically, culturally, and politically, the Gobnangou today is part of the Gourmantche kingdom (although locals seem mixed regarding allegiance to Fada N'Gourma).
This process may or may not be visible in the material culture and settlement pattern data, and the amount and effect of colonial and post-colonial ethnic "hardening" (as described by (MacEachern 2001) for the Mandara Mountains in Cameroon) on the homogeneity of modern Gourmantche is unknown. As suggested above, French colonial claims would have been advanced by conflating Gourmantche language, culture, and political structures. Given the state of current knowledge, even a lack of evidence for transformation would be of interest.

Finally, Remy's account of the history of Yobri provides a template for village coalescence and movement that is not only potentially applicable to the past 150 years, but also a model for the possible effects of insecurity in the region.

Table C.1: Chronology of the Gourma Kingdom (after Chantoux 19666)

Year A.D.	King of Gourma (after Chantoux 1966)	Events in Gourma (after Chantoux 1966)	Events in Gobnangou (after Chantoux 1966)
1204-1248	Diaba Lompo	Diaba Lompo founds the Gourma kingdom. Rules from Kankangou (near Pama)	
1248-1292	Tidarpo/Thiombiano	Tidarpo leads the first expeditions beyond the Pama region: he campaigns along the Gobnangou to Diapaga, west to Diabo, then returns to capital at Koudiaboangou Tidarpo's brothers found the chiefdoms of Madjoari and Gayeri	Tidarpo finds some brave warriors in the Gobnangou, but pushes the bulk of the inhabitants back to Koubargo (in Northern Benin)
1292-1336	Ountani	Ountani leads a campaign to consolidate the Gobnangou. Ountani's brothers found the chiefdoms of Komin-Yanga and Sougdouguy. Ountani leads a campaign to the north where numerous chiefdoms are forming, many organized by uncles and cousins of Ountani. They all come under his control, including Bogande. Mansa Moussa of Mali is unable to conquer the Gourmantche or Mossi Kingdoms (no specifics given)	Ountani leads a successful campaign to the Gobnangou, installing Kouatoueme as chief. Kouatoueme organizes a system of succession which rotates among multiple lineages. A brother of Ountani erects Bizougou. Namounou and Bitou became independent shortly thereafter.
1336-1380	Banidoba	1370- Banidoba leads an expedition against the Fulbe at Torodi. Expedition to the east results in the founding of Matiacoali and Kantchari Expedition to the south reaches Yanli and Sokode Chiefdoms of Yonde and Thion founded	
1380-1395	Labidiebo	Traveled throughout his reign leading a life of constant warfare to maintain control of the region. Died 40 km east of Fada N'Gourma	
1395-1439	Tenintouodiba	Remained at Pama throughout his reign	
1439-1483	Toukoulmou	Abuses his subjects throughout his reign	
1483-1527	Gnima	No record	

Table C.1: Chronology of the Gourma Kingdom (after Chantoux 19666), continued

Year A.D.	King of Gourma (after Chantoux 1966)	Events in Gourma (after Chantoux 1966)	Events in Gobnangou (after Chantoux 1966)
1527-1571	Golli	Chief of Pama revolted forcing him to flee to Madjoari where he was buried alive.	
1571-1615	Kampadiboagli	Reign begins with a famine	
1615-1659	Kambari	Yamba founded	
1659-1684	Tantiari	Takes up fight with the Tomba to the south Pama is sacked and court flees to Nassouadou Disputes with the chiefs of Bizougou and Yandioua	
1684-1709	Lissoagui	Attack by Tomba reaches Nassouadou but is repelled back to Pama. Tigba founded.	
1709-1736	Yendabri	Leads two expeditions to the south, the second of which drives the Tomba back to Bassari. Moves the capital to Nungou Unrest in the north	
1736-1761	Yembirima	Gains the throne with the help of the chief at Koupela following a succession dispute. Continuing unrest in the north	Intermarriage through the eastern part of the region (Namounou, Bizougou, Maticoali) with locals, particularly the hunters (Ouoba)
1761-1791	Baghama	Peaceful reign: increased population in the region surrounding Nungou and possible increase in inmigration.	
1791-1820	Yenghama	Gourma are ejected from Liptako by jihadist Fulbe. There is a major defeat at Dori (7 dead), retreat to Babrika. By 1817 the Gourma have pulled back to Koalla Yenghama is thrown from his horse and killed during battles relating to succession in Matiacoali	
1820-1849	Yenkirma	Invasions from the south reach Pama and possibly as far north as Nungou. Internal disputes with Diapangou results in the death of Yenkirma during a battle at Nungou	

Table C.1: Chronology of the Gourma Kingdom (after Chantoux 19666), continued

Year A.D.	King of Gourma (after Chantoux 1966)	Events in Gourma (after Chantoux 1966)	Events in Gobnangou (after Chantoux 1966)
1849-1853	Yentabri	Engages in warfare against rebellious chiefs at Yambi, Nagouli, Tigba, and Bilanga in the north. Aid sent to the chief of Tenkodogo. Engages in warfare against rebellious chiefs at Coaré and Pama. Killed in Pama.	
1853-1856	Yempabou	Killed subduing village of Diabo.	
1856-1883	Yempadigou	Period of relative peace. Northern chiefs fight among themselves. Chiefs of Bilanga and Matiacoali attack Bogande Fulbe of Say drive as a far as Pama	1857- Yenbirima, chief of Tambaga ousts Maticemba of Tansarga
1883-1892	Yenkoare	Chief of Matiacoali attacks Nabougou: refugees flee to Soudouguy. Aids chief at Tenkodogo Dies December 1892	
1892	Yentougouri	Designated heir killed almost immediately by Bantchande in battle at Nungou	
1892-1911	Bantchande	Bantchande enforces his crown during disputes with Diapangou, Bilango, Tigba, Komin-Yanga, Matiacoali, Bizougou. Bantchande is expelled from Nungou, and establishes himself in Diabo with the support of the chief of Diapangou. January 1895: Karnap (German) signs treaties with chiefs at Pama, Madjoari, and Kantchari. Decouer (French) signs treaty with Bantchande. February 1897: Expedition by Baud (French) reinstalls Bantchande at Nungou and establishes French control of the region. July 23, 1897: Commission in Paris draws the boundaries between modern Burkina Faso, Togo, and Benin. 1906- Bantchande suspected of fostering trouble 1911- Bantchande arrested and thrown in prison: dies shortly thereafter. Maubert, the French colonial governor, eliminates the title of King.	1907- Labidiedo of Yobri becomes chief. He has difficulty holding the region, and is briefly replaced by Tiemo (a former slave) but regains power in 1909 1910- Labidiebo is replaced by his son Yendieli Diergou

Table C.1: Chronology of the Gourma Kingdom (after Chantoux 19666), continued

Year A.D.	**King of Gourma (after Chantoux 1966)**	**Events in Gourma (after Chantoux 1966)**	**Events in Gobnangou (after Chantoux 1966)**
1911-1952	Simandari	1914- Expedition reaches Mango and takes it over, renewing the vassel relationship with Noungu. 1917- Somba insurrection in the south defeated 1919- Upper Volta becomes its own colony 1932- Upper Volta split: most becomes part of Ivory Coast, but Fada N'Gourma and Dori become part of Niger. French mediate numerous succession disputes 1952- Simandari arrested for stealing Fulbe children	1913- Diergou condemned for blackmail, and is replaced by Yenyama, chief of Tambaga 1915- Pendjari River becomes the southern limit of the Gourma kingdom: everything to the south becomes part of colonial Dahomey. 1931- Diergou dies and is succeeded by his son Aghadi
1952-1962	Hamtiouri	1961- Hamtiouri dies and is not replaced. Dynasty cedes to modern popular representation	

APPENDIX D: SITE INVENTORY

Key abbreviations used in Site Inventory:
(L) = assigned to occupation at a low confidence level
(H) = assigned to occupation at a high confidence level
34* cm = asterix indicates that the measured artifact was broken

Site: 500 (11° 38.617' N, 1° 48.867' E)
Occupation: Siga (L)
Area: 1550 m^2
Estimated Height: 1.3 m
Deposit: Light brown with dense laterite pebbles
Environment: Located near the edge of the floodplain just north of a small seasonally flooded depression. Two baobabs 50 m east of the site.
Chipped Stone: flint debitage (1 piece, 1g)
Ceramics: Surface ceramic density from systematic collection: 0.88 sherds/m^2, 10.5 g/m^2
Iron working: Occasional small pieces of slag
Sources of Disturbance: plowing, modern trash (?)
Comments: Site has a higher central area (ca. 375 m^2) surrounded by gently sloping debris

Site: 501 (11° 38.403' N, 1° 48.854' E)
Occupation: Tuali-B (L); Ring (L)
Area: 450 m^2
Estimated Height: 0.5 m
Deposit: Light brown with laterite pebbles
Environment: Located near the edge of the floodplain, with a large baobab 45 m to the south
Chipped Stone: Rare pieces of chipped flint, flint debitage (2 pieces, 2 g)
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 5.0 g/m^2
Sources of Disturbance: large borrow pit in north of site
Comments: There is a burned brick on the surface

Site: 502.1 (11° 38.241' N, 1° 48.898' E)
Occupation: Siga (H)
Area: 1700 m^2
Estimated Height: 2.5 m
Deposit: Light brown with dense laterite pebbles.

Environment: Located on the edge of a lateritic ridge, with a steep dropoff to the east, and a gentle slope to the north and west.
Chipped Stone: flint debitage (1 piece, 6g)
Groundstone: Flat surface white sandstone basal stone (*li naali)* fragment (62 g) in systematic collection. Unworked and small fragments of groundstone also recovered.
Ceramics: Surface ceramic density from systematic collection: 2.72 sherds/m^2, 18.56 g/m^2
Iron working: Isolated slag
Sources of Disturbance: Plowing.
Comments: Part of a complex of mounds (502.1-502.5) split by a seasonal drainage.

Site 502.2 (11° 38.241' N, 1° 48.898' E)
Occupation: Siga (H)
Area: 1550 m^2
Estimated Height: 3.5 m
Deposit: Light brown with laterite pebbles.
Environment: Located in the edge of a lateritic ridge, with a steep dropoff to the south and gullies to the east and west. Two large baobabs are on south end of mound.
Chipped Stone: 11g multidirectional flint core, flint debitage (2 pieces, 22g)
Groundstone: A small hachet made of what appears to be chipped green sandstone collected.
Ceramics: Surface ceramic density from systematic collection: 0.6 sherds/m^2, 22.48 g/m^2
Sources of Disturbance: Plowing.
Comments: Part of a complex of mounds (502.1-502.5) split by a seasonal drainage.

Site 502.3 (11° 38.241' N, 1° 48.898' E)
Occupation: Pwoli (H); Siga (H)
Area: 7200 m^2
Estimated Height: 6.5 m
Deposit: Light brown with dense laterite pebble content.
Environment: Mound drops off sharply to the west and gradually to the east. Bushes are distributed over the mound.
Groundstone: handstone (*u bindu*) fragment collected from surface and several additional pieces recovered from the excavations.
Ceramics: Surface ceramic density from systematic collection: 2.08 sherds/m^2, 19.76 g/m^2
Sources of Disturbance: Borrow pits.
Comments: Part of a complex of mounds (502.1-502.5) split by a seasonal drainage.

Site 502.4 (11° 38.241' N, 1° 48.898' E)
Occupation: Pwoli (L); Siga (H)
Area: 900 m^2
Estimated Height: 1.0 m
Deposit: Light brown with dense laterite pebble content.
Environment: Mound is on top of the rise. A Baobab is on its west side.
Ceramics: Cannery Fragments; Surface ceramic density from systematic collection: 1.56 sherds/m^2, 22.08 g/m^2
Sources of Disturbance: Plowing.
Comments: Part of a complex of mounds (502.1-502.5) split by a seasonal drainage.

Site 502.5 (11° 38.241' N, 1° 48.898' E)
Occupation: Siga (H)
Area: 600m^2
Estimated Height: 1.0 m
Deposit: Light brown with laterite pebble content
Environment: Mound is on top of rise. Several bushes are around its base.
Chipped Stone: 56g piece of raw flint
Groundstone: Flat surface red sandstone basal stone (*li naali*) fragment collected.
Ceramics: Surface ceramic density from systematic collection: 1.32 sherds/m^2, 18.32 g/m^2
Iron working: 502.5 is an iron furnace with dense slag and numerous tuyere fragments. One large tuyere sample had an exterior diamater of 7 cm and an interior diamater of 3.2 cm
Sources of Disturbance: Plowing.
Comments: Part of a complex of mounds (502.1-502.5) split by a seasonal drainage.

Site: 503 (11° 37.940' N, 1° 48.920' E)
Occupation: Siga (H)
Area: 300 m^2
Estimated Height: 0.75 m
Deposit: Light brown with laterite pebble content
Environment: Located near the edge of the floodplain.
Ceramics: Surface ceramic density from systematic collection: 1.0 sherds/m^2, 29.32 g/m^2
Sources of Disturbance: plowing

Site: 504 (11° 38.066' N, 1° 49.038' E)
Occupation: Siga (L)
Area: 125 m^2
Estimated Height: 0.75 m
Deposit: Light brown with laterite pebble content
Environment: Located in seasonally inundated floodplain.
Ceramics: Surface ceramic density from systematic collection: 0.92 sherds/m^2, 7.20 g/m^2

Site: 505 (11° 37.940' N, 1° 49.377' E)
Occupation: Siga (H)
Area: 2040 m^2
Estimated Height: 0.75 m
Deposit: Brown with low sand content and dense laterite pebble content
Environment: Located in seasonally inundated floodplain
Chipped Stone: flint debitage (1 piece, 5 g)
Groundstone: Patellar red sandstone handstone (*u bindu*) fragment collected.
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 13.36g/m^2
Other artifacts: Equid teeth recovered from the surface.
Sources of Disturbance: plowing, three large borrow pits
Comments: Sites 505-509 are in close enough proximity that they could be characterized as a cluster.

Site: 506 (11° 38.469' N, 1° 49.451' E)
Occupation: Siga (H)
Area: 2000 m^2
Estimated Height: 1.5 m
Deposit: Light brown with dense laterite pebble content
Environment: Located in seasonally inundated floodplain
Chipped Stone: 18g piece of raw flint
Groundstone: roughly rectangular white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 1.84 sherds/m^2, 43.84g/m^2
Sources of Disturbance: plowing
Comments: Site is an oblong mound, the south half of which has been virtually destroyed by agricultural activities: the north half is largely intact. Sites 505-509 are in close enough proximity that they could be characterized as a cluster.

Site: 507 (11° 38.500' N, 1° 49.471' E)
Occupation: Siga (H)
Area: 425 m^2
Estimated Height: 0.5 m
Deposit: Light brown with dense laterite pebble content
Environment: Located in a seasonally inundated floodplain
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 72.72g/m^2
Sources of Disturbance: plowing
Comments: Sites 505-509 are in close enough proximity that they could be characterized as a cluster.

Site: 508 (11° 38.535' N, 1° 49.467' E)
Occupation: Siga (H)
Area: 350 m^2 (?)
Estimated Height: 1.0 m (?)
Deposit: Red with dense laterite pebble content
Environment: Located in a seasonally inundated floodplain.
Chipped Stone: one flint flake (6 g), one piece of flint debitage (4 g)
Groundstone: Heavy ovoid sphere made of a high density unknown porous material.
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 51.04g/m^2
Iron working: Isolated small pieces of slag
Sources of Disturbance: A large borrow pit has been dug in the center of the mound, largely destroying it's original form.
Comments: Sites 505-509 are in close enough proximity that they could be characterized as a cluster.

Site: 509 (11° 38.506' N, 1° 49.392' E)
Occupation: Siga (H)
Area: 2025 m^2
Estimated Height: 1.5 m
Deposit: Light brown sandy deposit with high laterite pebble content
Environment: Located in a seasonally inundated floodplain with depression to the northeast.
Chipped Stone: 6 g multi-directional flint core,
Groundstone: Green stone discoid handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 11.84g/m^2
Sources of Disturbance: plowing, two borrow pits
Comments: Sites 505-509 are in close enough proximity that they could be characterized as a cluster.

Site: 510 (11° 38.490' N, 1° 49.337' E)
Occupation: Siga (L); Tuali-A (L)
Area: 125 m^2
Estimated Height: 0.8 m
Deposit: Light brown
Environment: In a seasonally inundated floodplain
Chipped Stone: flint debitage (2 pieces, 30g)
Ceramics: Surface ceramic density from systematic collection: 0.12 sherds/m^2, 1.0 g/m^2
Sources of Disturbance: Termite
Comments: Possibly associated with the 505-509 cluster. Termite nests encompass almost the entire site.

Site: 511 (11° 38.437' N, 1° 49.959' E)
Occupation: Siga (L); Tuali-B (H)
Area: 300 m^2
Estimated Height: 0.8 m
Deposit: Light brown with almost no sand
Environment: Located just to the east of the seasonally inundated zone. There is a large baobab tree in the center of the site
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 16.12g/m^2
Sources of Disturbance: plowing, baobab tree

Site: 512 (11° 38.266' N, 1° 49.697' E)
Occupation: Siga (H)
Area: 20 m^2
Estimated Height: 0.2 m
Deposit: Brown with laterite pebbles
Environment: Located just to the east of the seasonally inundated zone. Large tree in center of mound.
Chipped Stone: 79 g piece of raw flint, 9 g multidirectional flint core, flint debitage (1 piece, 2 g)
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 4.84 g/m^2
Iron working: Dense concentration of slag and tuyeres: a small, isolated iron furnace
Sources of Disturbance: plowed, tree roots
Comments: Site may have been pushed to surface by a recently cut down tree

Site: 513 (11° 38.171' N, 1° 48.523' E)
Occupation: Pwoli (L); Siga (H)
Area: 5700 m^2
Estimated Height: 2.25 m and 1.5 m
Deposit: Brown with dense laterite pebbles
Environment: Located just to the north of the seasonally inundated zone on a rise.
Chipped Stone: flint debitage (2 pieces, 5 g)
Groundstone: Large basal stone (*li naali*) fragment (30 x 26* x 4.5 cm), white granite with a flat grinding surface. Two white sandstone handstone (*u bindu*) fragments collected.
Ceramics: Surface ceramic density from systematic collection: 1.92 sherds/m^2, 33.84g/m^2
Sources of Disturbance: plowing
Comments: Site is an oblong mound with two peaks

Site: 514 (11° 38.339' N, 1° 48.512' E)
Occupation: Siga (H)
Area: 1290 m^2 (514.1- 460 m^2; 514.2- 255 m^2; 514.3- 300 m^2; 514.4- 175 m^2; 514.5- 100 m^2)
Estimated Height: 0.8-1.0 m
Deposit: Light brown with dense laterite pebbles
Environment: There is a large baobab tree adjacent to the iron furnace
Ceramics: Surface ceramic density from systematic collection: 1.32 sherds/m^2, 37.2 g/m^2
Iron working: 514.5 is a concentration of slag just off of 514.1, and is likely a furnace. Several vitrified pieces of tuyere collected, including a large fragment with an exterior diameter of 8 cm and an interior diameter of 4.0 cm
Sources of Disturbance: plowing, 514.3 has a borrow pit
Comments: A group of four shallow mounds and an iron furnace.

Site: 515 (11° 38.676' N, 1° 48.780' E)
Occupation: Siga (L); Ring (H)
Area: ca. 4000 m^2 (patchy distribution)
Estimated Height: 0 m
Deposit: Light brown with sparse laterite pebbles
Environment: Just northwest of a seasonally flooded depression. There are three large baobabs in the vicinity of the site
Groundstone: unworked piece of green sandstone recovered
Ceramics: Surface ceramic density from systematic collection: 0.88 sherds/m^2, 13.88g/m^2
Sources of Disturbance: plowing
Comments: Uneven low density scatter over a large area.

Site: 516 (11° 38.630' N, 1° 48.395' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.4 m
Deposit: Light brown with sparse laterite pebbles
Environment: Burned tree on on the site.
Ceramics: present, no systematic surface collection
Sources of Disturbance: plowing, burned tree in center of site

Site: 517 (11° 38.675' N, 1° 48.344' E)
Occupation: Not assigned
Area: 100 m^2
Estimated Height: 0.5 m
Deposit: Light brown with sparse laterite pebbles
Environment: Tamarind tree on the site
Chipped Stone: flint debitage (1 piece, 7 g)
Ceramics: No systematic surface collection
Sources of Disturbance: plowing

Site: 518 (11° 38.529' N, 1° 47.940' E)
Occupation: Siga (L)
Area: 255 m^2
Estimated Height: 0.6 m
Deposit: Light brown with dense laterite pebbles; hard
Environment: Seasonally flooded depression to the southwest. Baobab tree on site
Groundstone: White granite basal stone (*li naali*) fragment with flat grinding surface, 5 cm thick
Ceramics: Large jar *in situ;* Surface ceramic density from systematic collection: 0.08 sherds/m^2, 4.80 g/m^2
Iron working: Rare small pieces of slag
Sources of Disturbance: none
Comments: There is a 3 cm thick, slightly curved furnace or hearth wall visible on the surface

Site: 519 (11° 38.481' N, 1° 47.984' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Light brown with dense laterite pebbles
Environment: Seasonally flooded depression to the northeast
Groundstone: Basal stone (*li naali*) fragment with depressed grinding surface (at least 3 cm).
Ceramics: Surface ceramic density from systematic collection: 0.92 sherds/m^2, 22.36g/m^2
Sources of Disturbance: plowing

Site: 520 (11° 38.460' N, 1° 47.841' E)
Occupation: Siga (H)
Area: 350 m^2 (three small concentrations, each ca. 80 m^2, arranged in a semicircle)
Estimated Height: 0.4 m
Deposit: Soft light brown with dense laterite pebbles
Environment: Within sight of the Koabu channel, although not on the banks.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.6 sherds/m^2, 8.24 g/m^2
Sources of Disturbance: plowing
Comments: The deposit is scattered over a large area with three concentrations: the site could have initially been three distinct small mounds which have been smeared by plowing. Alternatively, they could be house mounds in a compound.

Site: 521 (11° 38.455' N, 1° 47.726' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: On the raised ground adjacent to the Koabu floodplain, ca. 50 m from the main channel.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.28 sherds/m^2, 162.04g/m^2
Sources of Disturbance: central termite mound, plowing

Site: 522 (11° 38.425' N, 1° 47.745' E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Near a seasonal drainage
Ceramics: Surface ceramic density from systematic collection: 0.08 sherds/m^2, 4.80 g/m^2
Sources of Disturbance: plowing

Site: 523 (11° 38.210' N, 1° 47.737' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.6 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: flint debitage (1 piece, 3 g)
Ceramics: Surface ceramic density from systematic collection: 0.40 sherds/m^2, 28.0 g/m^2
Sources of Disturbance: plowing

Site: 524 (11° 38.159' N, 1° 47.868' E)
Occupation: Siga (L)
Area: 1950 m^2
Estimated Height: 2.5 m
Deposit: Brown with dense laterite pebbles
Environment: No near-by surface water sources.
Ceramics: present, no systematic surface collection
Sources of Disturbance: plowing, modern trash, borrow pit
Comments: Site is a mound, composed at least in part of archaeological deposits (visible in cut of borrow pit). There is a currently occupied compound on the site, and extensive modern trash. Ceramics were collected from the area of the borrow pit to maximize the chances of recovering those from the earlier occupation.

Site: 525 (11° 38.096' N, 1° 47.971' E)
Occupation: Siga (H)
Area: 1250 m^2
Estimated Height: 2.0 m
Deposit: Dark brown with laterite pebbles
Environment: Near several areas where water pools seasonally. Site has a baobab tree.
Groundstone: White sandstone discoid handstone (*u bindu*) collected.
Ceramics: Surface ceramic density from systematic collection: 2.20 sherds/m^2, 124.52g/m^2
Sources of Disturbance: Borrow pit containing modern trash, plowing
Comments: The cut made by the borrow pit reveals mud brick melt, suggesting a tell site

Site: 526 (11° 38.664' N, 1° 49.369' E)
Occupation: Siga (L)
Area: 2150 m^2
Estimated Height: 0.8 m
Deposit: Light brown with laterite pebbles
Environment: In a seasonally innundated area. Two very large baobabs just to the south of the site.
Chipped Stone: Two flint flakes (3 g)
Groundstone: present. Unworked piece of milky quartz collected
Ceramics: Surface ceramic density from systematic collection: 2.52 sherds/m^2, 29.56g/m^2
Sources of Disturbance: plowing

Site: 527 (11° 38.736' N, 1° 49.389' E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.5 m
Deposit: Brown with laterite pebbles
Environment: Near a seasonally innundated area. Baobab tree.
Ceramics: Surface ceramic density from systematic collection: 2.36 sherds/m^2, 10.2 g/m^2
Sources of Disturbance: plowing, baobab roots may have pushed up artifacts

Site: 528 (11° 38.099' N, 1° 49.357' E)
Occupation: Siga (H)
Area: 130 m^2
Estimated Height: 0.4 m
Deposit: Light brown with dense laterite pebbles
Environment: Near seasonally innundated areas
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 59.6 g/m^2
Sources of Disturbance: plowing, borrow pit
Comments: Cut of borrow pit reveals at least 20 cm of archaeological deposit.

Site: 529 (11° 37.898' N, 1° 49.520' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.45 m
Deposit: Light brown with dense laterite pebbles
Environment: Very near seasonally innundated zone
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 11.32g/m^2
Groundstone: White sandstone basal stone (*li naali*) fragment collected.
Chipped Stone: flint debitage (1 piece, 4 g)
Sources of Disturbance: Central termite mound

Site: 530 (11° 38.091' N, 1° 49.675' E)
Occupation: Siga (H)
Area: 30 m^2
Estimated Height: 0.1 m
Deposit: Light brown with dense laterite pebbles (not distinguishing from surrounding area)
Environment: Small trees on site.
Ceramics: No systematic surface collection
Sources of Disturbance: termite mound at south end of site, plowing

Site: 531.1 (11° 38.119' N, 1° 49.783' E)
Occupation: Siga (L)
Area: 531.1- 225 m^2
Estimated Height: 0.6 m
Deposit: Light brown with dense laterite pebbles.
Environment: No nearby water sources.
Chipped Stone: flint debitage (3 pieces, 18 g)
Groundstone: possible trigonal white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 1.8 sherds/m^2, 12.68 g/m^2
Sources of Disturbance: plowing
Comments: Part of a dispersed cluster of mounds (531.1-531.5) in an open area.

Site: 531.2 (11° 38.119' N, 1° 49.783' E)
Occupation: Siga (H)
Area: 531.2- 275 m^2
Estimated Height: 0.9 m
Deposit: Light brown with dense laterite pebbles.
Environment: No nearby water sources.
Groundstone: discoid red sandstone handstone (*u bindu*) collected, as well as a broken, possibly unworked, white sandstone hemisphere
Ceramics: Surface ceramic density from systematic collection: 2.0 sherds/m^2, 21.6 g/m^2
Sources of Disturbance: plowing
Comments: Part of a dispersed cluster of mounds (531.1-531.5) in an open area.

Site: 531.3 (11° 38.119' N, 1° 49.783' E)
Occupation: Siga (H)
Area: 531.3- 150 m^2
Estimated Height: 0.6 m
Deposit: Light brown with dense laterite pebbles.
Environment: No nearby water sources.
Groundstone: White sandstone basal stone (*li naali*) fragment with a flat grinding surface. 531.3 may have a higher concentration of groundstone than the other two sites
Ceramics: Surface ceramic density from systematic collection: 1.28 sherds/m^2, 14.56 g/m^2
Sources of Disturbance: plowing
Comments: Part of a dispersed cluster of mounds (531.1-531.5) in an open area.

Site: 531.4 (11° 38.119' N, 1° 49.783' E)
Occupation: Siga (L)
Area: 531.4- 310 m^2
Estimated Height: 0.6 m
Deposit: Light brown with dense laterite pebbles.
Environment: No nearby water sources.
Chipped Stone: flint debitage (2 pieces, 20 g). Significantly more flint on 351.4 than on the other mounds.
Ceramics: Surface ceramic density from systematic collection: 4.68 sherds/m^2, 100.84 g/m^2
Sources of Disturbance: plowing
Comments: Part of a dispersed cluster of mounds (531.1-531.5) in an open area.

Site: 531.5 (11° 38.119' N, 1° 49.783' E)
Occupation: Siga (L)
Area: 531.5- 310 m^2
Estimated Height: 0.6 m
Deposit: Light brown with dense laterite pebbles.
Environment: No nearby water sources.
Ceramics: Surface ceramic density from systematic collection: 9.28 sherds/m^2, 89.8 g/m^2
Sources of Disturbance: plowing
Comments: Part of a dispersed cluster of mounds (531.1-531.5) in an open area.

Site: 532 (11° 38.269' N, 1° 49.847' E)
Occupation: Siga (L)
Area: 20 m^2
Estimated Height: 0.3 m
Deposit: Light brown with laterite pebbles
Environment: Near an area which may be seasonally innundated
Chipped Stone: one flint flake (3 g), flint debitage (one piece, 1 g)
Ceramics: Surface ceramic density from systematic collection: 1.12 sherds/m^2, 19.12 g/m^2
Sources of Disturbance: Central termite mound, plowing

Site: 533 (11° 38.360' N, 1° 49.751' E)
Occupation: Siga (H)
Area: 70 m^2
Estimated Height: 0.3 m
Deposit: Light brown with dense laterite pebbles
Environment: Along a slight rise
Ceramics: Surface ceramic density from systematic collection: 2.12 sherds/m^2, 22.2 g/m^2
Sources of Disturbance: Termite, plowing

Site: 534 (11° 38.500' N, 1° 49.723' E)
Occupation: Siga (H)
Area: 300 m^2
Estimated Height: 0.8 m
Deposit: Brown with dense laterite pebbles
Environment: Small cluster of *Anogeissus leiocarpus* trees on site.
Chipped Stone: one flint flake (2 g)
Groundstone: present on surface, including a large handstone (*u bindu*). White sandstone basal stone (*li naali*) fragment with a flat grinding surface collected.
Ceramics: Sherds on this site seemed relatively large: may have been more recently plowed than other sites in the area. Surface ceramic density from systematic collection: 2.12 sherds/m^2, 189.68 g/m^2
Sources of Disturbance: plowing
Comments: Sites 534 and 535 are possibly two mounds of the same state

Site: 535 (11° ’ N, 1° ’ E)
Occupation: Siga (H)
Area: 280 m^2
Estimated Height: 0.8 m
Deposit: Brown with dense laterite pebbles
Environment: Fig tree on site.
Groundstone: White sandstone basal stone (*li naali*) fragment with 2 cm grinding depression (max thickness 5 cm, min. thickness 3 cm)
Ceramics: No systematic surface collection
Sources of Disturbance: plowing
Comments: Only part of the site is plowed. The areas which are grassy have virtually no visible artifacts on the surface, and this mound would likely not have been identified as a site if not for the plowed area.

Site: 536 (11° ’ N, 1° ’ E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.4 m
Deposit: Light brown with sparse laterite pebbles
Environment: On high ground near the modern road
Chipped Stone: 52 g piece of raw flint,
Ceramics: Surface ceramic density from systematic collection: 1.76 sherds/m^2, 51.44 g/m^2
Sources of Disturbance: plowing

Site: 537 (11° ’ N, 1° ’ E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.6 m
Deposit: Light brown with laterite pebbles
Environment: In a seasonally innundated area
Chipped Stone: flint debitage (one piece, 3 g)
Groundstone: basal stone (*li naali*) fragment on surface. Smoothed red sandstone cobble collected.
Ceramics: Surface ceramic density from systematic collection: 1.48 sherds/m^2, 34.04 g/m^2
Sources of Disturbance: plowing
Comments: Site gives indications of being modern or sub-modern.

Site: 538 (11° ’ N, 1° ’ E)
Occupation: Ring (H)
Area: 900 m^2 (538.1- 750 m^2; 538.2- 150 m^2)
Estimated Height: 0.4-0.5 m
Deposit: Light brown with sparse laterite pebbles
Environment: On a sloping embankment above a seasonal water channel. Large baobab to the west of the site.
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 8.28 g/m^2
Sources of Disturbance: plowing, currently occupied compound on the site
Comments: Very dispersed site: the boundaries are difficult to determine.

Site: 539 (11° ’ N, 1° ’ E)
Occupation: Siga (H)
Area: unknown
Estimated Height: unknown
Deposit: Light brown with dense laterite pebbles
Environment: Adjacent to a large baobab
Groundstone: Unworked piece of white sandstone collected
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 4.12 g/m^2
Sources of Disturbance: Five borrow pits and plowing, currently occupied compound on the site.
Comments: Site consists of ceramics unearthed during digging of the borrow pits. Site is so disturbed that original dimensions could not be determined.

Site: 540 (11° 38.065’ N, 1° 48.289’ E)
Occupation: Siga (H)
Area: 130 m^2
Estimated Height: 0.6 m
Deposit: Brown and ashy (because of proximity to currently occupied compound)
Environment: Adjacent to a large baobab
Ceramics: Surface ceramic density from systematic collection: 0.40 sherds/m^2, 49.16 g/m^2
Groundstone: Possibly trigonal white sandstone partial handstone (*u bindu*) collected
Sources of Disturbance: Plowing, currently occupied compound on site

Site: 541 (11° 39.349' N, 1° 47.288' E)
Occupation: Pwoli (H); Siga (H)
Area: 1375 m^2
Estimated Height: 3.5 m
Deposit: Brown with dense laterite pebbles
Environment: There is a seasonal pool to the north-east of the site, and the Koabu is a few hundred meters to the west.
Chipped Stone: one flint flake (3 g), flint debitage (5 pieces, 14 g); also several flint and quartz chips recovered from excavation
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 8.80 sherds/m^2, 75.08 g/m^2
Sources of Disturbance: plowing
Comments: This site was chosen for excavation due to the density and diversity of surface artifacts, the prominent location in the landscape, and the presumed depth of deposit. More details on this site can be found with the excavation results, however excavation determined that the site is on a natural rise composed of pure gray clay, and has only 1.2 meters of cultural deposit.

Site: 542 (11° 39.226' N, 1° 47.135' E)
Occupation: Late Stone Age?
Area: Eroding from gully wall, see Figure 5.2
Estimated Height: Site is a lens 10-60 cm below the current surface and has been exposed by an erosional gully.
Deposit: Light brown with laterite pebbles. The matrix is extremely hard.
Environment: This site is located in an erosional gully leading into the main channel of the Koabu. The site is only 10-15 meters from the current main channel and has only been exposed through erosional processes.
Chipped Stone: Very dense and varied assemblage of flaked flint, including tools. On average, flakes and tools are relatively thin and large for the area. The provenience on the spatial association of the flakes is very poor: the highest density areas of the site had already eroded into the gully, and all formal tools were collected from erosional areas. The vast majority of the collected sample is flint but there are a few isolated quartz flakes. No blocks of raw material, but multidirectional cores, flakes, debitage, and formal tools.
Groundstone: A cylinder of white sandstone: possibly worked and possibly natural
Sources of Disturbance: Erosion
Comments: This site was chosen for excavation as the only partially intact chipped stone site identified during survey. Excavations determined that little material remained *in situ* and no organic material was recovered. Dates can only be estimated based on the morphology of the tools recovered. The lack of groundstone or ceramics suggests that the site is either early, hunter-gatherer affiliated, or a specialist activity site.

Site: 543 (11° 39.145' N, 1° 47.471' E)
Occupation: Siga (H); Tuali-A (L)
Area: 850 m^2
Estimated Height: 1.25 m
Deposit: Light brown with laterite pebbles
Environment: There is a seasonal pool to the north of the site, and the site is 200 m from the main channel of the Koabu drainage.
Chipped Stone: 38 g piece of raw quartz, one flint flake (1g), flint debitage (1 piece, 6 g)
Groundstone: Large sandstone basal stone (*li naali*) fragment with a 1 cm grinding depression (25 x 17* x 4-5 cm)
Ceramics: Surface ceramic density from systematic collection: 2.24 sherds/m^2, 30.08 g/m^2
Sources of Disturbance: There is a remnant of a mud brick structure (2 m diameter) on the site, which could indicate either recent reuse of an older site or a recent origin for all materials recovered from the site.
Comments: Possibly associated with site 544. Several currently occupied compounds are arranged around this seasonal pool and there may be more sites which cannot be identified.

Site: 544 (11° 39.186' N, 1° 47.432' E)
Occupation: Siga (L)
Area: 1590 m^2
Estimated Height: 2.0 m
Deposit: Light brown with laterite pebbles
Environment: On an embankment with a seasonal pool to the north. The site is 200 m from the main channel of the Koabu.
Chipped Stone: one flint flake (43 g), flint debitage (1 piece, 15 g)
Groundstone: Partial white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 3.04 sherds/m^2, 48.6 g/m^2
Other Objects: fragment of a ceramic pipe stem
Sources of Disturbance: plowing
Comments: Height is difficult to estimate due to location on a natural embankment, as are the precise boundaries of the site. May be associated with site 543. Several currently occupied compounds are arranged around this seasonal pool and there may be more sites which cannot be identified.

Site: 545 (11° 39.191' N, 1° 47.517' E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Light brown with sparse laterite pebbles
Environment: On embankment of seasonally flooded pool.
Chipped Stone: 13g piece of raw quartz, flint debitage (2 pieces, 12 g)
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 24.6 g/m^2
Sources of Disturbance: Plowing, currently occupied compound adjacent to site.
Comments: Several currently occupied compounds are arranged around this seasonal pool and there may be more sites which cannot be identified.

Site: 546 (11° 39.288' N, 1° 47.526' E)
Occupation: not assigned
Area: 310 m^2
Estimated Height: 0.4 m
Deposit: Light brown with sparse laterite pebbles
Environment: On embankment of seasonally flooded pool.
Groundstone: Round or oval white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 0.12 sherds/m^2, 1.2 g/m^2
Comments: Located directly across the pool from site 544. Several currently occupied compounds are arranged around this seasonal pool and there may be more sites which cannot be identified.

Site: 547 (11° 39.458' N, 1° 47.346' E)
Occupation: Siga (L); Tuali-A (L)
Area: 1140 m^2
Estimated Height: 2.5 m
Deposit: Light brown with dense laterite pebbles
Environment: There is a seasonal pool to the northwest. Located on a slight ridge.
Groundstone: Concentration of large grinding stone fragments in the southeastern part of the site. These included a light brown sandstone basal stone (*li naali*) with a grinding depression (30 x 38* x 10* cm) and light brown oval sandstone basal stone (*li naali*) with a flat grinding surface (24 x 34 x 7 cm). A discoid handstone (*u bindu*) and a nodule with a groove (possibly a net weight) were collected.
Ceramics: Surface ceramic density from systematic collection: 2.44 sherds/m^2, 26.36g/m^2
Sources of Disturbance: Plowing

Site: 548 (11° 38.540' N, 1° 47.691' E)
Occupation: Siga (L)
Area: 300 m^2
Estimated Height: 0.25 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: On a small ridge between two seasonally flooded depressions. The western of these separates the site from the Koabu.
Chipped Stone: 28 g piece of raw flint,
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 54.32g/m^2
Sources of Disturbance: Plowing

Site: 549 (11° 38.559' N, 1° 47.765' E)
Occupation: Siga (L); Ring (L)
Area: 900 m^2
Estimated Height: 0.6 m
Deposit: Ashy or muddy gray with no laterite pebbles
Environment: on a ridge between two seasonally flooded depressions
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.88 sherds/m^2, 12.72 g/m^2
Sources of Disturbance: plowing, centrally located termite mound
Comments: Across the seasonal depression from site 548

Site: 550 (11° 38.754' N, 1° 47.792' E)
Occupation: Siga (L)
Area: 700 m^2
Estimated Height: 2 m
Deposit: Light brown with dense laterite pebbles
Environment: On the bank of a large seasonal lake, which separates the site from the main channel of the Koabu. There are four large baobab trees on the site, all located slightly off peak.
Chipped Stone: flint debitage (1 piece, 1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.84 sherds/m^2, 59.28 g/m^2
Sources of Disturbance: Borrow pits near the base of the site.
Comments: This site is relatively undisturbed, perhaps in part because of the very hard matrix. Much of the site is covered with grass, brush, and other vegetation, limiting the quantity of material recovered in the surface collection. Sites 550 and 551 are on the same seasonal lake

Site: 551 (11° 38.816’ N, 1° 47.743’ E)
Occupation: Siga (H)
Area: 1000 m^2
Estimated Height: 1.25 m
Deposit: Light brown with dense laterite pebbles
Environment: On a seasonal lake with a very large baobab adjacent to the site.
Chipped Stone: Two flint flakes (4 g), flint debitage (1 piece, 1 g)
Groundstone: White basal stone (*li naali*) fragment with 3 cm grinding depression (thickness 3-6 cm)
Ceramics: Surface ceramic density from systematic collection: 2.64 sherds/m^2, 22.72 g/m^2
Sources of Disturbance: Plowing
Comments: Sites 550 and 551 are on the same seasonal lake.

Site: 552 (11° 38.976’ N, 1° 47.490’ E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: 50-100 m east of the main channel of the Koabu on a natural embankment
Chipped Stone: one flint flake (2 g)
Groundstone: present. A polished milky quartz stone (likely for burnishing pottery) was collected.
Ceramics: Surface ceramic density from systematic collection: 2.4 sherds/m^2, 18.96 g/m^2
Sources of Disturbance: plowing

Site: 553 (11° 39.071’ N, 1° 47.611’ E)
Occupation: Siga (H)
Area: 100 m^2
Estimated Height: 0.5 m
Deposit: Light brown with laterite pebbles
Environment: On the shore of the Lake Siega. Surrounding land is slightly lower and marshy.
Chipped Stone: flint debitage (2 pieces, 5 g)
Ceramics: Surface ceramic density from systematic collection: 1.04 sherds/m^2, 12.68 g/m^2
Iron working: Slag and a burned wall section of a small diameter structure. This structure could be an iron furnace or forge, although there were no tuyere fragments recovered.
Sources of Disturbance: Plowing

Site: 554 (11° 38.899’ N, 1° 47.739’ E)
Occupation: Siga (H)
Area: 275 m^2
Estimated Height: 0.4 m
Deposit: Powdery grey with laterite pebbles
Environment: On the shore of Lake Siega, across a seasonal depression from site 551. There is a very large baobab on the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.40 sherds/m^2, 39.56 g/m^2
Sources of Disturbance: Plowing

Site: 555 (11° 38.925’ N, 1° 38.896’ E)
Occupation: Siga (H)
Area: 110 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Tree north of site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.28 sherds/m^2, 4.40 g/m^2
Sources of Disturbance: Plowing, currently occupied compound near site

Site: 556 (11° 38.896’ N, 1° 47.832’ E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.6 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Tree on site.
Chipped Stone: flint debitage (1 piece, 3 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.0 sherds/m^2, 30.84 g/m^2
Sources of Disturbance: Plowing, possible termite mound

Site: 557 (11° 38.756' N, 1° 47.909' E)
Occupation: Siga (H)
Area: 180 m^2
Estimated Height: 0.4 m
Deposit: Hard light brown with dense laterite pebbles
Environment: No apparent near-by water sources, large baobab to the north of the site.
Ceramics: Two jars are visible on the surface. Jar 1 is 40 cm in diameter with a grog and organic temper. Jar 2 is 15 cm in diameter with micaceous temper. The jars were left in place: with the hardness of the matrix, it was not possible to get any information on vessel decoration or the percentage of the pots remaining below ground. Surface ceramic density from systematic collection: 1.4 sherds/m^2, 22.6 g/m^2
Sources of Disturbance: None

Site: 558 (11° 38.705' N, 1° 47.907' E)
Occupation: Siga (L)
Area: 110 m^2
Estimated Height: 0.4 m
Deposit: Light brownish grey with sparse laterite pebbles
Environment: Site on small rise.
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 5.36 g/m^2
Sources of Disturbance: Plowing, borrow pit, currently occupied compound adjacent to site.
Comments: Site is largely destroyed.

Site: 559 (11° 38.607' N, 1° 47.957' E)
Occupation: Siga (H)
Area: 90 m^2
Estimated Height: 0.6 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: In a seasonally innundated area with grey, clayey sediments
Ceramics: Surface ceramic density from systematic collection: 1.48 sherds/m^2, 45.36 g/m^2
Sources of Disturbance: Termite mound in center of site

Site: 560 (11° ' N, 1° ' E)
Occupation: Tuali-B (L); Ring (L)
Area: 50 m^2
Estimated Height: 0.7 m
Deposit: Light brown
Environment: Under a tamarind and a baobab tree which are virtually intertwined.
Ceramics: No systematic surface collection
Sources of Disturbance: Termite
Comments: Site consisted of only a few interesting pieces of pottery. Local guide Diassibo Ouaba suggested that it may be a place for sacrifices due to the unusual ceramics and presences of the trees.

Site: 561 (11° 39.165' N, 1° 47.611' E)
Occupation: Siga (H)
Area: 410 m^2
Estimated Height: 0.6 m
Deposit: Greyish light brown with dense laterite pebbles
Environment: Adjacent to a seasonal feeder of Lake Siega, and 150 meters from the lake itself.
Ceramics: Surface ceramic density from systematic collection: 0.04 sherds/m^2, 1.52 g/m^2
Sources of Disturbance: Plowing on part of the site
Comments: Most of the site is covered with grassy scrub: artifacts only recovered from the plowed section.

Site: 562 (11° 39.196' N, 1° 47.611' E)
Occupation: Siga (L)
Area: 200 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: Within sight of Lake Siega, but no water directly adjacent.
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 19.6 g/m^2
Sources of Disturbance: Borrow pit, significant trash from near-by currently occupied compound.

Site: 563 (11° 39.327' N, 1° 47.599' E)
Occupation: Tuali-A (H)
Area: 60 m^2
Estimated Height: 0.3 m
Deposit: Light brown with sparse laterite pebbles
Environment: No apparent near-by water sources.
Chipped Stone: one flint flake (18 g),
Ceramics: Surface ceramic density from systematic collection: 2.0 sherds/m^2, 35.6 g/m^2
Sources of Disturbance: Plowing

Site: 564 (11° 39.494' N, 1° 47.456' E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Light brown with sparse laterite pebbles
Environment: No apparent near-by water sources. A few bushes on site.
Groundstone: Two unworked pieces of milky quartz collected
Ceramics: No systematic surface collection
Sources of Disturbance: plowing

Site: 565 (11° 39.525' N, 1° 47.342' E)
Occupation: Siga (L)
Area: 510 m^2
Estimated Height: 0.6 m
Deposit: Brown with dense laterite pebbles
Environment: No apparent near-by water sources. Some bushes on site.
Chipped Stone: flint debitage (1 piece, 6 g)
Groundstone: White sandstone basal stone (*li naali*) fragment collected
Ceramics: Ceramics are concentrated at the east side of the site. Pattern may be erosional. Surface ceramic density from systematic collection: 1.32 sherds/m^2, 11.64 g/m^2
Sources of Disturbance: Plowing, termite mound at center of site
Comments: Possibly associated with Site 566

Site: 566 (11° 39.514' N, 1° 47.303' E)
Occupation: Siga (L)
Area: 660 m^2
Estimated Height: 0.6 m
Deposit: Brown with dense laterite pebbles
Environment: Seasonally flooded depressions to the north and east.
Ceramics: Surface ceramic density from systematic collection: 2.44 sherds/m^2, 58.48 g/m^2
Sources of Disturbance: Plowing
Comments: Possibly associated with site 565.

Site: 567 (11° 39.644' N, 1° 47.165' E)
Occupation: Tuali-B (H); Ring (H)
Area: 525 m^2
Estimated Height: 0.6 m
Deposit: Grayish brown with laterite pebbles
Environment: Seasonal depression containing water deep into the dry season is located ca. 100 m to the south. Two large *Parkia biglobasa* trees near the site.
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 9.08 g/m^2
Iron working: Slag on the surface.

Site: 568 (11° 39.652' N, 1° 47.129' E)
Occupation: Tuali-A (H)
Area: 420 m^2
Estimated Height: 0.6 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: Near the main channel of the Koabu.
Chipped Stone: 6 g piece of raw flint
Ceramics: Surface ceramic density from systematic collection: 1.56 sherds/m^2, 148.24 g/m^2
Sources of Disturbance: Plowing

Site: 569 (11° ' N, 1° ' E)
Occupation: Ring (H)
Area: 60 m^2
Estimated Height: unknown
Deposit: Consolidated laterite.
Environment: No apparent near-by suface water sources.
Ceramics: present, no systematic surface collection
Sources of Disturbance: Well in center of site.
Comments: All materials are from a pile of sediment surrounding a dry well ca. 2 m in depth. Difficult to determine nature of the site or the original context (e.g. surface or subsurface) of the ceramics.

Site: 570 (11° 38.932' N, 1° 48.306' E)
Occupation: Siga (H)
Area: 375 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Baobab tree adjacent to site
Chipped Stone: one flint flake (3 g), flint debitage (2 pieces, 11 g)
Groundstone: White sandstone basal stone (*li naali*) fragment collected
Ceramics: Surface ceramic density from systematic collection: 2.20 sherds/m^2, 22.0 g/m^2
Sources of Disturbance: plowing, termite mound

Site: 571 (11° 39.050' N, 1° 48.190' E)
Occupation: not assigned
Area: 60 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: No apparent near-by water sources.
Ceramics: No systematic surface collection
Sources of Disturbance: Plowing, currently occupied compound adjacent to site

Site: 572.1 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (H)
Area: 572.1- 1130 m^2
Estimated Height: 2.0 m
Deposit: Brown with dense laterite pebbles.
Environment: No apparent near-by water sources. Fig tree to the north.
Chipped Stone: flint debitage (1 piece, 1 g)
Groundstone: round white sandstone handstone (*u bindu*) collected and several addition groundstone pieces recovered from surface collections
Ceramics: Surface ceramic density from systematic collection: 2.16 sherds/m^2, 47.76 g/m^2
Sources of Disturbance: Plowing
Comments: Part of an isolated cluster of mounds (572.1-572.9). Chosen for excavation as the central mound of the complex. Although this mound had an apparent depth of 2 m, the sediment became rock-like with no apparent cultural content within 20-30 cm, and there were virtually no organic materials recovered from excavation. More details on this site are found in the excavation analysis.

Site: 572.2 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (H)
Area: 572.2- 1260 m^2
Estimated Height: 2.0 m
Deposit: Brown with dense laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: : flint debitage (1 piece, 1 g)
Groundstone: flat surface basal stone (*li naali*) fragment and a green stone hachet collected
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 10.80 g/m^2
Sources of Disturbance: Plowing
Comments: Part of an isolated cluster of mounds (572.1-572.9).

Site: 572.3 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (L)
Area: 1200 m^2
Estimated Height: 1.5 m
Deposit: Brown with dense laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone:
Groundstone: three white sandstone flat basal stone (*li naali*) fragments and a trigonal handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 1.28 sherds/m^2, 14.92 g/m^2
Sources of Disturbance: Plowing and borrow pit.
Comments: Part of an isolated cluster of mounds (572.1-572.9).

Site: 572.4 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (H)
Area: 960 m^2
Estimated Height: 1.5 m
Deposit: Light brown with dense laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: 72 g piece of raw flint
Groundstone: several large fragments including a 4 cm thick flat basal stone (*li naali*) and a smaller basal stone (*li naali*) with a depression that could have been made by pounding
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 17.68 g/m^2
Sources of Disturbance: Plowing
Comments: Part of an isolated cluster of mounds (572.1-572.9).

Site: 572.5 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (H)
Area: 350 m^2
Estimated Height: 0.75 m
Deposit: Brown with dense laterite pebbles.
Environment: No apparent near-by water sources. A Tamarind tree is on the site.
Chipped Stone:
Groundstone: elongated oddly triangular shaped object collected
Ceramics: Surface ceramic density from systematic collection: 0.4 sherds/m^2
Sources of Disturbance: Plowing
Comments: Part of an isolated cluster of mounds (572.1-572.9).

Site: 572.6 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (L)
Area: 910 m^2
Estimated Height: 1.25 m.
Deposit: Light brown with dense laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: 50 g piece of flint
Ceramics: Surface ceramic density from systematic collection: 1.72 sherds/m^2, 86.12 g/m^2
Sources of Disturbance: Plowing and borrow pits.
Comments: Part of an isolated cluster of mounds (572.1-572.9).

Site: 572.7 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 1.0 m
Deposit: Bown with laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: 19 g unidirectional flint core
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 5.56 g/m^2
Sources of Disturbance: Plowing; Borrow pits; directly adjacent to a currently occupied compound and the most heavily disturbed of the mounds.
Comments: Part of an isolated cluster of mounds (572.1-572.9).

Site: 572.8 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.6 m
Deposit: Light brown with dense laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: flint debitage (2 pieces, 11 g)
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 4.68 g/m^2
Sources of Disturbance: Plowing
Comments: Part of an isolated cluster of mounds (572.1-572.9).

Site: 572.9 (11° 39.550' N, 1° 47.939' E)
Occupation: Siga (L)
Area: 180 m^2
Estimated Height: 0.6 m
Deposit: Yellow brown with laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: flint debitage (1 piece, 5 g)
Ceramics: Surface ceramic density from systematic collection: 1.0 sherds/m^2, 7.24 g/m^2
Sources of Disturbance: Plowing
Comments: Part of an isolated cluster of mounds (572.1-572.9).

Site: 573 (11° 39.632' N, 1° 48.017' E)
Occupation: Siga (H)
Area: 800 m^2
Estimated Height: 1.25 m
Deposit: Light brown with dense laterite pebbles
Environment: On the same plateau as 572 and with the same hard sediment. Is further from water sources than 572.
Chipped Stone: Flint debitage and a possible formal tool recovered from excavation.
Groundstone: present; discoid handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 1.96 sherds/m^2, 25.84 g/m^2
Iron working: slag
Other objects: Ceramic pipe bowl fragment with comb impressed decoration
Sources of Disturbance: plowing
Comments: This site is possibly part of the 572 cluster. If so it is a distinct outlier, but it is significantly closer to 572 than to any other site.

Site: 574 (11° 39.562' N, 1° 48.083' E)
Occupation: Tuali-A (L)
Area: 415 m^2
Estimated Height: 0.7 m
Deposit: Light brown with laterite pebbles
Environment: No apparent near-by water sources.
Ceramics: Surface ceramic density from systematic collection: 2.0 sherds/m^2, 23.6 g/m^2
Sources of Disturbance: plowing

Site: 575 (11° 39.512' N, 1° 48.096' E)
Occupation: Siga (H)
Area: 415 m^2
Estimated Height: 0.7 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: two flint flakes (4 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.32 sherds/m^2, 11.68g/m^2
Sources of Disturbance: plowing

Site: 576 (11° 39.539' N, 1° 48.110' E)
Occupation: Siga (H)
Area: 110 m^2
Estimated Height: 0.25 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: one flint flake (1 g)
Groundstone: present, includes fragment of a flat basal stone (*li naali*) (thickness 3 cm); possible handstone (*u bindu*) fragment collected
Ceramics: Surface ceramic density from systematic collection: 1.28 sherds/m^2, 7.60 g/m^2
Sources of Disturbance: plowing

Site: 577 (11° 39.568' N, 1° 48.117' E)
Occupation: Siga (H)
Area: 110 m^2
Estimated Height: 0.25 m
Deposit: Light brown with dense laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 0.16 sherds/m^2, 11.32 g/m^2
Sources of Disturbance: plowing

Site: 578 (11° 39.656' N, 1° 48.088' E)
Occupation: Siga (L)
Area: 60 m^2
Estimated Height: 0 m
Deposit: Light brown with laterite pebbles
Environment: On a slight ridge with a tamarind tree at one end of the site. No near-by surface water sources
Chipped Stone: flint debitage (2 pieces, 20 g)
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 8.44 g/m^2
Iron working: slag
Sources of Disturbance: Plowing
Comments: Very low density site: a central core was mapped, but ceramics diffuse out over a larger area.

Site: 579 (11° 39.799' N, 1° 48.086' E)
Occupation: Tuali-A (H)
Area: 180 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: flint debitage (1 piece, 6 g)
Groundstone: Red sandstone basal stone (*li naali*) fragment with a flat grinding surface
Ceramics: Surface ceramic density from systematic collection: 3.84 sherds/m^2, 36.2 g/m^2
Sources of Disturbance: Plowing

Site: 580 (11° 39.776' N, 1° 47.944' E)
Occupation: Siga (L); Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Tamarind tree on site. No near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 9.96 g/m^2
Sources of Disturbance: Plowing

Site: 581 (11° 39.738' N, 1° 47.981' E)
Occupation: Siga (L)
Area: 325 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: 28 g and 39 g piece of raw flint, one flint flake (9 g), flint debitage (1 piece, 7 g)
Groundstone: Unworked piece of white sandstone recovered
Ceramics: Surface ceramic density from systematic collection: 1.32 sherds/m^2, 15.68g/m^2
Sources of Disturbance: plowing

Site: 582 (11° 39.713' N, 1° 47.878' E)
Occupation: Siga (H)
Area: 110 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: one flint flake (2 g)
Groundstone: present. Rose quartz polished stone collected (likely for burnishing pottery)
Ceramics: Surface ceramic density from systematic collection: 1.8 sherds/m^2, 35.84 g/m^2
Sources of Disturbance: plowing

Site: 583 (11° 39.680' N, 1° 47.785' E)
Occupation: Siga (H)
Area: 620 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: one flint flake (1g), flint debitage (1 piece, 1 g)
Ceramics: Surface ceramic density from systematic collection: 2.68 sherds/m^2, 25.72 g/m^2
Sources of Disturbance: plowing, a path running through the site
Comments: South of the path, the site has been plowed, while to the north the site has a hard, unplowed surface

Site: 584 (11° 39.660' N, 1° 47.672' E)
Occupation: Siga (H)
Area: 310 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: one quartz flake (3 g), flint debitage (1 piece, 3 g)
Ceramics: Surface ceramic density from systematic collection: 3.16 sherds/m^2, 29.72g/m^2
Sources of Disturbance: plowing, termite mound

Site: 585 (11° 39.808' N, 1° 47.872' E)
Occupation: Ring (H)
Area: 410 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles and a central ashy area
Environment: No near-by surface water sources. Three neem trees near the central courtyard
Chipped Stone: flint debitage (1 piece, 1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.16 sherds/m^2, 1.04 g/m^2
Sources of Disturbance: present
Comments: Ring compound with a central courtyard. Compound had west facing entrance and 7 structures.

Site: 586 (11° 39.793' N, 1° 47.872' E)
Occupation: Ring (H)
Area: 340 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources. Shea butter and neem trees around the exterior of the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.28 sherds/m^2, 3.84 g/m^2
Sources of Disturbance: plowing
Comments: Ring compound with depressed central courtyard. Compound had a west facing entrance, four structures, and an additional structure 20 m to the exterior (possibly a granary).

Site: 587 (11° 39.892' N, 1° 48.079' E)
Occupation: Siga (L)
Area: 310 m^2
Estimated Height: 0.4 m
Deposit: Sandy brown with dense laterite pebbles. Hard.
Environment: No near-by surface water sources
Groundstone: present (highly fragmented)
Ceramics: Surface ceramic density from systematic collection: 2.04 sherds/m^2, 43.36 g/m^2
Sources of Disturbance: plowing

Site: 588 (11° 39.946' N, 1° 48.068' E)
Occupation: Siga (H)
Area: 230 m^2
Estimated Height: 0.4 m
Deposit: Light brown with dense laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 1.4 sherds/m^2, 29.92 g/m^2
Sources of Disturbance: plowing

Site: 589 (11° 39.993' N, 1° 48.105' E)
Occupation: Siga (H)
Area: 490 m^2
Estimated Height: 0.4 m
Deposit: Fine brown with dense laterite pebbles
Environment: No near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 2.4 sherds/m^2, 29.48 g/m^2
Sources of Disturbance: plowing

Site: 590 (11° 39.857' N, 1° 48.236' E)
Occupation: Siga (H)
Area: 60 m^2
Estimated Height: 0.4 m
Deposit: Light brown with dense laterite pebbles. Hard.
Environment: No near-by surface water sources.
Ceramics: Ceramics may have been mixed during washing with those from site 670. Surface ceramic density from systematic collection: 1.16 sherds/m^2, 17.32 g/m^2
Sources of Disturbance: plowing, possible termite mound in center of site

Site: 591 (11° 39.811' N, 1° 48.331' E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.4 m
Deposit: Light brown with laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 0.88 sherds/m^2, 10.8 g/m^2
Sources of Disturbance:
Comments: Site is covered in weeds.

Site: 592.1 (11° 39.112' N, 1° 48.462' E)
Occupation: Siga (H)
Area: 592.1- 3320 m^2
Estimated Height: 2.0 m
Deposit: Yellow brown with dense laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: flint debitage (1 piece, 14 g);
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 17.84 g/m^2
Sources of Disturbance: Plowing, borrow pits
Comments: Part of a group of four mounds running along a ridge (592.1-592.4)

Site: 592.2 (11° 39.112' N, 1° 48.462' E)
Occupation: Siga (L)
Area: 592.2- 510 m^2
Estimated Height: 0.6 m
Deposit: Yellow brown with dense laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: one flint flake (8 g)
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 9.56 g/m^2
Sources of Disturbance:
Comments: Part of a group of four mounds running along a ridge (592.1-592.4)

Site: 592.3 (11° 39.112' N, 1° 48.462' E)
Occupation: Siga (H)
Area: 592.3- 710 m^2
Estimated Height: 0.5 m
Deposit: Light brown with some gray ash and laterite pebbles.
Environment: No apparent near-by water sources.
Chipped Stone: flint debitage (1 piece, 5 g)
Groundstone: unworked piece of white sandstone collected
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2
Sources of Disturbance: Plowing, borrow pits; adjacent to currently occupied compound and that mound is impacted by modern trash.
Comments: Part of a group of four mounds running along a ridge (592.1-592.4)

Site: 592.4 (11° 39.112' N, 1° 48.462' E)
Occupation: Siga (H)
Area: 592.4- 1960 m^2
Estimated Height: 0.7 m
Deposit: Light brown with dense laterite pebbles.
Environment: No apparent near-by water sources.
Ceramics: Surface ceramic density from systematic collection: 1.44 sherds/m^2, 11.52 g/m^2
Sources of Disturbance: Plowing and borrow pit.
Comments: Part of a group of four mounds running along a ridge (592.1-592.4)

Site: 593 (11° 38.909' N, 1° 48.440' E)
Comments: Recently occupied compound which is on a light mound. There could be a site at this location, however, no pottery or other artifacts were recovered.

Site: 594 (11° 39.266' N, 1° 48.423' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.4 m
Deposit: Brown with dense laterite pebbles
Environment: No near-by surface water sources
Groundstone: present. Possibly white sandstone handstone (*u bindu*) fragment collected
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 4.72 g/m^2
Sources of Disturbance: plowing

Site: 595 (11° 39.235’ N, 1° 48.406’ E)
Occupation: Tuali-B (H)
Area: 250 m^2
Estimated Height: 0.5 m
Deposit: Unknown- site is covered in dense grass. High laterite content.
Environment: No near-by surface water sources
Chipped Stone: flint debitage (2 pieces, 3 g)
Ceramics: Surface ceramic density from systematic collection: 2.4 sherds/m^2, 13.88 g/m^2
Sources of Disturbance: plowing
Comments: Exact boundaries of the site are difficult to determine as the site is not plowed and (consequently?) artifacts are scarce.

Site: 596 (11° 39.320’ N, 1° 48.423’ E)
Occupation: Siga (L)
Area: 350 m^2
Estimated Height: 1.0 m
Deposit: Brown with dense laterite pebbles
Environment: Shea butter trees at base of site. Small seasonal water pool to the southeast.
Chipped Stone: 24 g piece of raw flint, one flint flake (19 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.2 sherds/m^2, 9.64 g/m^2
Sources of Disturbance: plowing
Comments: Possibly associated with Site 597

Site: 597 (11° 39.350’ N, 1° 48.422’ E)
Occupation: Siga (L)
Area: 350 m^2
Estimated Height: 1.0 m
Deposit: Light brown with dense laterite pebbles
Environment: Shea butter tree at the top of the site. No near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 1.8 sherds/m^2, 32.56 g/m^2
Comments: Possibly associated with site 596

Site: 598 (11° 39.384’ N, 1° 48.397’ E)
Occupation: Siga (H)
Area: 350 m^2
Estimated Height: 0.3 m
Deposit: Light brown with dense laterite pebbles
Environment: Shea butter trees at edge of site. No near-by surface water sources.
Chipped Stone: flint debitage (2 pieces, 5 g)
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 47.4 g/m^2
Sources of Disturbance: plowing

Site: 599 (11° 39.366’ N, 1° 48.296’ E)
Occupation: Siga (L); Tuali-A (L)
Area: 200 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Balanites tree on the site. No near-by surface water sources
Chipped Stone: Flint debitage (1 piece, 5 g)
Ceramics: Surface ceramic density from systematic collection: 0.24 sherds/m^2, 17.0 g/m^2
Sources of Disturbance: plowing

Site: 600 (11° 39.584’ N, 1° 48.416’ E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.2 m
Deposit: Light brown with dense laterite pebbles
Environment: On the slope of a natural ridge. No near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 1.44 sherds/m^2, 12.92 g/m^2
Sources of Disturbance: Plowing, near the road and adjacent to a currently occupied compound.
Comments: Site is a thin lens on a natural rise.

Site: 601 (11° 39.982’ N, 1° 47.848’ E)
Occupation: Siga (H)
Area: 130 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: Acacia tree on the site. No near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 2.12 sherds/m^2, 9.48 g/m^2
Sources of Disturbance: plowing

Site: 602 (11° 38.817’ N, 1° 46.698’ E)
Occupation: Siga (H)
Area: 325 m^2
Estimated Height: 0.3 m
Deposit: Light brown with dense laterite pebbles
Environment: On a gradual slope leading to the main channel of the Koabu. The area 200 m to the east is seasonally flooded. Shea butter trees around the edge of the site.
Chipped Stone: 52 g unidirectional flint core, one flint flake (2 g), flint debitage (3 pieces, 13 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.64 sherds/m^2, 112.28 g/m^2
Sources of Disturbance: plowing

Site: 603 (11° 38.770' N, 1° 46.698' E)
Occupation: Tuali-A (H)
Area: 840 m^2
Estimated Height: 0.3 m
Deposit: Light brown with laterite pebbles
Environment: On a slight rise with seasonally flooded area to the east. Locust bean tree on the site.
Chipped Stone: one flint flake (2 g)
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 37.8 g/m^2
Other objects: Ceramic pipe stem fragment with a base. Pipe stem is flared with a round cross-section, pipe base is a circular pedestal with comb impressions
Sources of Disturbance: plowing
Comments: Diffuse artifacts make it difficult to determine the boundaries of the site. Pipe fragment recovered from the surface.

Site: 604 (11° 38.708' N, 1° 46.697' E)
Occupation: Siga (H)
Area: 310 m^2
Estimated Height: 0.6 m
Deposit: Light brown with dense laterite pebbles
Environment: Seasonally innundated area to the east
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 3.12 sherds/m^2, 24.64 g/m^2
Sources of Disturbance: plowing

Site: 605 (11° 38.655' N, 1° 46.574' E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Light brown with dense laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: one flint flake (8 g)
Ceramics: Surface ceramic density from systematic collection: 0.88 sherds/m^2, 12.8 g/m^2
Sources of Disturbance: plowing, central termite mound
Comments: Possibly associated with site 606

Site: 606 (11° 38.688' N, 1° 46.553' E)
Occupation: Siga (L)
Area: 80 m^2
Estimated Height: 0.5 m
Deposit: Light brown with dense laterite pebbles
Environment: Seasonally innundated area to the east-southeast.
Groundstone: Basal stone (*li naali*) fragments on the surface
Ceramics: No systematic surface collection
Sources of Disturbance: plowing, termite mound
Comments: Possibly associated with site 605

Site: 607 (11° 38.647' N, 1° 46.385' E)
Occupation: Siga (H)
Area: 400 m^2
Estimated Height: 0.3 m
Deposit: Sandy brown with dense laterite pebbles
Environment: On a natural lateritic outcrop. No near-by surface water sources.
Chipped Stone: 199 g piece of raw flint,
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 4.0 sherds/m^2, 55.88 g/m^2
Sources of Disturbance: Plowing, directly along the road

Site: 608 (11° 38.398' N, 1° 47.596' E)
Occupation: Siga (H)
Area: 130 m^2
Estimated Height: 0.4 m
Deposit: Slightly sandy, light brown with laterite pebbles
Environment: 50 meters from the main channel of the Koabu
Chipped Stone: one flint flake (1 g), flint debitage (1 piece, 4 g)
Ceramics: Many fragments of large storage jars on the surface. Surface ceramic density from systematic collection: 0.96 sherds/m^2, 39.56 g/m^2
Sources of Disturbance: plowing
Comments: Chunks of laterite on the surface

Site: 609 (11° 38.521' N, 1° 47.590' E)
Occupation: Siga (H)
Area: 90 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is directly adjacent to main channel of the Koabu
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 7.96 g/m^2
Sources of Disturbance: Plowing

Site: 610 (11° 38.150' N, 1° 47.421' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a primary tributary of the Koabu. Baobab tree adjacent to the site
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 22.4 g/m^2
Iron working: one piece of slag
Sources of Disturbance: plowing

Site: 611 (11° 38.121' N, 1° 47.300' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.5 m
Deposit: Silty light brown with sparse laterite pebbles
Environment: On a primary tributary of the Koabu
Ceramics: Surface ceramic density from systematic collection: 3.28 sherds/m^2, 45.24 g/m^2
Sources of Disturbance: plowing

Site: 612 (11° 38.374' N, 1° 47.281' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is just to the south of a seasonally innundated area. Located adjacent to a locust bean tree.
Chipped Stone: Piece of unworked flint, one flint flake (33 g),
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 6.56 g/m^2
Iron working: one piece of slag
Sources of Disturbance: plowing

Site: 613 (11° 38.651' N, 1° 47.269' E)
Occupation: Siga (H)
Area: 125 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 1.04 sherds/m^2, 18.16 g/m^2
Iron working: one piece of slag
Sources of Disturbance: plowing

Site: 614 (11° 38.633' N, 1° 47.225' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 8.60 g/m^2
Sources of Disturbance: plowing

Site: 615 (11° 38.588' N, 1° 47.140' E)
Occupation: Tuali-A (H)
Area: 430 m^2
Estimated Height: 2.0 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources. Locust bean tree at the base of the site
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 8.88 g/m^2
Sources of Disturbance: plowing

Site: 616 (11° 38.567' N, 1° 46.752' E)
Occupation: Siga (H)
Area: 130 m^2
Estimated Height: 0.6 m
Deposit: Light brown with dense laterite pebbles
Environment: Site is located on the downslope of a ridge adjacent to a seasonally innundated zone.
Groundstone: present. Patellar white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 1.72 sherds/m^2, 64.52 g/m^2
Sources of Disturbance: plowing, site is along the road

Site: 617 (11° 38.890' N, 1° 46.996' E)
Occupation: Siga (H)
Area: 320 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a natural rise.
Groundstone: Discoid handstone (*u bindu*) with a possible red ocher residue on one of the grinding surfaces
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 117.12 g/m^2
Sources of Disturbance: plowing, a path cuts through the site, dividing it into two slightly mounded sections. These divisions were treated as the result of erosion relating to the path.

Site: 618 (11° 38.925' N, 1° 47.081' E)
Occupation: Siga (H)
Area: unknown
Estimated Height: 0.2 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: Seasonal pool to the east. Locust bean tree adjacent to the site.
Ceramics: Surface ceramic density from systematic collection: 1.92 sherds/m^2, 15.16 g/m^2
Sources of Disturbance: plowing, two borrow pits
Comments: The majority of artifacts come from the two borrow pits, although there are a few trampled ceramics on the surface. Boundaries of the site were difficult to determine.

Site: 619 (11° 38.912' N, 1° 47.187' E)
Occupation: Siga (H)
Area: 1730 m^2
Estimated Height: 3.0 m
Deposit: Fine brown with laterite pebbles
Environment: This site is 100 m east of the Koabu, and there is a seasonal pool directly to the west. There is a large baobab on the site. The site is on a natural rise.
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 21.92 g/m^2
Sources of Disturbance: plowing
Comments: It is not possible to tell what percentage of the given height is cultural deposit and what percentage is the natural rise.

Site: 620 (11° 38.889' N, 1° 47.254' E)
Occupation: Siga (H)
Area: 110 m^2
Estimated Height: 0.6 m
Deposit: Sandy brown with a yellowish tinge and dense laterite pebbles
Environment: Site is on a 1.5 m natural rise and is 50 m from the main channel of the Koabu.
Ceramics: Surface ceramic density from systematic collection: 1.96 sherds/m^2, 21.60 g/m^2
Sources of Disturbance: plowing

Site: 621 (11° 38.839' N, 1° 47.256' E)
Occupation: Siga (L)
Area: 380 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with a yellowish tinge and sparse laterite pebbles
Environment: Site is on a natural 1.5 m rise 70 m from the main channel of the Koabu. There are two large baobab trees on the site.
Ceramics: Surface ceramic density from systematic collection: 1.32 sherds/m^2, 23.08 g/m^2
Sources of Disturbance: plowing

Site: 622 (11° 38.813' N, 1° 47.313' E)
Occupation: Siga (L)
Area: 175 m^2
Estimated Height: 1.0 m
Deposit: Sandy brown with laterite pebbles
Environment: Site is 50-70 m from the main channel of the Koabu and possibly on a natural rise. There is a large baobab tree adjacent to the site.
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 10.88 g/m^2
Sources of Disturbance: plowing, borrow pit

Site: 623 (11° 38.826' N, 1° 47.352' E)
Occupation: Siga (H)
Area: 450 m^2
Estimated Height: 0.7 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is 50 m from the main channel of the Koabu
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 7.08 g/m^2
Sources of Disturbance: plowing, several borrow pits concentrated in the eastern part of the site
Comments: Borrow pits may be the source of some of the larger ceramics.

Site: 624 (11° 38.850' N, 1° 47.420' E)
Occupation: Siga (H)
Area: 270 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: Directly on the banks of the Koabu on a natural rise. There is a locust bean tree on the site
Groundstone: Patellar gray sandstone handstone (*u bindu*) with a thumb impression on the opposite side collected
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 25.64 g/m^2
Sources of Disturbance: plowing, several borrow pits

Site: 625 (11° 41.272' N, 1° 47.208' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: one flint flake (5 g), flint debitage (1 piece, 4 g)
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 5.0 g/m^2
Sources of Disturbance: plowing, a path runs through the site
Comments: Sites 625, 626, and 627 form a triangle with several currently occupied compounds near-by.

Site: 626 (11° 41.295' N, 1° 47.239' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 2.36 g/m^2
Sources of Disturbance: plowing, currently occupied compound on the north side of the site: there is modern trash mixed in with the surface material
Comments: Sites 625, 626, and 627 form a triangle with several currently occupied compounds near-by.

Site: 627 (11° 41.295' N, 1° 47.172' E)
Occupation: not assigned
Area: 115 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: 26 g piece of raw flint, one flint flake (3 g)
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 3.96 g/m^2
Sources of Disturbance: plowing
Comments: Sites 625, 626, and 627 form a triangle with several currently occupied compounds near-by.

Site: 628 (11° 41.267' N, 1° 47.146' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: Site is on the edge of the seasonally innundated zone to the west
Chipped Stone: a few small flint chips, one flint flake (1 g), flint debitage (8 pieces, 45 g)
Ceramics: Surface ceramic density from systematic collection: 1.8 sherds/m^2, 13.68 g/m^2
Sources of Disturbance: plowing

Site: 629 (11° 41.341' N, 1° 47.123' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: Site is 50 m from the seasonally innundated zone to the west
Chipped Stone: Flint debitage (1 piece, 3 g)
Groundstone: present, small barely worked white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 6.80 g/m^2
Sources of Disturbance: plowing, termite mound adjacent to the site

Site: 630 (11° 40.884' N, 1° 46.648' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a natural rise 75 m to the east of the seasonally innundated zone. There is a fig tree on the site.
Chipped Stone: Flint debitage (3 pieces, 7 g)
Ceramics: Surface ceramic density from systematic collection: 1.12 sherds/m^2, 56.56 g/m^2
Sources of Disturbance: plowing

Site: 631 (11° 40.840' N, 1° 46.559' E)
Occupation: not assigned
Area: 50 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface collection made in the densest part of the site: actual ceramic density is much lower. Surface ceramic density from systematic collection: 1.0 sherds/m^2, 12.80 g/m^2
Sources of Disturbance: plowing

Site: 632 (11° 40.790' N, 1° 46.560' E)
Occupation: Tuali-A (H)
Area: 20 m^2
Estimated Height: 0.0 m
Deposit: Very sandy light brown with virtually no laterite pebbles
Environment: No near-by surface water sources
Groundstone: Roughly trigonal handstone (*u bindu*) in a very dense porous material collected
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 8.72 g/m^2
Sources of Disturbance: plowing
Comments: Site boundaries are difficult to delimit

Site: 633 (11° 40.739' N, 1° 46.571' E)
Occupation: not assigned
Area: 50 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: On a slight natural rise under a baobab tree. No near-by surface water sources
Ceramics: No systematic surface collection
Sources of Disturbance: plowing
Comments: Artifacts may have been pushed up by the roots of the baobab tree.

Site: 634 (11° 40.719' N, 1° 46.467' E)
Occupation: Tuali-A (H)
Area: 60 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Groundstone: Some pieces of sandstone are present, although they are not clearly worked.
Ceramics: Surface ceramic density from systematic collection: 3.76 sherds/m^2, 71.6 g/m^2
Sources of Disturbance: plowing
Comments: Site boundaries difficult to define

Site: 635 (11° 40.538' N, 1° 46.247' E)
Occupation: Siga (H)
Area: 750 m^2
Estimated Height: 1.5 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is located on an embankment adjacent to a broad, shallow seasonal watercourse along which are dry season gardens and mango trees.
Chipped Stone: flint debitage (1 piece, 2 g)
Groundstone: Some pieces of sandstone are present, although they are not clearly worked.
Ceramics: Surface ceramic density from systematic collection: 7.04 sherds/m^2, 66.36 g/m^2
Sources of Disturbance: plowing
Comments: Depth is difficult to determine as the site is located on a natural rise. Cultural deposits are likely less than the given estimated depth.

Site: 636 (11° 40.452’ N, 1° 46.075’ E)
Occupation: Siga (H)
Area: 140 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with a yellowish tinge and sparse laterite pebbles
Environment: Site is located on the downslope of a 1.5 m natural embankment adjacent to the Koabu floodplain.
Chipped Stone: 51 g piece of raw flint; two 52 g flint cores, one of which is unidirectional and one of which is multidirectional, three flint flakes (14 g), flint debitage (3 pieces, 4 g)
Groundstone: present. Small white sandstone basal stone (*li naali*) fragment collected
Ceramics: Surface ceramic density from systematic collection: 3.08 sherds/m^2, 45.48 g/m^2
Sources of Disturbance: plowing
Comments: Site location is unusual, and the artifacts may have eroded from further up the slope. However, there is no evidence of a site on top of the embankment.

Site: 637 (11° 40.282’ N, 1° 46.221’ E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles.
Environment: The site is located on a natural embankment between the main channel of the Koabu to the west and the Bwangwana (a seasonal tributary) to the east.
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: present: largely handstone (*u bindu*)s. Smoothed piece of quartz collected.
Ceramics: Surface ceramic density from systematic collection: 1.88 sherds/m^2, 26.0 g/m^2
Sources of Disturbance: plowing, cattle boma, and modern trash

Site: 638 (11° 40.254’ N, 1° 46.416’ E)
Occupation: Tuali-A (L)
Area: 50 m^2
Estimated Height: 0.0 m
Deposit: Hard red with laterite pebbles
Environment: Site is located at a sharp S-curve in the Koabu, directly on the river bank. At this location, the main channel widens significantly and, according to locals, this is an excellent location for fishing during the rainy season.
Chipped Stone: eroding from the downslope of the bank; two flint flakes (2 g); flint debitage (5 pieces, 25 g), one formal tool with retouch collected.
Ceramics: Diassibo Ouaba identified a large perforated ceramic fragment as part of a fish trap. Surface ceramic density from systematic collection: 0.64 sherds/m^2, 17.64 g/m^2
Sources of Disturbance: Erosion
Comments: This site has multiple uses/periods of deposition. There is a distinct concentration of lithics, and near-by, an area where ceramics are the dominant artifact. Since it is still used as an activity area today, the possibility of modern trash cannot be excluded.

Site: 639 (11° 40.098’ N, 1° 46.714’ E)
Occupation: Siga (H)
Area: 490 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is located on a 1.5 m natural ridge 50 m east of the Koabu. There is a baobab tree at the east end of the site.
Chipped Stone: one flint flake (4 g), flint debitage (3 pieces, 7 g)
Ceramics: Surface ceramic density from systematic collection: 1.04 sherds/m^2, 12.32 g/m^2
Iron working: one 3 g piece of slag in systematic collection
Sources of Disturbance: plowing
Comments: May be associated with site 640

Site: 640 (11° 40.059' N, 1° 46.691' E)
Occupation: Siga (H)
Area: Small erosional area
Estimated Height: Site is eroding from a minor run-off point into the Koabu, and is about 0.5-1.0 m below the surrounding surface.
Deposit: Sandy light brown
Environment: Within a few meters east of the Koabu drainage
Chipped Stone: Numerous flint flakes and debitage, in addition to several cores and blocks of unworked raw material. Likely being used for firestarting.
Ceramics: No systematic surface collection
Iron working: At least three iron furnaces in a small group. Significant slag, numerous tuyeres, and some evidence of furnace walls. Two vitrified tuyere fragments in the systematic collection.
Sources of Disturbance: Erosion
Comments: May be associated with site 639

Site: 641 (11° 40.014' N, 1° 46.736' E)
Occupation: Siga (H)
Area: 1 m^2
Estimated Height: 0.0 m
Deposit: Light brown with a tinge of red and laterite pebbles
Environment: Site is located on the slope of a ridge 50 m east of the Koabu. Under a balanites tree and with a baobab near-by.
Chipped Stone: 29 g multidirectional flint core, two flint flakes (11 g), flint debitage (6 pieces, 21 g)
Ceramics: Base of a large jar, in addition to a few other trampled ceramics. Surface ceramic density from systematic collection: 2.84 sherds/m^2, 44.04 g/m^2

Site: 642 (11° 39.887' N, 1° 46.849' E)
Occupation: Siga (H)
Area: 180 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge which drops off sharply on the east to the Koabu. To the north is a tributary of the Koabu.
Chipped Stone: flint debitage (1 piece, 3 g)
Groundstone: Some pieces of sandstone are present, although they are not clearly worked.
Ceramics: Surface ceramic density from systematic collection: 0.36 sherds/m^2, 15.32 g/m^2
Sources of Disturbance: plowing

Site: 643 (11° 39.842' N, 1° 46.854' E)
Occupation: Siga (L)
Area: 50 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles
Environment: 30 m east of the Koabu
Chipped Stone: one flint flake (4 g)
Groundstone: present, including basal stone (*li naali*) fragments. Green stone hachet with a patina on the blade collected.
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 8.24 g/m^2
Sources of Disturbance: plowing

Site: 644 (11° 39.693' N, 1° 46.930' E)
Occupation: Siga (H)
Area: 1200 m^2
Estimated Height: 0.0 m
Deposit: Hard light brown
Environment: Directly on the banks of the Koabu with scrubby Balanites trees common.
Chipped Stone: flint debitage (1 piece, 6 g)
Ceramics: Surface ceramic density from systematic collection: 0.36 sherds/m^2, 13.8 g/m^2
Sources of Disturbance: Numerous borrow pits
Comments: Site has been largely destroyed by borrow pits: difficult to estimate the original boundaries.

Site: 645 (11° 39.624' N, 1° 46.970' E)
Occupation: Tuali-A (H)
Area: 20 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is under a locust bean tree. No near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 16.52 g/m^2
Sources of Disturbance: plowing

Site: 646 (11° 39.905' N, 1° 47.253' E)
Occupation: Ring (H)
Area: 400 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with central ashy area
Environment: Baobab tree to the exterior of the site entrance. No near-by surface water sources.
Ceramics: No systematic surface collection
Comments: Site is a ring compound with five structures and a southeast entrance. The central courtyard area still contains wooden bed or granary bases, indicating a relatively recent abandonment. These collections provide a good baseline for identifying recently abandoned sites.

Site: 647 (11° 40.081' N, 1° 47.660' E)
Occupation: Siga (L)
Area: 20 m^2
Estimated Height: 0.2 m
Deposit: Fine light brown with dense laterite pebbles
Environment: No near-by surface water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.16 sherds/m^2, 2.36 g/m^2
Sources of Disturbance: plowing, threshing floor

Site: 648 (11° 40.037' N, 1° 47.751' E)
Occupation: Siga (H)
Area: 30 m^2
Estimated Height: 0.5 m
Deposit: Light brown with laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: 86 g piece of raw flint,
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.92 sherds/m^2, 47.84 g/m^2
Sources of Disturbance: plowing, possible termite mound

Site: 649 (11° 40.812' N, 1° 46.757' E)
Occupation: Siga (H)
Area: 310 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a natural rise with a seasonal drainage to the south. There are a couple of Balanites trees on the site.
Chipped Stone: one flint flake (1g), flint debitage (2 pieces, 1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 18.52 g/m^2
Sources of Disturbance: plowing, field hut on the site

Site: 650 (11° 40.701' N, 1° 46.659' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Baobab tree to the north of the site and a possible seasonal drainage to the east.
Chipped Stone: two flint flakes (3 g),
Groundstone: present, including large sandstone basal stone (*li naali*) fragments as much as 10 cm thick
Ceramics: Surface ceramic density from systematic collection: 2.56 sherds/m^2, 18.16 g/m^2
Sources of Disturbance: plowing

Site: 651 (11° 40.787' N, 1° 46.702' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources. Several very young Balanites trees on the site.
Chipped Stone: flint debitage (1 piece, 1 g)
Groundstone: Small white sandstone worked basal stone (*li naali*) fragment recovered.
Ceramics: Surface ceramic density from systematic collection: 2.84 sherds/m^2, 13.52 g/m^2
Sources of Disturbance: plowing

Site: 652 (11° 40.589' N, 1° 46.559' E)
Occupation: not assigned
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: one flint flake (1 g)
Ceramics: Systematic collection contained no artifacts
Sources of Disturbance: plowing
Comments: Site dimensions are difficult to determine.

Site: 653 (11° 40.365’ N, 1° 46.323’ E)
Occupation: Siga (H)
Area: 1590 m^2
Estimated Height: 0.5 m
Deposit: Sandy brown with laterite pebbles
Environment: Site is on a 2-3 m ridge on the east bank of the Bwangwana (a major Koabu tributary)
Chipped Stone: Flint debitage (2 pieces, 2 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.0 sherds/m^2, 14.4 g/m^2
Iron working: Occasional slag
Sources of Disturbance: plowing

Site: 654 (11° 40.393’ N, 1° 46.351’ E)
Occupation: not assigned
Area: 95 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: A little ways back on the 2-3 m ridge on the east bank of the Bwangwana
Chipped Stone: Flint debitage (2 pieces, 14 g)
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 6.0 g/m^2
Sources of Disturbance: Plowing

Site: 655 (11° 40.327’ N, 1° 46.405’ E)
Occupation: Siga (L)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with a yellowish tinge and sparse laterite pebbles
Environment: On a 2-3 m ridge on the east bank of the Bwangwana
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 15.8 g/m^2
Sources of Disturbance: plowing

Site: 656 (11° 40.376’ N, 1° 46.430’ E)
Occupation: Ring (H)
Area: 255 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: 75 m from the Bwangwana
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: present. Broken white sandstone trigonal handstone (*u bindu*) collected.
Ceramics: Surface ceramic density from systematic collection: 0.12 sherds/m^2, 3.80 g/m^2
Sources of Disturbance: plowing
Comments: Ring compound with an east facing entrance. There are four structures in the compound and a borrow pit to the exterior of the site.

Site: 657 (11° 40.470’ N, 1° 46.461’ E)
Occupation: Siga (L)
Area: 410 m^2
Estimated Height: 0.4 m
Deposit: Sandy brown with laterite pebbles
Environment: plateau
Chipped Stone: 27 g piece of raw quartz,
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.96 sherds/m^2, 35.32 g/m^2
Iron working: some pieces of slag
Sources of Disturbance: plowing, currently occupied compound adjacent to the site and modern trash on the site.

Site: 658 (11° 40.387’ N, 1° 46.503’ E)
Occupation: Siga (H)
Area: 20 m^2
Estimated Height: 0.1 m
Deposit: Hard sandy light brown
Environment: On a ridge overlooking the Chingjanchaldi
Ceramics: Surface ceramic density from systematic collection: 0.44 sherds/m^2, 12.32 g/m^2

Site: 659 (11° ’ N, 1° ’ E)
Occupation: Siga (H)
Area: 290 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: On a ridge overlooking the Chingjanchaldi
Groundstone: present
Ceramics: less artifact density that surface collection indicates. Surface ceramic density from systematic collection: 3.08 sherds/m^2, 95.92 g/m^2
Sources of Disturbance: plowing, borrow pit, adjacent to a currently occupied compound

Site: 660 (11° 40.275’ N, 1° 46.620’ E)
Occupation: Ring (H)
Area: 20 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Near main channel of Koabu
Chipped Stone: one flint flake (6 g)
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 6.76 g/m^2
Sources of Disturbance: plowing, small termite mound in center of the site

Site: 661 (11° 40.253' N, 1° 46.659' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.92 sherds/m^2, 17.28 g/m^2
Sources of Disturbance: plowing

Site: 662 (11° 40.301' N, 1° 46.729' E)
Occupation: not assigned
Area: 400 m^2
Estimated Height: 0.3 m
Deposit: Brown with dense laterite pebbles
Environment: Site is in a group of five baobabs. No near-by surface water sources.
Chipped Stone: Flint debitage (1 piece, 4 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.48 sherds/m^2, 17.68 g/m^2
Sources of Disturbance: plowing, two borrow pits
Comments: Artifact density is highest in and around the mud brick borrow pits: this could indicate that other sites near baobabs with sparse surface ceramics may have better preserved deposits below the surface.

Site: 663 (11° 40.190' N, 1° 46.778' E)
Occupation: Siga (H)
Area: 425 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on the edge of a natural ridge. There is a very large baobab on the site.
Chipped Stone: one flint flake (3 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 3.08 sherds/m^2, 42.56 g/m^2
Sources of Disturbance: plowing

Site: 664 (11° 40.131' N, 1° 46.776' E)
Occupation: Ring (H)
Area: 260 m^2
Estimated Height: 0.3 m
Deposit: Light brown with sparse laterite pebbles
Environment: No apparent near-by water sources.
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 2.44 g/m^2
Sources of Disturbance: Plowing
Comments: Ring compound with an east entrance and four structures.

Site: 665 (11° 40.102' N, 1° 46.814' E)
Occupation: Siga (L); Tuali-A (H)
Area: 325 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge with a slight slope.
Chipped Stone: Flint debitage (2 pieces, 14 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 3.32 sherds/m^2, 31.92 g/m^2
Iron working: some slag
Sources of Disturbance: plowing, borrow pit

Site: 666 (11° 39.892' N, 1° 46.932' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with yellowish-reddish tinge and sparse laterite pebbles
Environment: Scrubby Balanites on the site. No near-by surface water sources.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.44 sherds/m^2, 27.56 g/m^2
Iron working: some slag
Sources of Disturbance: plowing

Site: 667 (11° 39.788' N, 1° 47.123' E)
Occupation: Tuali-A (H)
Area: 50 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with laterite pebbles
Environment: No apparent near-by water sources.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 38.2 g/m^2
Sources of Disturbance: plowing

Site: 668 (11° 39.758’ N, 1° 47.123’ E)
Occupation: Tuali-A (H)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources
Ceramics: surface collection large for the sparseness. Surface ceramic density from systematic collection: 3.68 sherds/m^2, 172.48 g/m^2
Sources of Disturbance: borrow pit, recently occupied compound to the northwest of the site

Site: 669 (11° 39.794’ N, 1° 47.128’ E)
Occupation: Siga (H)
Area: 240 m^2
Estimated Height: 0.4 m
Deposit: Light brown with laterite pebbles
Environment: No apparent near-by water sources.
Chipped Stone: Flint debitage (1 piece, 3 g)
Ceramics: Surface ceramic density from systematic collection: 0.08 sherds/m^2, 0.92 g/m^2
Sources of Disturbance: plowing
Comments: Artifact density is extremely low despite an appearance in line with many of the higher density sites recorded.

Site: 670 (11° 39.935’ N, 1° 47.114’ E)
Occupation: Siga (L)
Area: 75 m^2
Estimated Height: 0.4 m
Deposit: Hard light brown
Environment: Baobab and tamarind trees adjacent to the site.
Ceramics: Ceramics may have been mixed during washing with those from site 590. Surface ceramic density from systematic collection: 1.2 sherds/m^2, 17.12 g/m^2
Sources of Disturbance: termite mound in center of site

Site: 671 (11° 40.560’ N, 1° 47.581’ E)
Occupation:
Area: 500 m^2
Estimated Height: 0.3 m
Deposit: Light brown
Environment: No apparent near-by water sources.
Ceramics: No systematic surface collection
Sources of Disturbance: plowing
Comments: Ring compound with an east/southeast facing entrance. Compound contains five structures with an ashy central area. A wooden base structure, likely for a granary, is still standing directly outside the compound entrance. No surface collection was made, although pottery is likely in line with that of other ring compounds, particularly those which which also still have standing wood.

Site: 672 (11° 40.653’ N, 1° 46.855’ E)
Occupation: Siga (L)
Area: 325 m^2
Estimated Height: 0.3 m
Deposit: Yellow with laterite pebbles.
Environment: Seasonal drainage 50 m to the north. Baobab tree is on site.
Ceramics: Surface ceramic density from systematic collection: 2.84 sherds/m^2, 46.48 g/m^2
Sources of Disturbance: Plowing.
Comments: Two surface collections taken.

Site: 673 (11° 40.631’ N, 1° 46.783’ E)
Occupation: not assigned
Area: 310 m^2
Estimated Height: 0.3 m
Deposit: Hard sandy light brown with laterite pebbles
Environment: Site is on a 1.5 m ridge with a seasonal drainage to the north
Chipped Stone: Flint debitage (2 pieces, 8 g)
Groundstone: Some pieces of sandstone are present, although they are not clearly worked.
Ceramics: The edges of several large intact jars are visible near some embedded laterite blocks. Surface ceramic density from systematic collection: 0.76 sherds/m^2, 7.08 g/m^2
Iron working: one piece of slag
Sources of Disturbance: heavy erosion

Site: 674 (11° 40.524' N, 1° 46.732' E)
Occupation: Siga (L)
Area: 160 m^2
Estimated Height: 0.0 m
Deposit: Hard sandy light brown with a yellowish tinge and laterite pebbles
Environment: Site is on a 1.5 m ridge with a seasonal drainage to the north. There is a baobab tree on the site.
Chipped Stone: Flint debitage (2 pieces, 10 g)
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 4.20 g/m^2
Iron working: One small vitrified fragment (32 g) collected from the surface. The fragment does not appear to be from a tuyere.

Site: 675 (11° 40.362' N, 1° 46.721' E)
Occupation: Siga (L)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with laterite pebbles
Environment: No apparent near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 0.4 sherds/m^2, 21.84 g/m^2
Sources of Disturbance: plowing. Site is 40 m from a currently occupied compound. There is significant modern trash in the area, including broken pottery, and we are not certain that there are any artifacts not originating from this compound on the site.
Comments: The site has a higher density of laterite pebbles than the surrounding, which is why it was identified and collected despite the reservations expressed above.

Site: 676 (11° 40.282' N, 1° 46.843' E)
Occupation: Siga (L)
Area: 95 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is located on a natural ridge with no near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 1.28 sherds/m^2, 40.24 g/m^2
Sources of Disturbance: plowing

Site: 677 (11° 40.281' N, 1° 46.890' E)
Occupation: Tuali-A (L)
Area: 150 m^2
Estimated Height: 0.1 m
Deposit: Greyish-brown with laterite pebbles (low visibility: covered with grass)
Environment: On a natural ridge near two baobab trees. No near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 9.16 g/m^2

Site: 678 (11° 40.225' N, 1° 46.861' E)
Occupation: Tuali-B (L)
Area: 95 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: There are two very small baobabs on the site
Chipped Stone: 103 g piece of unworked flint,
Ceramics: Surface ceramic density from systematic collection: 0.12 sherds/m^2, 1.24 g/m^2
Sources of Disturbance: plowing

Site: 679 (11° 39.950' N, 1° 47.008' E)
Occupation: Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Groundstone: present: sandstone basal stone (*li naali*) fragments
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 31.52 g/m^2
Sources of Disturbance: plowing

Site: 680 (11° 39.914' N, 1° 47.009' E)
Occupation: Tuali-A (H)
Area: 50 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with a yellish-reddish tinge and sparse laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: one flint flake (1 g)
Ceramics: Surface ceramic density from systematic collection: 0.28 sherds/m^2, 4.44 g/m^2
Sources of Disturbance: plowing

Site: 681 (11° 40.229' N, 1° 47.001' E)
Occupation: Siga (H)
Area: 75 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: Site is located south of a seasonal drainage (possibly the Chingjarwnchaldi)
Chipped Stone: Flint debitage (2 pieces, 6 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.88 sherds/m^2, 16.24 g/m^2

Site: 682 (11° 40.322' N, 1° 46.976' E)
Occupation: Tuali-A (H)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with a yellowish tinge and sparse laterite pebbles
Environment: Site is 50 m north of a seasonal drainage and has two baobab trees near-by.
Chipped Stone: Flint debitage (1 pieces, 8 g)
Ceramics: Surface ceramic density from systematic collection: 3.68 sherds/m^2, 41.28 g/m^2
Sources of Disturbance: plowing

Site: 683 (11° 40.343' N, 1° 47.070' E)
Occupation: Siga (H)
Area: 125 m^2
Estimated Height: 0.4 m
Deposit: Hard sandy light brown with laterite pebbles
Environment: Site has three baobabs on its edges.
Ceramics: Surface ceramic density from systematic collection: 1.68 sherds/m^2, 9.80 g/m^2

Site: 684 (11° 40.348' N, 1° 46.987' E)
Occupation: Tuali-A (H)
Area: 595 m^2
Estimated Height: 0.6 m
Deposit: Light brown with laterite pebbles (?)
Environment: Scrubby Balanites trees growing on the site
Chipped Stone: Flint debitage (2 pieces, 3 g)
Ceramics: Surface ceramic density from systematic collection: 0.36 sherds/m^2, 26.2 g/m^2
Sources of Disturbance: plowing around the edges
Comments: Plowed areas have most of the ceramics

Site: 685 (11° 40.472' N, 1° 47.001' E)
Occupation: Tuali-A (H)
Area: 115 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles (unplowed areas are hard)
Environment: Site is next to a baobab tree. No near-by surface water sources.
Chipped Stone: Flint debitage (2 pieces, 5 g)
Groundstone: present (may not be worked)
Ceramics: Surface ceramic density from systematic collection: 1.92 sherds/m^2, 27.12 g/m^2
Sources of Disturbance: plowing over half of the site

Site: 686 (11° 40.492' N, 1° 46.934' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: 12 g piece of unworked flint,
Groundstone: several sandstone basal stone (*li naali*) fragments including on 5 cm diameter and 5 thick with flat grinding surfaces. Locals suggest that it may be used for grinding tobacco.
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 19.12 g/m^2
Sources of Disturbance: plowing

Site: 687 (11° 39.668' N, 1° 46.642' E)
Occupation: Tuali_A (L)
Area: 300 m^2
Estimated Height: 0.2 m
Deposit: Brown with laterite pebbles
Environment: Site is on a 1.5-2 m ridge between the Koabu and the Pantabou. The site is bounded by three large baobab trees
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: Several large sandstone basal stone (*li naali*) fragments with flat and concave grinding surfaces.
Ceramics: Surface ceramic density from systematic collection: 1.08 sherds/m^2, 25.92 g/m^2
Sources of Disturbance: plowing
Comments: May be associated with site 688

Site: 688 (11° 39.666’ N, 1° 46.668’ E)
Occupation: Siga (L); Tuali-A (L)
Area: 95 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on a 1.5-2 m ridge between the Koabu and the Pantabou. It is just to the other side of one of the baobabs associated with site 687.
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 22.76 g/m^2
Sources of Disturbance: plowing

Site: 689 (11° 39.600’ N, 1° 46.729’ E)
Occupation: Tuali-A (H)
Area: 440 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on a 1.5-2 m ridge between the Koabu and the Pantabou, although here the ridge is closer to the latter rather than the former. There are several baobabs along this ridge.
Chipped Stone: 31 g piece of unworked flint, two flint flakes (37 g), flint debitage (4 pieces, 49 g), one formal tool with retouch collected,
Groundstone: basal stone (*li naali*) fragment. Small white sandstone slightly trigonal handstone (*u bindu*) with a thumb impression collected.
Ceramics: Surface ceramic density from systematic collection: 18.96 sherds/m^2, 186.56 g/m^2
Iron working: a piece of slag
Sources of Disturbance: plowing, 2 small borrow pits in the west of the site.

Site: 690 (11° 39.629’ N, 1° 46.544’ E)
Occupation: Siga (L)
Area: 115 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a 1.5-2 m ridge 75 m from the Pantabou (distance from the Koabu is difficult to determine).
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: sandstone pieces (may not be worked)
Ceramics: Surface ceramic density from systematic collection: 2.28 sherds/m^2, 41.04 g/m^2
Sources of Disturbance: plowing

Site: 691 (11° 39.504’ N, 1° 46.345’ E)
Occupation: not assigned
Area: 20 m^2
Estimated Height: 0.0 m
Deposit: Hard light brown with dense laterite pebbles
Environment: Site is in an erosional gully on a gently sloping bank of the Pantabou. There is a baobab and a tamarind near-by.
Ceramics: Surface ceramic density from systematic collection: 1.24 sherds/m^2, 7.44 g/m^2
Iron working: one piece of slag
Sources of Disturbance: erosion
Comments: Could be composed of eroded material from site 692

Site: 692 (11° 39.493’ N, 1° 46.367’ E)
Occupation: Siga (H)
Area: 210 m^2
Estimated Height: 0.4 m
Deposit: hard light brown with dense laterite pebbles
Environment: Site is slightly upslope of site 691 on the bank of the Pantabou.
Chipped Stone: present
Groundstone: Unworked piece of a black conglomerate collected
Ceramics: Includes some jar fragments from intact vessels (??). Surface ceramic density from systematic collection: 1.48 sherds/m^2, 11.36 g/m^2
Sources of Disturbance: erosion, termite mound

Site: 693 (11° 39.484’ N, 1° 46.338’ E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is located at the upper edge of the gently sloping bank of the Pantabou.
Chipped Stone: 3g multidirectional flint core, two flint flakes (g),
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 14.1g/m^2
Iron working: one piece of slag
Sources of Disturbance: plowing

Site: 694.1 (11° 39.495' N, 1° 46.292' E)
Occupation: not assigned
Area: 694.1- 260 m^2
Estimated Height: 0.4 m
Deposit: Light brown with very dense laterite pebbles.
Environment: The Pantabu is to the east, and a smaller seasonal drainage to the north.
Chipped Stone: present
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 5.16 g/m^2.
Sources of Disturbance: Plowing.
Comments: Part of a group of mounds at the edge of the plateau (694.1-694.3)

Site: 694 .2 (11° 39.495' N, 1° 46.292' E)
Occupation: Siga (H)
Area: 694.2- 510 m^2
Estimated Height: 0.4 m
Deposit: Brown with very dense laterite pebbles.
Environment: The Pantabu is to the east, and a smaller seasonal drainage to the north.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.32 sherds/m^2, 21.60 g/m^2
Sources of Disturbance: Plowing
Comments: Part of a group of mounds at the edge of the plateau (694.1-694.3)

Site: 694.3 (11° 39.495' N, 1° 46.292' E)
Occupation: Siga (H)
Area: 694.3- 175 m^2
Estimated Height: 0.5 m
Deposit: Brown with very dense laterite pebbles.
Environment: The Pantabu is to the east, and a smaller seasonal drainage to the north.
Chipped Stone: flint debitage (1 piece, 14 g)
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 12.12 g/m^2
Sources of Disturbance: Plowing.
Comments: Part of a group of mounds at the edge of the plateau (694.1-694.3)

Site: 695 (11° 39.458' N, 1° 46.317' E)
Occupation: not assigned
Area: 50 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with laterite pebbles
Environment: No near-by surface water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.2 sherds/m^2, 2.08 g/m^2
Sources of Disturbance: plowing

Site: 696.1 (11° 39.394' N, 1° 46.216' E)
Occupation: Siga (H)
Area: 696.1- 260 m^2
Estimated Height: 0.4 m
Deposit: Light brown with laterite pebbles.
Environment: Site is on a 2-2.5 m ridge on the south bank of a seasonal drainage. There is a scrubby Balanites
Chipped Stone: 28g piece of unworked flint, one flint flake (10 g)
Ceramics: Surface ceramic density from systematic collection: 2.48 sherds/m^2, 49.76 g/m^2
Sources of Disturbance: Plowing.
Comments: Part of group of two connected mounds (696.1-696.2). Site may be associated with site 697

Site: 696.2 (11° 39.394' N, 1° 46.216' E)
Occupation: Siga (H)
Area: 696.2- 510 m^2
Estimated Height: 0.8 m
Deposit: Light brown with dense pebbles.
Environment: Site is on a 2-2.5 m ridge on the south bank of a seasonal drainage. There is a baobab 30 m west of 696.2.
Chipped Stone: 11 g piece of unworked flint, 83 g piece of unworked flint with a smoothed convex surface, one flint flake (1 g), flint debitage (2 pieces, 2 g)
Groundstone: Trigonal white sandstone handstone (*u bindu*) collected.
Ceramics: Surface ceramic density from systematic collection: 6.36 sherds/m^2, 75.76 g/m^2
Sources of Disturbance: Plowing.
Comments: Part of group of two connected mounds (696.1-696.2). Site may be associated with site 697

Site: 697 (11° 39.309' N, 1° 46.206' E)
Occupation: Siga (H)
Area: 135 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with dense laterite pebbles
Environment: Site is just to the south of a baobab on the banks of a seasonal drainage.
Chipped Stone: flint debitage (1 piece, 2 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 4.48 sherds/m^2, 29.12 g/m^2
Sources of Disturbance: plowed on the edges
Comments: Site may be associated with site 696

Site: 698 (11° 39.103’ N, 1° 46.097’ E)
Occupation: Siga (H)
Area: 310 m^2
Estimated Height: 0.6 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is 50 m north of a seasonally inundated area, although modern wells near the site are comparatively deep for the region.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.44 sherds/m^2, 10.44 g/m^2
Sources of Disturbance: plowing

Site: 699.1 (11° 39.004’ N, 1° 46.120’ E)
Occupation: Tuali-A (H)
Area: 175 m^2
Estimated Height: 0.6 m
Deposit: Light brown with laterite pebbles.
Environment: Located to the west of inundated area.
Groundstone: present.
Ceramics: Surface ceramic density from systematic collection: 0.92 sherds/m^2, 11.52 g/m^2*Sources of Disturbance:* Plowed.
Comments: Part of a line of sites along the edge of an inundated zone (699.1-699.4).

Site: 699.2 (11° 39.004’ N, 1° 46.120’ E)
Occupation: not assigned
Area: 490 m^2
Estimated Height: 0.7 m
Deposit: Light brown with laterite pebbles.
Environment: Located to the west of inundated area.
Chipped Stone: 28 g and 39 g multidirectional flint cores
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.12 sherds/m^2, 54.0 g/m^2
Sources of Disturbance: Plowed.
Comments: Part of a line of sites along the edge of an inundated zone (699.1-699.4).

Site: 699.3 (11° 39.004’ N, 1° 46.120’ E)
Occupation: Siga (H)
Area: 705 m^2
Estimated Height: 0.9 m
Deposit: Light brown with laterite pebbles.
Environment: There is baobab. Located to the west of inundated area.
Chipped Stone: flint debitage (1 piece, 1 g)
Groundstone: small white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 0.20 sherds/m^2, 3.60 g/m^2
Sources of Disturbance: Plowed.
Comments: Part of a line of sites along the edge of an inundated zone (699.1-699.4).

Site: 699.4 (11° 39.004’ N, 1° 46.120’ E)
Occupation: Siga (L)
Area: 855 m^2
Estimated Height: 1.25 m
Deposit: Light brown with dense laterite pebbles.
Environment: Located to the west of inundated area.
Chipped Stone: flint debitage (1 piece 7 g)
Groundstone: white sandstone basal stone (*li naali*) fragment with a flat grinding surface
Ceramics: Surface ceramic density from systematic collection: 2.92 sherds/m^2, 29.88 g/m^2
Sources of Disturbance: Plowed.
Comments: Part of a line of sites along the edge of an inundated zone (699.1-699.4).

Site: 700 (11° 38.919’ N, 1° 46.141’ E)
Occupation: Siga (H)
Area: 380 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on the edge of an innundated zone with a baobab at the east end of the site. Modern wells near the site are comparatively deep for the region.
Chipped Stone: Flint debitage (1 piece, 1 g)
Ceramics: Surface ceramic density from systematic collection: 2.24 sherds/m^2, 20.12 g/m^2
Sources of Disturbance: plowing
Comments: Site may be part of the 699 chain.

Site: 701 (11° 38.914' N, 1° 46.117' E)
Occupation: Siga (H)
Area: 315 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is near the edge of the innundated zone. Modern wells near the site are comparatively deep for the region.
Chipped Stone: Flint debitage (1 piece, 14 g)
Groundstone: Fragment of a white sandstone basal stone (*li naali*) with a flat grinding surface and a fragment of a patellar handstone (*u bindu*) collected.
Ceramics: Surface ceramic density from systematic collection: 1.64 sherds/m^2, 37.56 g/m^2
Sources of Disturbance: plowing, erosional gully through the site

Site: 702 (11° 38.705' N, 1° 46.328' E)
Occupation: Siga (H)
Area: 390 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with dense pebbles
Environment: Shea butter tree near the site. Modern wells near the site are comparatively deep for the region.
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 3.92 sherds/m^2, 38.84 g/m^2
Sources of Disturbance: plowing

Site: 703 (11° 38.828' N, 1° 46.383' E)
Occupation: Siga (H)
Area: 380 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources. Modern wells near the site are comparatively deep for the region.
Chipped Stone: present
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.64 sherds/m^2, 86.08 g/m^2
Sources of Disturbance: plowing
Comments: Sites 703, 704, 705, 706 form a large diamond around a low, flat open area.

Site: 704 (11° 38.893' N, 1° 46.404' E)
Occupation: Siga (H)
Area: 490 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources. Modern wells near the site are comparatively deep for the region.
Chipped Stone: Flint debitage (1 piece, 7 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.16 sherds/m^2, 53.6 g/m^2
Sources of Disturbance: plowing over half of site
Comments: Sites 703, 704, 705, 706 form a large diamond around a low, flat open area.

Site: 705.1 (11° 38.851' N, 1° 46.308' E)
Occupation: Siga (H)
Area: 705.1- 1200 m^2
Estimated Height: 1.25 m
Deposit: dense pebbles
Environment: No near-by surface water sources.
Chipped Stone: two flint flakes (10 g), flint debitage (2 pieces, 5 g)
Groundstone: possible white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 4.96 sherds/m^2, 38.6 g/m^2*Sources of Disturbance:* plowing
Comments: Sites 703, 704, 705, 706 form a large diamond around a low, flat open area.

Site: 705.2 (11° 38.851' N, 1° 46.308' E)
Occupation: Tuali-A (H)
Area: 705.2- 225 m^2
Estimated Height: 0.4 m
Deposit: dense laterite pebbles.
Environment: No near-by surface water sources.
Chipped Stone: flint debitage (1 piece, 3 g), one formal tool with retouch collected
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.56 sherds/m^2, 31.92 g/m^2
Sources of Disturbance: Plowing.
Comments: Sites 703, 704, 705, 706 form a large diamond around a low, flat open area.

Site: 706 (11° 38.891' N, 1° 46.320' E)
Occupation: Siga (L)
Area: 490 m^2
Estimated Height: 0.7 m
Deposit: Sandy light brown with dense laterite pebbles.
Environment: No near-by surface water sources. Modern wells near the site are comparatively deep for the region.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.12 sherds/m^2, 9.52 g/m^2
Comments: Sites 703, 704, 705, 706 form a large diamond around a low, flat open area.

Site: 707 (11° 43.386' N, 1° 45.613' E)
Occupation: Siga (L); Tuali-A (H)
Area: 310 m^2
Estimated Height: 0.2 m
Deposit: Red with sparse laterite pebbles.
Environment: Site is located directly adjacent to the escarpment on slightly high ground between two erosional gullies. The escarpment at this point is 10-15 m high and pocked with several small caves
Chipped Stone: Flint debitage (3 pieces, 5 g); quartz debitage (2 pieces, 11 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 6.24 g/m^2
Sources of Disturbance: plowing
Comments: Site boundaries difficult to determine

Site: 708 (11° 43.308' N, 1° 45.572' E)
Occupation: Tuali-A (H)
Area: 360 m^2
Estimated Height: 0.2m
Deposit: Sandy light reddish-brown with sparse laterite pebbles. Frequent pieces of sandstone.
Environment: Site is less than 10 m from the escarpment on high ground with an erosional gully to the south. The escarpment is only ca. 10 m high at this point. There is a baobab 20 m from the site.
Chipped Stone: Flint debitage (2 pieces, 4 g); quartz debitage (1 piece, 1 g)
Ceramics: Surface ceramic density from systematic collection: 10.44 sherds/m^2, 134.2 g/m^2
Iron working: One vitrified tuyere fragment (6 g) in systematic collection
Sources of Disturbance: plowing

Site: 709 (11° 43.290' N, 1° 45.550' E)
Occupation: Tuali-A (H)
Area: 675 m^2
Estimated Height: 0.2 m
Deposit: Sandy red with sparse laterite pebbles and pieces of sandstone.
Environment: Site is 8 m from the escarpment on higher ground between erosional gullies.
Ceramics: Surface ceramic density from systematic collection: 1.2 sherds/m^2, 19.96 g/m^2
Sources of Disturbance: Plowing over half of the site
Comments: Unplowed areas are a hardpan.

Site: 710 (11° 43.223' N, 1° 45.557' E)
Occupation: Tuali-A (H)
Area: 380 m^2
Estimated Height: 0.3 m
Deposit: Sandy reddish brown with sparse laterite pebbles. Pieces of sandstone.
Environment: Site is ca. 40 m from the base of the escarpment and is near a baobab tree
Groundstone: Discoid red sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 7.4 sherds/m^2, 108.92 g/m^2
Iron working: piece of slag
Sources of Disturbance: plowing

Site: 711 (11° 43.164' N, 1° 45.514' E)
Occupation: not assigned
Area: 240 m^2
Estimated Height: 0.2 m
Deposit: Sandy light reddish brown with sparse laterite pebbles. Some sandstone.
Environment: Site is ca. 40 m from the base of the escarpment, and the site is located on higher ground near the edge of an erosional gully. There is a large baobab on the site.
Ceramics: Surface ceramic density from systematic collection: 2.0 sherds/m^2, 10.92 g/m^2
Iron working: some slag
Sources of Disturbance: plowing

Site: 712 (11° 42.999’ N, 1° 45.239’ E)
Occupation: not assigned
Area: 310 m^2
Estimated Height: 0.0 m
Deposit: Hard very sandy red with laterite pebbles
Environment: The site is located adjacent to the base of the escarpment at the mouth of a small canyon.
Chipped Stone: one flint flake (2g), flint debitage (4 pieces, 14 g), quartz debitage (1 piece, 10 g)
Ceramics: Surface ceramic density from systematic collection: 1.92 sherds/m^2, 6.8 g/m^2
Sources of Disturbance: erosion

Site: 713 (11° 43.052’ N, 1° 45.136’ E)
Occupation: Siga (L)
Area: 310 m^2
Estimated Height: 0.3 m
Deposit: Hard very sandy light brown with laterite pebbles and pieces of sandstone.
Environment: Site is located against the escarpment in a small canyon. It is on a sandy high bank that runs along the north side of the canyon (the main water channel and its floodplain run along the south side).
Chipped Stone: one flint flake (4 g), flint debitage (2 pieces, 13 g)
Ceramics: Surface ceramic density from systematic collection: 1.68 sherds/m^2, 10.52 g/m^2

Site: 714 (11° 43.101’ N, 1° 45.122’ E)
Occupation: Tuali-A (L)
Area: 310 m^2
Estimated Height: 0.0 m
Deposit: Very sandy light brown with sparse laterite pebbles and sandstone pieces
Environment: Site is located against the escarpment in a small canyon. It is on a sandy high bank that runs along the north side of the canyon (the main water channel and its floodplain run along the south side).
Ceramics: Surface ceramic density from systematic collection: 0.12 sherds/m^2, 5.6 g/m^2
Sources of Disturbance: plowing

Site: 715 (11° 43.145’ N, 1° 45.115’ E)
Occupation: Siga (L)
Area: 490 m^2
Estimated Height: 0.5 m
Deposit: Hard sandy light brown with dense laterite pebbles and sandstone pieces.
Environment: Site is located against the escarpment in a small canyon. It is on a sandy high bank that runs along the north side of the canyon (the main water channel and it’s floodplain run along the south side).
Groundstone: present: basal stone (*li naali*) with deeply depressed grinding basins.
Ceramics: Surface ceramic density from systematic collection: 1.6 sherds/m^2, 30.12 g/m^2
Comments: This site is notable for two 2 m diameter circles and one similarly sized oval made large blocks of sandstone. These features are virtually flush against the ground, and were likely foundations for either huts or granaries. No other features of this nature were recorded at archaeological sites and this type of foundation was not observed in currently occupied compounds.

Site: 716 (11° 43.102’ N, 1° 45.160’ E)
Occupation: Tuali-A (H)
Area: 160 m^2
Estimated Height: 0.1 m
Deposit: Hard very sandy light reddish brown with dense laterite pebbles and frequent sandsonte pieces
Environment: Site is located against the escarpment in a small canyon. It is on a sandy high bank that runs along the north side of the canyon (the main water channel and its floodplain run along the south side).
Chipped Stone: Flint debitage (1 piece, 4 g)
Ceramics: Surface ceramic density from systematic collection: 2.04 sherds/m^2, 16.68 g/m^2
Sources of Disturbance: termite mounds

Site: 717 (11° 42.828’ N, 1° 45.322’ E)
Occupation: Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Sandy light reddish brown with pieces of sandstone and no laterite pebbles
Environment: Site is adjacent to a baobab tree near the graded road.
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 9.92 g/m^2
Sources of Disturbance: plowing

Site: 718 (11° 42.945' N, 1° 45.492' E)
Occupation: Tuali-B (H)
Area: 50 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with no laterite pebbles
Environment: No near-by surface water sources.
Ceramics: Site ceramics are composed of a few broken vessels of recent origin. Surface ceramic density from systematic collection: 1.52 sherds/m^2, 87.48 g/m^2
Sources of Disturbance: plowing, site is adjacent to the center for handicapped youth.
Comments: This site is likely very recent.

Site: 719 (11° 42.963' N, 1° 45.506' E)
Occupation: Tuali-B (H)
Area: 115 m^2
Estimated Height: 0.3 m
Deposit: Sandy light reddish-brown with sparse laterite pebbles
Environment: Site is on a slight natural rise with no near-by surface water sources. There are several neem trees on the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.84 sherds/m^2, 48.72 g/m^2
Iron working: several pieces of slag
Sources of Disturbance: plowing, site is adjacent to the main road and next to a construction site.

Site: 720 (11° 39.556' N, 1° 46.967' E)
Occupation: Tuali-B (H)
Area: 30 m^2
Estimated Height: 0.0 m
Deposit: Very sandy light brown with no laterite pebbles
Environment: Site is less than 20 m from the Koabu, and is eroding from the banks.
Ceramics: Site could be the result of a single broken pot. Surface ceramic density from systematic collection: 0.48 sherds/m^2, 9.96 g/m^2
Sources of Disturbance: plowing, erosion

Site: 721 (11° 39.556' N, 1° 46.867' E)
Occupation: Siga (H)
Area: This site consisted of two borrow pits, one 20 x 17 m and one 12 x 12 m. Total dimensions were difficult to determine
Estimated Height: ca. 50 cm below the surface
Deposit: Light brown with laterite pebbles
Environment: Site is 20 m southwest of the Pantabou on a natural ridge.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 12.36 g/m^2
Iron working: There was a concentration of slag and tuyeres ca. 60 cm below the surface which was probably the remnants of a smelting installation. Three pieces of tuyere, two of them vitrified, were collected. Pieces of slag were strewn throughout the site.
Sources of Disturbance: borrow pits
Comments: The systematic and opportunistic surface collections were made in different borrow pits.

Site: 722 (11° 39.459' N, 1° 46.226' E)
Occupation: Siga (H)
Area: 90 m^2
Estimated Height: 0.0 m
Deposit: Sandy reddish brown with sparse laterite pebbles
Environment: This site is eroding out of the edge of a path. No near-by surface water sources.
Chipped Stone: Flint debitage (2 pieces, 21 g)
Ceramics: Surface ceramic density from systematic collection: 1.24 sherds/m^2, 18.04 g/m^2
Sources of Disturbance: erosion, plowing

Site: 723 (11° 39.512' N, 1° 46.585' E)
Occupation: LSA (L)
Area: 120 m^2
Estimated Height: 0.0 m
Deposit: Hard sandy light brown with a reddish tinge and laterite pebbles
Environment: This site is located in the floodplain of the Pantabou in a scrubby area with lots of Balanites trees.
Chipped Stone: predominant, three flint flakes (6 g), flint debitage (17 pieces, 22 g), quartz pieces (1 piece, 1 g)
Ceramics: Surface ceramic density from systematic collection: 0.16 sherds/m^2, 0.6 g/m^2
Sources of Disturbance: erosion

Site: 724 (11° 39.430' N, 1° 46.452' E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles
Environment: The site is ca. 20 m east of a seasonally innundated zone.
Chipped Stone: Flint debitage (1 piece, 2 g)
Ceramics: Surface ceramic density from systematic collection: 2.32 sherds/m^2, 32.88 g/m^2
Sources of Disturbance: plowing
Comments: There are a few pieces of possible burned earth on the surface of the site.

Site: 725 (11° 38.867' N, 1° 46.521' E)
Occupation: Siga (H)
Area: 2190 m^2
Estimated Height: 0.5 m
Deposit: Very sandy light brown with dense laterite pebbles
Environment: This site is ca. 50 m southwest of a seasonally innundated zone
Chipped Stone: one flint flake (4 g), flint debitage (1 piece, 34 g)
Groundstone: White sandstone basal stone (*li naali*) fragment with a flat grinding surface collected.
Ceramics: Surface ceramic density from systematic collection: 2.88 sherds/m^2, 23.36 g/m^2
Sources of Disturbance: plowing

Site: 726 (11° 38.805' N, 1° 46.551' E)
Occupation: Siga (H)
Area: 225 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is ca. 100 m from a seasonally innundated zone.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.72 sherds/m^2, 51.6 g/m^2
Sources of Disturbance: plowing

Site: 727 (11° 38.821' N, 1° 46.556' E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is ca. 100 m from a seasonally innundated zone.
Chipped Stone: one flint flake (2 g), flint debitage (2 pieces, 30 g)
Groundstone: White sandstone basal stone (*li naali*) fragment with two grinding surfaces collected
Ceramics: Surface ceramic density from systematic collection: 2.16 sherds/m^2, 18.8 g/m^2
Sources of Disturbance: plowing

Site: 728 (11° 39.246' N, 1° 46.798' E)
Occupation: Siga (L)
Area: 400 m^2
Estimated Height: 0.5 m
Deposit: Light brown with laterite pebbles
Environment: There are several neem trees on the site. No near-by surface water sources.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.72 sherds/m^2, 34.12 g/m^2
Iron working: A few large pieces of slag
Sources of Disturbance: several deep borrow pits, recently occupied mud brick structure on the site.

Site: 729 (11° 39.300' N, 1° 46.634' E)
Occupation: Siga (H)
Area: 65 m^2
Estimated Height: 0.3 m
Deposit: Sandy light yellowish brown with sparse laterite pebbles
Environment: No near-by surface water sources.
Ceramics: There is a smashed large jar on the site: a rim was included in the opportunistic collection. Surface ceramic density from systematic collection: 1.20 sherds/m^2, 13.96 g/m^2
Sources of Disturbance: plowing

Site: 730 (11° 39.415' N, 1° 46.656' E)
Occupation: Siga (H)
Area: 415 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a natural rise about 100 m northeast of the Pantabou.
Groundstone: present; roughly spherical green stone cobble with no worked surfaces collected
Ceramics: Surface ceramic density from systematic collection: 1.8 sherds/m^2, 49.76 g/m^2
Iron working: Significant quantities of slag, particularly on the upper part of the slope. Two vitrified tuyere fragments in the systematic collection. There was likely smelting at this site.
Sources of Disturbance: plowing

Site: 731 (11° 39.267' N, 1° 47.062' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is located on a 1.5-2.0 m ridge ca. 100 m from the Koabu and south of a seasonal lake.
Chipped Stone: one flint flake (3 g), quartz debitage (1 piece, 5 g)
Groundstone: present; small green stone hachet collected
Ceramics: Surface ceramic density from systematic collection: 4.48 sherds/m^2, 38.7 2g/m^2
Sources of Disturbance: plowing

Site: 732 (11° 39.380' N, 1° 46.998' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is 20-30 m from the Koabu.
Ceramics: Surface ceramic density from systematic collection: 2.2 sherds/m^2, 47.52 g/m^2
Sources of Disturbance: plowing

Site: 733 (11° 42.269' N, 1° 46.709' E)
Occupation: not assigned
Area: 350 m^2
Estimated Height: 0.5 m
Deposit: Very sandy light brown with laterite pebbles
Environment: The side is ca. 100 m south of a seasonal drainage.
Chipped Stone: one flint flake (8 g), flint debitage (1 piece, 2 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.04sherds/m^2, 26.84 g/m^2
Iron working: A few pieces of vitrified tuyere and several pieces of slag, some of which are fairly large. Two vitrified tuyere fragments in the systematic collection. Likely smelting at this site.
Sources of Disturbance: plowing

Site: 734 (11° 41.410' N, 1° 47.103' E)
Occupation: Siga (L)
Area: 415 m^2
Estimated Height: 0.5 m
Deposit: Sandy brown with dense laterite pebbles
Environment: There is a shea butter tree near the site. There are no near-by surface water sources.
Chipped Stone: Flint debitage (1 piece, 2 g), quartz debitage (1 piece, 3 g)
Groundstone: present; small lump of milky/rosy quartz with a pecked outer surface collected
Ceramics: Surface ceramic density from systematic collection: 1.32 sherds/m^2, 16.56 g/m^2
Sources of Disturbance: lightly plowed

Site: 735 (11° 41.426' N, 1° 47.119' E)
Occupation: Siga (L)
Area: 280 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: There are no near-by surface water sources.
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.72 sherds/m^2, 17.24 g/m^2
Sources of Disturbance: plowing, there is a recently occupied compound at the western edge of the site.

Site: 736 (11° 41.350’ N, 1° 47.065’ E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.4 m
Deposit: Hard very sandy light brown with dense laterite pebbles
Environment: Site is ca. 20 m north of a seasonally innundated zone
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 17.52 g/m^2
Iron working: a few pieces of slag

Site: 737 (11° 42.042’ N, 1° 46.539’ E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Fine sandy light brown with no laterite pebbles
Environment: Site is ca. 50 m north of a seasonally innundated zone
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 20.88 g/m^2
Sources of Disturbance: plowing

Site: 738 (11° 41.998’ N, 1° 46.542’ E)
Occupation: Tuali-B (H)
Area: 175 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with no laterite pebbles. The deposit shifts to clay only a few centimeters below the plow zone.
Environment: Tree on top of site.
Groundstone: present; grey sandstone cone with a flattened top: possibly a small handstone (*u bindu*) for grinding herbs or spices.
Ceramics: Surface ceramic density from systematic collection: 2.16 sherds/m^2, 25.4 g/m^2
Iron working: a piece of slag
Sources of Disturbance: plowing, borrow pit, adjacent to a currently occupied compound.

Site: 739 (11° 41.416’ N, 1° 46.658’ E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles.
Environment: The site is on the southwest edge of a seasonlly innundated zone. There is a baobab tree to the north of the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 43.84 g/m^2
Sources of Disturbance: plowing, termite mound at the center of the site

Site: 740 (11° 42.053’ N, 1° 46.358’ E)
Occupation: Siga (L); Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: The site is on a ridge between two seasonal drainages with several large locust bean trees.
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 10.4 g/m^2
Sources of Disturbance: plowing, borrow pit

Site: 741 (11° 41.983’ N, 1° 46.320’ E)
Occupation: Siga (H)
Area: 250 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge between two seasonal drainages. There is a young neem tree on the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.04 sherds/m^2, 12.52 g/m^2
Sources of Disturbance: plowing, borrow pits, modern trash (?)
Comments: The majority of artifacts are from the borrow pit. There is some glass of unknown origin on the site.

Site: 742 (11° 41.860' N, 1° 46.321' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: The site is on a ridge above a seasonal drainage.
Chipped Stone: Flint debitage (2 pieces, 7g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.08 sherds/m^2, 12.12g/m^2
Iron working: a few pieces of slag
Sources of Disturbance: plowing

Site: 743 (11° 41.595' N, 1° 46.388' E)
Occupation: Siga (H)
Area: 40 m^2
Estimated Height: 0.0 m
Deposit: Hard very sandy light brown with very sparse laterite pebbles.
Environment: The site is at the edge of a ridge on the shore of a seasonal pool. There are mango trees and two baobabs in a area of the site.
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 4.64 g/m^2
Sources of Disturbance: erosion

Site: 744 (11° 41.434' N, 1° 46.448' E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources.
Ceramics: Surface ceramic density from systematic collection: 1.60 sherds/m^2, 10.12 g/m^2
Sources of Disturbance: plowing

Site: 745 (11° 41.382' N, 1° 46.422' E)
Occupation: Siga (H)
Area: 415 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: The site is on a natural ridge north of a seasonal drainage and there is a baobab tree near-by.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.24 sherds/m^2, 37.72 g/m^2
Sources of Disturbance: plowing, borrow pit

Site: 746 (11° 41.272' N, 1° 46.331' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles.
Environment: The site is on a 1.5-2 m ridge ca. 75 m south of a seasonal drainage. There is a locust bean tree on the site.
Chipped Stone: one flint flake (1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.24 sherds/m^2, 37.72 g/m^2
Iron working: a piece of slag
Sources of Disturbance: plowing

Site: 747 (11° 41.380' N, 1° 46.302' E)
Occupation: Siga (L)
Area: 130 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles.
Environment: The site is on a 1.5-2 m ridge north of a seasonal drainage. There is a tamarind tree on the site.
Groundstone: present; possible white sandstone basal stone (*li naali*) fragment collected. It has two possible flat grinding surfaces, but neither is heavily abraded.
Ceramics: Surface ceramic density from systematic collection: 1.4 sherds/m^2, 30.40 g/m^2
Sources of Disturbance: plowing

Site: 748 (11° 41.808' N, 1° 46.165' E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles and a few pieces of laterite.
Environment: The site is on a 1.5 m ridge running north-south between two seasonal drainages. There is a neem tree near the densest part of the site.
Groundstone: Red sandstone trigonal handstone (*u bindu*) collected.
Ceramics: Surface ceramic density from systematic collection: 0.6 sherds/m^2, 57.88 g/m^2
Sources of Disturbance: plowing
Comments: There is an oddly shaped stone on the site (see picture).

Site: 749 (11° 41.833’ N, 1° 46.179’ E)
Occupation: Siga (L)
Area: 65 m^2
Estimated Height: 0.3 m
Deposit: Hard sandy light brown with laterite pebbles.
Environment: The site is on a 1.5 m ridge running north south between two seasonal drainages.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.16 sherds/m^2, 23.92 g/m^2
Sources of Disturbance: termite mound in the center of the site

Site: 750 (11° 41.996’ N, 1° 46.193’ E)
Occupation: not assigned
Area: 615 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: The site is on a natural ridge west of a seasonal drainage. There is a baobab at the south end of the site.
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.4 sherds/m^2, 6.12 g/m^2
Sources of Disturbance: plowing
Comments: Site is very diffuse over a large area.

Site: 751 (11° 42.101’ N, 1° 46.361’ E)
Occupation: Siga (H)
Area: 805 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: There is a seasonal drainage 50 m southeast of the site. Several locust bean trees near the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 33.64 g/m^2
Sources of Disturbance: plowing

Site: 752 (11° 42.205’ N, 1° 46.667’ E)
Occupation: Siga (H)
Area: 900 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Young fig tree on the site. No near-by surface water sources.
Chipped Stone: Flint debitage (1 piece, 9 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.6 sherds/m^2, 10.36 g/m^2
Iron working: a few pieces of slag; one piece of vitrified tuyere in the systematic collection
Sources of Disturbance: plowing, termite mound

Site: 753 (11° 40.152’ N, 1° 45.845’ E)
Occupation: Siga (H)
Area: 285 m^2
Estimated Height: 0.6 m
Deposit: Sandy brown with laterite pebbles.
Environment: Site is on a natural ridge in an area with several seasonal drainages.
Groundstone: present, possibly more frequent
Ceramics: Surface ceramic density from systematic collection: 3.08 sherds/m^2, 33.6 g/m^2
Iron working: occasional pieces of slag
Sources of Disturbance: plowing, borrow pits, adjacent to a currently occupied compound

Site: 754 (11° 39.799’ N, 1° 45.364’ E)
Occupation: Siga (H)
Area: 20 m^2
Estimated Height: 0.05 m
Deposit: Sandy light brown with a grayish tinge and sparse laterite pebbles.
Environment: Site is in a seasonally innundated area.
Chipped Stone: Flint debitage (1 piece, 1 g)
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 10.44 g/m^2
Sources of Disturbance: plowing
Comments: Site may be simply a pot smash except for the higher levels of laterite pebbles than the surrounding area.

Site: 755 (11° 39.569' N, 1° 45.105' E)
Occupation: Tuali-A (H)
Area: 350 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is in a seasonally innundated area and surrounded by scrubby brush
Chipped Stone: One formal flint tool, possibly notched, collected
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.56 sherds/m^2, 15.96 g/m^2
Iron working: a few pieces of slag
Sources of Disturbance: plowing

Site: 756 (11° 39.521' N, 1° 44.972' E)
Occupation: Siga (H)
Area: 910 m^2
Estimated Height: 1.25 m
Deposit: Sandy brown with reddish tinge and dense laterite pebbles.
Environment: Site is on a natural laterite outcrop with a seasonally innundated area to the east. There is a *Sclerocarya birrea* tree on the site.
Chipped Stone:
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.8 sherds/m^2, 13.6 g/m^2
Iron working: a few pieces of slag
Sources of Disturbance: Site is along a primary road
Comments: It is difficult to determine how much of the height of this site is cultural deposit: it may be significantly less than listed.

Site: 757 (11° 39.473' N, 1° 44.972' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.3 m
Deposit: Sandy brown with a reddish tinge with laterite pebbles.
Environment: No near-by surface water sources.
Chipped Stone: Flint debitage (1 piece, 3 g)
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 6.92 g/m^2
Sources of Disturbance: This site has been heavily impacted by the road grader, and a large portion has been completely destroyed.

Site: 758 (11° 39.426' N, 1° 45.065' E)
Occupation: Siga (L)
Area: 95 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 7.16 g/m^2
Sources of Disturbance: plowing

Site: 759 (11° 39.199' N, 1° 45.421' E)
Occupation: Siga (L); Tuali-A (L)
Area: 140 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with a reddish tinge and laterite pebbles
Environment: Site is in a seasonally innundated area.
Ceramics: There is a small inset pot eroding from the site which seems to contain human remains (probably infant). The pot was left undisturbed, but it appears to be undecorated, with 1.0 cm walls and quartz temper. Surface ceramic density from systematic collection: 1.0 sherds/m^2, 7.48 g/m^2
Iron working: A single small piece of slag
Sources of Disturbance: This site has been heavily impacted by the road grader, and a large portion has been completely destroyed.

Site: 760 (11° 39.220' N, 1° 45.465' E)
Occupation: Tuali-A (H)
Area: 240 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: The site is on the southern edge of a seasonally innundated zone.
Chipped Stone: 12g piece of unworked flint, one flint flake (1 g), flint debitage (2 pieces, 10 g)
Groundstone: a few large pieces of groundstone
Ceramics: Surface ceramic density from systematic collection: 2.32 sherds/m^2, 14.8 g/m^2
Sources of Disturbance: plowing in the south

Site: 761 (11° 39.214’ N, 1° 45.498’ E)
Occupation: Tuali-A (L)
Area: 95 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with laterite pebbles
Environment: There is a seasonally innundated zone to the north.
Groundstone: present, a few pieces
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 4.80 g/m^2
Sources of Disturbance: plowing

Site: 762 (11° 39.247’ N, 1° 45.548’ E)
Occupation: Siga (L); Tuali-B (L)
Area: 175 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with a yellowish tinge and laterite pebbles.
Environment: No near-by surface water sources.
Groundstone: present, a few large pieces
Ceramics: Surface ceramic density from systematic collection: 1.72 sherds/m^2, 17.8 g/m^2
Sources of Disturbance: plowing

Site: 763 (11° 39.203’ N, 1° 45.588’ E)
Occupation: Tuali-B (H)
Area: 200 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is 50 m southeast of a seasonally innundated zone.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.12 sherds/m^2, 27.72 g/m^2
Sources of Disturbance: plowing, borrow pit, site is adjacent to a currently occupied compound.

Site: 764 (11° 39.146’ N, 1° 45.613’ E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is ca. 100 m south of a seasonally innundated zone. There is a shea butter tree on the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 6.64 g/m^2
Iron working: a few isolated pieces of slag
Sources of Disturbance: plowing
Comments: Some possible preserved mud brick.

Site: 765 (11° 39.139’ N, 1° 45.695’ E)
Occupation: Siga (L); Tuali-B (L)
Area: 215 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources. There is a row of neem trees near the site (possibly a modern windbreak)
Chipped Stone: Flint debitage (1 piece, 6 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 4.52 sherds/m^2, 36.44 g/m^2
Iron working: one piece of slag
Sources of Disturbance: plowing, borrow pits covering most of the site

Site: 766 (11° 39.075’ N, 1° 45.820’ E)
Occupation: Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles.
Environment: No near-by surface water source. Shea butter tree near the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 15.28 g/m^2
Sources of Disturbance: plowing

Site: 767 (11° 39.070’ N, 1° 45.896’ E)
Occupation: Tuali-A (H)
Area: 200 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is 40 m from a seasonally innundated zone. There is a shea butter tree on the site.
Groundstone: present; Small white sandstone basal stone (*li naali*) fragment with a flat grinding surface
Ceramics: Surface ceramic density from systematic collection: 3.88 sherds/m^2, 27.48 g/m^2
Sources of Disturbance: plowing

Site: 768 (11° 38.982' N, 1° 46.013' E)
Occupation: Siga (H)
Area: 910 m^2
Estimated Height: 1.25 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources
Groundstone: present; small trigonal white sandstone handstone (*u bindu*) and small white sandstone basal stone (*li naali*) fragment collected.
Ceramics: Surface ceramic density from systematic collection: 3.08 sherds/m^2, 26.44 g/m^2
Sources of Disturbance: plowing, guinea fowl coop on the site
Comments: This site is part of a ground of sites extending to the south that were recorded earlier in the survey.

Site: 769 (11° 39.165' N, 1° 45.820' E)
Occupation: Siga (H)
Area: 95 m^2
Estimated Height: 0.2 m
Deposit: Sandy brown with sparse laterite pebbles
Environment: The site is on a slight natural ridge and has a fig tree on it. There is no near-by surface water source.
Chipped Stone: 16 g piece of unworked flint, one flint flake (2 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 3.24 sherds/m^2, 41.0 g/m^2
Iron working: slag
Sources of Disturbance: plowing

Site: 770 (11° 39.165' N, 1° 45.820' E)
Occupation: Tuali-B (H)
Area: 500 m^2
Estimated Height: 0.0 m
Deposit: Hard sandy brown with dense laterite pebbles
Environment: Site is along the top of a ridge with laterite outcrops near a seasonally innundated zone.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 4.88 g/m^2
Sources of Disturbance: plowing

Site: 771 (11° 39.531' N, 1° 45.172' E)
Occupation: Tuali-A (H)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Light brown with sparse laterite pebbles and an ashy central area.
Environment: A shea butter tree is outside the entrance of the site.
Chipped Stone: one flint flake (5 g)
Ceramics: no systematic surface collection
Sources of Disturbance: plowing
Comments: Ring compound with an east-southeast facing entrance. The number of structures is difficult to determine, but there are probably 6 or 7.

Site: 772.1 (11° 40.114' N, 1° 46.143' E)
Occupation: Siga (H)
Area: 70 m^2
Estimated Height: 0.35 m
Deposit: Light brown with laterite pebbles.
Environment: Site is located on a ridge only ca. 50 m from the Koabu.
Ceramics: There are several almost complete vessels that had been recently unearthed by locals manufacturing mud bricks. No systematic surface collection.
Iron working: Several large pieces of slag
Sources of Disturbance: Plowed and borrow pits.
Comments: Ceramics from 35 cm deep. Collections from 772.1 and 772.2 were made from borrow pits 30 m apart

Site: 772.2 (11° 40.114' N, 1° 46.143' E)
Occupation: Siga (H)
Area: 215 m^2
Estimated Height: 0.35 m
Deposit: Light brown with laterite pebbles.
Environment: Site is located on a ridge only ca. 50 m from the Koabu.
Ceramics: There are several almost complete vessels that had been recently unearthed by locals manufacturing mud bricks. No systematic surface collection.
Sources of Disturbance: Plowed and borrow pits.
Comments: Ceramics from 35 cm deep. Collections from 772.1 and 772.2 were made from borrow pits 30 m apart

Site: 773 (11° 39.994' N, 1° 46.070' E)
Occupation: Siga (H)
Area: 225 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles.
Environment: The site is 100 m southeast of the Kwofoni on a natural ridge.
Groundstone: present
Ceramics: Systematic collection taken from the plowed area away from the borrow pits. Surface ceramic density from systematic collection: 0.48 sherds/m^2, 9.80 g/m^2
Iron working: Very large pieces of slag from the borrow pits and smaller pieces on the surface.
Sources of Disturbance: plowing, borrow pits

Site: 774 (11° 39.543' N, 1° 45.605' E)
Occupation: Siga (H)
Area: 550 m^2
Estimated Height: 1.75 m
Deposit: Light brown with laterite pebbles: difficult to characterize because the site is overgrown with grass. A few pieces of sandstone on the surface.
Environment: The site is on a natural ridge overlooking a seasonally innundated zone to the south.
Ceramics: Whole pot eroding from the site: 23 cm diamater with 1.5 cm thick walls; tempered with grog; no visible decoration or preserved rim. Surface ceramic density from systematic collection: 4.32 sherds/m^2, 61.32 g/m^2

Site: 775 (11° 39.523' N, 1° 45.570' E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 0.3 m
Deposit: Sandy brown with dense laterite pebbles
Environment: The site is on a natural ridge overlooking a seasonally innundated zone to the south.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.52 sherds/m^2, 22.08 g/m^2
Sources of Disturbance: plowing

Site: 776 (11° 39.470' N, 1° 45.562' E)
Occupation: Siga (H)
Area: 315 m^2
Estimated Height: 1.25 m
Deposit: Light brown with laterite pebbles: site is overgrown with grass obscuring the deposit.
Environment: The site is on a natural ridge overlooking a seasonally innundated zone to the south. Several small baobabs on the site.
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 3.68 g/m^2
Sources of Disturbance: borrow pits, currently occupied compound adjacent to the site.

Site: 777 (11° 39.677' N, 1° 45.874' E)
Occupation: Ring (H)
Area: 490 m^2
Estimated Height: 0.5 m
Deposit: Light brown with sparse laterite pebbles, ashy central area.
Environment: No near-by surface water sources.
Groundstone: present
Ceramics: None observed and no collection made
Sources of Disturbance: plowing
Comments: Ring compound with south facing entrance. Compound has ca. 5 structures and the wooden base of a storage structure to the northwest of the site.

Site: 778 (11° 39.639' N, 1° 46.064' E)
Occupation: Siga (H)
Area: 290 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is ca. 75 m north of a seasonal drainage.
Chipped Stone: one flint flake (18 g)
Groundstone: present; unworked piece of white sandstone collected
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 7.92 g/m^2
Sources of Disturbance: plowing, borrow pits, recently occupied compound on the site and trash modern trash mixed with the prehistoric material.

Site: 779 (11° 39.945’ N, 1° 46.136’ E)
Occupation: Siga (L)
Area: 225 m^2
Estimated Height: 0.5 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is under a baobab
Groundstone: present in high quantities, including a complete basal stone (*li naali*) just below the surface. Trigonal white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 17.92 g/m^2
Sources of Disturbance: plowing, borrow pits, adjacent currently occupied compound

Site: 780 (11° 39.549’ N, 1° 46.196’ E)
Occupation: Siga (H)
Area: 1500 m^2
Estimated Height: 1.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: On ridge above minor drainage leading to Koabu.
Chipped Stone: numerous flint flakes recovered from excavation,
Groundstone: Several small basal stone (*li naali*) fragments recovered from excavation
Ceramics: Surface ceramic density from systematic collection: 2.4 sherds/m^2, 32.68 g/m^2
Iron working: Burial with 24 iron bracelets recovered by local resident while digging a borrow pit for mud brick. Several donated to the project.
Sources of Disturbance: Borrow pits, adjacent currently occupied compound
Comments: Site was selected for excavation: more information can be found in Chapter 6 and Appendix B.

Site: 781 (11° 39.780’ N, 1° 46.341’ E)
Occupation: not assigned
Area: 120 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles.
Environment: Small baobab near the site.
Chipped Stone: Flint debitage (1 piece, 10 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.08 sherds/m^2, 42.44 g/m^2
Iron working: a few pieces of slag
Sources of Disturbance: plowing, borrow pit, currently occupied compound adjacent to the site

Site: 782 (11° 40.016’ N, 1° 46.191’ E)
Occupation: Siga (L)
Area: 375 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is in an area with multiple seasonal drainages near-by
Groundstone: present
Ceramics: several very large pieces (near a complete pot find?). Surface ceramic density from systematic collection: 2.0 sherds/m^2, 251.92 g/m^2
Iron working: a few pieces of slag
Sources of Disturbance: plowing

Site: 783 (11° 40.091’ N, 1° 46.249’ E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.25 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on a high bank 50 m from the Koabu
Chipped Stone: 30 g piece of unworked flint,
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 17.6 g/m^2
Sources of Disturbance: plowing

Site: 784 (11° 41.743’ N, 1° 46.036’ E)
Occupation: Siga (L)
Area: 240 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on a 1.5-2 m natural ridge amidst several seasonal drainages
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 6.2 g/m^2
Iron working: occasional pieces of slag
Sources of Disturbance: plowing
Comments: Site is dispersed along the ridgetop, and it is difficult to determine where the site was originally focused.

Site: 785 (11° 41.746' N, 1° 46.153' E)
Occupation: not assigned
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with a yellow-reddish tinge and laterite pebbles
Environment: Site is on a 1.5 m ridge amidst several seasonal drainages.
Chipped Stone: Flint debitage (1 piece, 1 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.2 sherds/m^2, 50.56 g/m^2
Sources of Disturbance: plowing

Site: 786 (11° 41.710' N, 1° 46.152' E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a 1.5 m ridge amidst several seasonal drainages.
Chipped Stone: Flint debitage (2 pieces, 8 g)
Groundstone: present including several large pieces; Broken fragment of a white sandstone elongated cylindrical handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 13.8 g/m^2
Sources of Disturbance: plowing

Site: 787 (11° 41.419' N, 1° 46.169' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a 1.0 m ridge with a seasonal drainage to the east
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 48.24 g/m^2
Sources of Disturbance: borrow pit

Site: 788 (11° 41.291' N, 1° 46.243' E)
Occupation: Siga (H)
Area: 85 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on the south bank of a seasonal drainage
Chipped Stone: Flint debitage (1 piece, 11 g)
Groundstone: present; patellar white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 1.76 sherds/m^2, 14.04 g/m^2
Sources of Disturbance: plowing over half of the site

Site: 789 (11° 41.234' N, 1° 46.219' E)
Occupation: Tuali-A (H)
Area: 115 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles.
Environment: Site is southeast of a seasonal drainage
Chipped Stone: Flint debitage (1 piece, 7 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.32 sherds/m^2, 13.76 g/m^2
Sources of Disturbance: plowing

Site: 790 (11° 41.092' N, 1° 46.221' E)
Occupation: Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Light brown with sparse laterite pebbles
Environment: Site is east of a seasonal drainage
Groundstone: Several large basal stone (*li naali*) fragments
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 13.92 g/m^2
Sources of Disturbance: plowing

Site: 791 (11° 41.028' N, 1° 46.221' E)
Occupation: Siga (L); Tuali-A (L)
Area: 65 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is east of a large seasonal drainage. There is a baobab tree on the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 17.84 g/m^2
Sources of Disturbance: plowing

Site: 792 (11° 41.010' N, 1° 46.226' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.25 m
Deposit: Fine brown with a yellowish tinge and laterite pebbles
Environment: There are seasonal drainages to the south and west of the site
Chipped Stone: 16 g piece of unworked flint
Groundstone: present: several large pieces
Ceramics: Surface ceramic density from systematic collection: 3.08 sherds/m^2, 49.12 g/m^2
Sources of Disturbance: plowing, termite mound

Site: 793 (11° 41.015' N, 1° 46.283' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Fine brown with a yellowish tinge, dense laterite pebbles and a few pieces of sandstone
Environment: Site is just north of a small seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.32 sherds/m^2, 45.56 g/m^2
Sources of Disturbance: plowing

Site: 794 (11° 41.040' N, 1° 46.309' E)
Occupation: Tuali-A (L)
Area: 275 m^2
Estimated Height: 0.2 m
Deposit: Sandy brown with laterite pebbles
Environment: Site is on a natural ridge on the north bank of a seasonal drainage
Chipped Stone: Flint debitage (4 pieces, 11 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 10.76 sherds/m^2, 87.92 g/m^2
Sources of Disturbance: plowing, granary currently in use with active threshing activity on the site

Site: 795 (11° 40.967' N, 1° 46.334' E)
Occupation: Siga (L); Tuali-A (L)
Area: 855 m^2
Estimated Height: 0.2 m
Deposit: Sandy brown with dense laterite pebbles
Environment: Site is on the high south bank of a seasonal drainage.
Chipped Stone: 25g unidirectional flint core, one flint flake (7 g), flint debitage (1 piece, 12 g)
Groundstone: present; possible white sandstone fragment collected
Ceramics: Surface ceramic density from systematic collection: 4.64 sherds/m^2, 59.96g/m^2
Iron working: a few pieces of slag: one 87g piece of slag in systematic collection
Sources of Disturbance: plowing, there is a recently occupied compound on the southeastern part of the site.

Site: 796 (11° 41.386' N, 1° 46.038' E)
Occupation: Siga (H)
Area: 225 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site has seasonal drainages to the south and west with neem trees growing on the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 41.8 g/m^2
Sources of Disturbance: plowing

Site: 797 (11° 41.355' N, 1° 46.000' E)
Occupation: not assigned
Area: 145 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on a natural ridge 1 m above a seasonal drainage. There are neem trees on the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.36 sherds/m^2, 3.6 g/m^2
Sources of Disturbance: plowing, currently occupied compound adjacent to the site.

Site: 798 (11° 41.401' N, 1° 45.990' E)
Occupation: Siga (L)
Area: 215 m^2
Estimated Height: 0.5 m
Deposit: Light brown with sparse laterite pebbles
Environment: Site is on a natural ridge with a very large, old baobab tree and a large tamarind on the site.
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 16.2 g/m^2
Sources of Disturbance: plowing, borrow pit

Site: 799 (11° 41.820' N, 1° 45.983' E)
Occupation: Tuali-A (H)
Area: 40 m^2
Estimated Height: 0.0 m
Deposit: Very sandy light brown with sparse laterite pebbles.
Environment: Site is 100 m west of a seasonal drainage
Chipped Stone: Flint debitage (4 pieces, 17 g)
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.2 sherds/m^2, 23.44 g/m^2
Iron working: a few pieces of slag
Sources of Disturbance: plowing, eroding from a bike path

Site: 800 (11° 41.927' N, 1° 45.978' E)
Occupation: Tuali-A (H)
Area: 175 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with sparse laterite pebbles.
Environment: Site is on a seasonal drainage to the northeast and a Balanites tree on the site
Chipped Stone: 32 g piece of unworked flint; one formal tool, possibly notched, recovered.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 9.12 g/m^2
Iron working: two largish pieces of slag
Sources of Disturbance: plowing

Site: 801 (11° 42.090' N, 1° 45.943' E)
Occupation: Siga (H)
Area: 140 m^2
Estimated Height: 0.15 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is located on a 1.25 m natural rise with two drainages coming together to the south of the site.
Groundstone: lots of groundstone
Ceramics: Surface ceramic density from systematic collection: 2.72 sherds/m^2, 30.40 g/m^2
Sources of Disturbance: plowing

Site: 802 (11° 41.293' N, 1° 45.865' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles
Environment: The site is on a natural ridge above an east-west running drainage. There is a locust bean tree on the site.
Chipped Stone: flint debitage (1 piece)
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 9.8 g/m^2
Sources of Disturbance: plowing

Site: 803 (11° 41.278' N, 1° 45.900' E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: The site is on a natural ridge 40-50 m from an east-west running seasonal drainage. There are some locust bean trees in the area.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 19.48 g/m^2
Sources of Disturbance: plowing

Site 804: (11° 41.218’ N, 1° 45.930’ E)
Occupation: Tuali-A (L)
Area: 1135 m^2
Estimated Height: 1.0 m
Deposit: Very sandy light brown with laterite pebbles
Environment: The site is on a natural ridge 40-50 m from an east-west running seasonal drainage. There are locust bean and ficus trees in the area.
Groundstone: large basal stone (*li naali*) fragments, white sandstone handstone (*u bindu*) collected
Ceramics: large jar fragments on the surface; surface ceramic density from systematic collection: 1.72 sherds/m^2, 30.76 g/m^2
Sources of Disturbance: plowing

Site 805: (11° 41.154’ N, 1° 45.924’ E)
Occupation: Tuali-A (H)
Area: 510 m^2
Estimated Height: 1.0 m
Deposit: Very sandy light brown with laterite pebbles
Environment: The site is on a natural ridge 20-30 m from a north-south running seasonal drainage.
Groundstone: basal stone (*li naali*) fragment
Ceramics: Surface ceramic density from systematic collection: 0.92 sherds/m^2, 16.4 g/m^2
Sources of Disturbance: Modern trash, recently abandoned compound, three borrow pits
Comments: Site boundaries are not well defined

Site 806: (11° 41.080’ N, 1° 45.915’ E)
Occupation: Siga (H)
Area: 120 m^2
Estimated Height: 0.5 m
Deposit: Very sandy light brown with laterite pebbles
Environment: The site is at the end of a natural ridge 20-30 m from a north-south running seasonal drainage. Locust bean tree on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.44 sherds/m^2, 11.8 g/m^2
Sources of Disturbance: plowing

Site: 807 (11° 40.578’ N, 1° 45.941’ E)
Occupation: Siga (H)
Area: 300 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on the sloping bank of the Koabu, ca. 50 m from the channel. Shea butter trees on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.4 sherds/m^2, 18.0 g/m^2
Sources of Disturbance: plowing

Site: 808 (11° 41.135’ N, 1° 45.753’ E)
Occupation: Siga (L)
Area: 80 m^2
Estimated Height: 0.25 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Locust bean tree on site. No apparent near-by water
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 23.72 g/m^2
Sources of Disturbance: plowing
Comments: Possibly a ring site

Site: 809 (11° 41.298’ N, 1° 45.714’ E)
Occupation: Siga (L)
Area: 225 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with medium-sparse laterite pebbles
Environment: Site is on a natural rise 150-200 m from the Bwangwana channel. Balanites tree on site.
Chipped Stone: flint debitage,
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 18.92 g/m^2
Sources of Disturbance: plowing

Site: 810 (11° 41.564' N, 1° 45.637' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.5 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Two locust bean trees near site
Groundstone: present
Ceramics: large cannery fragments; Surface ceramic density from systematic collection: 1.16 sherds/m^2, 132.48 g/m^2
Sources of Disturbance: plowing

Site: 811 (11° 42.085' N, 1° 45.320' E)
Occupation: Tuali-A (H)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: In a flat plain
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 20.88 g/m^2
Sources of Disturbance: plowing
Comments: probably recent

Site: 812 (11° 41.953' N, 1° 44.701' E)
Occupation: Tuali-A (L); Tuali-B (L)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown
Environment: No trees or notable water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.08 sherds/m^2, 54.88 g/m^2
Iron working: slag
Sources of Disturbance: plowing, near the main road

Site: 813 (11° 41.856' N, 1° 45.029' E)
Occupation: Tuali-A (L)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with medium-low laterite pebbles
Environment: No trees or notable water sources
Chipped Stone: gray flint flake, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.24 sherds/m^2, 41.2 g/m^2
Iron working: slag
Sources of Disturbance: plowing
Comments: probably recent

Site: 814 (11° 41.811' N, 1° 44.990' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with medium-low laterite pebbles
Environment: No notable water sources. Shea butter tree on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.2 sherds/m^2, 33.64 g/m^2
Sources of Disturbance: plowing

Site: 815 (11° 41.852' N, 1° 45.094' E)
Occupation: Siga (H)
Area: 190 m^2
Estimated Height: 0.4 m
Deposit: Sandy light gray-brown with sparse laterite pebbles
Environment: Seasonal drainage to the south
Chipped Stone: 8 g piece of unworked quartz
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.56 sherds/m^2, 17.48 g/m^2
Sources of Disturbance: plowing

Site: 816 (11° 41.866' N, 1° 45.135' E)
Occupation: Tuali-B (H)
Area: 250 m^2
Estimated Height: 0.7 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a narrow ridge leading to a seasonal drainage 100 m to the north
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.24 sherds/m^2, 41.2 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 817 (11° 41.381' N, 1° 45.514' E)
Occupation: not assigned
Area: 225 m^2
Estimated Height: 0.5 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Seasonally innundated area ca. 100 m to the southwest.
Chipped Stone: gray flint core
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 11.08 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing
Comments: Similar sandy mound 100 m to the northwest of the site. This mound had no visible cultural remains.

Site: 818 (11° 41.347' N, 1° 45.514' E)
Occupation:
Area: 225 m^2
Estimated Height: 0.3 m
Deposit: Sandy brown with sparse laterite pebbles
Environment: No notable water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.36 sherds/m^2, 6.92 g/m^2
Iron working: slag
Sources of Disturbance: plowing

Site: 819 (11° 41.336' N, 1° 45.570' E)
Occupation: Tuali-B (H)
Area: 315 m^2
Estimated Height: 0.6 m
Deposit: Sandy brown with sparse laterite pebbles
Environment: Near seasonal drainage. Palm tree on site
Chipped Stone: flint debitage
Groundstone: present, red sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 13.96 g/m^2
Sources of Disturbance: plowing

Site: 820 (11° 41.368' N, 1° 45.599' E)
Occupation: Ring (L)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Near seasonal drainage.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.28 sherds/m^2, 7.44 g/m^2
Sources of Disturbance: plowing

Site: 821 (11° 41.320' N, 1° 45.606' E)
Occupation: Tuali-A (H)
Area: 115 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No notable water sources. Shea butter tree on site
Chipped Stone: 151 g piece unworked quartz
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 1.96 g/m^2
Sources of Disturbance: plowing

Site: 822 (11° 40.707' N, 1° 45.776' E)
Occupation: Tuali-A (H)
Area: 255 m^2
Estimated Height: 0.3 m
Deposit: Sandy-clay red with medium-sparse laterite pebbles
Environment: On the sloping back of a seasonal drainage
Chipped Stone: three gray flint flakes, flint debitage, 30 g piece unworked flint
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 18.48 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 823 (11° 40.639' N, 1° 45.846' E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 0.3 m
Deposit: Sandy light reddish-brown with pebbles
Environment: The site is on a 1.5-2.0 m ridge along the Koabu. Shea butter tree on site.
Chipped Stone: present in high quantities, two gray flint flakes, flint debitage, 11 g piece unworked flint
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.56 sherds/m^2, 30.4 g/m^2
Sources of Disturbance: plowing

Site: 824 (11° 40.705' N, 1° 45.690' E)
Occupation: Siga (H)
Area: 225 m^2
Estimated Height: 0.3 m
Deposit: Sandy light reddish-brown with dense laterite pebbles.
Environment: The site is on a 1.5-2.0 m ridge along the Koabu
Chipped Stone: present, four gray flint flakes, flint and quartz debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 36.92 g/m^2
Sources of Disturbance: plowing
Comments: Deposits are redder in areas with higher artifact densities.

Site: 825 (11° 40.733' N, 1° 45.640' E)
Occupation: Siga (H)
Area: 315 m^2
Estimated Height: 0.3 m
Deposit: Sandy light reddish brown with laterite pebbles
Environment: The site is on a 1.5-2.0 m ridge along the Koabu. The Koabu curves sharply here and passes just to the northwest of the site.
Chipped Stone: present, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.0 sherds/m^2, 26.76 g/m^2
Sources of Disturbance: plowing
Comments: Deposits are redder in areas with higher artifact densities.

Site: 826 (11° 40.876' N, 1° 45.581' E)
Occupation: Siga (H)
Area: ca. 315 m^2
Estimated Height: 0.3 m
Deposit: Sandy light reddish brown with sparse laterite pebbles.
Chipped Stone: present, flint debitage
Groundstone: present, including a flat sandstone basal stone (*li naali*)s
Ceramics: Surface ceramic density from systematic collection: 0.44 sherds/m^2, 34.96 g/m^2
Sources of Disturbance: plowing
Comments: Site boundaries are difficult to determine: laterite pebble density and artifact density seem to correspond, but both gradually diffuse.

Site: 827 (11° 41.710' N, 1° 45.056' E)
Occupation: Siga (L)
Area: 425 m^2
Estimated Height: 0.6 m
Deposit: Sandy brown with laterite pebbles
Environment: Site is on the banks of a broad, flat, shallow seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.12 sherds/m^2, 24.88 g/m^2
Sources of Disturbance: plowing

Site: 828 (11° 41.477' N, 1° 45.194' E)
Occupation: Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is on a 1.0 m ridge along a seasonal drainage. There is a neem tree on the site
Chipped Stone: flint debitage
Groundstone: present, handstone (*u bindu*) fragment collected
Ceramics: Surface ceramic density from systematic collection: 0.80 sherds/m^2, 17.88 g/m^2
Sources of Disturbance: plowing
Comments: Low density artifacts are scattered in the area between sites 828 and 829.

Site: 829 (11° 41.438' N, 1° 45.199' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is on a 1.0 m ridge along a seasonal drainage. There is a shea butter tree on site.
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 55.36 g/m^2
Sources of Disturbance: plowing
Comments: Low density artifacts are scattered in the area between sites 828 and 829.

Site: 830 (11° 41.270' N, 1° 45.317' E)
Occupation: Siga (H)
Area: 225 m^2
Estimated Height: 0.3 m
Deposit: Sandy brown with laterite pebbles
Environment: Site is on a 1.5-2.0 m ridge overlooking a wide, shallow seasonal drainage. Several small locust bean trees on site.
Chipped Stone: 7 g piece unworked flint
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.68 sherds/m^2, 131.88 g/m^2
Sources of Disturbance: plowing

Site: 831 (11° 41.045' N, 1° 45.441' E)
Occupation: Siga (H)
Area: 95 m^2
Estimated Height: 0.1 m
Deposit: Sandy light reddish brown with medium-sparse laterite pebbles
Environment: Site is on the slope of a ridge along the Koabu and is ca. 100 m from the main channel. Numerous *Piliostigma* sp. shrubs on site.
Groundstone: present, flint and quartz debitage
Ceramics: Surface ceramic density from systematic collection: 3.44 sherds/m^2, 58.68 g/m^2
Sources of Disturbance: plowing

Site: 832 (11° 41.245' N, 1° 45.172' E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles.
Environment: Site is on the backslope of a ridge along the Koabu. There is a smaller seasonal drainage to the north.
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 20.0 g/m^2
Sources of Disturbance: plowing, artifacts are sparse and may have eroded from the top of the ridge

Site: 833 (11° 41.332' N, 1° 45.056' E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is on a 1.5m ridge along the Koabu.
Chipped Stone: present
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 7.32 g/m^2
Sources of Disturbance: plowing

Site: 834 (11° 40.523' N, 1° 45.284' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: No notable water sources. Locust bean tree adjacent to the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.64 sherds/m^2, 32.76 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 835 (11° 40.569' N, 1° 45.272' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles
Environment: No notable water sources.
Chipped Stone: gray flint flake
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.84 sherds/m^2, 50.64 g/m^2
Iron working: Small (< 1 m in diameter) iron furnace with tuyeres in the northwest of the site. Slag scattered throughout.
Sources of Disturbance: plowing

Site: 836 (11° 40.557' N, 1° 45.245' E)
Occupation: Siga (L); Tuali-A (L)
Area: 150 m^2
Estimated Height: 0.4 m
Deposit: Light brown with sparse laterite pebbles
Environment: No notable water sources. There is a neem tree in the center of the site.
Ceramics: No systematic surface collection
Sources of Disturbance: plowing, modern trash, borrow pit
Comments: There is clearly a sub-modern ring compound on this site that the trash (including plastics) indicates may be very recent. Some indications of an earlier occupation, but very few artifacts.

Site: 837 (11° 40.466' N, 1° 44.984' E)
Occupation: Siga (H)
Area: 225 m^2
Estimated Height: 0.3 m
Deposit: Sandy gray with sparse laterite pebbles
Environment: Site is ca. 100 m from a seasonally innundated area. Balanites tree on site.
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 59.60 g/m^2
Iron working: slag
Sources of Disturbance: plowing, borrow pit
Comments: Most of the artifacts are concentrated near the borrow pit, and consequently may be from sub-surface deposits.

Site: 838 (11° 40.408' N, 1° 44.713' E)
Occupation: Tuali-B (H)
Area: 115 m^2
Estimated Height: 0.5 m
Deposit: Gray with sparse laterite pebbles
Environment: No notable water sources.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.24 sherds/m^2, 77.44 g/m^2
Sources of Disturbance: plowing, large termite mound has destroyed most of the site

Site: 839 (11° 40.383' N, 1° 44.653' E)
Occupation: Ring (H)
Area: 175 m^2
Estimated Height: 0.5 m
Deposit: light brown with ashy gray center
Environment: No notable water sources. Two shea butter trees on site
Ceramics: No systematic surface collection
Sources of Disturbance: plowing
Comments: Although the presence of a few sparse artifacts was noted, no collection was made. The recent date of this site is evidenced by the presence of extant wooden granary bases.

Site: 840 (11° 40.196' N, 1° 44.105' E)
Occupation: Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: No notable water sources. Several locust bean trees near the site.
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 4.08 g/m^2
Sources of Disturbance: plowing, site is 20 m from a major road

Site: 841 (11° 39.843' N, 1° 44.654' E)
Occupation: Tuali-A (H)
Area: 200 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is ca. 50 m from a seasonally innundated zone.
Groundstone: present, unworked piece of milky quartz
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 5.04 g/m^2
Sources of Disturbance: plowing; there is a currently occupied residence behind the site and there is modern trash and two borrow pits on the site

Site: 842 (11° 39.777' N, 1° 44.654' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is ca. 100 m from a seasonally innundated zone. There a shea butter tree on the site.
Ceramics: Surface ceramic density from systematic collection: 1.24 sherds/m^2, 8.32 g/m^2
Sources of Disturbance: plowing

Site: 843 (11° 39.703' N, 1° 44.689' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: unknown
Deposit: Sandy light brown with dense laterite pebbles
Environment: No notable water sources. There is a shea butter tree on the site.
Chipped Stone: flint debitage
Ceramics: Surface ceramic density from systematic collection: 2.56 sherds/m^2, 14.88 g/m^2
Sources of Disturbance: edge of the site has been cut by the road grader

Site: 844 (11° 39.667' N, 1° 44.973' E)
Occupation: Siga (H)
Area: 1500 m^2
Estimated Height: 1.5 m
Deposit: Sandy brown with a reddish tinge and dense laterite pebbles.
Environment: East of seasonally innundated zone. Several shea butter trees at the base of the site
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 5.40 sherds/m^2, 48.4 g/m^2
Iron working: slag
Sources of Disturbance: plowing
Comments: Possibly associated with sites 845 and 846

Site: 845 (11° 39.667' N, 1° 44.973' E)
Occupation: Siga (H)
Area: 255 m^2
Estimated Height: 0.7 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: East of seasonally innundated zone, shea butter tree on site
Groundstone: white sandstone basal stone (*li naali*) fragment collected
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 8.96 g/m^2
Sources of Disturbance: plowing
Comments: Possibly associated with sites 844 and 847

Site: 846 (11° 39.711' N, 1° 44.994' E)
Occupation: not assigned
Area: 345 m^2
Estimated Height: 1.0 m
Deposit: Sandy brown with dense laterite pebbles
Environment: Seasonally innundated zone to the east
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.44 sherds/m^2, 13.16 g/m^2
Sources of Disturbance: plowing
Comments: Possibly associated with sites 844 and 845

Site: 847 (11° 39.882' N, 1° 45.020' E)
Occupation: Siga (H)
Area: 175 m^2
Estimated Height: 0.6 m
Deposit: Sandy light brown with laterite pebbles
Environment: On the edge of a seasonally innundated zone
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 9.32 g/m^2
Sources of Disturbance: plowing, recently occupied compound to south of site

Site: 848 (11° 39.948' N, 1° 45.038' E)
Occupation: Siga (L)
Area: 225 m^2
Estimated Height: 0.7 m
Deposit: Very sandy light brown with laterite pebbles
Environment: On the edge of a seasonally innundated zone. Several shea butter trees on site.
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 12.12 g/m^2
Sources of Disturbance: plowing
Comments: Pipe fragment on site

Site: 849 (11° 40.601' N, 1° 45.613' E)
Occupation: Siga (H)
Area: at least 1000 m^2 but distributed over a large area and eroded.
Estimated Height: Varies from 0.2 to 0.9 m.
Deposit: Sandy light brown with laterite pebbles and eroded areas of red clay
Environment: On the banks of the Koabu. Large baobab and several balanites trees on site
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 7.0 sherds/m^2, 78.56 g/m^2
Iron working: Multiple very large slag piles with vitrified tuyeres, the largest of which is approximately 30 m x 10 m x 0.5 m.
Sources of Disturbance: borrow pit
Comments: Areas of ceramics, groundstone, and other cultural debris intermixed with numerous iron furnaces, spread along the ridge above the Koabu. This site has the largest iron-working installations away from the base of the escarpment.

Site: 850 (11° 40.460’ N, 1° 45.262’ E)
Occupation: Siga (H)
Area: 255 m^2
Estimated Height: 0.6 m
Deposit: Very sandy light brown with laterite pebbles
Environment: No near-by water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.60 sherds/m^2, 26.08 g/m^2
Sources of Disturbance: plowing

Site: 851 (11° 40.038’ N, 1° 45.428’ E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with a greyish tinge and sparse laterite pebbles
Environment: Next to a very small, shallow seasonal drainage
Chipped Stone: gray flint flake
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 32.64 g/m^2
Sources of Disturbance: plowing

Site: 852 (11° 39.957’ N, 1° 45.517’ E)
Occupation: Siga (H)
Area: 125 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Ca. 100 m from a seasonally innundated zone
Groundstone: present
Ceramics: Large cannery smashed on the surface. Surface ceramic density from systematic collection: 0.48 sherds/m^2, 4.88 g/m^2
Sources of Disturbance: plowing, borrow pit in center of site

Site: 853 (11° 40.039’ N, 1° 45.626’ E)
Occupation: Ring (H)
Area: 200 m^2
Estimated Height: 0.3 m
Deposit: Light brown
Environment: In a low-lying field, shea butter tree on site
Ceramics: present, no systematic surface collection
Sources of Disturbance: plowing
Comments: Ring compound with some modern debris such as glass among the surface artifacts

Site: 854 (11° 40.145’ N, 1° 45.597’ E)
Occupation: Ring (H)
Area: 150 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with no laterite pebbles
Environment: Near a seasonal drainage, mango tree on site
Ceramics: No surface collection
Sources of Disturbance: plowing
Comments: Ring compound with almost no visible artifacts: no surface collections

Site: 855 (11° 40.283’ N, 1° 45.753’ E)
Occupation: Siga (H)
Area: 1300 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a 1.5- 2.0 m ridge at the junction of the Kwofoni and Koabu drainages.
Chipped Stone: 110 g piece unworked flint, gray flint flake
Groundstone: present
Ceramics: Several large ceramics recovered from borrow pits. Surface ceramic density from systematic collection: 0.96 sherds/m^2, 14.08 g/m^2
Sources of Disturbance: plowing, borrow pits

Site: 856 (11° 40.322’ N, 1° 45.899’ E)
Occupation: Siga (H)
Area: 400 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a 2.0 m ridge between the Koabu and Kwofoni drainages
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.4 sherds/m^2, 10.04 g/m^2
Iron working: several large pieces of slag and vitrified tuyeres
Sources of Disturbance: plowing

Site: 857 (11° 40.647’ N, 1° 45.030’ E)
Occupation: Siga (L)
Area: 150 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: ca. 100 m from a seasonal drainage
Chipped Stone: 45 g piece unworked flint, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.52 sherds/m^2, 47.04 g/m^2
Sources of Disturbance: plowing

Site: 858 (11° 40.617' N, 1° 44.812' E)
Occupation: Tuali-A (H)
Area: 50 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: On the downslope of a small ridge near a seasonal drainage
Chipped Stone: 8 g gray flint core, flint debitage
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 14.96 g/m^2
Sources of Disturbance: plowing

Site: 859 (11° 40.458' N, 1° 44.032' E)
Occupation: Siga (L)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Sandy gray with sparse laterite pebbles
Environment: In a muddy cotton field
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 10.76 g/m^2
Sources of Disturbance: plowing

Site: 860 (11° 40.743' N, 1° 44.845' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: On a 2.0 m ridge adjacent to a seasonal drainage. *Sclercarya birrea* tree on site.
Chipped Stone: 14 g piece unworked quartz, 66 g gray flint core, gray flint flake, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 4.20 g/m^2
Iron working: slag
Sources of Disturbance: plowing

Site: 861 (11° 40.786' N, 1° 44.927' E)
Occupation: not assigned
Area: 240 m^2
Estimated Height: 0.6 m
Deposit: Very sandy light brown with laterite pebbles
Environment: On a 2.0 ridge adjacent to a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.24 sherds/m^2, 19.16 g/m^2
Sources of Disturbance: some plowing

Site: 862 (11° 40.790' N, 1° 44.970' E)
Occupation: Tuali-A (L)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a ridge near a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 29.68 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 863 (11° 40.787' N, 1° 45.340' E)
Occupation: Tuali-B (H)
Area: 240 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with a reddish tinge and sparse laterite pebbles
Environment: Site is on a ridge between two seasonal drainages, one ridge over from the Koabu.
Chipped Stone: 21 g gray flint core, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.20 sherds/m^2, 6.68 g/m^2
Iron working: numerous pieces of slag
Sources of Disturbance: plowing

Site: 864 (11° 40.814' N, 1° 45.488' E)
Occupation: LSA (L); Siga (L)
Area: 95 m^2
Estimated Height: 0 m
Deposit: Sandy light brown with dense laterite pebbles
Environment: On a sandy ridge between the Koabu and Kwofoni drainages
Chipped Stone: Significant chipped stone debitage: 6 gray flint flakes, flint and quartz debitage collected
Ceramics: Only a few very trampled ceramics. Surface ceramic density from systematic collection: 0.20 sherds/m^2, 1.0 g/m^2
Sources of Disturbance: plowing

Site: 865 (11° 41.290' N, 1° 44.595' E)
Occupation: Siga (L)
Area: 115 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on a slope adjacent to the Koabu. Palm tree on site.
Groundstone: white sandstone basal stone (*li naali*) or handstone (*u bindu*) fragment collected
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 2.76 g/m^2
Sources of Disturbance: plowing

Site: 866 (11° 41.214' N, 1° 44.936' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown with a reddish tinge and sparse laterite pebbles
Environment: On a ridge above the Koabu
Chipped Stone: gray flint flake, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.72 sherds/m^2, 9.88 g/m^2
Sources of Disturbance: plowing
Comments: Site boundaries are poorly defined as there is very low density scatter

Site: 867 (11° 41.242' N, 1° 44.838' E)
Occupation: LSA (H); Siga (L)
Area: 15 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown with no laterite pebbles
Environment: On a ridge above the Koabu
Chipped Stone: Sites consists entirely of flint debris. 5 pieces of unworked flint ranging from 5 g to 117 g, six flint cores ranging from 37 g to 119 g, 3 gray flint flakes collected.
Sources of Disturbance: plowing

Site: 868 (11° 41.328' N, 1° 44.711' E)
Occupation: Siga (L)
Area: 225 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a ridge above the Koabu
Chipped Stone: flint debitage
Groundstone: numerous pieces including flat basal stone (*li naali*)s
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 72.6 g/m^2
Iron working: slag
Sources of Disturbance: plowing

Site: 869 (11° 41.337' N, 1° 44.671' E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with a reddish tinge and laterite pebbles
Environment: On a ridge above the Koabu
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.20 sherds/m^2, 1.68 g/m^2. Systematic collection taken in a low density area of the site: under-represents the ceramic density at this site.
Sources of Disturbance: plowing

Site: 870 (11° 41.327' N, 1° 44.631' E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with a reddish tinge and laterite pebbles
Environment: On a ridge above the Koabu
Chipped Stone: 83 g gray flint core, flint debitage
Groundstone: red sandstone handstone (*u bindu*) fragment collected
Ceramics: Surface ceramic density from systematic collection: 1.36 sherds/m^2, 23.52 g/m^2
Sources of Disturbance: plowing

Site: 871 (11° 41.352' N, 1° 44.618' E)
Occupation: Siga (H)
Area: 490 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: On a ridge above the Koabu
Ceramics: present -no systematic surface collection
Sources of Disturbance: plowing
Comments: Ceramics collected from a small area – possibly a toss zone for a local farmer. Possibly a part of site 870.

Site: 872 (11° 41.419’ N, 1° 44.496’ E)
Occupation: Siga (H)
Area: 490 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: On a ridge above the Koabu, near year-round gardens.
Chipped Stone: flint debitage
Groundstone: white sandstone handstone (*u bindu*) collected
Ceramics: Surface ceramic density from systematic collection: 1.60 sherds/m^2, 10.04 g/m^2
Sources of Disturbance: plowing

Site: 873 (11° 41.412’ N, 1° 44.458’ E)
Occupation: Siga (H)
Area: 270 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: In a palm grove on a ridge above the Koabu
Chipped Stone: 11 g piece unworked flint, gray flint flake
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.96 sherds/m^2, 51.68 g/m^2
Sources of Disturbance: plowing

Site: 874 (11° 41.377’ N, 1° 44.345’ E)
Occupation: not assigned
Area: 315 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with a reddish tinge and laterite pebbles
Environment: On a ridge above the Koabu, in a palm grove with shea butter and neem trees
Chipped Stone: gray flint flake, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.36 sherds/m^2, 24.12 g/m^2
Sources of Disturbance: plowing

Site: 875 (11° 41.404’ N, 1° 44.241’ E)
Occupation: Siga (L)
Area: 200 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a ridge above the Koabu
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.60 sherds/m^2, 4.92 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 876 (11° 41.369’ N, 1° 44.121’ E)
Occupation: Siga (H)
Area: 200 m^2
Estimated Height: 0.0 m
Deposit: Sandy brown with sparse laterite pebbles
Environment: On a high ridge above the Koabu
Ceramics: Surface ceramic density from systematic collection: 0.24 sherds/m^2, 15.64 g/m^2
Iron working: Reduction site with three piles of large slag pieces and tuyere fragments. Two are large (4 and 5 m diameter respectively) and one is significantly smaller (1 m diameter). One tuyere fragment collected.
Sources of Disturbance: plowing

Site: 877 (11° 41.408’ N, 1° 44.088’ E)
Occupation: not assigned
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with a reddish tinge and sparse laterite pebbles
Environment: On a ridge above the koabu, shea butter tree on site
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.24 sherds/m^2, 3.64 g/m^2
Sources of Disturbance: plowing

Site: 878 (11° 41.462’ N, 1° 44.057’ E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: On a ridge above the Koabu with shea butter trees on the site
Chipped Stone: flint debitage
Groundstone: present, including several large basal stone (*li naali*) fragments
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 15.84 g/m^2
Iron working: 18g vitrified tuyere fragment, isolated slag
Sources of Disturbance: plowing, site is adjacent to the road

Site: 879 (11° 42.724' N, 1° 45.116' E)
Occupation: Siga (H); Tuali-A (L)
Area: 350 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on the banks of a seasonal drainage and about 100 m from the foot of the escarpment.
Chipped Stone: 264 g piece of unworked flint, flint and quartz debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.64 sherds/m^2, 70.4 g/m^2
Iron working: Two large iron furnaces/slag piles at eastern and western ends of the site (4 and 5 m diameter respectively). vitrified tuyeres collected
Sources of Disturbance: plowing
Comments: Site consists of the two slag piles and the cultural debris scatter between them.

Site: 880 (11° 42.770' N, 1° 45.109' E)
Occupation: Tuali-B (H)
Area: 30 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is on the edge of a seasonal drainage, about 50 m from the foot of the escarpment, near the mouth of a small, narrow canyon.
Chipped Stone: formal flint tool collected
Ceramics: Surface ceramic density from systematic collection: 1.24 sherds/m^2, 21.16 g/m^2
Sources of Disturbance: plowing

Site: 881 (11° 42.535' N, 1° 45.156' E)
Occupation: not assigned
Area: 350 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is the banks of a seasonal drainage
Ceramics: present, no systematic surface collection
Sources of Disturbance: Site is heavily disturbed by road construction activity, plowing, and a footpath.
Comments: Determination of original site boundaries difficult: may have been multiple smaller sites smeared together.

Site: 882 (11° 42.674' N, 1° 44.963' E)
Occupation: Siga (H)
Area: 30 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on the edge of a seasonal drainage, near the foot of the escarpment.
Chipped Stone: flint debitage
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 10.08 g/m^2
Sources of Disturbance: some plowing

Site: 883 (11° 42.534' N, 1° 44.884' E)
Occupation: Siga (L); Tuali-B (H)
Area: 115 m^2
Estimated Height: 0.3 m
Deposit: Sandy brown with sparse laterite pebbles
Environment: Site is 50 m from the foot of the escarpment, baobab and tamarind trees on site.
Ceramics: Surface ceramic density from systematic collection: 1.24 sherds/m^2, 39.04 g/m^2
Sources of Disturbance: plowing

Site: 884 (11° 42.516' N, 1° 44.925' E)
Occupation: Siga (L)l Tuali-B (L)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is on the banks of a seasonal drainage, near the base of the escarpment
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 126.56 g/m^2. High weight density due in part to smashed large pot on the site, sections of which were included in systematic surface collection
Iron working: isolated slag
Sources of Disturbance: plowing, modern compound near site
Comments: Modern compound separates sites 884 and 885

Site: 885 (11° 42.478' N, 1° 44.931' E)
Occupation: Siga (H)
Area: 285 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on the banks of a seasonal drainage, near the base of the escarpment
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Section of buried upside-down pot in borrow pit profile taken as part of opportunistic collection. Surface ceramic density from systematic collection: 1.08 sherds/m^2, 16.6 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing, modern compound near site, borrow pit
Comments: Modern compound separates sites 884 and 885

Site: 886 (11° 42.487' N, 1° 44.825' E)
Occupation: Siga (L); Tuali-B (L)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a rise near several seasonal drainages and 50m from the base of the escarpment. Palm trees on site
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 11.92 g/m^2
Sources of Disturbance: plowing, modern compound near site
Comments: In addition to the currently occupied compound, there is evidence of a decayed ring compound on the site. However, there may be an older occupation as well.

Site: 887 (11° 42.451' N, 1° 44.742' E)
Occupation: Tuali-A (L)
Area: 275 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is at the foot of the escarpment with seasonal drainages to the north and south. Palm trees on site
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.88 sherds/m^2, 46.56 g/m^2
Sources of Disturbance: plowing
Comments: site boundaries difficult to determine

Site: 888 (11° 42.380' N, 1° 44.820' E)
Occupation: Tuali-B (L)
Area: 80 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: On the bank of a wide, shallow seasonal drainage ca. 100 m from the foot of the escarpment
Chipped Stone: flint debitage
Ceramics: Surface ceramic density from systematic collection: 0.92 sherds/m^2, 15.32 g/m^2
Sources of Disturbance: plowing, erosion towards the seasonal drainage
Comments: site boundaries difficult to determine

Site: 889 (11° 42.363' N, 1° 44.791' E)
Occupation: Tuali-A (H)
Area: 50 m^2
Estimated Height: 0.0 m
Deposit: Sandy light gray brown with sparse laterite pebbles
Environment: On the bank of a wide, shallow seasonal drainage ca. 100 m from the foot of the escarpment. Baobab intertwined with a tamarind tree on site.
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 8.84 g/m^2
Sources of Disturbance: plowing
Comments: site boundaries difficult to determine

Site: 890 (11° 42.197' N, 1° 44.741' E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is on the banks of a seasonal drainage
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 5.88 g/m^2
Iron working: 30 g slaglike vitrified tuyere fragment in systematic surface collection. Isolated as no iron-working debris noted on site.
Sources of Disturbance: plowing

Site: 891 (11° 39.822' N, 1° 46.451' E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with a reddish tinge and sparse laterite pebble
Environment: Site is located on a plateau between two major seasonal drainages (ca. 150 m in each direction). Baobab tree near the site.
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.8 sherds/m^2, 39.72 g/m^2
Iron working:
Sources of Disturbance: plowing

Site: 892 (11° 39.857' N, 1° 46.448' E)
Occupation: Siga (L); Tuali-A (L)
Area: 160 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is located on a plateau between two major seasonal drainages (ca. 150 m in each direction).
Chipped Stone: flint debitage
Groundstone: present: numerous basal stone (*li naali*) and handstone (*u bindu*) fragments on site
Ceramics: Surface ceramic density from systematic collection: 1.12 sherds/m^2, 28.0 g/m^2
Sources of Disturbance: plowing, borrow pit

Site: 893 (11° 39.915' N, 1° 46.457' E)
Occupation: Tuali-A (L)
Area: 115 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is near the end of a plateau between two major seasonal drainages
Chipped Stone: present
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.52 sherds/m^2, 26.68 g/m^2
Sources of Disturbance: plowing

Site: 894 (11° 39.933' N, 1° 46.437' E)
Occupation: Siga (L); Tuali-A (H)
Area: 225 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is at the headland of a plateau where two major seasonal drainages come together.
Chipped Stone: Gray flint flake, flint debitage collected
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.36 sherds/m^2, 6.28 g/m^2
Sources of Disturbance: plowing

Site: 895 (11° 41.289' N, 1° 43.894' E)
Occupation: Siga (L)
Area: 80 m^2
Estimated Height: 0.0 m
Deposit: Hard red with no laterite pebbles
Environment: Site is on a ridge overlooking the Koabu. Two small tamarind trees among the brush on the site.
Chipped Stone: gray flint flake collected
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 4.56 g/m^2
Sources of Disturbance: erosion

Site: 896 (11° 41.208' N, 1° 43.927' E)
Occupation: Siga (H)
Area: 250 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge above the Koabu.
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.12 sherds/m^2, 14.76 g/m^2
Iron working: A fair amount of slag, but no evidence of tuyeres
Sources of Disturbance: plowing

Site: 897 (11° 41.089' N, 1° 44.114' E)
Occupation: Siga (H)
Area: 250 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge above the Koabu. Shea butter and palm trees on site.
Chipped Stone: Two flint flakes, quartz debitage collected
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 27.32 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 898 (11° 41.149' N, 1° 44.342' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a ridge above the Koabu
Chipped Stone: Flint core, 3 flint flakes, flint debitage collected
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 18.88 g/m^2
Sources of Disturbance: plowing in previous years
Comments: Site is a particularly dense concentration, however there are very low density artifacts all along the ridge.

Site: 899 (11° 41.157' N, 1° 44.391' E)
Occupation: Siga (H)
Area: 205 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with a reddish tinge and laterite pebbles
Environment: Site is on a ridge above the Koabu floodplain.
Chipped Stone: flint flake, flint debitage collected
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 17.36 g/m^2
Sources of Disturbance: plowing

Site: 900 (11° 41.131' N, 1° 44.476' E)
Occupation: Siga (H)
Area: 265 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge above the Koabu floodplain
Chipped Stone: Two flint cores, two flint flakes, flint debitage collected
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 5.52 sherds/m^2, 55.76 g/m^2
Sources of Disturbance: plowing

Site: 901 (11° 41.109' N, 1° 44.512' E)
Occupation: not assigned
Area: 490 m^2
Estimated Height: 0.3 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is on the gently sloping high ground above the Koabu. Shea butter and palm trees on site.
Chipped Stone: flint debitage, 11 g piece raw quartz
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.36 sherds/m^2, 29.44 g/m^2
Sources of Disturbance: plowing

Site: 902 (11° 41.107' N, 1° 44.560' E)
Occupation: Pwoli (L); Siga (L)
Area: 380 m^2
Estimated Height: 1.0 m
Deposit: Sandy brown with dense laterite pebbles
Environment: Site is on a ridge above the Koabu
Chipped Stone: 61 g raw flint
Groundstone: present in high quantities
Ceramics: present, no systematic surface collection
Sources of Disturbance: plowing in previous seasons, borrow pits near the edges of the site
Comments: Very high quantities of animal bone on the surface, most of which is clearly from the archaeological deposits. Site appears to be a deep, intact site with little disturbance.

Site: 903 (11° 41.101' N, 1° 44.637' E)
Occupation: Siga (H)
Area: 575 m^2
Estimated Height: 0.8 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is along a ridge above the Koabu. Shea butter and locust bean trees on site.
Groundstone: present, including large, deeply hollowed basal stone (*li naali*)s.
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 21.72 g/m^2
Sources of Disturbance: plowing

Site: 904 (11° 40.947' N, 1° 44.783' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is about 50 m back from the edge of the ridge overlooking the Koabu floodplain. Locust bean tree on site.
Groundstone: present in high quantities
Ceramics: Surface ceramic density from systematic collection: 1.68 sherds/m^2, 29.6 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 905 (11° 40.942' N, 1° 45.049' E)
Occupation: Siga (H)
Area: 95 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is about 75 m back from the edge of the ridge overlooking the Koabu floodplain.
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.52 sherds/m^2, 19.72 g/m^2
Sources of Disturbance: present

Site: 906 (11° 41.003' N, 1° 45.215' E)
Occupation: Siga (L)
Area: 50 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on the ridge overlooking the Koabu floodplain. There are balanites and tamarind trees on the site
Chipped Stone: flint flake, flint debitage collected
Ceramics: Surface ceramic density from systematic collection: 0.6 sherds/m^2, 24.44 g/m^2
Sources of Disturbance: plowing

Site: 907 (11° 40.961' N, 1° 45.344' E)
Occupation: Siga (L)
Area: 330 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with a reddish tinge and laterite pebbles
Environment: Site is on the edge of a ridge above the Koabu. Scrubby vegetation on the site
Chipped Stone: Two formal flint tools, five flint flakes, flint and quartz debitage
Ceramics: Surface ceramic density from systematic collection: 0.4 sherds/m^2, 1.6 g/m^2
Sources of Disturbance: erosion

Site: 908 (11° 40.874' N, 1° 45.439' E)
Occupation: Siga (H)
Area: 230 m^2
Estimated Height: 0.1 m
Deposit: Loose silty light brown with reddish tinge and sparse laterite pebbles
Environment: Site is on the end of a ridge above the Koabu and a seasonal drainage.
Chipped Stone: two flint flakes, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 11.0 g/m^2
Sources of Disturbance: plowing

Site: 909 (11° 40.915' N, 1° 44.791' E)
Occupation: Tuali-B (H)
Area: 200 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a plateau, about 150 m from the edge of the ridge above the Koabu. Tamarind tree on site
Groundstone: present, 5 x 5 cm smoothed ball of rose quartz broken in half collected
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 25.56 g/m^2
Sources of Disturbance: plowing

Site: 910 (11° 40.884' N, 1° 44.746' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a broad plateau between the Koabu and an additional seasonal drainage.
Chipped Stone: flint debitage, 102 g raw flint
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.24 sherds/m^2, 2.52 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing, two mud brick pits
Comments: Mud brick pit profiles suggest that the cultural deposits are very thin.

Site: 911 (11° 41.007' N, 1° 44.629' E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 5.08 g/m^2
Sources of Disturbance: plowing

Site: 912 (11° 40.757' N, 1° 44.401' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on the edge of seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 14.96 g/m^2
Sources of Disturbance: plowing

Site: 913 (11° 40.644' N, 1° 44.018' E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by water sources
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 25.88 g/m^2
Sources of Disturbance: plowing

Site: 914 (11° 40.574' N, 1° 44.013' E)
Occupation: not assigned
Area: 65 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 52.6 g/m^2
Sources of Disturbance: plowing

Site: 915 (11° 40.561' N, 1° 43.900' E)
Occupation: Siga (H)
Area: 190 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: No near-by surface water sources. Neem tree windbreak planted near site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.44 sherds/m^2, 8.40 g/m^2
Sources of Disturbance: plowing, near road

Site: 916 (11° 40.774' N, 1° 44.022' E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.36 sherds/m^2, 3.56 g/m^2
Sources of Disturbance: plowing

Site: 917 (11° 40.957' N, 1° 43.687' E)
Occupation: Siga (H)
Area: unknown
Estimated Height: unknown
Deposit: unknown
Environment: No near-by surface water sources
Ceramics: present, no systematic surface collection
Sources of Disturbance: road construction
Comments: Several ceramics collected from a pile of displaced sediment associated with road construction/repair. Sediment appears to have been bulldozed from just adjacent to the pile. No contextual information available.

Site: 918 (11° 41.218’ N, 1° 43.468’ E)
Occupation: Tuali-B (H)
Area: 230 m^2
Estimated Height: 0.2 m
Deposit: Sandy red with no laterite pebbles.
Environment: Site is adjacent to a small seasonal drainage near the foot of the escarpment Palm tree on site.
Ceramics: At least one large cannery smash on the site. Surface ceramic density from systematic collection: 0.8 sherds/m^2, 65.28 g/m^2
Sources of Disturbance: plowing
Comments: Site consists of two artifact concentrations with a greyish patch between them. This seems to suggest the presence of a decayed ring compound. Site may be continuous with Site 919.

Site: 919 (11° 41.267’ N, 1° 43.442’ E)
Occupation: Tuali-A (H)
Area: 175 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with a reddish tinge and sparse laterite pebbles
Environment: Site is adjacent to a small seasonal drainage near the foot of the escarpment.
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 22.6 g/m^2
Iron working: small concentration of slag could be a small iron furnace
Sources of Disturbance: plowing
Comments: This site was identified by our local guide, Diassibo Ouaba, as a previous location of the village of Kidikanbou. Site boundaries were difficult to determine, and it may be continuous with Site 918.

Site: 920 (11° 41.434’ N, 1° 43.149’ E)
Occupation: Tuali-B (H)
Area: 615 m^2
Estimated Height: 0.0 m
Deposit: Ash
Environment: Site is located near the foot of the escarpment.
Ceramics: present, no systematic surface collection
Indigo Dyeing: Site consists of very large piles of ash (1.5 to 2.0 m in height) surrounding a group of plastered indigo dye pits. Four pits are visible, but it is likely that more are buried under the slump from the ash piles. The visible pits are 1.0 m in diameter at the surface, but narrow as they descend, an effect exaggerated by the thicker layer of internal plastering.
Sources of Disturbance: none
Comments: These dyes pits were likely associated with the residences at Site 919.

Site: 921 (11° 41.267’ N, 1° 43.062’ E)
Occupation: Unknown
Area: The panel was roughly 6 m wide by 3 m tall.
Deposit: Sandstone rockshelter roughly five meters up the escarpment.The surface of the ledge was well-worn from frequent visits.
Pigment: Red ochre with binding agents.
Comments: Rock art site located in a small hollow in the wall of the escarpment. No artifacts. Art was a composite palimpsest of geometric patterns and wavy lines that was fairly degraded. Rock art of similar style is common in West Africa, although Burkina Faso only has certain regions where appropriate rockshelters are present.

Site: 922 (11° 41.220' N, 1° 43.115' E)
Occupation: Siga (L); Tuali-A (L)
Area: 1470 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown with a reddish tinge and sparse laterite pebbles
Environment: Site is located near a small seasonal drainage directly adjacent to the foot of the escarpment.
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 27.6 g/m^2
Comments: Three greyish, ashy spots suggest the possible presence of three ring compounds. This site was identified by our local guide, Diassibo Ouaba, as the original location of the village of Kidikanbou. According to Ouaba, the founders consisted of three members of the Lumpo family who moved from Logobou.

Site: 923 (11° 40.988' N, 1° 43.272' E)
Occupation: Tuali-B (H)
Area: 415 m^2
Estimated Height: 0.6 m
Deposit: ash
Environment:
Ceramics: present, no systematic surface collection
Indigo Dyeing: Site consists of at least 14 indigo dye pits set into a low mound of ash. The dye pits are ca. 1.0 m in diameter, and are filled with ash. One pit is slightly less finished and may have been for crushing the indigo leaves rather than dyeing cloth.
Sources of Disturbance: Site is adjacent to the road.

Site: 924 (11° 41.334' N, 1° 43.292' E)
Occupation: Tuali-A (H)
Area: 200 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with a reddish tinge and sparse laterite pebbles
Environment: Site is near the ridge above the Koabu. Locust bean tree on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.48 sherds/m^2, 9.80 g/m^2
Sources of Disturbance: plowing
Comments: dark ashy patches similar to those characteristic of ring compounds

Site: 925 (11° 41.619' N, 1° 43.004' E)
Occupation: unknown
Area: Roughly 5 m wide by 3 m high.
Deposit: Sandstone rockshelter roughly 50 meters up the escarpment, with a wide ledge in front of wall. The surface of the ledge was well-worn from frequent visits.
Pigment: Red ochre with binding agents.
Ceramics: present, no systematic surface collection. The ceramics were part of a ritual assemblage, and were an older style. The assemblage was only visually inspected from a distance following the advice of our local guide, owing to the sacred nature.
Comments: Rock art site. The fairly large panel had several layers (although not as many as Site 921). Images depicted ranged from parallel and independent wavy lines to geometric figures, that was fairly degraded. Rock art of similar style is common in West Africa, although Burkina Faso only has certain regions where appropriate rockshelters are present.

Site: 926 (11° 41.562' N, 1° 43.076' E)
Occupation: Siga (H)
Area: 1200 m^2
Estimated Height: 0.0 m
Deposit: Sandy light reddish brown with laterite pebbles
Environment: Site is located along a ridge overlooking the Koabu, near the base of the escarpment. Scrubby brush including *Balanites* sp. on the site.
Chipped Stone: One gray flint formal tool, flint and quartz debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 6.48 sherds/m^2, 34.52 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing, severe erosion along the edge of the ridge

Site: 927 (11° 41.504' N, 1° 43.528' E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a section of ridge that protrudes into the Koabu floodplain. Shea butter tree on site.
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 34.68 g/m^2
Sources of Disturbance: plowing

Site: 928 (11° 41.430' N, 1° 43.638' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with a reddish tinge and sparse laterite pebbles
Environment: Site is on the downslope of a ridge overlooking the Koabu. Shea butter tree on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 27.56 g/m^2
Sources of Disturbance: plowing

Site: 929 (11° 41.333' N, 1° 43.696' E)
Occupation: Siga (L); Tuali-B (L)
Area: 625 m^2
Estimated Height: 0.0 m
Deposit: Sandy red with sparse laterite pebbles
Environment: Site is location on a couple of small ridges sections that extend into the Koabu floodplain.
Chipped Stone: present, Three gray flint flakes, flint and quartz debitage,
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 15.76 g/m^2
Iron working: At least two and possibly more iron smelting furnaces. Large concentrations of slag and tuyeres which have been heavily smeared.
Sources of Disturbance: plowing

Site: 930 (11° 41.277' N, 1° 43.728' E)
Occupation: Tuali-B (L)
Area: 200 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a ridge overlooking the Koabu. Shea butter tree near the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.2 sherds/m^2, 3.0 g/m^2
Sources of Disturbance: plowing

Site: 931 (11° 41.262' N, 1° 43.811' E)
Occupation: Siga (H)
Area: 125 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with laterite pebbles
Environment: On a ridge overlooking the Koabu. Palm tree on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 27.56 g/m^2
Sources of Disturbance: plowing, site is adjacent to an area of road construction and may have been partially destroyed.

Site: 932 (11° 41.606' N, 1° 43.736' E)
Occupation: Siga (H)
Area: 65 m^2
Estimated Height: 0.2 m
Deposit: Very sandy red with laterite pebbles
Environment: Site is on a very steep, narrow, eroded ridge adjacent to the Koabu floodplain
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.40 sherds/m^2, 5.96 g/m^2
Sources of Disturbance: erosion

Site: 933 (11° 41.702' N, 1° 43.433' E)
Occupation: Siga (H)
Area: 1375 m^2
Estimated Height: 2.0 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is 75 m from the Koabu floodplain, and adjacent to one of the low sandstone outcrops that run parallel to the escarpment.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.40 sherds/m^2, 12.88 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 934 (11° 41.684' N, 1° 43.294' E)
Occupation: Siga (L)
Area: 175 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on some high ground at the mouth of a valley that opens onto the Koabu floodplain. Tamarind tree on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 16.2 g/m^2
Sources of Disturbance: plowing

Site: 935 (11° 41.803' N, 1° 43.144' E)
Occupation: Siga (H)
Area: 275 m^2
Estimated Height: 0 cm
Deposit: Sandy red with sparse laterite
Environment: Site is on a rise near Maadaga rock-shelter, between the escarpment and a sandstone outcrop that runs parallel to it.
Chipped Stone: One gray flint formal tool, one gray flint flake, flint and quartz debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.84 sherds/m^2, 16.28 g/m^2
Iron working: Several very large pieces of slag: there may have been a furnace here in the past
Sources of Disturbance: plowing, site is very heavily disturbed by erosion and most artifacts are displaced to the downslopes

Site: 936 (11° 41.782' N, 1° 43.261' E)
Occupation: Siga (H)
Area: 805 m^2
Estimated Height: 0.0 m
Deposit: Sandy red with laterite pebbles
Environment: Site is at the mouth of a narrow canyon formed by the escarpment and one of the small sandstone ridges that runs parallel to it. Scrubby brush including *Balanites* sp. on site.
Chipped Stone: Flint and quartz debitage
Ceramics: Ceramics distributed very unevenly over the site. Surface ceramic density from systematic collection: 4.44 sherds/m^2, 48.12 g/m^2
Sources of Disturbance: heavy erosion

Site: 937 (11° 41.900' N, 1° 43.368' E)
Occupation: Tuali-B (H)
Area: m^2
Estimated Height: 0.2 m
Deposit: Sandy red with sparse laterite pebbles
Environment: Site is on a rise near Koabu small canyon. Bushes and trees on surface.
Chipped Stone: One gray flint flake
Groundstone: present including heavily used basal stone (*li naali*)s
Ceramics: Surface ceramic density from systematic collection: 1.08 sherds/m^2, 19.80 g/m^2
Iron working: Several piles of slag, tuyeres
Indigo dyeing: At least four dye pits inset into an ash pile. The ash pile is very overgrown with brush and small trees, and there are likely more dye pits in this area

Site: 938 (11° 41.619' N, 1° 43.906' E)
Occupation: Siga (H)
Area: 190 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is at the peak of the ridge adjacent to the Koabu. Shea butter trees on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 23.52 g/m^2
Iron working: High densities of slag dispersed throughout the site. No tuyeres noted on the surface, but based on the slag quantities there may have been smelting.
Sources of Disturbance: plowing

Site: 939 (11° 41.512' N, 1° 44.010' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown
Environment: Site is on a gentle ridge adjacent to the Koabu, shea butter tree near the site
Ceramics: present, no systematic surface collection
Iron working: Site is a large, very dense concentration of slag that has been smeared by plowing. No tuyeres noted on the surface
Sources of Disturbance: plowing

Site: 940 (11° 41.816' N, 1° 44.706' E)
Occupation: Siga (H)
Area: 20 m^2
Estimated Height: 0.0 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.60 sherds/m^2, 9.72 g/m^2
Sources of Disturbance: plowing
Comments: Several large, inset stones which may be granary bases. If they are, the granaries could be field storage and significantly post-date the site.

Site: 941 (11° 41.698' N, 1° 44.886' E)
Occupation: Tuali-A (H)
Area: 0.4 m^2
Estimated Height: 150 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 25.36 g/m^2
Sources of Disturbance: plowing

Site: 942 (11° 41.634' N, 1° 44.903' E)
Occupation: Tuali-B (H)
Area: 200 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources, although wells in the area reach the water table at only 3 m in the dry season.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.28 sherds/m^2, 32.16 g/m^2
Sources of Disturbance: plowing

Site: 943 (11° 41.531' N, 1° 44.898' E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources, although wells in the area reach the water table at only 3 m in the dry season.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.40 sherds/m^2, 12.68 g/m^2
Sources of Disturbance: plowing

Site: 944 (11° 41.504' N, 1° 44.912' E)
Occupation: Tuali-B (H)
Area: 115 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown
Environment: No near-by surface water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 7.64 g/m^2
Sources of Disturbance: plowing

Site: 945 (11° 41.341' N, 1° 44.994' E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge adjacent to a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 11.52 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 946 (11° 41.263' N, 1° 45.022' E)
Occupation: not assigned
Area: 705 m^2
Estimated Height: 0.0 m
Deposit: Sandy brown with sparse laterite pebbles
Environment: Site is on a ridge adjacent to a seasonal drainage
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 10.68 g/m^2
Sources of Disturbance: plowing
Comments: site boundary difficult to define

Site: 947 (11° 41.170' N, 1° 45.045' E)
Occupation: LSA (L)
Area: 115 m^2
Estimated Height: 0.0 m
Deposit: Sandy red
Environment: Site is on a ridge above the Koabu
Chipped Stone: 11 gray flint flakes, flint and quartz debitage, 24 g piece raw flint
Sources of Disturbance: erosion
Comments: Chipped stone spread along the ridge, only the highest density area is included in site dimensions.

Site: 948 (11° 41.676' N, 1° 44.639' E)
Occupation: Tuali-A (H)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 19.48 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

Site: 949 (11° 41.467' N, 1° 44.625' E)
Occupation: Tuali-B (H)
Area: 80 m^2
Estimated Height: 0.2 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 1.0 sherds/m^2, 39.16 g/m^2
Sources of Disturbance: plowing

Site: 950 (11° 41.922' N, 1° 43.616' E)
Occupation: Tuali-B (H)
Area: 90 m^2
Estimated Height: 0.5 m
Deposit: NA
Environment: Site is on a ridge next to a seasonal pool
Groundstone: pecked round milky quartz cobble collected
Ceramics: present, no systematic surface collection
Iron working: Site is a large slag pile at least 15 m long and 1.0 m high. There is one exceptionally large tuyere visible (19 cm exterior diamater, 8 cm interior diameter).

Site: 951 (11° 41.980' N, 1° 43.698' E)
Occupation: Tuali-B (H)
Area: 13 m^2
Estimated Height: 0.4 m
Deposit: NA
Environment: Site is near the base of the escarpment, no near-by surface water sources
Groundstone: Several large intact basal stone (*li naali*)s adjacent to slag pile. Basal stone (*li naali*) with flat grinding surface has 45 x 35 cm grinding area, while deeply concave example has 60 x 30 cm grinding area.
Ceramics: present, no systematic surface collection
Iron working: 4 m diameter slag pile.

Site: 952 (11° 41.989' N, 1° 43.737' E)
Occupation: Tuali-B (H)
Area: 7 m^2
Estimated Height: 0.4 m
Deposit: Sand with sandstone chunks.
Environment: Site is near the base of the escarpment, no near-by surface water sources
Ceramics: present, no systematic surface collection
Iron working: 3 m diameter slag pile with sandstone chunks mixed in with the slag.

Site: 953 (11° 42.038' N, 1° 43.961' E)
Occupation: Tuali-B (L)
Area: 50 m^2
Estimated Height: 0.8 m
Deposit: Sand with sandstone chunks.
Environment: Site is near the base of the escarpment, no near-by surface water sources. Many trees in area.
Ceramics: present, no systematic surface collection
Iron working: large, very dense slag pile. Multiple tuyere fragments collected, includes one vitrified tuyere with slag inside. Definite smelting site.
Sources of Disturbance: several small bushes growing in slag pile

Site: 954 (11° 42.178' N, 1° 43.998' E)
Occupation: Tuali-A (H)
Area: 95 m^2
Estimated Height: 0.3 m
Deposit: Sandy brown with sparse laterite pebbles
Environment: Site is located on a gently sloping surface amongst the sandstone ridges running parallel to the escarpment. No near-by surface water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.96 sherds/m^2, 47.52 g/m^2
Sources of Disturbance: plowing, erosion

Site: 955 (11° 42.150' N, 1° 44.056' E)
Occupation: Tuali-A (H)
Area: 200 m^2
Estimated Height: 0.4 m
Deposit: brown
Environment: Site is located high on a gently sloping surface amongst sandstone ridges amongst the sandstone ridges running parallel to the escarpment. No near-by surface water sources. Baobab tree on site
Chipped Stone: gray flint flake, flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 3.08 sherds/m^2, 23.6 g/m^2
Sources of Disturbance:
Comments: Inset stones in a circular pattern. These could be a hut or granary foundation, although they could also post-date the collected ceramics.

Site: 956 (11° 42.112’ N, 1° 44.081’ E)
Occupation: Tuali-A (H)
Area: 250 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is located on a gently sloping surface amongst sandstone ridges amongst the sandstone ridges running parallel to the escarpment. No near-by surface water sources. Baobab tree on site
Chipped Stone: 2 gray flint flakes
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 4.52 sherds/m^2, 54.2 g/m^2
Sources of Disturbance: plowing

Site: 957 (11° 42.239’ N, 1° 44.146’ E)
Occupation: Tuali-A (H)
Area: 200 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is located at the top of a gently sloping surface amongst sandstone ridges amongst the sandstone ridges running parallel to the escarpment. No near-by surface water sources.
Chipped Stone: 13 g piece of raw flint
Groundstone: Polishing stone made from milky quartz with red veins
Ceramics: Surface ceramic density from systematic collection: 4.68 sherds/m^2, 72.24 g/m^2
Sources of Disturbance:

Site: 958 (11° 42.060’ N, 1° 44.591’ E)
Occupation: Siga (H)
Area: 150 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles.
Environment: No near-by surface water sources
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.0 sherds/m^2, 23.88 g/m^2
Sources of Disturbance: plowing

Site: 959 (11° 42.203’ N, 1° 44.946’ E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.0 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is on sloping bank of a seasonal drainage
Chipped Stone: 11 g piece of raw quartz
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 14.16 g/m^2
Sources of Disturbance: plowing

Site: 960 (11° 42.196’ N, 1° 45.052’ E)
Occupation: not assigned
Area: 175 m^2
Estimated Height: 0.0 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is on the downslope of a ridge along a seasonal drainage
Groundstone: present
Ceramics: No systematic surface collection
Sources of Disturbance: plowing

Site: 961 (11° 42.162’ N, 1° 45.508’ E)
Occupation: Siga (H)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources, shea butter tree on site
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.44 sherds/m^2, 7.48 g/m^2
Sources of Disturbance: plowing

Site: 962 (11° 42.235’ N, 1° 45.771’ E)
Occupation: Siga (H)
Area: 125 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: No near-by surface water sources, large baobab tree on site
Chipped Stone: gray flint flake
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 8.36 g/m^2
Sources of Disturbance: plowing, artifacts may have been pushed up by tree roots

Site: 963 (11° 42.252' N, 1° 46.075' E)
Occupation: Tuali-A (L)
Area: 150 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a rise next to a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.56 sherds/m^2, 60.2 g/m^2
Sources of Disturbance: plowing

Site: 964 (11° 42.251' N, 1° 46.245' E)
Occupation: Tuali-B (H)
Area: 50 m^2
Estimated Height: 0.0 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 1.44 sherds/m^2, 32.96 g/m^2
Sources of Disturbance: plowing, modern compound and modern trash (including smashed pot) on site

Site: 965 (11° 42.251' N, 1° 46.387' E)
Occupation: Siga (H)
Area: 255 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is adjacent to a seasonal pool. Locust bean tree on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 11.2 g/m^2
Sources of Disturbance: plowing

Site: 966 (11° 42.313' N, 1° 46.395' E)
Occupation: Siga (H)
Area: 925 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is adjacent to a seasonal pool. Baobab tree near the site
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.28 sherds/m^2, 13.04 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing, two borrow pits on site

Site: 967 (11° 42.333' N, 1° 46.492' E)
Occupation: Siga (L); Tuali-A (H)
Area: 80 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: No near-by surface water sources
Ceramics: Surface ceramic density from systematic collection: 0.56 sherds/m^2, 18.72 g/m^2
Sources of Disturbance: plowing

Site: 968 (11° 42.374' N, 1° 46.231' E)
Occupation: not assigned
Area: 200 m^2
Estimated Height: 0.2 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a ridge above a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 6.04 g/m^2
Small Finds: Several pipe fragments on site
Sources of Disturbance: plowing

Site: 969 (11° 42.369' N, 1° 45.787' E)
Occupation: Siga (H)
Area: 490 m^2
Estimated Height: 0.5 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge above a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.0 sherds/m^2, 37.84 g/m^2
Sources of Disturbance: plowing

Site: 970 (11° 42.418' N, 1° 45.280' E)
Occupation: Siga (L)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on the bank of a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 24.16 g/m^2
Sources of Disturbance: plowing, significant modern trash

Site: 971 (11° 43.111' N, 1° 46.174' E)
Occupation: Siga (H)
Area: 95 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is located near a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.44 sherds/m^2, 66.36 g/m^2
Sources of Disturbance: plowing

Site: 972 (11° 43.156' N, 1° 46.162' E)
Occupation: Siga (H)
Area: 90 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is located on the banks of a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.08 sherds/m^2, 3.28 g/m^2
Iron working: Numerous large chunks of slag and tuyeres: site is composed primarily of smelting debris. 6 tuyere fragments collected, most of which have vitrification
Sources of Disturbance: plowing

Site: 973 (11° 42.799' N, 1° 46.375' E)
Occupation: Siga (H)
Area: 490 m^2
Estimated Height: 1.25 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is near a seasonal drainage with a baobab and tamarind tree at the top of the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.80 sherds/m^2, 33.12 g/m^2
Sources of Disturbance: plowing

Site: 974 (11° 42.638' N, 1° 46.391' E)
Occupation: Siga (H)
Area: 20 m^2
Estimated Height: 0.1 m
Deposit: Very sandy light brown with sparse laterite pebbles
Environment: Site is in a low-lying area
Ceramics: present, no systematic surface collection
Iron working: Site consists almost entirely of a small slag concentration with vitrified tuyeres; tuyere fragment with exterior vitrification collected
Sources of Disturbance: plowing

Site: 975 (11° 42.707' N, 1° 46.283' E)
Occupation: Siga (H)
Area: 105 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is near a seasonal drainage, shea butter tree on site
Ceramics: Surface ceramic density from systematic collection: 1.2 sherds/m^2, 25.56 g/m^2
Sources of Disturbance: plowing

Site: 976 (11° 42.933' N, 1° 46.235' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.4 m
Deposit: Sandy brown with laterite pebbles
Environment: Site is on the banks of a seasonal drainage, tamarind tree on site
Groundstone: present
Sources of Disturbance: plowing, termite mound

Site: 977 (11° 43.222' N, 1° 45.953' E)
Occupation: Tuali-A (L)
Area: 660 m^2
Estimated Height: 1.25 m
Deposit: Sandy brown with laterite pebbles
Environment: Site is on the banks of a seasonal drainage, neem trees on site
Chipped Stone: 51 g piece of raw quartz
Ceramics: Surface ceramic density from systematic collection: 2.68 sherds/m^2, 32.28 g/m^2
Sources of Disturbance: plowing, modern trash

Site: 978 (11° 42.625' N, 1° 46.153' E)
Occupation: Siga (H)
Area: 145 m^2
Estimated Height: 0.5 m
Deposit: Very sandy light brown with dense laterite pebbles
Environment: Site is on the banks of a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 2.08 sherds/m^2, 36.32 g/m^2
Sources of Disturbance: plowing

Site: 979 (11° 42.554' N, 1° 46.179' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge between several seasonal drainages
Ceramics: Surface ceramic density from systematic collection: 0.84 sherds/m^2, 31.88 g/m^2
Sources of Disturbance: plowing

Site: 980 (11° 42.557' N, 1° 46.037' E)
Occupation: Siga (H)
Area: 225 m^2
Estimated Height: 0.4 m
Deposit: Very sandy light brown with laterite pebbles
Environment: Site is near a seasonal drainage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.88 sherds/m^2, 28.76 g/m^2
Sources of Disturbance: plowing

Site: 981 (11° 42.919' N, 1° 45.824' E)
Occupation: Siga (H)
Area: 105 m^2
Estimated Height: 0.3 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is in a field with several seasonal drainages within a couple hundred meters.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.64 sherds/m^2, 11.76 g/m^2
Sources of Disturbance: plowing

Site: 982 (11° 42.794' N, 1° 45.745' E)
Occupation: Siga (H)
Area: 50 m^2
Estimated Height: 0.1 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a rise between two seasonal drainages, one of which is much larger than the other
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 26.96 g/m^2
Sources of Disturbance: plowing

Site: 983 (11° 42.733' N, 1° 45.798' E)
Occupation: Siga (H)
Area: 115 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on the high ground between several seasonal drainages. Locust bean trees near site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.16 sherds/m^2, 15.2 g/m^2
Sources of Disturbance: plowing

Site: 984 (11° 42.647' N, 1° 45.844' E)
Occupation: Siga (L)
Area: 1350 m^2
Estimated Height: 0.7 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on the high ground between several seasonal drainages. Shea butter and locust bean trees on the exterior edges of the site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 1.68 sherds/m^2, 15.96 g/m^2
Sources of Disturbance: plowing
Comments: Slightly ashy area in the center of the site, although site is significantly larger and more oval in shape than other ring sites.

Site: 985 (11° 42.585' N, 1° 45.866' E)
Occupation: Tuali-B (H)
Area: 175 m^2
Estimated Height: 0.4 m
Deposit: Sandy light brown with sparse laterite pebbles
Environment: Site is on a rise near a seasonal drainage
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.68 sherds/m^2, 14.6 g/m^2
Sources of Disturbance: plowing

Site: 986 (11° 42.487' N, 1° 45.837' E)
Occupation: Siga (L)
Area: 80 m^2
Estimated Height: 0.1 m
Deposit: Sandy brown with sparse laterite pebbles
Environment: Site is on a rise along a seasonal drainage; shea butter, locust bean, and *Balanites* sp. trees on site.
Ceramics: Surface ceramic density from systematic collection: 0.2 sherds/m^2, 4.56 g/m^2
Sources of Disturbance: plowing

Site: 987 (11° 42.583' N, 1° 45.760' E)
Occupation: Siga (H)
Area: 225 m^2
Estimated Height: 0.7 m
Deposit: Sandy light brown with laterite pebbles
Environment: Site is on a ridge above a seasonal drainage, tamarind and shea butter trees on site.
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.8 sherds/m^2, 6.52 g/m^2
Sources of Disturbance: plowing

Site: 988 (11° 43.429' N, 1° 45.664' E)
Occupation: Siga (L); Tuali-B (L)
Area: 450 m^2
Estimated Height: 0.0 m
Deposit: Sandy red with sparse laterite pebbles
Environment: Site is adjacent to the foot of the escarpment
Chipped Stone: present
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.6 sherds/m^2, 8.84 g/m^2
Sources of Disturbance: plowing

Site: 989 (11° 43.434' N, 1° 45.684' E)
Occupation: Tuali-B (L)
Area: 80 m^2
Estimated Height: 0.0 m
Deposit: Sandy red
Environment: Site is adjacent to the foot of the escarpment
Chipped Stone: present
Ceramics: Surface ceramic density from systematic collection: 0.32 sherds/m^2, 5.04 g/m^2
Iron working:
Sources of Disturbance: plowing

Site: 990 (11° 43.505' N, 1° '45.692 E)
Occupation: Siga (H)
Area: 400 m^2
Estimated Height: 0.0 m
Deposit: Sandy red
Environment: Site is adjacent to the foot of the escarpment
Chipped Stone: flint debitage
Groundstone: present
Ceramics: Surface ceramic density from systematic collection: 0.76 sherds/m^2, 5.32 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing
Comments: Site may be an extension of site 988

Site: 991 (11° 43.476' N, 1° 45.721' E)
Occupation: not assigned
Area: 225 m^2
Estimated Height: 0.2 m
Deposit: Sandy red with sparse laterite pebbles
Environment: Site is adjacent to the foot of the escarpment, baobab tree on site.
Chipped Stone: present, 13 g piece raw flint collected
Ceramics: Surface ceramic density from systematic collection: 6.76 sherds/m^2, 58.76 g/m^2
Iron working: isolated slag
Sources of Disturbance: plowing

BIBLIOGRAPHY

Adams, W. Y. and E. W. Adams

1991 *Archaeological Typology and Practical Reality*. Cambridge University Press, Cambridge.

Ahn, P. M.

1970 *West African Soils*. 3 ed. Oxford University Press, Oxford.

Allan, W.

1949 *Studies in African Land Usage in Northern Rhodesia*. The Rhodes-Livingstone Papers. Oxford University Press, London.

1965 *The African Husbandman*. Oliver and Boyd, London.

Allsworth-Jones, P.

1987 The Earliest Settlement in West Africa and the Sahara. *West African Journal of Archaeology* 17:87-129.

Ambrose, S. H.

2002 Small Things Remembered: Origins of Early Microlithic Industries in Sub-Saharan Africa. *Archaeological Papers of the American Anthropological Association* 12:9-30.

Ames, K.

1991 Sedentism: A Temporal Shift or a Transitional Change in Hunter-Gatherer Mobility Patterns. In *Between Bands and States*, edited by S. A. Gregg, pp. 108-134. Occasional Paper No. 9. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Andah, B.

1978 Excavations at Rim, Upper Volta. *West African Journal of Archaeology* 8:75-138.

Andah, B. W.

1995 Studying African Societies in Cultural Context. In *Making Alternative Histories: The Practice of Archaeology and History in Non-Western Settings*, edited by P. R. Schmidt and T. C. Patterson, pp. 149-81. School of American Research Press, Santa Fe, NM.

Andrén, A.
1997 *Between Artifacts and Texts: Historical Archaeology in Global Perspective*. Translated by A. Crozier. Contributions to Global Historical Archaeology. Plenum Press, New York :.

Anschuetz, K. F., R. H. Wilshusen and C. L. Scheick
2001 An Archaeology Of Landscapes: Perspectives And Directions. *Journal of Archaeological Research* 9(2):157-211.

Arnold, D.
1985 *Ceramic Theory and Cultural Process*. Cambridge University Press, Cambridge.

Aubrévile, A.
1949 *Climats, Forêts, et Désertification de l'Afrique Tropicale*. Société d'Edition de Géographie Maritime et Coloniales, Paris.

Bahuchet, S., D. McKey and I. de Garine
1991 Wild Yams Revisited: Is Independence from Agriculture Possible for Rain Forest Hunter-Gatherers? *Human Ecology* 19:213-243.

Bailey, R., G. Head, M. Jenike, B. Owen, R. Rechtman and E. Zechenter
1989 Hunting and Gathering in Tropical Rainforest: Is it Possible? *American Anthropologist* 91:59-82.

Baker, K. M.
2000 *Indigenous Land Management in West Africa: An Environmental Balancing Act*. Oxford University Press, Oxford.

Barham, L. and P. Mitchell
2008 *The First Africans: African Archaeology from the Earliest Toolmakers to Most Recent Foragers*. Cambridge University Press, New York.

Barral, H.
1968 *Tiogo: Étude Géographique d'un Terroir Léla (Haute-Volta)*. Mouton, Paris.

Bascom, W.
1951 Yoruba Cooking. *Africa: Journal of the International African Institute* 21(2):125-37.

Bassett, T. J. and D. Crummey
2003 Contested Images, Contested Realities: Environment and Society in African Savannas. In *African Savannas: Global Narratives and Local Knowledge of Environmental Change*, edited by T. J. Bassett and D. Crummey, pp. 1-30. Heinemann, Portsmouth, NH.

Bassett, T. J. and D. Crummey (editors)
2003 *African Savannas: Global Narratives & Local Knowledge of Environmental Change*. James Currey, Oxford.

Bayala, J., Z. Teklehaimanot and S. J. Ouedraogo
2002 Millet production under pruned tree crowns in a parkland system in Burkina Faso. *Agroforestry Systems* 54:203-14.

Becker, M. and F. Wendorf
1993 A Microwear Study of a Late Pleistocene Qadan Assemblage from Southern Egypt. *Journal of Field Archaeoogy* 20(4):389-398.

Bedaux, R., J. Polet, K. Sanogo and A. Schmidt (editors)
2005 *Recherches Archéologiques à Dia dans le Delta Intérieur du Niger (Mali): Bilan des Saisons de Fouilles 1998-2003*. Mededelingen van het Rijksmuseum voor Volkenkunde, Leiden.

Berelov, I.
2006 Signs of Sedentism and Mobility in an Agro-Pastoral Community during the Levantine Middle Bronze Age: Interpreting Site Function and Occupation Strategy at Zahrat Adh-Dhra' 1 in Jordan. *Journal of Anthropological Archaeology* 25:117-43.

Binford, L.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.
1982 The Archaeology of Place, *Journal of Anthropological Archaeology* 1: 5–33.

Binneman, J. N. F.
1997 Usewear Traces on Robberg Bladelets from Rose Cottage Cave. *South African Journal of Science* 93:479-481.

Blanton, R. E.
2005 The Achievements of and Prospects for Survey Archaeology. In *Settlement, Subsistence, and Social Complexity: Essays Honoring the Legacy of Jeffrey R. Parsons*, edited by R. E. Blanton, pp. 295-301. University of California, Los Angeles, Los Angeles.

Blier, S. P.
1987 *The Anatomy of Architecture: Ontology and Metaphor in Batammaliba Architectural Expression*. Cambridge University Press, New York.

Boffa, J.-M., S. J.-B. Taonda, J. B. Dickey and D. M. Knudson
2000 Field-Scale Influence of Karité (*Vitellaria paradoxa*) on Sorghum Production in the Sudan Zone of Burkina Faso. *Agroforestry Systems* 49:153-75.

Bohannan, P.
1954 *Tiv Farm And Settlement*. Colonial Research Studies No. 15. Her Majesty's Stationerry Office, London.

Boulet, R. and J. C. Leprun
1969 *Etude Pédologique de la Haute-Volta, Région Est*. ORSTOM, Dakar.

Bousman, C. B.
2005 Coping With Risk: Later Stone Age Technological Strategies at Blydefontein Rock Shelter, South Africa. *Journal of Anthropological Archaeology* 24:193-226.

Breunig, P. and K. Neumann
2002 From Hunters and Gatherers to Food Producers: New Archaeological and Archaeobotanical Evidence from the West Africa Sahel. In *Droughts, Food and Culture: Ecological Change and Food Security in Africa's Later Prehistory.* , edited by F. Hassan, pp. 123-156. Kluwer/Plenum, New York.

Breunig, P. and H.-P. Wotzka
1991 Archaologische Forschungen im Sudosten Burkina Fasos 1989/90: Vorbericht uber die erste Grabungskampagne des Frankfurter Sonderforschungsbereiches 268 >>Westafrikanische Savanne<<. *Sonderdruck aus Beitrage Zur Allgemeinen Und Vergleichenden Archaologie* 11:145-187.

Brunk, K. and D. Gronenborn
2004 Floods, Droughts and Migrations: The Effect of Late Holocene Lake Level Oscillations and Climate Fluctuations on the Settlement and Political History in the Chad Basin. . In *Living with the Lake. Perspectives on History, Culture and Economics of Lake Chad*, edited by M. Krings and E. Platte, pp. 101-32. Rüdiger Kuoppe Verlag, Cologne.

Buchanan, K. M. and J. C. Pugh
1955 *Land and People in Nigeria: The Human Geography of Nigeria and its Environmental Background*. University of London Press, London.

Bunting, A. H. and E. Bunting (editors)
1984 *The Future of Shifting Cultivation in Africa and the Task of Universities* FAO, Rome.

Burkhill, H. M.
1985 *The Useful Plants of West Tropical Africa: Volume 1, Families A-D*. 2 ed. Royal Botanical Gardens, Kew.
1994 *The Useful Plants of West Tropical Africa: Volume 2, Familes E-I*. 2 ed. Royal Botanical Gardens, Kew.
1995 *The Useful Plants of West Tropical Africa: Volume 3, Families J-L*. 2 ed. Royal Botanical Gardens, Kew.
1997 *The Useful Plants of West Tropical Africa: Volume 4, Families M-R*. 2 ed. Royal Botanical Gardens, Kew.
2000 *The Useful Plants of West Tropical Africa: Volume 5, Families S-Z, Cryptograms, Addenda*. 2 ed. Royal Botanical Gardens, Kew.
2004 *The Useful Plants of West Tropical Africa: Volume 6, General Index*. 2 ed. Royal Botanical Gardens, Kew.

Cameron, C. M. and S. A. Tomka (editors)
1993 *The Abandonment of Settlements and Regions: Ethnoarchaeological and Archaeological Approaches*. Cambridge University Press, Cambridge.

Capron, J.
1973 *Communautés Villageoises Bwa: Mali- Haute Volta*. Muséum National d'Histoire Naturelle: Mémoires de l'Institut d'Ethnologie- IX. Musée de l'Homme: Institut d'Ethnologie, Paris.

Cartry, M.
1963 Notes sur les Signes du Géomancien Gourmantché. *Journal de la Société des Africanistes* 33(2):275-306.
1966 Clans, Lignages et Groupes Familiales chez les Gourmantché. *L'Homme* 6(2):53-81.
1968 La Calabasse de l'Excision en Pays Gourmantché. *Journal de la Société des Africanistes* 38(2):189-225.

Casey, J.
2005 Holocene Occupations of the Forest and Savanna. In *African Archaeology*, edited by A. Stahl, pp. 225- 248. Blackwell, Oxford.

Chantoux, A.

1952 *Gurmantie Telimi Pimu - Cinquante Contes Gourmantché*. Centre IFAN, Niamey.

1954 *Essai de Grammaire Gourmantché*. Centre IFAN, Niamey.

1954 *Dictionnaire Gourmantché-Français*. Centre IFAN, Niamey.

1966 *Histoire du pays Gourma: Traditions orales*. 1 ed. Editions Ti Dogu, Fada N'Gourma (Burkina Faso).

Chantoux, A., A. Gontier and A. Prost

1968 *Grammaire Gourmantché*. Intitiations et Études Africaines 23. IFAN, Dakar.

Cheney, D. M.

2007 *The Hierarchy of the Catholic Church: Current and Historical Information about its Bishops and Dioceses*. vol. 2007.

Chenorkian, R.

1983 Ivory Coast Prehistory: Recent Developments. *African Archaeological Review* I:127-142.

Childs, S. T.

2000 Traditional Iron Working: A Narrated Ethnoarchaeological Example. In *Ancient African Metallurgy*, edited by J. O. Vogel, pp. 199-254. Altamira, Walnut Creek.

Clark, C. and M. Haswell

1966 *The Economics of Subsistence Agriculture*. 2 ed. St. Martin's Press, New York.

Clark, J. D.

1969 *Kalambo Falls Prehistoric Site Volume I: the Geology, Palaeoecology and Detailed Stratigraphy of the Excavations*. Cambridge University Press, Cambridge

Close, A. E. and G. Sampson

1998 Backed Microlith Clusters in Late Holocene Rock Shelters of the Upper Karoo. *The South African Archaeological Bulletin* 53(168):63-72.

Cole, M. M.

1986 *The Savannas: Biogeography and Geobotany*. Academic Press, New York.

Conklin, H.

1954 An Ethnoecological Approach to Shifting Agriculture. *Transcripts of the New York Academy of Sciences* 17(2):133-42.

1963 *The Study of Shifting Cultivation*. Union Panamerica, Washington, DC.

Costin, C.
1991 Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production. *Archaeological Method and Theory* 3:1-56.

Coulibaly, É.
2006 *Savoirs et Savoir-Faire des Anciens Métallurgistes d'Afrique: Precédés et Techniques de la Sidérurgie Directe dans le Bwamu (Burkina Faso et Mali)*. Karthala, Paris.

D' Andrea, C. and J. Casey
2002 Pearl Millet and Kintampo Subsistence. *African Archaeological Review* 19(3):147- 173.

David, N., J. Sterner and K. Gavua
1998 Why Pots are Decorated. *Current Anthropology* 29(3):365-89.

Davies, O.
1967 *West Africa before the Europeans: Archaeology & Prehistory*. Methuen & Co LTD, London.

De Barros, P.
2000 Iron Metallurgy: Sociocultural Context. In *Ancient African Metallurgy*, edited by J. O. Vogel, pp. 147- 198. Altamira, Walnut Creek.

DeCorse, C. R. and G. L. Chouin
2003 Trouble with Siblings: Archaeological and Historical Interpretation of the West African Past. In *Sources and Methods in African History: Spoken, Written, Unearthed*, edited by T. Falola and C. Jennings, pp. 7-15. University of Rochester Press, Rochester, New York.

Devisse, J. (editor)
1993 *Vallées du Niger*. Éditions de la Réunion des Musées Nationaux, Paris.

de Zeeuw, F.
1997 Borrowing of Land, Security of Tenure, and Sustainable Land Use in Burkina Faso. *Development and Change* 28:583-97.

Donkin, R. A.
1991 *Meleagrides, an Historical and Ethnographical Study of the Guinea Fowl*. Ethnographica, London.

Dueppen, S.
2008 *Reinventing Equality: The Archaeology of Kirikongo, Burkina Faso*, University of Michigan.

Dunnell, R. C.
1992 The Notion Site. In *Space, Time, and Archaeological Landscapes*, edited by J. Rossignol and L. Wandsnider, pp. 21-42. Plenum Press, New York.

Duvall, C. S.
2006 *Villages, Vegetation, Bedrock, and Chimpanzees: Human and Non-Human Sources of Ecosystem Structure in Southwestern Mali*, University of Wisconsin.
2007 Human Settlement and Baobab Distribution in South-Western Mali. *Journal of Biogeography* 34(11):1947-61.

Eerkens, J. W.
2003 Residential Mobility and Pottery Use in the Western Great Basin. *Current Anthropology* 44(5):728-238.

Epstein, H.
1971 *The Origin of the Domestic Animals of Africa* 2 volumes. Africana Publishing, New York.

Estes, R. D.
1991 *The Behavior Guide to African Mammals*. University of California Press, Berkeley.

Fairhead, J. and M. Leach
1996 *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic*. African Studies Series ; 90. Cambridge University Press, Cambridge [England] ; New York :.

FAO
1957 Shifting Cultivation. *Unasylva* 1: 9-11
1984 *Institutional Aspects of Shifting Cultivation in Africa*. Food and Agriculture Organization of the United Nations, Rome.
1989 *Report of the FAO Expert Consultation on Fish Technology in Africa: Abidjan, Côte d'Ivoire, 25-28 April 1988*. FAO Fisheries Report no. 400. FAO, Rome.

Folorunso, C. A.
2002 The Archaeology and Ethnoarchaeology of Soap and Dye Making at Ijaye, Yorubaland. *African Archaeological Review* 19(3):127-145.

Ford, R. I.
1985 The Processes of Plant Food Production in Prehistoric North America. In *Prehistoric Food Production in North America*, edited by R. I. Ford, pp. 1-18. Anthropological Papers of the Museum of Anthropology no. 75. University of Michigan, Ann Arbor.

Fortes, M. and S. L. Fortes
1936 Food in the Domestic Economy of the Tallensi. *Africa: Journal of the International African Institute* 9(2):237-76.

Frank, B.
1998 *Mande Potters and Leather-workers*. Smithsonian Institution Press, Washington and London.

Frank, T., P. Breunig, P. Muller-Haude, K. Neumann, W. Van Neer, R. Vogelsang and H.-P. Wotzka
2001 The Chaine de Gobnangou, SE Burkina Faso: Archaeological, Archaeobotanical, Archaeozoological and Geomorphological Studies. *Sonderdruck aus Beitrage Zur Allgemeinen Und Vergleichenden Archaologie* 21:127-190.

Gabrilopoulos, N., C. Mather and C. R. Apentiik
2002 Lineage Organisation of the Tallensi Compound: The Social Logic of Domestic Space in Northern Ghana. *Africa: Journal of the International African Institute* 72(2):221-44.

Gallay, A. and E. Huysecom
1989 *Ethnoarcheologie africaine: un programme d'étude de la céramique récente du Delta Intériur du Niger (Mali, Afrique de l'Ouest)*. Document du Département d'Anthropologie et d'Ecologie de l'Université de Genève. University of Geneva, Geneva.

Ganguly, J. B.
1969 *Economic Problems of the Jhumias of Tripura: A Socio-economic Study of the System of Shifting Cultivation in Transition*. Bookland Private Ltd., Calcutta, India.

Geis-Tronich, G.
1989 *Les Metiers Traditionnels Des Gulmance: Bi Gulmanceba Maasuagu Tuonbuoli*. Franz Steiner Verlag Wiesbaden GMBH, Stuttgart.
1991 *Materielle Kultur Der Gulmance in Burkina Faso*. Franz Steiner Verlag Stuttgart, Stuttgart.

Girard, P.
2002 Charcoal production and use in Africa: what future? *Unasylva* 53:30-35.

Goody, J.
1958 *The Developmental Cycle in Domestic Groups*. Cambridge University Press, Cambridge.
1962 *Death, Property and the Ancestors: A Study of the Mortuary Customs of the LoDagaa of West Africa*. Stanford University Press, Stanford, CA.

Gooneratne, W., P. Wickremasekara, M. Samad and C. M. Wijayaratne
1980 *Rainfed Farming in the Dry Zone of Sri Lanka: A Case Study of Two Villages in the North Central Province*. Research Study. Agrarian Research and Training Institute, Colombo, Sri Lanka.

Gordon, R. B. and D. J. Killick
1993 Adaptation of Technology to Culture and Environment: Bloomery Iron Smelting in America and Africa. *Technology and Culture* 34(2):243-70.

Gosselain, O. P.
2000 Materializing Identities: an African Perspective. *Journal of Archaeological Method and Theory* 7(3):187-217.

Graham, M.
1994 *Mobile Farmers: An Ethnoarchaeological Approach to Settlement Organization among the Raramuri of Northwestern Mexico*. International Monographs in Prehistory, Ann Arbor, MI.

Gross, D. R.
1975 Protein Capture and Cultural Development in the Amazon Basin. *American Anthropologist* 77(3):526-49.

Grove, A. T.
1985a The Environmental Setting. In *The Niger and its Neighbors: Environmental history and hydrobiology, human use and health hazards of the major West African rivers*, edited by A. T. Grove, pp. 3-20. A.A. Balkema, Rotterdam.
1985b The Physical Evolution of the River Basins. In *The Niger and its Neighbors: Environmental history and hydrobiology, human use and health hazards of the major West African rivers*, edited by A. T. Grove, pp. 21-60. A.A. Balkema, Rotterdam.

Grove, A. T. and F. M. G. Klein
1979 *Rural Africa*. Cambridge University Press, London.

Guinko, S.
1984 *Végétation de la Haute-Volta*. PhD Dissertation, University of Bordeaux.

Guyer, J. I.
1981 Household and Community in African Studies. *African Studies Review* 24(2/3):87-137.

Guyer, J. I., E. F. Lambin, L. Cliggett, P. Walker, K. Amanor, T. Bassett, E. Colson, R. Hay, K. Homewood, O. Linares, O. Pabi, P. Peters, T. Scudder, M. Turner and J. Unruh
2007 Temporal Heterogeneity in the Study of African Land Use. *Human Ecology* 35:3-17.

Haaland, R.
1995 Sedentism, Cultivation, and Plant Domestication in the Holocene Middle Nile Region. *Journal of Field Archaeology* 22(2):157-174.

Haour, A., V. Winton, O. A. Idé, H. Rendell and M. Clarke
2006 The Projet SAHEL 2004: An Archaeological Sequence in the Parc W, Niger. *Journal of African Archaeology* 4(2):299-315.

Hargreaves, J. D.
1974 *West African Partitioned*. Macmillan, New York.

Harris, D.
1989 An Evolutionary Continuum of People-Plant Interaction. In *Foraging and Farming: The Evolution of Plant Exploitation*, edited by D. Harris and U. Hillman, pp. 11-26, London.

Harroy, J.-P.
1944 *Afrique Terre Qui Muert*. Marcel Hayez, Brussels.

Harry, D. and L. Frink
2009 The Arctic Cooking Pot: Why Was It Adopted? *American Anthropologist* 111(3):330-343.

Haswell, M.
1953 *Economics of Agriculture in a Savannah Village*. Colonial Research Studies 8, H. M. Stationary Office, London.

Hegmon, M.
1992 Archaeological Research on Style. *Annual Review of Anthropology* 21:517-36.

Henige, D. P.
1974 *The Chronology of Oral Tradition; Quest for a Chimera*. Oxford Studies in African Affairs. Clarendon Press, Oxford.

Hirshfield, C.
1979 *The Diplomacy of Partition: Britain, France, and the Creation of Nigeria 1890/1898*. Kluwer, Hingham, MA.

Hocking, J. A.
1977 Twentieth-Century Evolution of Rural Settlement in the Abuja Area. *Savanna* 6(1):55-70.

Hopkins, B.
1974 *Forest and Savanna: An Introduction to Tropical Terrestrial Ecology with Special Reference to West Africa*. 2 ed. Heinemann, London.

Hough, J. L.
1989 *National Park- Local People Relationships: Case Studies from Northern Benin, West Africa and the Grand Canyon, USA*, Ph.D. Natural Resources, University of Michigan.

Hughes, R. H. and J. S. Hughes
1992 *A Directory of African Wetlands*. IUCN/UNEP/WCMC, Cambridge and Nairobi.

Huysecom, E., S. Ozainne, F. Raeli, A. Ballouche, M. Rasse and S. Stokes
2004 Ounjougou (Mali): A History of Holocene Settlement at the Southern Edge of the Sahara. *Antiquity*:579-93.

Jha, L. K.
1997 *Shifting Cultivation*. APH Publishing Corporation, New Dehli.

Johnson, M.
1977 Cloth Strips and History. *West African Journal of Archaeology* 7:169-78.
1980 Cloth as Money: The Cloth Strip Currencies of Africa. *Textile History* 11:193-202.

Kahlheber, S.
2004 *Perlhirse und Baobab - Archäobotanische Untersuchungen im Norden Burkina Fasos*. PhD Dissertation, Johann Wolfgang Goethe University

Keay, R. W. J.
1959 Derived Savanna - Derived from What? *Bulletin de l'IFAN, Séries A* 21(2):427-38.

Kelly, R. L.
1992 Mobility/Sedentism: Concepts, Archaeological Measures, and Effects. *Annual Review of Anthropology* 21:43-66.

Kelly, R. L., L. Poyer and B. Tucker
2006 Mobility and houses in southwestern madagascar: Ethnoarchaeology among the Mikea and their neighbors. In *Archaeology and Ethnoarchaeology of Mobility*, edited by F. Sellet, R. Greaves and P.-L. Yu, pp. 75-107. University Press of Florida, Gainesville, Florida.

Kent, S. (editor)
1990 *Domestic Architecture and the Use of Space: An Interdisciplinary Cross-Cultural Study*. Cambridge University Press, Cambridge.

Kiethega, J. B.
2009 *La Métallurgie Lourde du Fer au Burkina Faso*. Karthala, Paris.

Killick, D.
2004 What do we Know About African Iron Working? *Journal of African Archaeology* 2:97-113.

Killion, T. W.
1990 Cultivation Intensity and Residential Site Structure: An Ethnoarchaeological Examination of Peasant Agriculture in the Sierra de los Tuxtlas, Veracruz, Mexico. *Latin American Antiquity* 1(3):191-215.

Kingdon, J.
1997 *The Kingdon Field Guide to African mammals*. Academic Press Limited, London.
2004 *The Kingdon Pocket Guide to African Mammals*. Princeton University Press, Princeton and Oxford.

Koechlin, J.
1997 Ecological Conditions and Degradation Factors in the Sahel. In *Societies and Nature in the Sahel*, edited by C. Raynaut, E. Grégroire, P. Janin, J. Koechlin and P. L. Delville, pp. 12-36. Routledge, London.

Kohler, T. A.
1992 Field Houses, Villages, and the Tragedy of the Commons in the Early Northern Anasazi Southwest. *American Antiquity* 57(4):617-35.

Koster, S. H.
1981 *A Survey of the Vegetation and Ungulate Populations in Park W, Niger.* Master's Thesis, Department of Fisheries and Wildlife, Michigan State University.

Kowal, J. M. and A. H. Kassam
1978 *Agricultural Ecology of the Savanna: A Study of West Africa*. Clarendon Press, Oxford.

Kriger, C. E.
2006 *Cloth in West African History*. AltaMira Press, Lanham, MD.

Kuba, R. and C. Lentz (editors)
2006 *Land and the Politics of Belonging in West Africa*. Brill, Boston.

Küppers, K.
1996 *Die Vegetation der Châine de Gobnangou*. PhD Dissertation, Johann Wolfgang Goethe-Universität, Frankfurt, Germany.

Labouret, H.
1931 *Les Tribus du Rameau Lobi*. Institut d'Ethnologie, Paris.

Lavachery, P.
1990 The Holocene Archaeological Sequence of Shum Laka Rock Shelter (Graslands, Western Cameroon). *African Archaeological Review* 18:213-247.

Lal, R.
1974 Soil Erosion and Shifting Agriculture. In *Shifting Cultivation and Soil Conservation in Africa: Papers Presented at the FAO/SIDA/ARCN Regional Seminar Held at Ibadan, Nigeria, 2-21 July 1973,* edited by FAO, pp. 48-71. FAO Soils Bulletin 24. Food and Agriculture Organization of the United Nations, Rome.

LaViolette, A.
2000 *Ethno-Archaeology in Jenné, Mali*. BAR:Archaeopress, Oxford.

Law, R.
1988 History and Legitimacy: Aspects of the Use of the past in Precolonial Dahomey. *History in Africa* 15:431-456.

Lawrence, D. L. and S. M. Low
1990 The Built Environment and Spatial Form. *Annual Review of Anthropology* 19:453-505.

Lawson, A.
2003 *Megaliths and Mande States:Sociopolitical Change in the Gambia Valley over the Past Two Millenia*., Ph.D. Thesis, Department of Anthropology, University of Michigan, Ann Arbor

Lawson, G. W. (editor)
1986 *Plant Ecology in West Africa: Systems and Processess*. John Wiley and Sons, New York.

Leach, M. and R. Mearns (editors)
1996 *The Lie of the Land : Challenging Received Wisdom on the African Environment*. International African Institute in association with James Curry; Heinemann, Oxford : Portsmouth, N.H. :.

Lentz, C.
2000 Of Hunters, Goats and Earth-Shrines: Settlement Histories and the Politics of Oral Tradition in Northern Ghana. *History in Africa* 27:193-214.
2006 Land Rights and the Politics of Belonging in Africa: An Introduction. In *Land Rights and the Politics of Belonging in West Africa*, edited by R. Kuba and C. Lentz, pp. 1-34. Brill, Boston.

Lentz, C. and H.-J. Sturm
2001 Of Trees and Earth Shrines: An Interdisciplinary Approach to Settlement Histories in the West African Savanna. *History in Africa* 28:139-168.

Little, B. J. (editor)
1992 *Text-Aided Archaeology*. CRC Press, Boca Raton, FL :.

MacDonald, K. C.
1997 Kourounkorokalé Revisited: the Pays Mande and the West African Microlithic Technocomplex. *African Archaeological Review* 14:161-200.

MacDonald, K. C. and P. Allsworth-Jones
1994 A Reconsideration of the West African Macrolithic Conundrum: New Factory Sites and an Associated Settlement in the Vallée du Serpent, Mali. *African Archaeological Review* 12:73-104.

MacEachern, S.
2001 Setting the Boundaries: Linguistics, Ethnicity, Colonialism, and Archaeology South of Lake Chad. In *Archaeology, Language, and History: Essays on Culture and Ethnicity*, edited by J. E. Terrell, pp. 79-102. Bergin and Garvey, Westport, Connecticut.

Madiega, G.
1982 Contribution à l'Histoire Précoloniale du Gulma (Haute Volta). *Studien zur Kulturkunde Wiesbaden* 62:1-260.

Madiega, G., B. B. Ouoba, O. Kabore and N. C. Somda
1983 *Projet Gulma: Histoire du Peuplement du Gulma par la Tradition Orale*. Institut de Recherche en Science Sociales et Humaines (Haute Volta), Ouagadougou.

Magnavita, S., M. Hallier, C. Pelzer, S. Kahlheber and V. Linseele
2002 Nobles, Guerriers, Paysans. Une Nécropole de l'Age de Fer et son Emplacement dans l'Oudalan Pré- et protohistorique. *Berichte des Sonderforschungsbereichs, Frankfurt a.M*. 268(22):21-64.

Maley, J.
1981 *Études Palynologiques dans le Bassin du Tchad et Paléoclimatologie de l'Afrique Nord-Tropicale de 30,000 Ans à l'Époque Actuelle*. Travaux et Documents de l' O.R.S.T.O.M #129. O.R.S.T.O.M, Paris.

Manessy, G.
1960 *Tâches Quotidiennes et Travaux Saisonneirs en Pays Bwa*. Publications de la Section de Langages et Littératures. Université de Dakar: Facult´´des Lettres et Sciences Humaines, Dakar, Senegal.

Marchal, J. Y.
1978 Vestiges d'Occupation Ancienne au Yatenga (Haute Volta): Une Reconnaissance du pays Kibga. *Cahier ORSTOM, Séries Science Humaine* XV(4):449-484.

Marchal, M.
1983 *Les Paysages Agraires de Haute-Volta: Analyse Structurale par la Méthode Graphique*. Atlas des Structures Agraires au Sud du Sahara. ORSTOM, Paris.

Martin, R.
1993 *Pflanzensoziologische und Ethnobotanische Untersuchungen der Dorfvegetation in der Provinz Tapoa, Burkina Faso*. Diplomarbeit, Johann Wolfgang Goethe-Universität.

Mayor, A., E. Huysecom, A. Gallay, M. Rasse and A. Ballouche
2005 Population dynamics and Paleoclimate over the past 3000 years in the Dogon Country, Mali. *Journal of Anthropological Archaeology* 24:25-61.

McFarland, D.
1978 *Historical Dictionary of Upper Volta*. Scarecrow Press, Metuchen, NJ.

McIntosh, R. J.
1998 *The Peoples of the Middle Niger: The Island of Gold*. Blackwell Publishers, Oxford.
2005 *Ancient Middle Niger: Urbanism and the Self-Organizing Landscape*. Case Studies in Early Societies. Cambridge University Press, Cambridge.

McIntosh, S. K. (editor)
1995 *Excavations at Jenné-Jeno, Hambarketolo, and Kaniana (Inland Niger Delta, Mali), the 1981 Season*. University of California Press, Berkeley.

McIntosh, S. K., D. Gallagher and R. McIntosh
2003 Tobacco Pipes From Excavations at the Museum Site, Jenne, Mali. *Journal of African Archaeology* 1(2):171-199.

Menaut, J. C. and J. Cesar
1982 The Structure and Dynamics of a West African Savanna. In *Ecology of Tropical Savannas*, edited by B. L. Huntley and B. H. Walker, pp. 80-100. Springer-Verlag, New York.

Menaut, J. C., M. Lepage and L. Abbadie
1995 Savannas, Woodlands and Dry Forests in Africa. In *Seasonally Dry Tropical Forests*, edited by S. H. Bullock, H. A. Mooney and E. Medina, pp. 64-92. Cambridge University Press, Cambridge.

Mercier, P.
1968 *Tradition-Changement-Histoire: Les 'Somba' du Dahomey Septentrional*. Anthropos, Paris.

Mikesell, M. W.
1967 Geographic Perspectives in Anthropology. *Annals of the American Association of Geographers* 57:617-34.

Millogo, K. A.
1993a Recherches Préhistoriques au Burkina Faso. *L'Anthropologie* 97(1):97-118.
1993b Résultats des Premiers Sondages dans l'Abri de Yobri (Sud-Est du Burkina Faso). *L'Anthropologie* 97(1):119-30.

Monteil, C.
1927 *Le Coton chez les Noirs*. Librairie Emile LaRose, Paris.

Moody, K.
1974 Weed Control in Shifting Cultivation. In *Shifting Cultivation and Soil Conservation in Africa: Papers Presented at the FAO/SIDA/ARCN Regional Seminar Held at Ibadan, Nigeria, 2-21 July 1973*, edited by FAO, pp. 155-66. FAO Soils Bulletin 24. Food and Agriculture Organization of the United Nations, Rome.

Moreland, J.
2001 *Archaeology and Text*. Duckworth Press, London.
2006 Archaeology and Texts: Subservience or Enlightenment? *Annual Review of Anthropology* 35:135-51.

Mortimore, M.
1998 *Roots in the African Dust: Sustaining the Sub-Saharan Drylands*. Cambridge University Press, Cambridge.

Müller-Haude, P.
1995 *Landschaftsökologie und Traditionelle Bodennutzung in Gobnangou (SE-Burkina Faso, Westafrika)*. Frankfurter Geowissenschaftliche Arbeiten: Serie D, Physische Geographie. Institut für Physische Geographie, Frankfurt am Main.

Mvondo, O. J. P.
1994 La Question des Pipes Archéologiques en Afrique: Les Nouvelles Évidences. *West African Journal of Archaeology* 24:1-19.

National Research Council (NRC
1996 *Lost Crops of Africa Volume I: Grains*. National Academy Press, Washington, DC.
2006 *Lost Crops of Africa Volume II: Vegetables*. National Academy Press, Washington, DC.
2008 *Lost Crops of Africa Volume III: Fruits*. National Academy Press, Washington, DC.

Nelson, M. C. and G. Schachner
2002 Understanding Abandonments in the North American Southwest. *Journal of Archaeological Research* 10(2):167-206.

Netting, R. M.
1968 *Hill Farmers of Nigeria: Cultural Ecology of the Kofyar of the Jos Plateau*. University of Washington Press, Seattle.

Neumann, K.
1999 Early Plant Food Production in the West African Sahel: New Evidence. In *The Exploitation of Plant Resources in Ancient Africa*, edited by M. Van Der Veen. Kluwer/Plenum, New York.

Neumann, K., A. Butler, and S. Kahlheber ed.
2003 *Food, Fuel and Fields: Progress in African Archaeobotany*. Africa Praehistorica 15. Heinrich Barth Institute, Cologne.

Nye, P. H. and D. J. Greenland
1960 *The Soil Under Shifting Cultivation*. Commonwealth Agricultural Bureau, Bucks, England.

Ogundiran, A.
2003 Chronology, Material Culture, and Pathways to the Cultural History of Yoruba-Edo Region, 500 B.C. - A.D. 1800. In *Sources and Methods in African History: Spoken, Written, Unearthed*, edited by T. Falola and C. Jennings, pp. 33-79. University of Rochester Press, Rochester, New York.

Okigbo, B. N.
1984 Shifting Cultivation in Tropical Africa: definition and description. In *The Future of Shifting Cultivation in Africa and the Task of Universities*, edited by A. H. Bunting and E. Bunting, pp. 18-36. Food and Agriculture Organization of the United Nations, Rome.

Oliver, P.
1969 *Shelter and Society*. Frederick A. Praeger, New York.

Parsons, J. P.
1972 Archaeological Settlement Patterns. *Annual Review of Anthropology* 1:127-150.

Pedler, F. J.
1955 *Economic Geography of West Africa*. Longmans, Green, London.

Pélissier, P.
1966 *Les Paysans du Sénégal: Les Civilisations Agraires du Cayor à Casamance*. Fabrègue, St. Yriex.

Petit, L.
2005 *Archaeology and History in North-Western Benin*. BAR International Series 1398. Archaeopress, Oxford.

Petit-Maire, N.
1986 Palaeoclimates in the Sahara of Mali: A Multidisciplinary Study. *Episodes* 9(1):7-16.

Phillipson, D. W.
1976 *The Later Prehistory of Zambia*. British Institute in Eastern Africa, Nairobi.

Pieri, C. J. M. G.
1992 *Fertility of Soils: A Future for Farming in the West African Savanna*. Springer-Verlag, New York.

Pigeonnière, A. L. and S. Jomni
1998 *Atlas du Burkina Faso*. Editions Jeune Afrique, Paris.

Prudencio, C. Y.
1993 Ring Management of Soils and Crops in the West African Semi-Arid Tropics: The Case of the Mossi Farming System of Burkina Faso. *Agriculture, Ecosystems and Environment* 47:237-64.

Prussin, L.
1969 *Architecture in Northern Ghana: A Study of Forms and Functions*. University of California Press, Berkeley.

Pullan, R. A.
1974 Farmed Parkland in West Africa. *Savanna* 3(2):119-151.

Rafferty, J.
1985 The Archaeological Record on Sedentariness: Recognition, Development, and Implications In *Advances in Archaeological Methods and Theory*, edited by M. B. Schiffer. Academic Press, New York.

Ramakrishnan, P. S., K. G. Saxena and K. S. Rao (editors)
2006 *Shifting Agriculture and Sustainable Development of North-Eastern India: Tradition in Transition*. UNESCO, New Dehli.

Rapoport, A.
1969 *House Form and Culture*. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Reid, A. and R. Young
2000 Pottery Abrasion and the Preparation of African Grains. *Antiquity* 74(283):101-111.

Remy, G.
1967 *Yobri: Étude Géographhique du Terroir d'un Village Gourmantché de Haute-Volta*. Atlas des Structures Agraires au Sud du Sahara. Mouton and Co., Paris.

Rice, P. M.
1987 *Pottery Analysis: A Sourcebook*. University of Chicago Press, Chicago.
1999 On the Origins of Pottery. *Journal of Archaeological Method and Theory* 6(1):1-54.

Roberts, R. L.
1996 *Two Worlds of Cotton: Colonialism and the Regional Economy in the French Soudan, 1800-1946*. Stanford University Press, Stanford.

Robertshaw, P.
2000 Sibling Rivalry? The Intersection of Archaeology and History. *History in Africa* 27:261-86.

Rossignol, J.
1992 Concepts, Methods, and Theory Building: A Landscape Approach. In *Space, Time, and Archaeological Landscapes*, edited by J. Rossignol and W. LuAnn, pp. 3-20. Plenum Press, New York.

Rossignol, J. and L. Wandsnider (editors)
1992 *Space, Time, and Archaeological Landscapes*. Plenum Press, New York.

Rountree, H.
1989 *The Powhatan Indians of Virginia: Their Traditional Culture*. University of Oklahoma Press, Norman.

Ruthenberg, H.
1971 *Farming Systems in the Tropics*. Oxford University Press, London.

Sahlins, M.
1957 Land Use and the Extended Family in Moala, Fiji. *American Anthropologist* 59(3):449-62.

Saltman, C., C. L. Goucher and E. W. Herbert
1986 The Blooms of Banjeli: Technology and Gender in African Ironmaking [film], Documentary Educational Resources, USA.

Sattran, V. and U. Wenmenga
2002 *Geology of Burkina Faso*. Czech Geological Survey, Praha-Ouagadougou-London.

Savonnet, G.
1959 Un systeme de cultures perfectionné, practiqué par les bwa-Bobo-Oulé de la region de Houndé (Haute Volta). *Bulletin de l'IFAN* XXI, serie B(3-4).
1970 *Pina: Étude d'un Terroir de Front Pionnier en Pays Dagari*. Atlas des Structures Agraires au Sud du Sahara 4, Mouton, Paris.
1976 *Les Birifor de Diépla et sa Région, Insulaires du Rameau Lobi: Haute-Volta*. Atlas des Structures Agraires au Sud du Sahara 12, Mouton, Paris.

Schiffer, M. B.
1987 *Formation Processes of the Archaeological Record*. Albuquerque: University of New Mexico Press.

Schlanger, S.
1991 On Manos, Metates, and the History of Site Occupations. *American Antiquity* 56:460-474.
1992 Recognizing Persistent Places in Anasazi Settlement Systems. In *Space, Time, and Archaeological Landscapes*, edited by J. Rossignol and L. Wandsnider, pp. 91-112. Plenum Press, New York.

Schlippe, P. d.
1956 *Shifting Cultivation in Africa: The Zande System of Agriculture*. Routledge and Kegan Paul, London.

Schmidt, P. R.
1978 *Historical Archaeology : A Structural Approach in an African Culture*. Contributions in Intercultural and Comparative Studies. no. 3. Greenwood Press, Westport, Conn. :.

Schmidt, P. R. and J. R. Walz
2007 Re-Representing African Pasts through Historical Archaeology. *American Antiquity* 72(1):53-70.

Schwahn, J.
2003 Zur Fischfauna des Pendjari-Nationalparks in Benin (Westafrika). *Deutsche Gesellschaft fûr Limnologie (DGL)- Tagungsbericht 2002 (Braunschweig)*:6p.

Shanahan, T. M., J. T. Overpeck, C. W. Wheeler, J. W. Beck, J. S. Pigati, M. R. Talbot, C. A. Scholz, J. Peck, J. W. King and
2006 Paleoclimatic Variations in West Africa from a Record of late Pleistocene and Holocene Lake Level Stands of Lake Bosumptwi, Ghana. *Palaeogeography, Palaeoclimatology, Palaeoecology* 242:287-302.

Shaw, T.
1978 Holocene Adaptations in West Africa: the Late Stone Age *Early Man News* 3/4:51-82.
1985 The Prehistory of West Africa. In *History of West Africa, Volume I*, edited by J. F. A. Ajayi and M. Crowder, pp. 48-86. Longman, New York.

Shea, P. J.
1975a *The Development of an Export Oriented Dyed Cloth Industry in Kano Emirate in the Nineteenth Century*, Ph.D. thesis, Department of Anthropology. University of Wisconsin-Madison.
1975b Responses to Changing Economic Conditions in the Indigo-Dyeing Industry in Kano in the Nineteenth Century. *African Economic History Review* 2(1):30-32.

Shennen, S.
1989 Introduction: Archaeological Approaches to Cultural Identity. In *Archaeological Approaches to Cultural Identity*, edited by S. Shennen, pp. 1-32. Unwin-Hyman, London.

Shinnie, P. L. and F. J. Kense
1989 Archaeology of Gonja, Ghana: Excavations at Daboya. University of Calgary Press, Calgary.

Shipton, P.
1994 Land and Culture in Tropical Africa: Soils, Symbols, and the Metaphysics of the Mundane. *Annual Review of Anthropology* 23:347-77.

Skinner, E. P.
1989 *The Mossi of Brukina Faso: Chiefs, Politicians and Soldiers*. Waveland Press, Inc., Prospect Heights, IL.

Slingerland, M. and M. Masdewel
1996 Mulching on the Central Plateau of Burkina Faso: Widespread and Well Adapted to Farmers' Means. In *Sustaining the Soil: Indigenous Soil and Water Conservation in Africa*, edited by C. Reij, I. Scoones and C. Toulmin, pp. 85-89. Earthscan Publications Ltd., London.

Smith, B.
2001 Low Level Food Production. *Journal of Archaeological Research* 9(1):1-43.

Spinage, C. A.
1986 *The Natural History of Antelopes*. Cromm Helm, London.

Stahl, A.
1993 Intensification in the West Africa Late Stone Age. In *The Archaeology of Africa: Foods, Metals and Towns*, edited by T. Shaw, P. Sinclair, B. Andah and A. Okpoko, pp. 261-273. Routledge, London.
2001 *Making History in Banda: Anthropological Visions of Africa's Past*. New Studies in Archaeology. Cambridge University Press, New York.

Stahl, A. B., M. das Dores Cruz, H. Neff, M. D. Glascock, R. J. Speakman, B. Giles and L. Smith
2008 Ceramic Production, Consumption and Exchange in the Banda area, Ghana: Insights from Compositional Analyses. *Journal of Anthropological Archaeology* 27(3):363-381.

Stone, G. D.
1993 Agricultural Abandonment: A Comparative Study in Historical Ecology. In *Abandonment of Settlements and Regions: Ethnoarchaeological and archaeological approaches*, edited by C. M. Cameron and S. A. Tomka, pp. 74-81. Cambridge University Press, Cambridge.
1996 *Settlement Ecology: The Social and Spacial Organization of Kofyar Agriculture*. The University of Arizona Press, Tucson.

Swanson, R. A.
1979 *Gourmantche Agriculture*. USAID.
1985 *Gourmantche Ethnoanthropology*. University Press of America, Lanham, Maryland.

Swift, J.
1996 Desertification: Narratives, Winners, and Losers. In *The Lie of the Land: Challenging Received Wisdom on the African Environment*, edited by M. Leach and R. Mearns, pp. 73-90. International African Institute in association with Heinemann, Portsmouth, N.H.

Swindell, K.
1992 African Food Imports and Agricultural Development: Peanut Basins and Rice Bowls in The Gambia 1843-1933. In *Agricultural Change, Environment and Economy: Essays in Honour of W. B. Morgan*, edited by K. Hoggart, pp. 159-79. Mansell Publishing, New York.

Talbot, M. R. and G. Delibrias
1980 A New Late Plaistocene-Holocene Water-Level Curve for Lake Bosumtwi, Ghana. *Earth and Planetary Science Letters* 47:336-344.

Tauxier, L.
1912 *Le Noir du Soudan. Pays Mossi et Gourounsi. Documents et analyses.* Larose, Paris.

Thilmans, G., C. Descamps and B. Khayat
1980 *Protohistoire du Sénégal:Recherches archéologiques.* IFAN, Dakar.

Timmer, L. A., J. J. Kessler and M. Slingerland
1996 Pruning of Néré trees (*Parkia biglobosa* (Jacq.) Benth.) on the farmlands of Burkina Faso, West Africa. *Agroforestry Systems* 33:87-98.

Trochain, J.
1940 *Contribution A L'Etude De La Vegetation Du Senegal.* Mémoires de l'Institut Francais d'Afrique Noire No.2. I.F.A.N., Dakar.

Trouillot, M.-R.
1995 *Silencing the Past. Power and the Production of History.* Beacon Press, Boston.

Turner, B. L. I. and S. B. Brush (editors)
1987 *Comparative Farming Systems.* The Guilford Press, New York.

1987 Purpose, Classification, and Organization. In *Comparative Farming Systems*, edited by B. L. I. Turner and S. B. Brush, pp. 3-10. The Guilford Press, New York.

UNEP
2008 *Africa: Atlas of our Changing Environment.* UNEP, Nairobi, Kenya.

van der Veen, M. ed.
1999 *The Exploitation of Plant Resources in Ancient Africa.* Kluwer-Plenum, New York.

Vansina, J.
1965 *Oral Tradition: A Study in Historical Methodology.* Routledge and Keegan Paul, London.
1985 *Oral Tradition as History.* University of Wisconsin Press, Madison, Wis.
1995 Historians, Are Archeologists Your Siblings? *History in Africa* 22:369-408.

Varien, M. D.
1999 *Sedentism and Mobility in a Social Landscape: Mesa Verde and Beyond.* University of Arizona Press, Tucson.

Vernet, R.
1996 *Le Sud-Ouest du Niger de la Prehistoire au Début de l'Histoire*. Études Nigériennes. IRSH-SÉPIA, Paris.

Walker, B. H. and I. Noy-Meir
1982 Aspects of the Stability and Resilience of Savanna Ecosystems. In *Ecology of Tropical Savannas*, edited by B. L. Huntley and B. H. Walker, pp. 556-90. Springer-Verlag, New York.

Whallon, R. and J. A. Brown (editors)
1982 *Essays on Archaeological Typology*. Center for American Archaeology Press, Evanston, Illinois.

Whittlesey, D.
1937 Fixation of Shifting Cultivation. *Economic Geography* 13(2):139-54.

Wills, J. B. (editor)
1962 *Agriculture and Land Use in Ghana*. Oxford University Press, London.

Wittig, R. and R. Martin
1995 Krautige Wildpflanzen in der Provinz Tapoa (Burkina Faso) und ihre Nutzung für die menschliche Ernährung. In *Mensch un Natur in Westafrika: Eine interdisziplinäre Festschrift für Günter Nagel*, edited by K. Brunk and U. Greinert-Byer, pp. 203-14. Berichte des Sonderforschungsberiech 268: Kulturentwicklung und Sprachgeschichte im Naturraum Westafrikanishe Savanne. Johann Wolfgang Goethe-Universität, Frankfurt am Main.

Wotzka, H.-P. and C. Goedicke
2001 Thermoluminescence Dates on Late Stone Age and Later Ceramics from Tapoa Province (southeastern Burkina Faso and Konduga (Borno, Northeastern Nigeria). *Sonderdruck aus Beitrage Zur Allgemeinen Und Vergleichenden Archaologie* 21:75-126.

Wylie, A.
2002 *Thinking from Things: Essays in the Philosophy of Archaeology*. University of California Press, Berkeley.