Excavations at Jenne-Jeno, Hambarketolo, and Kaniana (Inland Niger Delta, Mali): the 1981 Season

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<th>McIntosh, Susan Keech</th>
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<td>Date</td>
<td>1995</td>
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<td>Resource type</td>
<td>Books</td>
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<td>Language</td>
<td>English</td>
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<td>Subject</td>
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<td>Coverage (spatial)</td>
<td>Middle Niger, Mali, Djenné</td>
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<td>Format extent</td>
<td>652 pages</td>
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To Desmond Clark, Brian Fagan, Merrick Posnansky, Thurstan Shaw, and the late Raymond Mauny, whose collective encouragement and support have played an important role in the Jenn6 research. Would that all young scholars could have such wonderful mentors and friends.

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Foreword
It is indescribably sweet to have this monograph completed at long last. Based on our execution of the published report of the 1977 excavations at Jenn6-jeno within three years of the end of the fieldwork, one might have anticipated the publication of the 1980-1981 fieldwork well before this. But life was simpler then, before the appearance of babies and administrative posts in the University that operated like gigantic black holes in our lives, sucking in all available time. The 1980-1981 excavations were also considerably more extensive than those in 1977. Teaching for an eight-year stretch without sabbatical or any other leave, from 1981-1989, made it impossible to create a block of time large enough to allow total immersion in the voluminous data whose intricate patterning across many excavation units was the key to understanding the chronology and development of the Jenn4-jeno site complex. My sabbatical year at the Center for Advanced Study in the Behavioral Sciences in 1989-1990 offered me the first real opportunity to do this. Drafts for all chapters except Metals and the final, concluding chapter were completed that year. The remaining chapters were completed at Rice in 1991-1992, following a year of fieldwork in Senegal. Since completion of the manuscript in August 1992, much time has been taken up by review, copyediting, and revision and by preparation of camera-ready copy. It is unfortunate, but true, that American publishers generally will not undertake to publish archaeological monographs by traditional typesetting methods. The production costs for such lavishly illustrated volumes are simply too high. Camera-ready copy is the cost-effective solution for the presses. For those preparing the camera-ready copy, however, the process is anything but efficient. This monograph has required over 600 hours of preparation, much of it in getting tables and figures to fit within the specified margins and cutting and pasting them onto the page. Because Rice is a small university without the secretarial, drafting, or other support staff that large institutions often enjoy, I have had to do a good deal of this work myself. I am grateful for the patience of Rose Anne White, editor of the University of California Press monograph series in Anthropology as I staggered, slowly and often painfully, up the steep CRC learning curve.
It must be acknowledged that a good deal of this souffrance is selfinflicted. Despite the disgruntlement expressed by one reviewer of the first

Foreword
monograph that so many data were provided, creating weighty appendices of dubious utility, I have not repented. As much as 50% of this monograph consists of data in tabular or graphic form, much of it relegated to appendices. I remain
firm in my conviction that only this detailed level of reportage creates what I call a "living" document. By this I mean a report that permits new analyses and interpretations. The data sets it contains can be prodded and probed and manipulated quantitatively to yield new insights. It provides adequate detail for comparative purposes as new material becomes available. It becomes an important tool in ongoing and future evaluations of the site or regional archaeology. There is nothing more chilling than an archaeological report that is the antithesis of this: a "dead" document. In such a report, the archaeologist eschews details and presents interpretive generalities. Evaluation of the two fundamental properties of archaeological interest—association and context—is impossible due to insufficient stratigraphic detail. Small subsets of material are selected for analysis and comment, but we are not told why the greater part of the material does not merit comment, nor what its characteristics are. In these reports, there are no data quarries to mine for comparisons with new material from the same or other sites. There is only the sinking realization of the vast and precious array of material culture and ecofacts that died under that archaeologist's spade; of all the things we could have known but now may never know. While acknowledging that it is impossible to recover all the potential data yielded up by excavation, since these are virtually infinite and our techniques and finances are limited, careful recovery and description of basic categories of material culture, botanical and faunal remains provide exceptionally powerful tools for interpreting the past of a poorly-known area, such as the Inland Niger Delta. It has been our goal to deploy these tools as fully as possible. For sites such as Jenn6-jeno, painstaking documentation is especially important, because the Inland Niger Delta occupation mounds are seriously menaced by pothunting. Undisturbed archaeological deposits are a vanishing resource.

There is also the fact, as numerous reviewers of the 1977 work have pointed out, that the claims that we have made for Jennd-jeno as an indigenous African town require substantiation from the 1980-1981 research. It is part of our scholarly responsibility to provide the fullest documentation so that readers may understand and assess the data on which we base them. It is precisely the quality and variety of the data recovered that has made Jenn6-jeno such an important site for understanding Iron Age society in subSaharan Africa.

It is a matter of considerable anguish for all of us who conduct archaeological research in the Inland Delta that the pace of looting has demonstrably increased in recent years. It is part of a worldwide pattern in which the collector's quest for authenticity in "primitive" art has led inexorably towards the archaeological past as acculturation of traditional peoples has eliminated or transformed the production of ethnographic art. The well-known market excesses of the 1980's pushed prices sky-high, which had predictable consequences for source areas of particularly sought-after antiquities. It is true that the archaeologist, under these conditions, must chart a dreary course between the Scylla of silence concerning the scientific results of his
or her research and the Charybdis of providing aid and succor to the antiquities dealers in the form of knowledge that can potentially increase their profits. This dilemma was already apparent to us in 1977, when we first began excavations at Jennd-jeno. The site surface at that time was heavily disturbed by looters. Baudoin de Grunne, the premier collector of "Jennd" terracottas had already assembled a considerable collection that Jacqueline Evrard studied for a master's thesis at the University of Louvain in 1977. The existence of a looting problem was well-known at that time to the Directeur du Patrimoine Culturel, Alpha Konaré (now President of Mali), who commented on it to us as we worked together at Jennd-jeno during the first week of excavation in 1977. The discovery of a rather poor-quality terracotta statuette in situ, providing hitherto unavailable information on the context and use of these figures, placed us squarely on the horns of the familiar dilemma: to publish or not to publish. During Alpha Konard's visit to Santa Barbara in 1978, we laid the question before him. What did he feel was the right thing to do? Without hesitation, he replied that we must publish as widely as we could. The need to understand Mali's extraordinary past could not be held hostage to fear of looters. And of course, he was and is right. As various other African archaeologists have observed, refusing to publish the results of archaeological research because the information might be used by antiquaires simply creates another mechanism whereby the richness of the African past is consigned to obscurity, relegating Africa to perpetual status as the land of the People without History. Emboldened by Konard's response, we took the direct approach of publishing the 1977 statuette discovery in a journal widely read by collectors, African Arts. It was a piece very much concerned with the context of the piece and its scientific significance and very little with its aesthetics. Like many of our subsequent articles and presentations on the terracottas, it had a serious didactic purpose to inform both scholars and collectors of the incalculable damage wrought by looting. Rod McIntosh, in particular, made the ethical issues attached to the servicing and facilitation, by scholars, of the illegal antiquities trade a full time crusade. He has published widely on the topic and helped organize and moderate conferences and symposia dedicated to mitigating the trade in African antiquities. The much increased visibility of the topic at meetings of the African Studies Association, the Triennial Symposium on African Art, and the Society for African Archaeology is due, at least in part, to his dedication. Given this history of concerns, reflections and actions on the topic of our research in the face of the activities of looters in the Jennd area, I cannot leave unaddressed some of the misrepresentations that have emerged from the mouths and pens of some of our European colleagues who have recently taken up the eminently worthy cause of the African antiquities trade. The Dutch archaeologist Diderik van der Waals and the French archaeologist Jean Polet have both served up to a broad European public the claim that looting at Inland Delta mounds was negligible or relatively unimportant until our excavations. In Walter van Beek's documentary ("The African King") on the
antiquities trade, van der Waals implicates our research as a factor greatly accelerating the rate of potholing at Jennd-jeno. It is the only causal factor he suggests, leaving unexamined the larger economic forces that drove demand for antiquities throughout the 1980s.

Jean Polet, writing on the antiquities trade in autumn, 1993 in the French magazine Gio, prefers to let the sequence of events speak for itself: Inland Delta terracotta statuettes appeared on the Dakar market in the 1960's but no one was interested. It was only after the discovery of a "superb" statue (described in this volume) during excavations in 1977 (sic) and the attribution of considerable antiquity to the terracottas by radiocarbon dating that the market came alive. Polet's understanding of the excavations is revealed by his comment, "whatever the ethical sense of the archaeologist may be, the American system of "sponsoring" the excavations at Jenn6-jeno (by the National Geographic Society) tied the scientific issues to journalistic coverage." (118, translation mine) The "facts" as Polet reports them do not inspire confidence in his analysis. The excavations at Jenn6-jeno were funded by the National Science Foundation and the American Association of University Women, a fact that is easily accessible in our numerous publications. National Geographic provided no funds for the research at Jenn6-jeno. It is worth mentioning, however, since I have received funding for other archaeological projects from the National Geographic Society's Committee on Research and Exploration, that the research arm of the society is entirely distinct and autonomous from National Geographic Magazine. To suggest that scientific concerns are tied to journalistic concerns by the Committee on Research without investigating the matter is simply irresponsible. To compound the error by identifying this alliance as part of the "American system" of research financing suggests an ideological bias at work. Polet's account is riddled with other factual errors that peer review or simple correspondence could have eliminated. But these are incidental to the question at hand, which is the extent to which our publications on our research at Jennd-jeno (the present volume included) accelerate the looting and what can be done about it.

I have already offered my opinion on the necessity of publishing despite the threat of accelerated looting. Whatever one's opinion may be of popular vehicles such as National Geographic, the undeniable truth is that in the case of Jenn6-jeno, they opened up a previously unknown civilization to millions of people who might never have guessed that such marvelous places existed so long ago in sub-Saharan climes. Furthermore, because the article also appeared in Gio, the people of Mali, and especially of Jenn6, could bask in the glory of this common past. Is this what Alpha Konar6 had in mind when he urged us to publish as widely as possible? I rather suspect it was.

But for our purposes here, the real lesson comes from the response of Jenn6's inhabitants towards the past buried at Jennd-jeno. Their pride in this common history has resulted in the development of a protective attitude toward the site. During our stays in Jennd in 1977 and 1981, we attempted to

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establish the foundation for this by making the effort to educate and sensitize the
townspeople to the importance of the past under their feet. We
conducted tours for locals at the site and notified prominent elders and keepers of
tradition when significant finds were made, so that they could contribute to the
interpretation of the past. Shortly before our departure in 1981, a group of
prominent local men founded the Amis de Jenn6, one goal of which was the
preservation of Jennd-jeno. Our Gio article provided renewed impetus for their
efforts. This is, I believe, a real success story in the battle against looting. Our
visits to Jenn6-jeno in 1984 and 1986 indicated that pothunting at the site had not
increased beyond the level we had noted in 1977. It is unclear on what basis van
der Waals claimed the contrary. Rather, disapproval of such activities at Jenn6-
jeno pushes looters into more remote areas where local sentiment remains
indifferent. But indifference can be transformed through education. Our
experience at Jennd-jeno suggests that change at the grass roots level is a
powerful tool in the struggle to preserve Africa's past. It can take as little to
initiate that change as Western archaeologists taking the time to talk to the locals
about their past and how archaeology discovers it. It can take as much as a
splashy National Geographic article. How we get there doesn't matter. We all
have a stake in preserving the archaeological legacy of the Inland Niger Delta for
posterity. And it will take more archaeologists than are currently working in all of
Mali to even make a dent. Let's leave the posturing behind, pull together, and get
on with the job.

Acknowledgments
As is always the case for a large-scale archaeological project such as the one
described in this volume, many people have contributed greatly to its success. It is
my pleasure to acknowledge their contributions here. In Mali, permission for the
work was graciously granted by M. Bakary Traourd, Directeur d'Enseignement
Superieur et de la Recherche Scientifique; M. Bokar Keita, Directeur du
Patrimoine Culturel of the Ministry of Arts, Sports, and Culture; and K16na
Sanogo of the Institut des Sciences Humaines. We owe a special debt of gratitude
to Alpha Omar Konar4, newly elected president of Mali, for his continuing
support of our research in the Inland Niger Delta since he first inaugurated work
at Jennd-jeno with us in 1977. Our friend and brother Ali Tamboura helped us out
of many rough spots. The research could not have been completed without his
generous contribution of time and effort. Several members of the American
Embassy were also interested in the research and helped us in various ways:
former U. S. ambassadors to Mali Ann Holloway and Parker Borg provided a
great deal of moral support to the project; and our dear friend Barbara Court
extended boundless hospitality and desperately needed R&R on our trips to
Bamako. We also thank Beth Ann and George Taylor and David and Marilee
Rhody for friendship and hospitality, both in 1980-1981 and other years.
In Jenne, Hama Bocoum provided friendship and support beyond measure. He
graciously applied himself to resolving the myriad small problems that toubabs
(white people) living and working outside their own culture inevitably encounter.
Acknowledgments

forbearance and good humor under extremely difficult conditions. You are the best.

In the United States, many people have contributed time to the analysis of excavated materials. We thank Kathryn Cruz-Uribe and Richard Klein for preliminary study of the faunal material, and Kevin MacDonald for restudying the material, getting to comparative collections at his own expense, and writing the report in this volume. The fish bones were preliminarily examined by Robert Travers, at the suggestion of Gordon Howes, and we thank them both, as well as Wim van Neer, who restudied the material and wrote the report in this volume.

John Scheuring, Youssouf Bor, Abdoulaye Sow, and Jack Harlan kindly identified botanical material from flotation samples. We are particularly grateful to John Scheuring and Youssouf Bor for their persistence in following up on not only the ethnographic use of wild cereals in the Inland Niger Delta today but also the tricky identification of the wild Brachiaria recovered from so many of the flots. Timothy Garrard offered comments on shaped pottery discs as potential goldweights conforming to a Roman or Islamic weight system. Pat Jaccoberger of the National Air and Space Museum examined soils samples from the floodplain and later verified Roderick J. McIntosh’s geomorphological interpretations in the field. Jean Michel also examined soils samples and produced a report that will be included in a later publication on the site survey results. Robert H. Brill and Sidney Goldstein of The Corning Museum of Glass kindly undertook the examination and analysis of the glass from Jenn6-jeno. Iron artifacts, as well as metallurgical debris, were examined by Ronald F. Tylecote. Subsequently, Peter Loos of Hughes Tool in Houston sectioned and examined one of the earliest pieces of iron with scanning electronic microscopy and an energy dispersive X-ray analyzer. He also performed X-ray dispersive analysis on nine copper artifacts, at the request of Professor Franz Broten, of the Materials Science Department at Rice. We are grateful to both Professor Broten and Mr. Loos for their help. Several students at Rice have worked on data from the 1980-1981 field season, and it is my pleasure to acknowledge them here: Eric Salituro performed a statistical analysis on site survey data (“An urban hierarchy: The statistical analysis of artifact constellations in the region surrounding Jenn6-jeno, Mali”), Heather Miller and Dan Groneck considered the metallurgical remains at Jenn6-jeno (“Metallurgical remains at Jenn6-jeno: analysis and interpretations”), Helen
Haskell transferred all the artifact data from notebooks to computer and edited the stratigraphy chapter, and Lin Dai transferred all the survey data from record sheets to computer. Final pottery drawings were produced by Kathryn Barnard from originals by S. McIntosh, and all other artifact drawings are ink renditions of originals by Karol Stoker, with the exception of the sandstone, drawn by Gavin Rees. Helen Haskell took the pottery photographs. All other photographs and drawings were done by R. or S. McIntosh. This project was funded by National Science Foundation Grant BNS 80-04868, which was administered by the Social Process Research Institute at the University of California, Santa Barbara. We extend grateful thanks to David Brokensha, then director of SPRI, for his support and encouragement, and to all the SPRI staff who met long-distance crises with aplomb. Subsequently, funds for drafting the excavation and artifact drawings in ink were provided by Rice University. The bulk of this manuscript was written in 1989-1990 when I was a fellow at the Center for Advanced Study in the Behavioral Sciences, supported by NSF Grant BNS 87-00864. I am grateful to the center and its staff for all their assistance in helping me bring this mammoth task to its conclusion at last. I am indebted to Rogier Bedaux, Laurence Garenne-Marot, and Paul Craddock for reading and commenting on drafts of various chapters. I also thank Brian Fagan for his unwavering support through the years. But most of all, I thank my husband and project co-director, Rod McIntosh, for making this research possible. He has always been, and remains, the best field archaeologist I have had the privilege to work with, and his genius for organizing complex projects in remote places has been the key to all our successes. Thank you for sharing the despair and the exhilaration, but, most of all, thank you for making the soil speak to us so eloquently about life in the Inland Delta so many centuries ago.

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1 BACKGROUND TO THE 1981 RESEARCH
Susan Keech McIntosh
Roderick J. McIntosh

INTRODUCTION
This volume is devoted to presenting and discussing the results of the excavations carried out in 1981 at the settlement mounds of Jenn(-jeno, Hambarketolo, and Kaniana in the Inland Niger Delta (IND) of Mali (Figure 1.1). These excavations, and the regional site survey that was undertaken during the same field season, are part of an ongoing effort to document change through time in culture and society within the IND and to investigate the processes underlying these changes. Although the IND has long been recognized as a region critical to our understanding of West African prehistory, very few systematically collected archaeological data from the region were available when we began research in
1977. Innovations thought to have been transmitted along the Middle Niger corridor include plant domestication (Munson 1976:205), aspects of the "Kintampo" Neolithic (Davies 1967:222; Goody 1966), iron technology (Davies 1966; Shaw 1969:229), and painted pottery (Davies 1964; Mathewson 1968; Posnansky 1975). The IND was also identified as the possible locus of indigenous domestication of African rice (Oryza glaberrima) and fonio (Digitaria exilis) (Portes 1976). We were initially attracted to the IND precisely because so many claims had been advanced for its role in West African prehistory in the virtual absence of relevant archaeological data.

The results of the 1977 regional survey and excavations at the 33 ha mound of Jenn6-jeno quickly reoriented our early concerns with plant domestication and the late Stone Age/Iron Age transition to questions of urban process. While no late Stone Age material was found at any point in the survey or excavations, the 1977 Jenn6-jeno sequence indicated that the site was rapidly expanding in size in the early centuries of the first millennium A.D. and reached its maximum extent by A.D. 900. Survey results suggested that site density in the region peaked at approximately the same time. We hypothesized that these developments could be best understood in a context of indigenous urban process fueled by the growth of interregional trade. Perhaps the most significant aspect of these results was the suggestion that complex social and economic organization not only arose much earlier in the IND than commonly believed but also emerged in response to local rather than externally driven processes and innovations (R. McIntosh and S. McIntosh 1981; S. McIntosh 1981; and R. McIntosh 1980, 1981). Our

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subsequent work in the IND has been designed to cross-check, refine, and amplify the data base upon which this hypothesis rests. The 1981 excavations described in this volume constitute a substantial part of this work. The results of the 1981 survey and an extensive interpretive essay drawing together the results of both the excavation and survey, will be published separately.

Figure 1.1 Map of the Inland Niger Delta of West Africa, showing details of the Jenn6 region and the location of Jenn6-jeno, Hamberketolo, and Kaniana (from R. McIntosh and S. McIntosh 1981:11).

GEOGRAPHY, GEOMORPHOLOGY, CLIMATE

Geomorphology and Geography

The IND is a vast interior region of swamps and standing waters which crosscuts savanna grassland and scrub Sahel vegetation belts. Its false deltaic hydrology is fed by the Niger and Bani rivers (Figure 1.1), which contribute to the flooding of a 30,000-km² area during six to nine months of the year. The IND is characterized by a large number of different landforms (floodplain, dunes, levees, old river channels) and soils (sands, loams, clays) created by

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different fluvial and aeolian processes. Virtually all the visible features have been created within the last 20,000 years; they testify to a fairly rapid alternation of dry periods associated with dune formation and wet periods during which the
migrating distributaries characteristic of an active hydrological system dissected and reworked continental features and created levee systems. The result is a characteristic interlocking of highland and floodplain landforms and soils, which are summarized below (Figure 1.2). For detailed description of the soil types, see Bertrand (1975:131-132, 139-148), Brunet-Moret et al. (1986, 11:37-41), and Guerra de Macedo in Tricart (1965:113172).

Jenn6-jeno was founded within the clay channel of the Souman-Bani, at a point where the major distributary that loops north of Jenn6 breached the highland levee (mixed light loam and sand) of that channel. The clay channel is built of a series of low parallel levees (inundated most years) separated by clay-filled interlevee basins. The location must have been attractive to the first settlers because of the availability of water year-round and because it is at the juncture of three ecological units.

To the south of Jenn6-jeno is the Nyansannari, the broad levee of the Barn. This is a 3-to 5-km-wide strip of sandy-loam to clay soils much favored today by Bambara growers of millet (Pennisetum spp). At the transition of Nyansannari to floodplain, the soils and slope would have been favorable for dicrue sorghum cultivation, which perhaps explains the proliferation of Iron Age settlements there. The high levees would also have been a source of trees for firewood and for iron smelting. Particularly useful species are Acacia seyal, A. albida, A. ataxacantha, and Hyphaene thebaica (branching dune palm).

West of the levee is the Pondori, the deepest basin of the Jenn6-jeno hinterland. The inundated soils are hydromorphic gleys ("fluvisols," Bertrand 1975:131-134) typical of soils created by inundation in a tropical regime. The Pondori soils grade (in bathimetric progression from high to low) from shallow and middle sandy loams, to middle light and heavy loams, to deep clay in the lowest parts. This is prime territory for the cultivation of African rice, Oryza glaberrima.

To the north is a higher inundated plain. Immediately north of Jenn6-jeno is the beveled remnant of the Ogolian red dune (created in the late Pleistocene at the last glacial maximum), with several small white or yellow (recent) dunes that mark the local reworking of red dune material. Jenn6-jeno's location at the edge of this red dune is probably not coincidental. During the dry phase of the last few centuries B.C. and first few centuries A.D. (see below), this area may have been above annual flooding (thus allowing permanent occupation) but close to the rice fields of the deep Pondori. Between Jenn6-jeno and the Niger this shallow plain displays a crazed pattern of meandering distributaries, ancient Niger scrolls and meander scars, small dunes and minor levees. This region is not as densely populated as the Pondori or Nyansannari, but the dune and pond combination here are of critical importance to cattle pastoralists during those seasons when the herds must come out of the Sahara searching for dry season pasturage. Those dunes permanently above flooding are essentially denuded except for sparse

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14* 30
10 MOn~efiéS

Figure. 1.2. Map of landforms and Jennd in the Upper Niger Delta
soils in the 1977 survey region around Jenné.

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Geomorphology of the Survey Region in the Vicinity of Jenné, Mali (1977)

INUNDATED FLOODPLAIN  DRY LAND

*Deep Clay Basin  Lo Plain, Light Loam  Oune  PPermanenent Water or Sand

Middle Plain. Heavy to Sand Channel and Levees  Ancient Levee  Light Loam  Light or Sand

Clay Channel and Levees  Middle Plain, Sand  Ancient Levee  Heavy Loam

Key to Figure 1.2

cover of Guiera senegalensis and Cynodon dactylon (Bermuda quack). Below is the classic bathimetric progression of vegetation so useful during survey as a rough-and-ready guide to the relative duration of flooding: the gramineae Andropogon gayanus at the flood margin, Vetiveria negritana (submerged fewer than three months), wild rice, Oryza barthii, flooded for three to six months, and the so-called bourgou pasturage for the Fulani herds, Echinochloa spp. and Panicum stagnium.

If this distribution of landforms seems chaotic, it is rendered all the more so by the extreme interannual variability in rainfall and flood regimes, the consequence of which has been the specialized exploitation of different microenvironments by different ethnic groups. The rivers and streams are fished by two specialist groups, the Bozo and the Somono. Pastoralism and rice and millet cultivation are largely the preserve of different ethnic groups, the Fulani, Marka, and Bambara (respectively). Yet climatic and floodplain variability means that a plot of land appropriate to one exploitation system during one year might be greedily sought after by another ethnic group the next. Under such circumstances, we would expect competition to be a recurrent feature of human interactions within the IND. Many groups have evolved elaborate accommodation mechanisms to mitigate the disruptive consequences of competition (R. McIntosh 1993).

Climate and Flood

The two salient characteristics of the semi-arid tropical climate are high interannual variability and unpredictability. The Niger flood regime is also extreme and unpredictable in its year-to-year ranges. These characteristics conspire to force fishing, agricultural, and pastoral systems to be highly adaptive to stress and surprise, as well as to gradual changes (barely discernible within the lifetime of an individual). In this section, we examine present climate, and, in the next, we look at trends in climate change over the long term.

Jenné receives an average of 589 mm of rain, confined largely to the three months of July, August, and September (Gallais 1967a:64; Annuaire Statistique 1967:16-21, 1971:14, 18). The site is thus well north of the 750 mm
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Isohyet frontier between the northern savanna and the Sahel (Brunet-Moret et al. 1986, II: Figure 2). The rainfall regime tends to be highly irregular year-to-year. Jenn6 receives 316 mm, or over half of its annual rainfall, during the short official rainy season; the rain is uncharacteristically torrential for the southern Middle Niger (Gallais 1967b:65-66).

High interannual variability has been documented at nearby Mopti (Figure 1.3). There, during the years 1936-1964, annual rainfall totals ranged from 962 mm (1952) to 360 mm (1947). During that period, eleven years had rains of greater than the mean-plus-one-quarter. Seven years had rains of the mean-minus-one-quarter. From 1924 to 1973, the wettest decade averaged 838 mm and the driest decade averaged 416 mm (Brunet-Moret et al. 1986, 11:63). Gallais (1967a:54, Figure 9) and Brunet-Moret et al. (1986, 1:31-32) confirm the observation of unpredictability, or lack of regular oscillations or regular clustering of good or bad years made by others as far back as the beginning of the Colonial period (Monteil 1903:35).

250
200
150
100
50
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Figure 1.3. Average rainfall per month at Mopti for the years 1950-1956

Mopti has an average annual temperature of 27.70 C., with a May maximum of 40.9° and a January minimum of 14.1.0 (Gallais 1967a:46-47) remarks that the floodplain has a somewhat moderating effect on those high temperatures, relative to surrounding regions (including those to the south). Typically, there are two hot periods of the year (May and October are the hottest) interrupted by a minor cooling brought on by the rains in July and August and the greater relief of the true cool season from the end of November to the end of February. Relative humidity reaches a high in August with ranges of from 95% and 60% and a low in April with ranges from 19% to 12% (Gallais 1967a:50). The season of SW moderate winds (monsoonal) runs from May to October, and the more dramatic NNE trades blow from November to April (Gallais 1967b:67-69). There are few days without appreciable wind. Winter's end (September-October) is the calmest.

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At the beginning of the NNE trades, the wind begins to pick up, and between December and July there are more than ten days each month with winds of 5 m or more per second (strong or violent winds). Winds are at there most violent during the dry season (March-June), when there will be many dry whirlwinds, daily and, at the end of March, walls of wind and sand appear regularly during the afternoons.
Transposed over the seasons defined by temperature and precipitation is the season defined by the annual inundation (Figure 1.4). The doungou, or season of true rains (end of June through early September), is followed in September through November by the rise of the flood. The Niger and Bani flood regimes are subtly different and for both there is significant interannual variability in flood height, date of arrival, and date of evacuation, sediment, and soluable materials load. Further, slight differences in flood height can make dramatic differences in the total area flooded and in which parts of the floodplain are flooded (Gallais 1967b:84). This is because the Upper Delta is fed by a complex system of distributaries (locally called marigots), some of which are Niger dependent and some fed by the Bani.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline
\hline
\end{tabular}
\caption{Major Seasons: DOUNGOU TIOLTE DABBUDE TIEDOU}
\end{table}

Figure 1.4. Flood progression and seasons in the Upper Inland Niger Delta, based on flood data from Mopti 1957-1958 (adapted from Gallais 1984:43)

The general aspects of the Upper Delta flood are known from secure data obtained from the Mopti recording station since 1940 (Brunet-Maret et al. 1986, 11:132-136, 164-165). The "average" flood reaches the southern margin of the Upper Delta (Segou) between mid-September and mid-October. The Niger crest reaches Mopti between 20 October and 10 December; the Bani flood reaches that station three weeks later. That difference in arrival dates has a curious effect in the Jennd-jeno region (Gallais 1967a:63 and 1967b:86). The Niger flood begins weakly with the first rains of the headwater region. But the crest forms quickly to 6-6.75 m in height (at Ke-Macina) and the Upper Delta distributaries fill rapidly. Included among these is the Souman-Bani, the channel linking the Niger and Bani (passing > 1 km east of the site), which fills from north to south, first, and then, as the Bani crest catches up, the current runs south to north. The Bani flood is faster when it comes and averages 7-8 m, but is highly variable in height from year to year.

Vast quantities of the Upper Delta flood infiltrate to the subterranean water table; evaporation and evapo-transpiration by vegetation is significant in this Sahelian regime, and the many backswamp depressions prevent a significant proportion of the flood from evacuating the Upper Delta during the dry period. Gallais (1967a:56) estimates that of the 70 km3 of water that enters the Middle Niger below Lake Debo, only half is evacuated. Sedimentation can be significant. The flood waters are most turbid during the earliest flood period of each year; that is, the earliest torrential rains in the headwaters remove the most material from a landscape exposed during the preceding dry season. The maximum sediment load at Koulikoro south of the Upper Delta is c. 75 g/m.3 With estimates of between
1,800,000 and 4,875,000 tons of sediment deposited in the Middle Niger each year (note the high variability in this figure), Gallais (1967b:91) estimates an annual lens of sediment of between 0.07 mm to 0.2 mm deposited over the inundated surfaces of the Upper Delta (c. 1 m in 5,000 years). These floods are covering a plain of very weak slope (< 5 cm/km). Lastly, and happily for the long-term sustainability of floodplain agriculture, the floodwaters are remarkably weak in dissolved salts (Grove 1972:285-288). Thus the high evaporation rates of the Upper Delta are not necessarily accompanied by the high rates of salinization that are the curse of semi-arid floodplains elsewhere in the world.

The flood graces the dry season and thus allows the Middle Niger an unusual potential for human exploitation compared to neighboring southern Saharan and Sahelian regions. But high potential is linked with high variability (Gallais 1967a:60-66). This tendency is, if anything, amplified in the Jenn6-jeno region because of the complex interplay of the Niger and Bani floods (with an interannual variability of maximum flood of > 1 m) (Annuaire Statistique 1967:19; see Brunet-Moret et al. 1986:154-155). Beyond the interannual variability in flood height and dates of arrival is the complication of highly individual distributaries and basins. High floods can bring prosperity to one basin and destruction to settlements in a neighboring basin. Minor reductions in flood height can mean that some basins never fill (as in the case of the critical Pondori, which did not fill at all in 1950), or that their floods are of insufficient height or duration for rice cultivation (again the case of the Pondori for most of the Sahel drought). The Jenn6-jeno region is again unusual for its slow flooding of the floodplain (to highly variable levels) and by the quick onset and rapidity of the drought (Gallais 1967a:63).

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Local rain variability complicates the picture. For example, if the rains are weak, fewer hectares are prepared for cultivation than in years when sufficient rains allow the indurated clays and clay-loams to be worked by hand-held hoes. Since regular measurements were begun, variability in the Middle Niger floods has been characterized weakly by oscillations of high and low floods of five- to ten-year periods (Gallais 1967b:84). But the variability of flood height during those phases, of the length of each oscillation, and of the onset and duration of a shift from a dry to wet period is highly unpredictable. It is very likely that this unpredictability can be extrapolated back into historic and prehistoric times.

Paleoclimate
A Holocene humid period that was in full swing by 6,500 B.P. set the stage for the permanent occupation, several thousand years later, of the Upper IND. In the late seventh millennium B.P., permanent streams filled with large capitaine (Lates maliensis) flowed in the Azawad, as far as 350 km north of Timbuktu (Petit-Maire and Gayet 1984). Precipitation was strongly seasonal and torrential (Muzzolini 1985:20-21). The increased sediment load and increased tendency to seasonal flooding left a legacy of meandering channels and multiple levees and deep modeling of the floodplain (in the Middle Senegal valley these are the so-called post-Nouakchottian features). In the Middle Niger, the oscillating conditions
during this humid period probably contributed greatly to the creation of the mosaic of fluvial, paludial, and aeolian features of the Upper IND (Muzzolini 1985:20; Talbot 1980). At this time, there were multiple breaches of the red Ogolian dune, and a tendency for the channel of the Bani to shift by avulsion towards its present position to the east. Some authors (Nicholson 1976:52;70-71; Tricart 1965:25-27) have argued that a huge Ogolian dunefield north of Lake Ddbo (the Erg of Bara) blocked the renewed Bani and Niger at this time, creating a vast Paleolake D~bo over much of the Upper IND until as late as 4,500 B.P. Others (Jacobberger 1987; R. McIntosh 1983) remain unconvinced, given the lack of classic lake deposits anywhere in the region.

These oscillations apparently pick up pace and intensity at c. 4,500-4,000 B.P. There is widespread lake regression at that time: Lake Chad (Maley 1973:175; Servant and Servant 1970:65-90), the Tichitt lake (Munson 1976), and Lake Bosumtwi (Talbot and Delibrias 1980:341). This coincidence of lakelevel readings indicates to Street and Grove (1979:102-103) that West African rainfall had assumed its present regime and that earlier Holocene lacustrine conditions had finished permanently. Talbot (1980, see Muzzolini 1985:22) sees evidence of higher winds from 4,500-3,800 B.P. and of general deflation and remobilization of dunes throughout the Sahel. In the Jennd-jeno area, this was probably the period of erection of a second generation (the first at c. 8,000) of smaller white or yellow dunes.

Oscillations continue, with an overall decline in Saharan conditions that must have at least stimulated experimentations with new habits of food production (leading in some cases to domestication), to increased mobility and pastoralism for some, and in migration to the better-watered south for others. Saharan lakes were transgressive again from 3,500-3,000 B.P., but by 3,000-2,900 B.P. lakes such as that near Tichitt had essentially disappeared (Munson 1976; Nicholson 1976:51-52, 76-80) and, by 2,500, Lake Chad had attained its present level (Maley 1973:177). Oscillations after 2,500 B.P. (e.g., increased rainfall of several centuries in the mid first millennium B.C.) are significant to the human populations having to cope with surprise and change, but probably result in no new landforms in the Upper Delta. Indeed, there is a developing consensus that, perhaps worldwide, the period around 2,500 B.P. was one of major shift in climatic mechanisms (Mörner 1987; Muzzolini 1985:22). If not necessarily a permanent body of water, a Paleo-Debo, the Upper Delta may still have been a seasonal swamp with its share of water-borne diseases before the late first millennium B.C. Something must explain the lack of late Stone Age evidence in the deep floodplain, when compared to the density of settlement at the same period in the "dead" basins of the M–ma and Azawad (Guitat 1972; Petit-Maire et al. 1983; Raimbault and Dutour 1989). But that changes rapidly. There is a flood of colonization, probably from the north, into the Jenn&jeno region, coinciding with a significant dry period beginning 300 B.C. and ending c. A.D. 300. Rainfall is estimated at below -20% of the A.D. 1930-1960 average; lakes in the Lake Chad basin drop or disappear for all time and the Senegal discharge is so
low that seawater invades the Lower Senegal Valley and Ferlo (Brooks 1986; Lfzine and Casanova 1989; Monteillet et al. 1981). Even if this translates in the Jenn6-jeno region only into a half-millennium of low floods, this would have allowed ample sedentary occupation for settlements to build up a depth of debris sufficient to put them above most floods when conditions then began to improve. Jenn6jeno's position on the edge of the red dune, yet near to the channels etched into that dune by the Souman-Bani, would have been doubly advantageous. It would have been above most floods during this dry episode, yet near sources of water that were probably available year-round.

From c. A.D. 300 to 700, precipitation rises to +20% of the 1930-1960 average and rains are generally good at least until A.D. 1000 and perhaps as late as 1200. Lake Chad is moderately high in the second half of the first millenium A.D., but declines at A.D. 1000-1150, rises again, but declines severely at c. 1300 (Maley 1973:177). Bosumtwi recovers slowly during the first millennium A.D. from a lowstand at 300 B.C. (to c. A.D. 500), but at A.D. 1000 suffers a regression as severe as any since 13,000 B.P. (Talbot and Delibrias 1980:341-342). The lake recovers rapidly but is low again by the thirteenth century. Overall it appears that West African conditions were generally good during much of the first millennium A.D., perhaps even quite excellent in exceptional floodplains such as the Middle Niger, but that variability on the order of 50-150 years picked up considerably after A.D. 1000.

Or it may be that we simply have better resolution on that variability because of the availability of oral traditions and historical records of droughts, floods, and their legacy of human suffering. Generally, West African

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conditions are similar to those of the present century, except from the mid sixteenth century to the eighteenth century. The wetter conditions then corresponded to the little Ice ages of the northern latitudes (Nicholson 1979:42-44). But even with improved conditions, there were significant oscillations in the Middle Niger (Nicholson 1979:44-48 and Lamb and Peppler 1991:126-128; summarized here in Table 1.1).

**Table 1.1. Historical climatic oscillations in the Middle Niger, 1592-1988**

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Climatic Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1592, 1616, 1618-1639</td>
<td>High flooding (Lake Chad at +4 m from 1600)</td>
</tr>
<tr>
<td>1640-1644</td>
<td>Severe drought</td>
</tr>
<tr>
<td>1670s and 1680s</td>
<td>Severe drought (Lake Chad falls)</td>
</tr>
<tr>
<td>1738-1756, 1770s,1790s</td>
<td>Severe droughts</td>
</tr>
<tr>
<td>1820-1840</td>
<td>Sustained dry</td>
</tr>
<tr>
<td>1860s to 1900</td>
<td>Wet phase</td>
</tr>
<tr>
<td>Most of 1910s</td>
<td>Drought comparable to Sahel drought</td>
</tr>
<tr>
<td>1950-1958</td>
<td>Wet phase</td>
</tr>
<tr>
<td>1972-1988</td>
<td>Drought</td>
</tr>
</tbody>
</table>

This record has clear implications for interpreting the struggle of the prehistoric peoples of the Jenn6-jeno region to adapt to their environment. The salient characteristics of the climate and flood regime of today, namely, its high interannual variability and difficulty of prediction from year to year (much less at
longer perspectives), can probably be extrapolated back to prehistoric time. That year-by-year variability can further be transposed over oscillations of wet and dry episodes of 10-30 year duration, interrupted by the occasional year or half-decade of severe floods or drought. Those oscillations are felt locally at a time perspective of 100 years. But they are further transposed over oscillations felt as a time perspective of 1,000 years (e.g., the wet spell correlated with the Little Ice Age or the dry centuries between 300 B.C. and A.D. 300) and of 10,000 years (e.g., the rapid lake rises and falls of c. 4,500-2,500 B.P.) (Table 1.2). Stress, surprise, and unpredictability were the constant realities of the physical environment for the inhabitant of the Upper Delta. The adaptations, economic and social, that they developed allowed them to thrive and create a long-lived urban civilization in these conditions of profound constraint.

HISTORICAL BACKGROUND

Prior to the twentieth century and the French colonial hegemony, the Upper IND was dominated by a single major commercial town, Jenn6, located less than 3 km away from all three of the sites excavated in 1981. Little can be said with certainty about Jenn6 prior to 1447, when the Italian merchant Antonio Background to the 1981 Research

Malfante mentioned the civitate of Geni, thereby implying the existence of a city state (Crone 1937:87; La RonciZre 1918:152-153). Like the majority of medieval chroniclers who write about West Africa, Malfante never visited the places he described, but relied on information from other travellers and merchants. His account of Jennnd, however, is substantiated by early sixteenthcentury sources that refer to the cidade of Gyna or Jany (Fernandes 1938:85; Pereira 1937:80-81); and clearly indicate that the source of Jenn.'s prosperity was trade (treatment of the historical documentation for these and all other sources in more fully developed in R. McIntosh and S. McIntosh 1981; S. McIntosh and R. McIntosh 1980, 1:41-59).

Table 1.2. Holocene geomorphological events in the Upper Delta of the Middle Niger

<table>
<thead>
<tr>
<th>Period</th>
<th>Conditions</th>
<th>Jenn6-jeno Region Landforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000-8,000 B.P.</td>
<td>First Holocene pluvial</td>
<td>Pal~o-D6bo (?) or, Niger-Bani meanders, deep alluvium and high levees, first set of Red Dune breaches</td>
</tr>
<tr>
<td>8,000 B.P.</td>
<td>Dry millennium</td>
<td>First white-yellow dune</td>
</tr>
<tr>
<td>6,500-4,500 B.P.</td>
<td>Second Holocene pluvial</td>
<td>Further Red Dune breaches; Niger-Bani find present channels, low levees</td>
</tr>
<tr>
<td>4,500-4,000 B.P.</td>
<td>Dry</td>
<td>White-yellow dunes</td>
</tr>
<tr>
<td>4,000-2,500 B.P.</td>
<td>Rapid oscillations</td>
<td>Dunes and levees reworked (edges remodeled)</td>
</tr>
<tr>
<td>300 B.C.-A.D. 300</td>
<td>Dry</td>
<td>First occupation of Upper Delta</td>
</tr>
<tr>
<td>A.D. 300-700</td>
<td>Stable, improving precipitation</td>
<td></td>
</tr>
<tr>
<td>A.D. 700-1000</td>
<td>Optimal conditions</td>
<td></td>
</tr>
<tr>
<td>A.D. 1000-1200</td>
<td>Rapid oscillations</td>
<td></td>
</tr>
<tr>
<td>A.D. 1200-1400</td>
<td>Severe droughts</td>
<td></td>
</tr>
<tr>
<td>c. A.D. 1570-1830</td>
<td>Wet, dry interruptions</td>
<td></td>
</tr>
</tbody>
</table>
Advantageously located at the western end of the navigable IND, Jennd was a primary collecting point for gold, kola, ivory, and slaves that moved north from the forest and savanna. River transport downriver to Timbuktu completed the next leg of the great journey, and the goods were then loaded onto camel caravans for the trans-Saharan crossing that would ultimately bring them to European markets.

In the seventeenth century, the local

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chronicler as-Sa'di (1964:23) commented that "it is because of this blessed city that camel caravans come to Timbuktu from all points of the horizon."

Although historians have tended to place primary emphasis on Jennd's strategic trading location, it is clear that another major factor in the town's economic development was the presence of a highly productive rural hinterland. The diversity of the region's topography and geomorphology encouraged, as we saw earlier, an intricate symbiosis of farmer, fisher, pastoralist, and merchant. Today, seven different ethnic groups live in close proximity in and around Jennd (Gallais 1967a; Sundström 1972). The oral history of Jenn6 (Monteil 1971:29-36) suggests that such economic interdependence is a long-established pattern in the region. In historical times, these interdigitating productive systems provided for the export of staple commodities in great quantities to Timbuktu and Saharan trade towns even further north. Rend Caillid, who in 1828 became the first Western explorer to reach Jenn and provide a detailed description of the city, observed that the existence of Timbuktu and other Saharan trade towns was made possible only by the massive export of agricultural staples and dried fish from Jenn6 (Caillid 1968, 11:57-59). Three centuries earlier, Leo Africanus had similarly described an extensive trade in food via pirogue from Jenn6 to Timbuktu (Africanus 1896:822; Bovill 1968:148). It appears that Jennd's commercial and productive importance made it a target for domination by successive empires. We learned from a city history, procured by us in Jennd in 1977, that Jenn6 came under the domination of the empire of Mali in 1325, subsequently fell to Songhay leader Sonni Ali Ber in 1468, after a seige of seven years, seven months, and seven days, and was the first town to come under Moroccan control after the Songhay were defeated at Tondibi in 1591 (S. McIntosh and R. McIntosh 1980, 1:53). A period of relative autonomy (under the Moroccans, to be sure) followed in the seventeenth century, at which time the extent of the DjennE-wr6's (chief's) influence is delineated by as-Sa'di (1964) (Figure 1.5). In 1862 Jennd fell under the domination of the Tukolor, who in turn were routed by the French, led by Colonel Archinard, on 12 April 1893. Archinard's impressions were of a city dominated by trade: "A Jenn6, tout se paie, tout a son prix." The djenn6 notables told him: "We were placed on this earth to be traders and merchants" (cited in Gallais 1984:153-154).

We have argued (S. McIntosh and R. McIntosh 1980) that the dual role of Jennd as both an entrep6t in long-distance gold and salt trade and a major production and bulking center for regional commerce in staples may substantially predate the period of historical documentation. Historians have generally ignored this possibility until recently, preferring to believe that the earliest historical mention
of Jenne approximately coincides with its emergence as a trading city some time in the late thirteenth or early fourteenth century A.D. This viewpoint is contradicted by oral traditions in Jenne, which maintain that the town was originally founded in the eighth century A.D. on the nearby site of Zoboro (also known as Jenné-jeno) and subsequently moved to its present location (as-Sa'di 1964:23; Monteil 1971:32-33). The original founding population at Nono (Soninké) is

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TIMBUKTU

0 100 200 km

II 1

DOUENTZA
SEGU
WAGADUGU
SIKASSO
BOBO DIOULASSO

Djenné Wër6 a Commercial staging points
Traditional commercial routes Limit of authority of
Djenné Wër6 in the
17th century Limits of inundation

Figure 1.5. Limit of the Djenné.wr6's authority in the seventeenth century
(adapted from Gallais 1984:146)

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said to have migrated from Dia, a town c. 100 km to the west in the IND, which gave rise to an extraordinary diaspora of Soninké merchants across the Western Sudan (S. McIntosh 1981; Perinbam 1974). The oral traditions provide an impression of Dia as an early commercial center of considerable importance that was later eclipsed by the prosperity and importance of its offspring, Jenné. Since the picture provided by the historical documents is so thin, archaeology offers the only substantial hope for clarifying the chronology of Jenné's origins and growth (Plate 1).

PRIOR ARCHAEOLOGICAL RESEARCH IN THE INLAND NIGER DELTA
The existence of large numbers of archaeological sites in the Inland Delta has been known since early in this century, when Desplagnes (1907:47) wrote of ancient village sites with funerary urns eroding from the surface. Subsequently, a number of other observers reported burial urns eroding from sites near Mopti, Jenné, and Ke-Macina (Frobenius 1929:9599; Mauny 1961:103-104; Monod 1955). Interest in the Upper Delta grew after 1940 with the discovery of terracotta statuettes on mounds in the floodplain between Mopti and Jenn. Recovered either as surface finds or during construction activities, these statuettes shared a wide-eyed, prognathic style of human representation (Haselberger 1965, 1966; Ligers 1957; Malzy 1967; Masson-Detourbet 1953; Mauny 1949; Monod 1943; Vieillard 1940). Prior to the 1950s, subsurface investigations in the IND consisted mainly of pits dug by French administrators or teachers. Although such
excavations were potentially quite destructive (witness Clerisse's devastation of the megalithic site of Tondidorou; Dembélé and Person 1987; Person et al. 1991), Vieillard's 1938 sondages at Jenn-jeno may have actually protected the site from subsequent potholing because so little of interest was recovered from them (unpublished document reported in Mauny 1961:102). In any case, there is no indication that amateur digging at IND sites was undertaken with anywhere near the frequency reported for the mounds and tumuli of the adjacent Mdma and Lakes regions (see Mauny 1961:95-101).

The first excavations by a trained archaeologist were undertaken in the IND in the 1950s. Szumowski, an archaeologist working at IFAN (Bamako), undertook excavations at several sites near Mopti and published short reports of his discoveries (Szumowski 1954, 1955, 1956). Barth and Sarr also excavated near Mopti and produced brief reports (Barth 1976, 1977; Sarr 1972). However, the turning point in archaeological exploration of the IND came with the survey and excavations at Togudr's Doupwil and Galia by a Dutch team in 1974 and 1975, which resulted in the first detailed description of the stratigraphy and the osteological, paleoeconomic, and cultural remains at IND sites (Bedaux and Huinziga 1975; Bedaux and van der Waals 1976; R. Bedaux et al. 1978). From the radiocarbon dates from these sites, it appears that Galia was primarily occupied in the eleventh and twelfth centuries cal A.D. and Doupwil slightly later. The tobacco pipes in the upper deposits at Galia probably represent reoccupation after the sixteenth century. No tobacco pipes were encountered in the deposits at Doupwil, although they are present on the surface of the site. For earlier periods, Gallay's 1964 excavation of a pit feature at a habitation site near Tiebala, which yielded radiocarbon dates of the mid first millennium A.D., has resulted in a detailed description of the pottery (Curdy 1982).

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the surface of the site. For earlier periods, Gallay's 1964 excavation of a pit feature at a habitation site near Tiebala, which yielded radiocarbon dates of the mid first millennium A.D., has resulted in a detailed description of the pottery (Curdy 1982).

This was the state of IND archaeology when we began survey and excavation in the IND in 1977. Not only was there virtually no information on occupation within the IND in the first millennium A.D., but knowledge of where sites were located in the Delta and how they were distributed across the landscape was rudimentary. A distribution map shows how few sites were known in 1977 within the floodplain to the north and east of Jenn6-jeno (Figure 1.6). The extensive site survey and excavations that we undertook in the region of Jennd has filled in some of these gaps (S. McIntosh and R. McIntosh 1980). The long sequence of deposits at Jenn6-jeno covers the period from approximately 250 B.C. to A.D. 1400, enabling us to consider the evolution of human settlement in the Jenn6 region during much of the Iron Age (Plate 2). In the next section, the major results of the initial 1977 excavations at Jenns-jeno are outlined, providing the background to the problem orientation of the 1981 excavations. The results of the 1977 survey will not be discussed in any detail here but rather in a subsequent publication devoted to the 1981 regional survey.

RESULTS OF THE 1977 FIELD SEASON
The questions we sought to answer in 1977 were extremely basic ones concerning the antiquity of settlement in the IND, and the nature of change through time in subsistence economy, technology, material culture, exchange relations (as indicated by exotics), and settlement organization. The fieldwork was thus oriented toward controlled, stratigraphic excavation of a deeply stratified site from which a lengthy chronological sequence could be derived, followed by extensive regional survey to identify the full range of sites present with respect to location, size, surface features, and chronology. Our fortuitous introduction to Jenn6-jeno through the good offices of Rogier Bedaux at the beginning of the 1977 season provided us with an ideal site for our purposes. Excavation of two 3-by-3 m excavation units (M1, M2) in the north central sector of the site revealed over 5 m of well stratified, continuous Iron Age domestic deposits above sterile floodplain alluvium (Figure 1.7). A third 3-by-3 m unit (JF 1) was placed in a cemetery precinct near the southeast edge of the site. An internally consistent series of eight radiocarbon dates placed the occupation of Jenn6-jeno between c. 250 B.C. and A.D. 1400, one of the longest Iron Age sequences in West Africa. Evaluation of temporal change in pottery and construction technology, and the identification of discrete series of stratigraphic events, permitted us to identify four unbroken phases of occupation. This phase chronology was intended to facilitate the ordering, analysis, and description of the 1977 data, with explicit recognition that further excavation at Jenn6-jeno might result in changes to it.

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Settlement of the site in Phase I was initiated by iron-using colonists in the last centuries B.C. The form and decoration of the pottery used by the initial inhabitants suggests Saharan affinities. Their subsistence base was heavily reliant on wild resources (bovids, fish and waterfowl), although they also possessed domestic cattle. No domestic plants were recovered from these early deposits, nor was any permanent mud architecture identified. The presence of iron slag in all levels indicates that iron was worked on the site, having been necessarily imported in the form of ore or smelted blooms from outside the IND. Other Phase I exotics included stone beads and sandstone grinders.
Mud wall collapse provided a lower boundary for Phase II, for which associated charcoal yielded a radiocarbon date of a.d. 40 ± 50 [Note: here, and throughout the text, the standard convention of citing uncalibrated radiocarbon dates in years a.d. and b.c. is followed. Calibrated dates are indicated by cal A.D. and cal B.C.]. From the same level, we recovered a substantial sample of well-preserved chaff of domestic rice, Oryza glaberrima. The archaeofauna continued to be dominated by fish and bovids. The ceramic sequence developed for the site indicates that Phase
II material is present in the lowest levels of JF1, located near the present edge of the site. These deposits appear to consist of material eroded from higher areas of the Phase II settlement. The fact that Phase II material was present in all three excavation units, separated by a maximum distance of 400 m, indicates that by the end of Phase II (c. A.D. 400) the settlement may have measured at least this distance along one axis. This was an unanticipated finding.

Phase III is identified by the characteristic painted pottery that was produced between A.D. 400 and 900. During this time, tauf construction technology was common, and urn burial and inhumation unaccompanied by grave goods in crowded cemetery precincts was practiced. The subsistence economy does not change demonstrably from that of Phase II. In addition to iron and stone, imported copper appears, suggesting the expansion of exchange networks. By the end of the phase, Jennd-jeno had reached its maximum areal extent of 33 ha.

Sometime around A.D. 800-900, mud brick building technology appears at the site, and painted geometric pottery decoration is replaced fairly rapidly by plastic impressed, incised, and stamped geometric decoration. We have used these changes to define Phase IV, the final occupation phase at the site before its abandonment by A.D. 1400. Initially used in round houses, cylindrical mud bricks continued to be used when rectilinear architecture was introduced later in Phase IV. Spindle whorls and opaque glass beads of probable European manufacture, believed to have been introduced from North Africa, appear in Phase IV deposits. Copper artifacts are present, as well as iron and stone. The elaboration of ritual in this phase is suggested by the appearance of terracotta statuettes and of raised anthropomorphic and zoomorphic figures on non-utilitarian ceramics.

Archaeological sites within a 25-km radius to the north and west of Jenn6-jeno were located and selected for investigation using air photos and a randomized sampling methodology. The approximate date of abandonment

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of each site investigated was determined by comparing surface pottery collections with the Jenn6-jeno ceramic chronology. One of the startling conclusions of the survey was that, of forty-two sites investigated in the course of the sample survey, almost three-quarters were abandoned by the end of Phase IV, and none was abandoned before Phase III. Almost all sites investigated are tells with deposits exceeding 2 m in height above the floodplain. Such an accumulation probably represents several centuries of occupation prior to abandonment. Surface remains on several of the largest sites in the immediate vicinity of Jenn6-jeno indicate a maximum extent of occupation during Phase III/early Phase IV, and a reduction in area of more recent deposits before abandonment at a later date. These results
imply that site density in Jenn6-jeno's hinterland reached its greatest expression in late Phase III/early Phase IV, at the same time that Jenn6-jeno achieved its maximum areal extent, and thereafter began to decline. At its maximum, site density in the survey region may have been as great as ten times the density of occupied settlements in the region today.

THE 1981 RESEARCH: PROBLEM ORIENTATION AND METHODOLOGY

While the limited fieldwork conducted in 1977 produced important results, it clearly was designed as a preliminary inquiry to retrieve the baseline information necessary to formulate more sophisticated hypotheses about the development of the site and processes effecting the various changes documented. Due to the limited excavation sample in 1977, important goals in 1981 were to cross-check the sequence of change reconstructed from the 1977 excavations, to refine the ceramic and absolute chronologies for the site, and to expand the number of site sectors tested in order to better understand intrasite variability. We also needed to expand subsurface testing to other sites, not only to see how their occupation chronologies compared to that at Jenn6-jeno but to begin to investigate intersite variation in material culture, technology, and subsistence. Additional objectives of the 1981 excavations included the testing of several hypotheses about the growth and development of Jenn6-jeno, the recovery of additional economic data vital to reconstructing subsistence economy through time at the site, and an improved understanding of the stratigraphic complexity of the Jenn6-jeno deposits. The size, placement, and number of units excavated were determined by these project objectives and the limitations imposed by the availability of time and personnel. In order to ensure that stratigraphic control was maintained during excavation, the number of units open simultaneously could not exceed the number of supervisory crew available (five). In total, six units on Jenn6-jeno and one each on the nearby sites of Hambarketolo and Kaniana were excavated, resulting in the examination and subsequent backfilling of almost 500 m3 of deposits in the period from 6 January to 30 April 1981. Twenty-five workers recruited in Jenn6 assisted with the digging.

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The six units on Jenn6-jeno were spatially dispersed to gain a better understanding of how the nature and chronology of deposits in various parts of the site varied (Figure 1.8). Below, the units excavated and particular research objectives they were intended to serve are discussed, in the order in which they were opened in 1981.
LX (Large Exposure): a 10-by-6-m unit in the north central "residential" sector of JennL-jeno. This unit was excavated in two parts (Units LX-N and LX-S), each of which was treated as a separate excavation unit both in the field and for purposes of analysis. The LX was located midway between Units M1 and M2 of the 1977 season and was intended to test the similarity of the ceramic sequences of those two units, to provide detailed horizontal and vertical information on the deep central deposits of the mound, and to provide a strong central reference point for the northwest-southeast line of units used to estimate the extent of settlement during different periods.

Size was the distinguishing feature of this unit, for several reasons. First, we wanted to open a unit larger than the standard 3-by-3 m in order to improve visibility of levels and features during horizontal excavation. Units LX-N and LX-S were each large enough to encompass a variety of features that could only be sampled in smaller units, a factor that significantly aided in the definition and interpretation of such horizontally extensive features as architectural remains and activity areas. Second, we wanted a large expanse of continuous deposits that would yield enough organic remains, pottery, and other artifacts to enable us to confirm and refine our 1977 artifact and radiocarbon chronologies in some detail. This was a primary objective of the 1981 field season. While the number of ceramics recovered from the 1977 excavations had been more than sufficient to indicate major chronological trends, the refinement of the sequence depended upon adequate representation of secondary aspects of major trends and confidence that minor trends were visible. We hoped that excavation of a unit the size of LX would provide a large enough number of ceramics and other artifacts to permit statistical treatment of low-frequency types or attributes which might otherwise be recovered rarely if at all. This same reasoning applied to rare artifact classes, such as copper, gold, and early trans-Saharan imports.

HK (Hook): a 3-by-3-m unit placed in the hooklike spit at the extreme south of the site. This unit was opened early in the field season to investigate the hypothesis that the first settlement at Jenn6-jeno was located to the west or south of the present mound, near the only perennial body of water (Figure 1.9). Unit HK was intended to test for early deposits near the stream channel to the south. A single significant surface occurrence of early (Phase I/II) material had been found north of HK, suggesting that early deposits were present in the southern sector of the site. Additionally, HK served as the southernmost extension of the line of excavation units (Units ALS, M1, LX, CTR and JF1) which we used to estimate the size of the ancient settlement at different periods in its occupation history.

CTR (Center): a 3-by-3-m unit located close to the center of Jenn6-jeno, approximately midway between 1977 Units JF1 and M1. Surface scatter near CTR was moderately heavy and consisted largely of pottery and slag. We were

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Background to the 1981 Research

initially drawn to the area because it lay midway between the "residential" and "cemetery" areas recognized in 1977. This location, therefore, had the potential to resolve one of the questions left unanswered in 1977: during the first centuries A.D., or even earlier, did the areas tested by the M1 and JF1 excavations represent parts of one very large settlement, or two settlement mounds separated by uninhabited floodplain (R. McIntosh and S. McIntosh 1981:16)?

WFL (Waterfront Location): a 3-by-3 m unit placed at the westernmost margin of Jenn(-jeno, overlooking the permanently flowing Senuba marigot. Our purpose in selecting this location was to test the hypothesis that the earliest occupation at the site occurred adjacent to the Senuba. This particular area of the waterfront was selected for excavation because of the height of the deposits deposits and the presence on the surface of many ceramics from Phases III and IV.

NWS (North Wall Section): a special investigation of the city wall at the northern periphery of the Jennd-jeno mound. The city wall could be traced around the periphery of much of the site and was complete in very long sections. In the far north of the mound, however, the boundaries of the wall were particularly clear and appeared to have been protected from the effects of later erosion by the accumulation of deep wall collapse and wall melt. In the immediate area of NWS, the city wall was unusually complete, with individual bricks showing on the surface and with a clear distinction visible between the wall foundation and surrounding wall collapse.

Unit NWS was excavated in three sections. In the western part of the excavation precinct we opened two narrow north-south trenches perpendicular to either side of the wall. These excavation trenches (the North Test and South Test Units) extended up to but did not include the wall itself, and were intended to investigate evidence of wall construction and wall decay in the surrounding deposits. The North Test unit, running north from the north face of the wall, measured 1.5 m east-west by 1 m north-south. The South Test unit, immediately to the south on the other side of the wall, measured 1.5 m east-west by 2 m north-south. The third section of the NWS excavation, the Wall Trench Section, was a 6-by-1.1 m unit which paralleled the North and South Tests 0.5 m to the east. The Wall Trench Section bisected the city wall foundation as well as the adjacent deposits to the north and south, and was opened in order to examine the internal wall structure and the relation of the wall to surrounding and underlying deposits.

ALS (Adria's Last Stand): a 2-by-2 m test pit located at the northern end of Jennd-jeno, in the area between the "residential" area excavations (M1, M2, LX-N, and LX-S), the city wall section (NWS), and WFL. This was the final unit opened at Jennd-jeno during the 1981 season, and was intended to complete an approximate line of excavation units, arranged from JF1 to CTR to M1, whose deposits permitted estimation of settlement size during the various occupational phases. With only two weeks remaining before all backfilling had to be completed, ALS
was opened as a test excavation only and was thus smaller than the usual 3-by-3-m unit.

Background to the 1981 Research
In addition to the excavations at Jennd-jeno, limited subsurface testing was undertaken at Hambarketolo (HAMB), the 9 ha occupation mound immediately to the north of Jennd-jeno and connected to it by a causeway (Figure 1.8), and Kaniana (KAN), a low, 41 ha mound located just under 1 km northwest of the present city of Jennd.

HAMB: a 2-by-2-m test excavation for the purpose of comparing the ceramic, radiocarbon, and stratigraphic sequence for the site of Hambarketolo with that documented at Jennd-jeno. More specifically, we wished to know whether occupation on Hambarketolo was unbroken, as it appeared to have been at Jenn6-jeno, and whether there were significant functional differences between the two sites. The spot in which the unit was located was undisturbed by treasure seekers or by burrowing animals and was covered by an unusually thick blanket of Phase IV sherds.

KAN: a 2-by-2-m test excavation for the purpose of developing a preliminary ceramic and radiocarbon chronology for this site, which surface collection in both 1977 and 1981 had indicated was abandoned in Phase IV. The date and the unusual size and shallowness of the site suggested that Kaniana might be critical to understanding the apparent late first and early second millenium population movement away from distant rural villages toward more concentrated settlements in the immediate vicinity of Jennd-jeno (S. McIntosh and R. McIntosh 1980, 11:429-32). A test unit was therefore placed on one of the higher parts of the mound, approximately in the center of Kaniana, in order to determine whether occupation had continued over a long period as at Jennd-jeno, or whether the settlement had a short but intensive occupation later in the Jennd-jeno sequence. Kaniana was also characterized by abundant surface remains of iron smelting activity, a common feature at this site. We hoped by excavating here to find more in situ evidence of iron smelting than we had at Jennd-jeno.

EXCAVATION METHODS
Particular care was taken to excavate by natural levels. Our workmen were very sensitive to minute changes in soil texture and degree of compaction, especially using the local, short-handled agricultural hoes (daba) that we favor for excavation. Features such as house floors and walls, burials, funerary urns, and any unusual spatial concentration of artifacts were normally excavated and recorded separately. Artifacts and bone were picked out of the excavated deposits by hand, accompanied by a constant breaking up of clay clods with the wooden butt of the daba. The high clay content of the deposits discouraged screening, which we had attempted unsuccessfully in 1977. It is clear that a solution to this problem must be found for future work, such as dry screening a small proportion of the excavated deposits as a means to assess loss rates for small artifacts and bone. Although this should ideally be done for all deposits, regardless of context, the time required to manually break up structural material and wall wash such that it can be successfully screened is so great that consideration should be given to
screening primarily ashy, soft deposits at these sites. This was not done, however, for the 1981

Background to the 1981 Research excavations, with predictable implications for the interpretation of recovered samples. These are discussed at appropriate points in subsequent chapters. Pottery and slag were bagged separately from bone; all were bagged by excavated level. All other artifacts were treated as special finds: exact provenience was recorded, and each artifact was individually bagged after receiving a number and any necessary conservation treatment prior to removal from the site. Special finds were cleaned, weighed, described, and logged during the afternoon of the day they were excavated. Pottery recording also took place concomitent with excavation; recording methods are described in Chapter 3. Slag was counted and weighed for each level. Ten-liter soil samples were taken from each nonstructural depositional level in LX-N, LX--S and CTR for manual flotation using 0.5 mm mesh. Charcoal samples for radiocarbon determinations were collected from sizable concentrations using tweezers immediately after exposure, and placing the sample in a double envelope of aluminum foil.

As always, the indurated clays present in structural matrix and wall melt at the site provided a real challenge, due to their hardness (making excavation a slow and exhausting business) and to the difficulty of detecting brick and especially tauf walls within a matrix of collapse or wash. As an aid to the latter, the "thwack test" was developed and successfully applied to detect mud brick within an outwardly homogeneous matrix. For this, the wooden butt of the daba is tapped against the matrix at closely spaced intervals. The sound produced by mud brick when thwacked in this manner has a slight ringing quality not found in the dull thud of wall melt. Numerous mud brick house foundations were detected and exposed in 1981 using this handy aural test.

Special finds recovered from the 1981 excavations were placed in the care of the Institut des Sciences Humaines (ISH), as was a study collection of pottery. Unfortunately, in the absence of a project field vehicle transportation of larger collections of excavated pottery and other materials could not be arranged with ISH, and so the decision was made to bury the bulk of the pottery in the backfill of the excavated units at Jenn6-jeno. Human remains were also reinterred in the backfill after study. The faunal and botanical material from the excavations, as well as several soil and slag samples, and a study collection of pottery were exported from Mali under a permit dated 19 June 1981 issued by the Director of the ISH.

STRATIGRAPHY, FEATURES, and CHRONOLOGY
Roderick J. McIntosh
Susan Keech McIntosh
The stratigraphy encountered at Jenn4-jeno was extremely complex, involving many episodes of pit digging and house construction. Understanding this stratigraphy and the extent to which it was successfully followed during excavation is the key to evaluating the chronological relationships of the material
recovered. The following format is used to describe each of the seven excavation units at Jenn6-jeno and the two test excavations at Kaniana and Hambarketolo: (1) the location of the unit with reference to a permanent benchmark; (2) a summary of the major outlines of depositional history represented in the unit, including all significant features, presented in the order in which they were encountered, that is, in reverse chronological order; (3) a description of the correspondence of excavated to natural strata as seen in the unit walls. Each unit description is accompanied by a summary table with levels and features listed in chronological order, outlining the probable events responsible for the deposition of each level (e.g., wall collapse, ash pit), with related events enclosed by brackets. Detailed descriptions of excavated levels and features, and the collection of associated charcoal samples that have been radiocarbon dated, are given in Appendix A.

The location of each unit, and a brief account of its place in the 1981 research design, is presented found in the preceding chapter. In all units where sterile soil was encountered, cultural deposits were found to overlie floodplain alluvium. The cultural deposits formed an apparently continuous sequence and lacked the sterile lensing or horizons of cataclysmic settlement destruction which might indicate temporary site abandonment.

UNIT ALS (JENN&-JENO)
Unit ALS was oriented north-south and measured 2-by-2 m. The datum of the unit, called the point of origin (PO), was 1.42 m above the site datum, Cement Marker 1. The PO was oriented 322° from magnetic north from Cement Marker 1 at a distance of 439 m. Excavated levels showed a fairly high degree of correspondence to natural strata as revealed in the unit profiles (Figures 2.1-2.3). Cultural deposits extended to a depth of 5.4 m, within which thirteen cultural levels and three features were recorded. The archaeological deposits

**Table 2.1. Reconstruction of depositional sequence in Unit ALS**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Chronology</th>
<th>Level(s)</th>
<th>Depositional Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1L. 1</td>
<td>Feat. 50 collapse and subsequent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---- Phase IV ----</td>
<td>L. 6/Feat. 52</td>
<td>Cap of ash pit; rubbish accumulation</td>
<td></td>
</tr>
<tr>
<td>---- Phase III ----</td>
<td>L. 7/9</td>
<td>Ash pit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L. 8</td>
<td>Compact remains of structure(s)</td>
<td></td>
</tr>
</tbody>
</table>

Note: The assistance of Helen Haskell in revising and editing this chapter is gratefully acknowledged.
L 10 Slow accumulation of wall collapse
L 11 Abundant domestic debris
L 12 Wall collapse and domestic debris
---- Phase I/II----  
L 13 Clay, ash, and organic laminations; mat-and-pole impressed burnt clay
L 14 Sterile floodplain alluvium

aRelated events enclosed by brackets.

Consisted primarily of mud wall collapse and associated domestic debris, with the lowest levels containing many burnt earth fragments showing distinct impressions of mat-and-pole architecture. About one-third of the way through the excavation the accumulation of wall collapse was interrupted by an apparent living floor with many small ash pits (Level 6), and by an enormous ash pit, 2 m in depth, which was excavated as Levels 7 and 9.

Features. On the surface, Unit ALS was marked by an agglomeration of cylindrical sun-dried bricks occupying approximately the northern half of the unit and continuing some 3 m to the north and northeast. A second mass of bricks, 2 to 5 m west of the unit, may have been associated (Figure 2.4). These brick remains (Feature 50 = House 13) appeared upon excavation to be the superimposed remains of at least two separate building foundations, with walls only one brick deep. Wall collapse from this feature was represented in Level 1, but little domestic debris was present. House 13 appeared to be the final manifestation of a short-lived Phase IV occupation of the ALS area, also represented by wall collapse and domestic debris in Levels 2 and 3, deposited directly on top of late Phase III occupation levels. Other than undifferentiated clay wall collapse, no further architectural remains were encountered in Phase III or Phase IV levels. Level 13, the earliest occupational level in the

Stratigraphy, Features, and Chronology

unit, yielded large chunks of terracotta with mat-and-pole impressions, possibly the remains of a disturbed Phase I/II structure just above floodplain level. Within Level 5, a carinated pot covered by a potlid (Feature 54, Figure 2.5) contained the extremely fragmented remains of two children, aged six to twelve months and four to five years, in the bottom 10 cm of the pot. Both Level 5 and Level 4 above it consist of structural collapse dating to the end of Phase III. The style of the carinated pot is consistent with a late Phase III date for the burial. There is a hole 4 cm in diameter broken through the bottom. Feature 52 was an enigmatic, circular patch of pure yellow clay, 0.51 m in diameter and 3 cm deep. No artifacts were found within it, in contrast to the Level 6 matrix surrounding it, which had abundant Phase III pottery.

Summary of Depositional Events. On the basis of the stratigraphy (presented in Appendix A) and the results of pottery seriation, the chronological order of events responsible for the deposition of strata could be reconstructed with considerable confidence. This reconstruction is presented in Table 2.1. The majority of the deposits in ALS could be attributed to Phases I/II and III, with the Feature 50 house remains and immediately underlying levels apparently representing a short-lived reoccupation of the area during late Phase IV.
UNIT CTR (JENNt-JENO)
The PO (northeast corner) of Unit CTR was 2.73 m above the site datum at Cement Marker 1 and was 140 m at 3380 from magnetic north from Cement Marker 1. The unit was excavated as a 3-by-3 m square, oriented north-south. It contained thirty-eight recognized cultural levels (Levels 1-37 and 39; Level 38 was sterile flood plain material, encountered at 3.8 m depth) and eight archaeological features. Stratigraphy was extremely complex in this unit. Deposits consisted of a combination of funerary and domestic material, with the matrix of accumulated wall collapse/domestic debris repeatedly intruded upon by pits for funerary urns and domestic refuse pits of varying size and age (Appendix A). Artifacts indicated a continuous sequence of occupation from Phase I/II through early Phase IV. Because of the complexity of the stratigraphy arising from Unit CTR's role at different points in time as a cemetery and residential precinct, correlation of excavated levels to natural strata was much less precise than in Unit ALS. Profiles of excavated levels and natural stratigraphy are presented in Figures 2.6 and 2.7.

Features. Features 12 and 13, two small rectilinear structures of cylindrical mud brick, were visible on the surface of the unit (Figure 2.8). Feature 12 (= House 8) was a small rectangular structure, 1.6-by-1.2 m, which extended 30 cm below the surface. Feature 13 (House 9), an irregular wall shaped like an elongated letter E, abutted Feature 12 in the southwest and extended northward alongside it for a length of c. 2.3 m. This feature was clearly associated with Feature 12, but underlay it by several cm; its southern part had been disturbed when Feature 12 was built. Although these two features were labeled "House 8" and "House 9/" their small size suggested that

Stratigraphy, Features, and Chronology
Table 2.2. Reconstruction of depositional sequence in Unit CTR Phase

<table>
<thead>
<tr>
<th>Chronology</th>
<th>Level(s)a</th>
<th>Depositional Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase IV</td>
<td>L. 8, 4</td>
<td>Surface deposits postdating destruction of Feat. 12/13</td>
</tr>
<tr>
<td></td>
<td>L. 7, 2/3</td>
<td>Small pit dug into L. 2 Wall collapse from Feat. 12/13</td>
</tr>
<tr>
<td></td>
<td>L. 6, 14</td>
<td>Wall collapse from Feat. 12/13</td>
</tr>
<tr>
<td></td>
<td>L. 12, 13</td>
<td>Houses 8 and 9: function unknown</td>
</tr>
<tr>
<td></td>
<td>L. 17/18/20</td>
<td>Top of ash pit in Feat. 12</td>
</tr>
<tr>
<td></td>
<td>L. 25, 27/29</td>
<td>Original surface for construction of Feat. 12/13 and excavation of L. 8 [MIXING]</td>
</tr>
</tbody>
</table>
Long period of slow accumulation  
Heterogeneous ash layers  
Urn burial and fill  
Heterogeneous ash  
Urn burial and associated fill  
Urn burial and fill  
Small pit dug into Level 13  
Wall collapse; possible tauf walls  
Disturbance to Level 16  
Accumulated wall collapse and ash  
Hard floor covering layer of domestic debris  
Top of large pit feature  
Upper levels of large pit feature  
Lower part of pit  
Lower part of pit  
[MIXING?]  
L. 30  
L. 23  
L. 26  
L. 28  
---- Phase I/II .----  
L. 32  
Feat. 45  
L. 37/39  
L. 34  
L. 36  
Small pit feature  
HORIZON: slow accumulation  
Wall collapse and floor; possible disturbed structure  
Slow accumulation of structural debris  
Ash lens below Level 32  
Large pit feature. Slow accumulation of wall collapse  
and domestic debris  
L. 38  
Sterile floodplain alluvium  
a Related events enclosed by brackets.

Stratigraphy, Features, and Chronology  

neither was intended to serve a domestic function. Although the shape and dimensions of Feature 12 are appropriate for a granary or small storehouse, the presence of a deep pit inside the feature (extending down 2.5 m to the bottom of Level 8) is not consistent with such an interpretation. Level 8 was extraordinarily rich in large sherds, particularly of funerary wares such as carinated pots, plates, and potlids. Wall collapse from Features 12 and 13 extended over the entire unit and was excavated as Levels 2 and 3. Feature 14, a small circular ash pit, was dug into the wall collapse at the top of Level 2 and appeared to postdate Features 12 and 13. Both features and Levels 1-5 and 8 date to Phase IV. Under a 10-cm-deep accumulation of firm deposits (Level 6) extending to 0.65 m in depth, the soft ashy soil of the interment pits for three urn burials, Features 22, 23, and 24, was encountered near the center of CTR. Pit fill includes Levels 10, 11, 14, and 19 and extended to a depth of approximately 2 m. (Figures 2.9, 2.10, and 2.11). All three urn burials appear to date to late Phase III. The inverted carinated pot covering the funerary urn of Feature 22 was encountered at 0.76 m. This is the most recent of the three urn burials. The 52-cm-tall urn contained a small amount of almost completely disintegrated bone in the bottom 10 cm of the urn, overlain by 40 cm of stratified windblown sand and silt. The urn had a 4-cm-wide hole broken through the bottom (Figure 2.12). Feature 23, lying just northeast of Feature 22, consisted of a large central funerary urn (Figure 2.13) associated with fragments of two smaller carinated pots with potlids.
(Figure 2.14). It appears from the disposition of the various fragments that the central urn had disturbed earlier burials in the two carinated pots. One of the pots contained a small amount of almost completely disintegrated bone. The small size of the pot suggests an infant or child burial. More than half of the other carinated pot and potlid had been broken away; no bone remained inside. The central urn was 51.5 cm high and 49 cm in diameter, with a 4-cm-wide hole in the bottom, and had originally been covered by a third carinated pot and potlid that had fallen to one side (Figure 2.13). In the bottom 20 cm of the vessel were the densely packed remains of two adults. Immediately above these remains were fragments of a pottery plate overlain by a concentration of cremated bone. Other fragments of cremated bone and several more pieces of the same plate were dispersed in the homogeneous soil that filled the top 30 cm of the urn. Fragments of the urn rim found at c. 30 cm depth suggested that the urn was reopened to insert the later cremation burial. An intact inverted plate encountered at x1.23 m was the final urn cover put in place.

Feature 24 consisted of a single carinated urn, 44 cm high and 54 cm in diameter (Figure 2.15), encountered just southeast of Feature 22 at x1.59 m. This urn had also originally been covered with a carinated vessel and potlid which had fallen to one side. The bottom 10 cm contained the cremated remains of an adult or subadult individual, overlain by 21 cm of unconsolidated sandy soil. Fragments of the top carinated pot found 10 cm above the bottom of the vessel appeared to confirm that this was the level of the original urn fill.

Stratigraphy, Features, and Chronology
The two remaining features of Unit CTR were ashy levels associated with Phase III and Phase I/II occupational remains. Feature 25 was a shallow ash pit, c. 0.5 m in diameter, associated with the early Phase III ash/wall collapse of Level 16 and dug into the domestic debris of Level 22. Feature 45 was a shallow ash lens separating the Phase I occupational Levels 32 and 34; it likely marks the top and overspill of the earliest refuse pit (Levels 37 and 39).

Evidence for building technology in Unit CTR came primarily from the wall collapse levels into which the Phase III/IV ash pits and the broad refuse pits of Phase I/II had been dug. Mud brick fragments were visible throughout the Phase IV matrix and in upper Phase III as low as Levels 7 and 9. Level 12, a small pit filled with intact cylindrical bricks, appeared to mark the transition from dried brick to coursed mud (tauj) architecture. This feature intruded directly into a set of one and possibly two parallel curvilinear lines of hard clay, which appeared to be the facing for a round tauj structure in the northeast corner of the upper Phase III Level 13 (Figure 2.10). Wall collapse from this structure was represented by the hard homogeneous loam of Level 13, which extended throughout the northern and eastern sectors of the unit. Both the walls and the surrounding collapse material contained large amounts of rice chaff, presumably from straw used in the wall’s construction. Level 16, a level of early Phase III wall collapse, was composed of much the same material, as were Levels 23 and 26 at the top of Phase I/II. In both these instances, associated fire-hardened floors suggested that structures of either tauj or wattle-and-daub may have been present but overlooked because of the
absence of clearly defined foundations. Abundant evidence of wattle-and-daub construction, in the form of terracotta chunks with distinct mat-and-pole or twig impressions, came from the earliest of the Phase I occupational levels (Levels 32, 34, and 36) and from the lower of the two late Phase I/II refuse pits (Levels 37 and 39).

Summary of Depositional Events. The stratigraphic confusion generated by repeated intrusions, both funerary and domestic, resulted in substantial mixing of chronologically distinct materials in Unit CTR. Nevertheless, pottery seriation and analysis of the available stratigraphic information permitted a reasonable degree of confidence in reconstruction of the probable overall sequence of depositional events. This reconstruction is presented in Table 2.2. Where serious mixing of deposits is suspected, it is indicated by appropriate level, both in Table 2.2 and the level descriptions of Appendix A.

UNIT HAMB (HAMBARKETOLO)

HAMB was oriented north-south, with the PO (northeast corner) 1.67 m above the site datum for Jenn6-jeno (Cement Marker 1) and 711 m at 3570 from that benchmark. Twenty-five cultural levels and one feature were excavated in HAMB. Archaeological deposits consisted of four major horizons of structural collapse and domestic debris, ranging from Phase I/II in the lowest levels to early Phase IV at the top. These were interrupted by a large pit or pits (Levels 3 and 4) near the surface of the unit, and two shallow extended urn burials (Feature 51) which had been excavated into Level 12.

Stratigraphy, Features, and Chronology

Table 2.3. Reconstruction of depositional sequence in Unit HAMB

<table>
<thead>
<tr>
<th>Phase</th>
<th>Chronology</th>
<th>Level(s)a</th>
<th>Depositional Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. 1</td>
<td>Disturbed surface remains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 3</td>
<td>Pit feature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---- Phase IV----</td>
<td>[ L. 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 2</td>
<td>Domestic accumulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 5</td>
<td>HORIZON ends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 6</td>
<td>Slow accumulation of wall collapse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 7/8</td>
<td>Same as L. 6 but sandier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 9/10</td>
<td>HORIZON begins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 11</td>
<td>Fill surrounding Feat. 51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. Feat. 51</td>
<td>Two urn burials (superior)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 12</td>
<td>HORIZON: slow accumulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 13</td>
<td>Transition to L. 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---- Phase III--L. 15</td>
<td>Ash lenses and patches (inferior)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 18</td>
<td>Transition to L. 19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 19</td>
<td>Heterogeneous; domestic activity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
L. 20 Ash lens
L. 21 Slow accumulation of structural debris
---- Phase I/II---- L. 22/23 Classic Phase I/II olive brown heavy loam (rich in artifacts)
L. 24
L. 25 Continuation of L. 24, grading into sterile floodplain alluvium
a Related events enclosed by brackets.
The majority of the lower Phase III deposits were characterized by extensive accumulation of ash (Levels 15-17), while the transition from Phase I/II to Phase III was marked by a thin (5 cm) layer of sterile clay at the top of Level 21. This sterile layer was the only indication anywhere on Jennd-jeno, Hambarketolo, or Kaniana of a possible break in the continuity of occupation before the end of the first millennium A.D.
Excavated levels from HAMB are described in Appendix A and illustrated in Figure 2.16. Natural stratigraphic levels as they appeared in the unit profiles are shown in Figure 2.17. Profiles showed a large possible pit feature, excavated as part of Levels 14-18, which may account for much of the ash in
Stratigraphy, Features, and Chronology
those levels. Otherwise, excavated levels corresponded closely with natural stratigraphy.
Features. Feature 51, a late Phase III urn burial, was the only feature recognized in Unit HAMB. This feature actually consisted of two separate urn burials, encountered at depths of x1.72 and x1.65 m (Figure 2.18). The more northerly of the two burials was oriented approximately north-northwest and extended into the north wall of the unit. The second burial, oriented directly northeast, was too firmly embedded in the south wall for excavation.
The excavated burial consisted of a slightly flexed, badly disintegrated adult skeleton placed lengthwise inside two separate urns laid end-to-end, with the northern urn fitting around the mouth of the southern urn. Both urns were crushed, suggesting that they may have lain just beneath the surface of the unit for some time. Both burials were interred in shallow irregular trenches dug into the slow accumulation material of Level 12. The trenches were filled with a friable, sandy soil containing dispersed charcoal and rice chaff, identical to the material of the overlying Level 11. Level 11 formed a clear discontinuity with the clayey soils of Levels 10 and 12 and appeared to be a layer of artificial fill used to fill in and cover the site of the burials.
Deposits elsewhere in Unit HAMB consisted primarily of slowly accumulated horizons of undifferentiated wall collapse material, with no evidence of architecture. No terracotta chunks from wattle-and-daub construction were encountered in the Phase I/II deposits at the bottom of the unit.
Summary of Depositional Events. Table 2.3 illustrates our reconstruction of the probable chronological sequence of events which formed the deposits in Unit HAMB.
UNIT HK (JENNP-JENO)
Unit HK measured 3-by-3 m at the surface, but was reduced to 2-by-2 m at a depth of 1.82 m and to 1 m square at a depth of 1.9 m below the PO. The unit was oriented north-south, with its PO (northwest corner) 0.7 m below the site datum, Marker 1. Only seven cultural levels were excavated in Unit HK, with the lowest two levels (Levels 8 and 9) consisting entirely of sterile preoccupational deposits, encountered at 1.22 m depth. The one recorded feature in this unit, Feature 5, was a Phase IV inhumation extending south from the north central wall at a depth of x0.33-0.53 m. The skeleton of Feature 5 appeared to be that of an adult female, slightly flexed and propped on the right side, with the right hand cradled beneath the cranium (Fig. 2.19). It had been interred in a shallow trench dug into what appeared to be a long-exposed surface in Level 3. All other cultural deposits consisted of wall collapse and wall melt, containing varying amounts of domestic debris and dating from early Phase III into Phase IV. No Phase I/II material was found. Occupation was established on a sand-clay geomorphological feature, possibly a levee, which began to appear in Level 7 and was excavated in entirety as Levels 8 and 9. The uneven surface of this feature was apparently reflected in a c. 450

Stratigraphy, Features, and Chronology
tilt of the westernmost strata in the lower levels of the unit (Figure 2.20). Although this irregularity was not reflected in the excavated levels (Figure 2.21), its localized nature and the straightforward, relatively homogeneous composition of the cultural deposits permitted a high degree of confidence in reconstruction of the chronology of depositional events.

Summary of Depositional Events. This sequence is illustrated in Table 2.4.

Table 2.4. Reconstruction of depositional sequence in Unit HK

<table>
<thead>
<tr>
<th>Phase</th>
<th>Chronology</th>
<th>Level(s)a</th>
<th>Depositional Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase IV</td>
<td>----</td>
<td>L. 1</td>
<td>Eroded and leached surface remains</td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>L. 2</td>
<td>Slow wall collapse with scant</td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>L. 3</td>
<td>Long exposure as surface of site</td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>Feat. 5</td>
<td>Inhumation</td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>L. 4</td>
<td>Original surface into which Feat. 5 was excavated</td>
</tr>
<tr>
<td>Phase III</td>
<td>----</td>
<td>L. 5</td>
<td>Moderately slow wall melt with much domestic debris</td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>L. 6</td>
<td>Slow to moderate wall collapse</td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>L. 7</td>
<td>Earliest occupational level</td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>L. 8</td>
<td>Sterile levee feature</td>
</tr>
<tr>
<td></td>
<td>----</td>
<td>L. 9</td>
<td></td>
</tr>
</tbody>
</table>

Related events enclosed by brackets.

UNIT KAN (KANIANA)
Unit KAN itself was sunk into a concentration of furnace and tuyre parts and was located immediately north of a 4-by-2.5m pile of cinder-textured slag. Large
concentrations of waste iron were located nearby, one at 22 m at 2200 and one at 22.5 m at 90° from the PO (northeast corner) of the unit. The benchmark for Kaniana was a point which we marked on the "1957" bridge leading north from Kaniana across the Hute marigot to the village of Fokolore. This datum point, located on the southeast corner of the concrete platform at the southern end of the bridge, was painted and labeled at the time of excavation. The PO for Unit KAN was 0.76 m above the benchmark, at a distance of 359.6 m at 1860 from magnetic north. Unit KAN was oriented north-south and measured two by two ms at the surface. It was reduced to 1 m square at a depth of approximately 1 m. This was an extremely shallow unit, containing only seven archaeological levels, the lowest of which

Stratigraphy, Features, and Chronology consisted of floodplain material marked by scattered disturbances from temporary occupation. Excavated levels from Unit KAN are described in Appendix A and illustrated in Figure 2.22. Natural stratigraphy of the unit is shown in Figure 2.23.

Table 2.5. Reconstruction of depositional sequence in Unit KAN

<table>
<thead>
<tr>
<th>Phase</th>
<th>Chronology</th>
<th>Level(s)</th>
<th>Depositional event</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. 1</td>
<td>Disturbed surface accumulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 6</td>
<td>Small ash pit dug into L. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 2</td>
<td>Upper level of large pit feature dug into L. 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 4</td>
<td>Lower level of pit feature (inferior)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 3</td>
<td>Slow accumulation of wall collapse and domestic debris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 5</td>
<td>MIXED: early occupational deposits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feat. 53</td>
<td>Hearth (temporary occupation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 7</td>
<td>Floodplain alluvium with remains of temporary occupations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Related events enclosed by brackets

The primary occupation level, Level 3, was composed of wall collapse material containing scattered fragmentary brick. A pit (Levels 2 and 4) dug into this matrix contained many nearly whole cylindrical sun-dried bricks, as well as a number of unusual large loaf-shaped bricks, many slipped and fired (see Chapter 4). The top edge of the pit was outlined by a curvilinear line of fired cylindrical bricks. The only recorded feature in Unit KAN, Feature 53, was an apparent hearth found at a depth of x1.36 m, beneath approximately 20 cm of somewhat disturbed floodplain alluvium (Figure 2.24). This feature consisted of a c. 30-by-80 cm patch of fire-oxidized earth, ash, and charcoal, containing pottery sherds and the remains of burnt fish bone. Feature 53, which did not yield sufficient pottery for chronological interpretation, appeared to represent the remains of a temporary campsite antedating the permanent occupation of the KAN area.

Summary of Depositional Events. Aside from one small pit dug into Level 3 and undetected during excavation, natural and excavated levels showed an extremely close correlation and permitted a high degree of confidence in the reconstruction.
of the chronology and depositional sequence of Unit KAN. This reconstruction is presented in Table 2.5.

Stratigraphy, Features, and Chronology
UNIT LX-N (JENNP-JENNO)
Unit LX-N was the northern half of the 10-by-6 m unit, known as LX, which was opened in the central "residential" precinct of the Jenn6-jeno mound. LX was opened in a high spot near the center of the mound which was characterized by a jumble of brick foundations and a heavy blanket of artifacts, including slag, clay net weights, glass beads, and abundant Phase III painted pottery. The unit was oriented north-south, with the two halves, Units LX-N and LX-S, each measuring 6 m east-west by 4.75 m north-south (Plate 3). The two subunits were separated by a 0.5 m baulk, which was photographed, drawn, and removed following each m of vertical excavation. Units LX-N and LX-S were separately excavated by two crews under different supervision, and artifacts were handled and analyzed as coming from two discrete excavation units. In this and succeeding chapters, descriptions and analyses of stratigraphy and artifacts from the two units are presented separately.

The PO (northeast corner) of Unit LX-N was 4.14 m above the Jennd-jeno benchmark Cement Marker 1, at a distance of 309 m at 3430 from that marker. Unit LX-N contained eighteen features and fifty-two levels, ranging in time from early Phase I/II to late Phase IV and extending to a depth of 5.32 m before bottoming out on sterile floodplain alluvium in Level 50. Cultural deposits in Unit LX-N were almost entirely domestic throughout the 5.32 m of deposits. Virtually all archaeological levels and features, with the exception of burial Feature 26 and the possibly associated Feature 30, appeared to be related to the domestic function of the area. Of the eighteen archaeological features recorded, six were building foundations ranging in date from late Phase IV to early Phase III. Nearly all levels and features from these occupational phases appeared to be associated with either the occupation or abandonment of these structures. The single feature reported from Phase I/II, Feature 48, was a burnt earth floor probably associated with a domestic dwelling.

Because of the large number of structures found in Unit LX-N, the evolution of building styles was particularly clear in this unit. Walls from three rectilinear buildings constructed of cylindrical mud brick (Features 1, 8, and 9) were uncovered in upper Phase IV deposits. Following a hiatus represented by wall collapse and runoff from unidentified nearby structures (Levels 12 and 13), building resumed in lower Phase IV with round brick houses (Features 20 and 37). The disappearance of mud brick construction coincides in this unit with the transition to Phase III. Both upper and lower Phase III deposits contained collapse from tauf or mud wall structures, with apparent tauf wall collapse at the top of Phase III (Level 35) and a round tauf house (Feature 46) visible at the very bottom of the Phase III deposits. Phase I/II contained what appeared to be the floor and wall collapse from a mud structure (Feature 48) near the top of Phase I. The associated Level 47 and all underlying levels down to sterile floodplain yielded terracotta chunks with impressions from mat-and-pole or twig-and-pole
construction. These were particularly numerous in Level 49, just above floodplain level.

Stratigraphy, Features, and Chronology
Excavated levels and natural stratigraphy from Unit LX-N are illustrated in Figures 2.25a-b and 2.26a-b.

Features. Feature 1 (House 1) was visible on the surface as an irregular L-shaped line of cylindrical bricks in the western part of the unit. Excavation exposed it as an approximately T-shaped foundation with the southern arm of the T disappearing into the southern baulk of the unit (Figure 2.27). This structure appeared to represent two separate construction episodes, with the northern arm built of large irregular bricks bonded onto an earlier structure of small, regular bricks which disappeared into the southern and eastern profiles. Depth of the southern walls was x0.40-0.57 m, and that of the later northern wall was x0.30 m. Associated deposits suggested that the interior of this house lay to the north of the earlier, southern wall during all phases of occupation. Two successive floors of compact loam (Levels 4 and 7) were found in this northern area, extending from a depth of x0.35-x0.51 m. Both appeared to at least partially antedate the later north-south wall that formed their eastern boundary. An apparent external living surface, composed of heterogeneous compact loam with small fragmented sherds, was found in Level 5 to the south of the earlier wall. Level 3, a level of platy heterogeneous loam, appeared to represent external occupational debris accumulated to the west of the later wall. The house had been built on top of Level 6, a soft microlayered level of occupational debris possibly associated with House 3 of Unit LX-S. Wall collapse from Feature 1 was visible in Levels 1 and 2.

Immediately underlying the Feature 1 deposits was Feature 8 (House 14), an apparent wall stump of cylindrical brick that protruded 0.84 m from the southern baulk (Figure 2.28). This feature actually consisted of two adjacent brick features, with the higher, eastern "stump" (found at a depth of x0.55-0.66 m) interpreted as possible wall collapse from the lower (x0.79-0.87 m). The position of this feature at the edge of the LX-N/LX-S baulk raised the possibility that it was a northern extension of one of the various Phase IV buildings in Unit LX-S. Because of the superposition of the two northern houses (Houses 3 and 6) in Unit LX-S on the same site, it was uncertain which, if either, of these two features the Feature 8 wall might be related to, although it seemed more likely that it was part of House 6 (see text below on LX-S features). Feature 8 was overlain by wall collapse in Level 8, and was associated with an ashy, flaky level of occupational debris in Level 9. In addition to pottery, bone, and other organic remains, this level contained many quartzite flakes that may have been debris from bead making and may reflect the deposition of waste outside a workshop. Feature 8 appeared to have been dug into Level 11, a level of wall collapse and domestic debris associated with the nearby Feature 9.

Feature 9 (House 5) was the northern part of a rectilinear foundation extending into the southern baulk some 1.6 m west of Feature 8 (Figure 2.28). This foundation was only two bricks wide and one brick deep and was found at
approximately the same depth as Feature 8 (xO.74-xO.84 m). Level 11, to the
south and east of the two existing walls of this structure, contained domestic
debris from the interior of the house. Wall collapse from Feature 9 was evident in
the upper part of Level 11 and in the adjacent Level 10.

Stratigraphy, Features, and Chronology
Feature 9 was built on top of the wall wash and former exposed surface of Levels
12 and 13, which may have been contemporary with House 7 in Unit LX-S. In the
northeastern part of Level 13, a pit had been excavated beginning at a depth of
approximately x1.25 m. This pit, extending to the bottom of Level 24 at x2.12 m,
had been deliberately filled in with brick rubble. At the bottom it contained the
remains of a skeleton (Feature 26) disturbed, presumably, by the pit digging
activity. Directly beneath the skeleton were found two concentrations of large
sherd and terracotta chunks, underlain by small, hard platforms that appeared to
be deliberate pedestals. This material, excavated as Feature 30, appeared to be
mixed, with some sherds associated with the Feature 26 burial and some with the
surrounding domestic debris of Level 27.

A distinct juncture at the bottom of the deep wall wash deposits of Level 12/13
marked the transition to deposits associated with Feature 20 (House 10), the more
recent of the two round brick houses in Unit LX-N. The rapid collapse of this
house appeared to be represented by Level 14, a loosely compacted level of ashy
wall collapse. House 10 was by far the most complex of the various structures
excavated in Unit LX-N. It was located approximately in the center of the unit,
and first appeared in Level 14 as the outline of three triangular brick ovens
(Features 15, 17, and 19) attached to the house walls in the east, northwest, and
southwest (Figure 2.29). Subsequent excavation revealed a slightly subrounded
central structure with a maximum diameter of slightly more than 4 m and with at
least three external partition walls separating the three ovens in the southeast,
northeast, and northwest (Figure 2.30). Possible doorways appeared in the
northwestern and southern walls of the structure. Just east of the apparent
southern entryway was a small rectangular hard earth platform, enclosed within
the wall of the house, upon which was found in situ a pair of kneeling male and
female statuettes facing south toward the house exterior (see Chapter 4). All
construction of House 10 and associated features were of cylindrical sun-dried
brick, with multiple renderings of yellow and gray clay still visible in places on
the external house walls.

Average depth of the House 10 foundation and associated partition walls was
x1.97 m. The original floor of the house (Level 20) was encountered slightly
above this depth at x1.75 m, and consisted of a hard red sandy surface with
several sandstone grinders, but few other artifacts. Hard clay levels to the north,
west, and east of the house (Levels 19, 21, and 22) appeared to represent
exterior living surfaces at approximately the same depth. Overlying these levels,
both to the interior and exterior of the house walls, was a thick level of domestic
debris excavated as Levels 16 and 17. This accumulation continued southward to
cover all of Unit LX-S as Level 31 of that unit. Features found in the northern part
of Level 31 and possibly associated with House 10 were a large sandstone cache
with appliquéd-decorated ceramics (Feature 21) and a series of four small ash pits (Pit 3).
Ash and terracotta debris from the three House 10 ovens was found throughout Levels 16 and 17, and in the overlying wall collapse of Level 14. A thick ash layer (Level 15) overlying the northeastern part of Level 16 clearly represented waste and destruction debris specifically associated with the

Stratigraphy, Features, and Chronology
Feature 15 oven. Earlier waste from this oven was evident in a deep pit which had been dug beneath the "taphole" opening of Feature 15 in the southeast of the unit. This pit, excavated as Level 18 and Feature 39, extended to a depth of x2.80 m, more than 1 m below the house floor. In its lower levels, Level 18/Feature 39 considerably undercut the southeastern wall of House 10 and the adjoining partition wall. It seems likely that an otherwise inexplicable downward extension of these walls to x2.17-2.21 m, some 20-25 cm below the other foundation remains, reflected repair necessitated by this undermining. Beneath the horizon of wall collapse upon which House 10 was built were two overlapping levels of ashy deposits (Levels 24 and 25) that appeared to represent accumulation of domestic refuse. Apparently dug from Level 24 into Level 25 were three small ash-filled pits, Features 27 and 28, in the northeastern part of the unit. These pits were all clearly related to Level 24 as well as to each other. The eastern of the two pits designated Feature 28 contained a large piece of iron slag weighing 275 g and was fire-oxidized on the bottom. Underlying these ashy levels, and some 60 cm below the foundation of House 10, were deposits from Feature 37 (House 11), the final brick house encountered in Unit LX-N. This was a round house, c. 3.8 m in diameter and, like House 10, it was completely exposed within the unit (Figure 2.31). In the southeast corner, the foundation had been obliterated by the Feature 39 pit feature associated with House 10. House 11 was made of large, irregular bricks, ranging from cylindrical to loaf-shaped and widely spaced in a matrix of heavy mud mortar. A thick coating of yellow clay was visible over most of the wall exterior. An apparent partition wall extended off the foundation in the northwest, and an unidentified architectural feature (Level 33), consisting of a thick terrace of pure compact loam covered with the same yellow rendering as the house walls, adjoined it from the northeast. Fine microlensing of the living surface between these two features (Level 30) raised the possibility that they may have enclosed a "bath area" like that identified by the workmen outside House 2 of Unit LX-S.
The decay of House 11 appeared to be represented in Level 25 and the adjoining Level 26, both of which included material from long-exposed wall collapse and wall wash. Occupational debris from both the interior and exterior of the house was represented by ash and domestic debris in the immediately succeeding Level 27. The house floor, Level 28, was a compact level of light loam, charcoal, and terracotta chunks, encountered at a depth of approximately x2.70 m. To the west and north, large amounts of bone in upper Level 29 and the microlayered surface at the top of Level 30 appeared to represent external living surfaces at approximately the same depth. A small ash pit (Feature 38), dug into Level 29 and
adjoining the western house wall, clearly represented a refuse area dating to the occupation of the structure (Figure 2.31). Immediately underlying the House 11 floor in the southwest was a large ash pit (Feature 40) which had been dug into Level 29 to a depth of x3.11 m (Figure 2.31). This feature extended both inside and outside the walls of

Stratigraphy, Features, and Chronology

Table 2.6. Reconstruction of depositional sequence in Unit LX-N Phase

<table>
<thead>
<tr>
<th>Chronology</th>
<th>Level(s)</th>
<th>Depositional Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase IV (superior)</td>
<td>L. 4 L. 5 L. 7 Feat. 1 L. 6</td>
<td>Mix: House 1 occupation debris and collapse</td>
</tr>
<tr>
<td></td>
<td>L. 8 L. 9 Feat. 8 L. 10 L. 11</td>
<td>Mix: Exposed surface; possible debris from House 3 (Unit LX-S)</td>
</tr>
<tr>
<td></td>
<td>Feat. 9 L. 12/13</td>
<td>Wall collapse/debris from House 6</td>
</tr>
<tr>
<td></td>
<td>Feat. 26 L. 14 L. 16/17</td>
<td>Occupation debris from House 6 Probable northern extent of House 6</td>
</tr>
<tr>
<td></td>
<td>L. 24</td>
<td>Rectilinear brick building (House 5) Horizon: wall collapse and exposed surface</td>
</tr>
<tr>
<td></td>
<td>Feat. 27/28</td>
<td>Inhumation originating in Level 13 Rapid collapse of House 10 Domestic debris on House 10 floor</td>
</tr>
<tr>
<td></td>
<td>Disturbed surface and House 1 collapse</td>
<td>Ash from Feature 15 oven.</td>
</tr>
<tr>
<td></td>
<td>Rapid collapse of House 1 Mix: House 1 occupation debris and collapse</td>
<td>Exterior living surface of House 10</td>
</tr>
<tr>
<td></td>
<td>Original living surfaces of House 1</td>
<td>Westernmost House 10 oven and associated ash</td>
</tr>
<tr>
<td></td>
<td>Rectilinear brick house (House 1) Mix: Exposed surface; possible debris from House 3 (Unit LX-S)</td>
<td>Probable floor of House 10 Round brick house (House 10) and two attached ovens</td>
</tr>
<tr>
<td></td>
<td>Wall collapse/debris from House 6</td>
<td>Horizon: wall collapse</td>
</tr>
<tr>
<td></td>
<td>Occupation debris from House 6 Probable northern extent of House 6</td>
<td>Ash accumulation after abandonment of House 11</td>
</tr>
<tr>
<td></td>
<td>Slow wall collapse from House 5 Mix: wall collapse and domestic debris from House 5</td>
<td>Small ash pits</td>
</tr>
</tbody>
</table>

Stratigraphy, Features, and Chronology

Table 2.6-continued. Reconstruction of depositional sequence in Unit LX-N Phase
<table>
<thead>
<tr>
<th>Chronology</th>
<th>Level(s)</th>
<th>Depositional Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase IV (inferior)</td>
<td>L. 25 L. 26 L. 27 Feat. 38 L. 28 Feat. 30</td>
<td>Phase IV (inferior)</td>
</tr>
<tr>
<td></td>
<td>L. 37/L. 33 Feat. 40 L. 32 L. 29/30 L. 31/34</td>
<td>transition IV/III</td>
</tr>
<tr>
<td>(superior)</td>
<td>L. 35</td>
<td></td>
</tr>
</tbody>
</table>

Stratigraphy, Features, and Chronology
House 11, making it clear that the structure had been built directly on top of it. It contained occasional sherds but no other artifacts. Feature 40 and surrounding levels appeared to signal the transition from Phase IV to Phase III in Unit LX-N, with House 11 built directly atop the Phase III Levels 31 and 34. Immediately beneath these levels, a level of homogeneous friable clay (Level 35), quite distinct from the more heterogeneous wall collapse above, was interpreted as a possible level of tauf wall collapse and may have marked the change from brick to mud wall architecture. This level was underlain by approximately 1.2 m of ashy household debris in Levels 36 and 37 and the associated pit features Level 38 and Feature 44. Feature 44 was a small round ash pit, c. 1 m in diameter, intruding upon the larger pit of Level 38 in the southwestern sector of the unit. Both had been dug into the underlying wall collapse and foundation of Feature 46 (House 12) (Figure 2.32). The indistinct, badly disturbed walls of Feature 46 first appeared in the eastern sector of the unit at a depth of c. x3.50 m. Although only the outline of the eastern interior could be traced with confidence, this feature appeared to be the remains of a circular tauf house with an interior diameter of roughly 3.4 m. Visible walls consisted of an approximate arc of hard clay running from northeast to southeast, with its easternmost section obscured by the eastern profile of the unit. At the southern end of the wall, but separated from it by a low triangular platform of burnt earth, was a circular clay feature (diameter 85 cm) similar to Feature 52 of Unit ALS. This feature was made of the same pure hard clay as the House 12 walls and was covered by a distinct facing of yellow clay. Overlying wall collapse and subsequent melt from House 12 were excavated as Levels 39, 40, and 41. On the west, an indistinguishable mass of foundation material and wall collapse was removed as a single unit in Level 43. At the bottom of Level 41, a level of compact red and black mottled loam yielding several sandstone grinders appeared to mark the original house floor at a depth of c. x3.65 m. House 12 appeared to mark the approximate lower limit of early Phase III occupation in Unit LX-N. In most of the unit, deposits associated with this house were immediately underlain by a thick level of yellowish wall collapse (Level 46) representing the decay of a mud wall structure, possibly either tauf or wattle-and-daub, that appeared to be associated with the Phase I/II Feature 48 (Figure 2.33). This feature was a hard thin burnt clay floor, apparently intentionally fired, that extended from the southern part of Unit LX-N through the baulk into Unit LX-S. Feature 48 was encountered at a depth of approximately x4.4 m, and covered a total area of c. 2.1 m north-south and c. 2.5 m east-west. Level 47, a shallow refuse pit located just to the west at the same depth, appeared to be associated with this feature. Level 47, like the underlying Phase I/II Levels 48-49 and 52, contained fragments of burnt clay with mat-and-pole or twig-and-pole impressions, raising the possibility that Feature 48 and Level 46 may have represented the final phase of wattle-and-daub construction in this unit. Summary of Depositional Events. Despite the extent and depth of excavation, the stratigraphic and excavated profiles show a strong degree of

Stratigraphy, Features, and Chronology
correspondence. The proposed sequence of depositional events in Unit LX-N, reconstructed from stratigraphic description and artifact analysis, is presented in Table 2.6.

UNIT LX-S (JENN-JENO)
Unit LX-S was the southern half of the 10-by-6 m LX excavated in the central "residential" precinct of Jennd-jeno. Research objectives for this unit were the same as those for Unit LX-N and are explained in the chapter section on that unit. Like Unit LX-N, LX-S was characterized on the surface by a heavy blanket of artifacts and visible brick foundations. It measured six ms east-west by 4.75 m north-south, and was separated from Unit LX-N by a 0.5 m baulk. Vertical control in Unit LX-S was maintained by a separate PO which was 4.13 m above the site datum at Cement Marker 1, and 304 m distant from it at 343. As in Unit LX-N, cultural deposits in Unit LX-S were excavated to a depth of more than 5 m.

Excavated deposits consisted of eighty-one levels and twenty-four features, ranging in date from Phase I through late Phase IV. The features are dominated by five late Phase IV rectilinear mud brick house foundations and eleven shaft pits, some associated with the houses, but all dating to Phase IV. The five Phase IV houses appeared to reflect three major building episodes, with the two latest houses (Houses 2 and 3) constructed directly atop and in alignment with the foundations of Houses 4 and 6. House 7, found to the east of Houses 4 and 6 at a slightly lower level, was oriented along the same axis as those features, suggesting that the entire architectural sequence reflected a fairly short period of intensive building and rebuilding. The shaft pits were generally characterized by greenish waterstained soil with a distinctive chemical odor resembling the pesticide DDT. Most had a slight bell shape, resulting in a larger diameter in the lower levels. Diameter of the pits averaged c. 0.75 m in the upper levels and approximately 1.15 m in the lower levels. They ranged in depth from well over 3 m (Pits 1, 6, 7, and 8) to less than 1 m or the four small pits excavated together as Pit 3. Pits 1, 2, and 8 were fairly clearly associated with houses at the same level and appeared to be latrines or drainage for water-stained "bathing areas." Two other pits (7 and 11) contained funerary urns at the bottom. Beginning at just under 3 m depth, Phase IV deposits are underlain in most of the unit by extensive ash pits dating to the Phase III/IV transition. The excavation of these large pits down as far as floodplain alluvium removed or disturbed most of the earlier deposits in the unit, with only Level 78 remaining to indicate Phase I/II occupation.

Excavated levels in Unit LX-S are described in Appendix A and illustrated in Figure 2.34a-b. Natural stratigraphic levels are shown in Figure 2.35a-b.

Features. Feature 3 (House 3) was the most recent of the architectural remains excavated in Unit LX-S. This house was dated to late Phase IV, although its occupation appeared to have overlapped with that of the adjoining House 2. Walls from both House 3 and House 2 were encountered just beneath the surface. The House 3 foundation, located in the northeast,

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sector of the unit, consisted of the western portion of a rectangular "room," measuring c. 2.4 m north-south and with an east-west length of over 2.51 m before it disappeared into the eastern wall of the unit. The edge of what appeared to be a second "room" was obscured by the northern baulk with Unit LX-N (Figure 2.36). House 3 was constructed of cylindrical sun-dried bricks, with one to two courses of bricks remaining throughout the foundation. The foundation terminated at a depth of x.360-x.405 m. A sandstone grinder found at a depth of x0.285 m appeared to mark the floor of House 3. This was surrounded and covered by a layer of soft loam with black and orange ash (Level 6) that may have represented the remains of burnt thatch mixed with initial wall collapse of the structure. This mixture of ash and loam expanded to cover the entire unit in Levels 3 and 4 and was in turn overlain by a level of hard wall collapse (Level 2), probably representing slow erosion of fallen remains. Level 2 narrowed in its lower levels to cover only the area of House 3 and appeared to have originated with that structure. Level 6 of Unit LX-N, immediately underlying House 1 of that unit, may have represented a northern extension of occupational debris from House 3.

Feature 2 (House 2) was located less than 1 m to the west of Feature 3. This feature consisted of the southeastern corner of a second rectangular structure of cylindrical bricks, aligned along the same axis as House 3 (Figure 2.36). The brick walls of House 2 were three courses deep, terminating at a depth of x0.42-x0.44 m. The base of these walls was several cm below that of House 3, suggesting that it had been constructed at a slightly earlier date. The floor of House 2 appears to have been encountered in Level 5, where sandstone grinders were found at a depth of x0.18 m, approximately 10 cm above the bottom of the foundation. Above this level, Level 5 consisted of a light loam with small brick fragments and appeared to represent slow melt from the house walls. As in House 3, this level was overlain by mixed ash and wall collapse in Level 4.

The outstanding feature associated with Houses 2 and 3 was Pit 1, a deep shaft pit located directly south of House 3 and connected to the southeastern corner of House 2 by a c. 2.8 m man-made trough (Level 9) (Figure 2.34). Level 9 was filled with a strongly laminar, green-stained, water-deposited soil which also formed the top level of the pit. The entire area was identified by our workmen as a "bathing area" and latrine. Pit 1 contained nine distinct levels below Level 9 (Feature 4 and Levels 22, 23, 25, 26, 40, 45, 60, and 62), and reached a maximum depth of x-4.49 m, or 4.17 m below the top of Level 9. Diameters ranged from 0.71 m at the bottom of Level 9 to a maximum of c. 1.58 m in Levels 40 and 45. Fill in this pit consisted of alternating levels of ash, sand, and loam, much of it clearly water-deposited and containing large amounts of pottery and bone. Several loamy levels in the upper part of the pit had a distinct greenish cast similar to that of Level 9.

A second trough of green-stained soil was found between Houses 2 and 3, just below the depth of the House 3 walls (x0.41 m). This trough was approximately 20 cm deep and was found beneath a layer of tumbled bricks in Level 10. This feature led southward, directly toward Pit 1 and the Level 9 trough. To the south of Houses 2 and 3, exterior deposits consisted of a
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compact fine-grained loam (Level 11) with patches of red and black burnt earth just outside House 2 and, elsewhere, areas of laminar, green-stained, water-deposited soil. This greenish staining continued into Level 15, a level of wall collapse underlying the floor and walls of House 3, and was cut into by the southwest wall of that structure. This appeared to confirm that at least the initial use of the Pit 1 "bathing area" was associated with House 2 and antedated the construction of House 3.

Immediately beneath the walls of Houses 2 and 3, walls from an earlier phase of construction were visible. These were Feature 10 (House 6) and Feature 7 (House 4), two rectilinear structures whose walls followed the lines of Houses 2 and 3 and had clearly formed the basis for the construction of those later structures (Figure 2.37). House 6, in the north center of the unit, consisted of the fragmentary remains of an approximately L-shaped foundation whose northern leg precisely underlay the western wall of House 3. This foundation was one brick thick and extended from a depth of x0.74 m-x0.83 m. It appeared to continue into Unit LX-N as the wall stump of Feature 8, which appeared on the northern side of the baulk along the same axis (Figure 2.36). The floor of House 6 appeared to be represented by a level of sandy loam with ash (Level 20), found within the house walls at the same depth as the remaining bricks. Level 19, an area of hard burnt earth to the northeast, appeared to represent the exterior surface associated with House 6 and may have been the remains of a courtyard with vestiges of cooking fires. The largest patch of burnt earth was found at a depth of x0.77 m.

Occupational debris to the north of House 6 may have been represented by Level 9 of Unit LX-N, a level of ashy, loamy sand associated with the Feature 8 wall stump. Level 8 of Unit LX-N, immediately overlying Level 9, appeared to represent wall collapse from House 6 and Feature 8.

The southern wall of House 6 was at a right angle to and appeared to have been bonded to the eastern wall of the slightly earlier House 4. Excavated remains of House 4 consisted of two parallel walls cutting through the western half of the unit from northwest to southeast, at a distance of about 2 m apart (Figure 2.37). Like House 6, these foundations were made of cylindrical bricks. They were each three courses deep and extended from a depth of x.56-x0.94 m, suggesting that this structure must have been built before House 6, although the two were clearly associated. The eastern wall of House 4 lay directly beneath the eastern wall of House 2.

To the east of House 4 was a level of loose loamy sand (Level 16), with sandstone grinders and burnt earth patches at a depth of x0.68 m. This appeared to represent the original exterior living surface and subsequent accumulation during the occupation of House 4. Within House 4, a level of heavy brick rubble occupying the southern half of the area between the walls was designated Feature 6. This feature consisted of a mass of loose individual cylindrical bricks which clearly represented the initial rapid collapse of House 4. The bricks of Feature 6 were set within the soft matrix of Level 18, a level of powdery loam that covered the entire area between the House 4 walls and appeared to represent debris from the final
use and destruction of House 4. Feature 6 bricks terminated in the north at a point parallel with the overlying northern wall of House 2. Together with the fact that the eastern wall of House 2 directly overlays that of House 4, this suggests that the two houses were fairly close in age, with House 2 built directly on the remains of House 4. Subsequent wall collapse from House 4 was evident in Levels 13 and 14, which appeared to reflect slow wall collapse following the initial rapid collapse of Feature 6/Level 18. Levels 15 and 17 appeared to represent slow wall collapse reworked as surface material immediately underlying Houses 2 and 3.

The foundations of both House 4 and House 6 had been dug into a thick level of hard-packed heterogeneous wall collapse (Level 21) which had clearly been exposed as the site surface at various points. This was the upper level of wall collapse from Feature 11 (House 7), whose walls were clearly visible at the bottom of the level. Pits 6, 7, and 8, three deep shaft pits, had been dug into this material. Pit 6 was a deep shaft pit excavated into the top of Level 21 in the northwest corner of the unit. It was first detected during excavation at a depth of x2.07 m, but in profile it could be seen as high as X1.20 m. It terminated at a depth of x4.79 m. Fill in Pit 6 (Levels 41, 42, and 57) consisted entirely of ash and ashy loam containing moderate to large amounts of pottery.

Pit 7, an apparent funerary pit, extended from x0.9 m to a total depth of X4.22 m, with a diameter of approximately 0.7 m at the top and 1.17 m at the bottom. This pit remained undetected during excavation until a depth of x2.23 m, where it was enclosed by a single circle of cylindrical bricks designated as Feature 29. Upper levels of Pit 7 were, however, clearly visible in the northeastern profile of the unit, showing that, like the shaft burial Feature 26 at approximately the same depth in Unit LX-N, it had been filled in with brick rubble to a depth of x2.92 m. The bottom 70 cm of this brick fill, excavated as Level 44, contained almost no other artifacts. Beneath the brick fill, a level of ashy loam extending to the bottom of the pit (Level 56) contained a covered funerary urn recorded as Feature 47 (Plate 4). The urn was 70 cm in height and 49 in diameter, and rested in an upright position on the bottom of the pit (Figure 2.38). It contained the tightly flexed remains of two adult skeletons, a male and a female. The covering pot (49 cm high by 43 cm in diameter) had been inverted over the first and was filled with unstratified sterile earth which appeared to have been its original fill. A broken pot lid, 63 cm in diameter, adhered to the side of the upper urn. Pit 7 had been excavated just north of the House 7 walls, either during or after deposition of the Level 21 wall collapse from that structure. Although it may have been associated with House 7, it appeared to postdate that structure.

Pit 8 was also excavated into the Level 21 wall collapse, at a slightly higher level than Pit 7. This apparent drainage pit extended from x0.8 m to a depth of x3.96 m in the far southeastern corner of the unit. Like Pit 7, it was undetected through its upper levels, with excavation as a separate feature beginning only at a depth of x2.25 m. At this level, Pit 8 was excavated as Feature 33, a level of ash, sand, and greenish loam resembling that of the upper deposits of Pit 1. Feature 33 contained
burnt brick, large sherds, and large amounts of fish bone and had a distinctive chemical odor like the water-stained soil of Pit 1.

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Succeeding levels in Pit 8 (Levels 52 and 61) consisted of homogeneous sand and loam containing nearly whole vessels, and may have represented a layer of deliberate fill following the initial use of the pit, which appeared to be represented by the water-deposited bottom Level 74. The top of Pit 8 appeared in profile well above the bottom of the House 7 foundation, but its position in the center of the southern "room" of House 7 suggested some association with that structure. It is possible that Pit 8 provided the drainage for an enclosed bath or latrine area, either during the occupancy of House 7 or after its partial collapse.

Feature 11 (House 7), encountered at the bottom of Level 21, was a rectilinear structure of cylindrical bricks, located in the southeast of the unit c. 1.5 m to the east of House 4 and only a few centimeters below the lowest bricks of the House 4 foundation. Although it clearly antedated Houses 4 and 6 (their foundations had been dug into its wall collapse), House 7 was aligned along the same axis as those structures. House 7 consisted of the northwestern corner of a rectilinear structure apparently partitioned into two sections by a third wall near the southern edge of the unit. The western wall had been disturbed by Pit 1 (Figure 2.39). Walls were uniformly three bricks wide and generally one brick deep, extending from a depth of c. x0.89-x1.01 m. The floor of House 7 appeared to be represented in the northern "room" by Level 28, a level of compact loam with occasional greenish patches, and in the southern compartment by Level 29, a level of moderately compact loam which included material from the upper levels of Pit 8. Exterior deposits and living surface of House 7 were represented by Level 24, a thin level of homogeneous sandy loam that covered the entire unit north and west of House 7 and appeared to continue into Unit LX-N as Level 13. This level was directly overlain by the wall collapse of Level 21.

The foundation of House 7 was dug into Level 27, a horizon of longexposed wall collapse containing many sherds and sandstone grinders, suggesting exposed living or working surfaces. A shaft pit (Pit 2) dug into this level at its interface with Level 24, was probably associated with the occupation of House 7. Pit 2 was encountered approximately in the center of the unit, just west of House 7, at a depth of x1.21 m. This was another drainage pit, very similar to Pit 1 outside Houses 2 and 3. Its top level, Feature 18, consisted of a scoop-shaped trough of greenish loam leading directly into the pit shaft, where it surrounded a central "plug" of green-stained brick debris (Level 32) that rose some 17 cm above the top of the pit. These greenstained levels were underlain in the lower levels of the pit by layers of waterdeposited loam and fine sand (Levels 34 and 35) containing much pottery. The diameter of Pit 2 was 0.7 m at opening, and 1.21 m at closing. Pit 2 terminated at a depth of x2.71 m. Its lower levels overlapped with what appeared to be the upper levels of an earlier shaft pit (Pit 5) originating in the wall collapse of Level 36 below.

Also dug into the upper part of Level 27 was Feature 16, a cache of fifty incised black clay spindle whorls buried in a small pit in the north central part of the unit.
This pit extended from a depth of x1.22 m to x1.41 m. Fill was a soft reddish brown loam. Found with the spindle whorls were a fragmentary black ceramic bracelet and a concentration of large sherds, as well as fragments of burnt brick and burnt earth. At the top of the feature, spindle whorls were found dispersed outside the area of the pit into the surrounding Level 27 matrix, as though the top of the cache had been disturbed. Five incised spindle whorls recorded with Level 27 were probably originally part of Feature 16. Beneath Level 27, another thick horizon of interspersed wall collapse and domestic debris was excavated as Level 31. This level, which appeared to be a southward continuation of Levels 16 and 17 outside House 10 of Unit LX-N, contained several features just south of the northern baulk that may have been associated with that structure. These were Pit 6, an ash-filled shaft pit; Pit 3, a series of four small ash pits; and Feature 21, a cache of sandstone grinders.

Pit 3 (Level 33) was actually a series of four small straight-sided pits running east-west along the northern baulk of the unit. These pits had been dug into Level 31 at a depth of c. x1.46 m, some 26 cm below the top of Pit 6. They were all clearly related and contained a similar ash and sand fill yielding abundant large sherds and some wall collapse fragments. Diameters of the pits ranged from 0.55 m to 1.09 m, and depths ranged from x1.64 m to x1.92 m.

Feature 21 was a cache of ninety-three pieces of sandstone found about halfway through Level 31 in the northwest corner of the unit (Figure 2.40; Plate 5). This concentration of sandstone was associated with numerous other objects, including a fragment of a terracotta statuette (Small Find 538), a serpent-motif potlid, and at least three in situ ceramic vessels (Figure 2.40). A large serpent-motif vessel in the center of the feature contained thirty-eight rounded sandstone grinders and a polished granite handax (see Chapter 4). In and around the edges of the feature were a number of oblong dried clay bricks. This feature showed much evidence of fire exposure, including ashy patches and patches of burnt earth. Underlying Feature 21 was an apparently associated level of loam and ash (Level 43) containing chunks of wall collapse, a pocket of burnt brick, and a large fire-damaged bowl with Twine 1 decoration.

Underlying Level 31 was another horizon of heterogeneous wall collapse (Levels 36 and 49) containing ash and localized burnt areas. Dug into the upper part of Level 36 were two shaft pits, Pit 4 and Pit 5. Pit 4, located in the northeastern sector of the unit, extended from a depth of x1.99 m to x3.53 m, and was delineated by a curved row of bricks at a depth of x2.11 m. Diameter ranged from a maximum of c. 1.12 m at the top and bottom of the pit, to a minimum of c. 0.88 m at a depth of x2.56 m. Fill in the upper part of Pit 4 consisted of 0.84 m of moderately compact light loam (Levels 38 and 39), demarcated by a heavy concentration of pottery and sandstone at the top and a mass of bricks at the bottom. This was underlain by 0.7 m of stratified, waterdeposited loam in Level 50, the lowest level of the pit. The lower levels of Pit 4 intruded into Pit 11, an apparent funerary pit dug into the ash deposits below Level 36.
Pit 5 was the offset continuation of Pit 2, the apparent drainage pit associated with House 7 above. Pit 5 intersected the lower levels of Pit 2 from the east and appeared to be an earlier shaft pit into which Pit 2 had intruded. It extended from a depth of x2 m to x4.62 m, with an opening diameter of 0.63 m and a closing diameter of 0.76 m. Fill in the upper level of Pit 5 (Level 37) was a moderately compact loam with large quantities of bone and pottery at the top but otherwise poor in artifacts. At a depth of x3.38 m, the pit expanded laterally to a width of 1.02 m, with an abrupt change in fill to red and black ash levels containing many artifacts. This ash fill (Levels 48 and 51) continued to the bottom of the pit.

Underlying the wall collapse of Levels 36 and 49 were Levels 46 and 47, the first of the many ash levels which characterized the earliest Phase IV deposits. Within the basin formed by these two levels, Pit 9, an ashy crescentshaped feature adjoining the lower levels of Pit 1, was at first thought to be the western edge of another shaft pit. Excavation showed this feature to be only a shallow ash pocket (depth x2.69-x2.80 m) entirely contained within Level 47. Pit 9 was excavated in entirety as Level 54.

Pit 11, encountered just beneath Level 36, overlapped with the lower levels of Pit 5 above and may have been a continuation of that pit, although stratigraphic evidence suggested it was in fact a separate feature. Pit 11 extended from a depth of x2.56-x4.36 m, with an opening diameter of 1.26 m and a closing diameter of 1.36 m. It was entirely excavated as Level 55. Fill consisted of a water-deposited loam containing much ash and pottery, and with a strong chemical odor similar to that of previously excavated drainage pits. A large upright burial urn (Feature 42) measuring 86-by-46 cm was found resting on the bottom of the pit (Figure 2.41). This urn was covered by an intact inverted carinated pot and contained the remains of a tightly flexed adult male.

Within the transitional Phase III/Phase IV deposits underlying these features, the only feature encountered was Pit 10, an ash pit dug into Levels 72 and 76, which surrounded the lowest levels (71, 75, and 77) of the huge ash basins dating to the Phase III/V transition. In its upper levels Pit 10 extended into and was excavated as part of this ash basin. It was only recognized as a separate feature midway through Level 78, the Phase I/II matrix underlying Levels 72 and 76. The excavated depth of Pit 10 was x4.69-x5.15 m, with an opening diameter of 1.9 m and a closing diameter of 1.47 m. It was excavated as a single level, Level 79, with a soft ash/light day fill containing loaf-shaped bricks, large amounts of pottery, and some bone.

Phase I/II deposits underlying the Phase III ash basins contained two features: Feature 48, the apparent southern extension of the hard clay floor first encountered in Unit LX-N, and Feature 49, an inhumation dug into sterile floodplain deposits. Both were associated with Level 78, the only Phase I/II occupational level in Unit LX-S. This level appeared to be a continuation of the Phase I/II deposits Levels 48 and 49 of Unit LX-N. Feature 48 was encountered at the top of Level 78 along the east central edge of the northern baulk. As in Unit Stratigraphy, Features, and Chronology
LX-N, this feature consisted of a thin clay pavement, apparently intentionally fired, encountered at a depth of x4.38-x4.40 m. The inhumation of Feature 49 consisted of a shallow irregular pit dug from Level 78 into the sterile floodplain below. The pit contained a badly disintegrated

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Table 2.7. Reconstruction of depositional sequence in Unit LX-S

<table>
<thead>
<tr>
<th>Phase</th>
<th>Chronology</th>
<th>Level(s)a</th>
<th>Depositional Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. 1</td>
<td>Disturbed surface deposits</td>
<td></td>
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<tr>
<td>r L. 2</td>
<td>Slow wall collapse from House 3</td>
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<tr>
<td>I L. 3/4</td>
<td>Exposed surface following rapid collapse of Houses 2 and 3</td>
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<tr>
<td>I L. 6</td>
<td>Rapid wall collapse on original floor of House 3</td>
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<tr>
<td>[Feat. 3</td>
<td>Rectilinear brick house (House 3)</td>
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<tr>
<td>L. 5</td>
<td>Rapid wall collapse on original floor of House 2</td>
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<td></td>
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<tr>
<td>L. 10</td>
<td>MIXED: Top of level is House 2 bath/latrine area associated with Pit 1; bottom is deposits below Houses 2 and 3</td>
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<tr>
<td>L. 11</td>
<td>Activity area outside House 2 (water-stained)</td>
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<tr>
<td>L. 9</td>
<td>Feat. 4</td>
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<td>L. 22</td>
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<td>L. 23</td>
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<tr>
<td>---- Phase IV ---- L. 25</td>
<td>Pit 1: deep shaft pit draining (sup.)</td>
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<tr>
<td>(superior) L. 26</td>
<td>bath/latrine area outside House 2</td>
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<td>L. 40</td>
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<td>L. 45</td>
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<td>L. 60</td>
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<td>L. 62</td>
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<tr>
<td>Feat. 2</td>
<td>Rectilinear brick house (House 2)</td>
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<tr>
<td>L. 7/12</td>
<td>Debris on exposed surface below</td>
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<tr>
<td>L. 8</td>
<td>Houses 2 and 3</td>
<td></td>
<td></td>
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<tr>
<td>L. 15/17</td>
<td>Slow wall collapse from House 4, exposed as surface</td>
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<tr>
<td>L. 13/14</td>
<td>Moderately slow wall collapse from House 4</td>
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<tr>
<td>Feat. 6</td>
<td>Accumulation inside House 4 of rapid initial wall collapse</td>
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<td>L. 18</td>
<td>House 4 destruction debris and tumbled bricks</td>
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<tr>
<td>L. 16</td>
<td>House 4 occupational debris and exterior living surface</td>
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<tr>
<td>L. 19</td>
<td>Surface of House 6 courtyard.</td>
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</tbody>
</table>
Stratigraphy, Features, and Chronology
Table 2.7-continued. Reconstruction of depositional sequence in Unit LX-S Phase
Chronology Level(s)a Depositional Event

---- Phase IV----(superior)
L. 20 Feat. 10
Feat. 7
L. 44 Feat. 29 L. 56 Feat. 47
Feat. 33 L. 52 L. 61 L. 74
L. 41 L. 42
L. 57
L. 21 L. 24
Feat. 18 L. 32 L. 34
L. 35
L. 28/29 Feat. 11
L. 27/Feat. 16/L. 30 L. 31
----Phase IV----
Feat. 21/L. 43 L. 33
L. 38 L. 39 L. 50
Interior floor of House 6 Rectilinear brick building (House 6), bonded to House 4
Rectilinear brick building (House 4)
Pit 7: shaft pit with urn burial; dug into Level 21
Pit 8: shaft pit dug into Level 21; probable latrine/bath drainage
Pit 6: shaft pit with ashy fill, dug into Level 21
Moderately slow wall collapse from House 7; some exposure as site surface
Living surface outside House 7
Pit 2: probable latrine/bath drainage pit at depth of House 7
Interior floors of House 7 Rectilinear brick building (House 7)
HORIZON: slow accumulation exposed as site surface
HORIZON: accumulation outside House 10 of Unit LX-N Sandstone cache in Level 31
Pit 3: series of four small ash pits beginning in Level 31
Pit 4: shaft pit beginning below Level 31; light loam fill

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Table 2.7-continued. Reconstruction of depositional sequence in Unit LX-S Phase
Chronology Level(s)a Depositional Event
r L. 37
I L. 48 Pit 5: shaft pit with loam and ash fill;
I disturbed by Pit 2
L 51 L. 36 HORIZON: heterogeneous wall
collapse
r 49 L. 46 Upper level of ash-filled
depression
I

--- Phase IV ---
I L. 47 Lower level of ashy depression
L 54 Pit 9: ash pocket within Level 47
L 55 Pit 11: shaft pit with urn burial;
Feat. 42 intruded upon by Level 50 of Pit 4
L 53 Sediment covering deep ash deposit
L 58/59 Upper level of ash deposit
L 63 Crust formed by temporary exposure
of ash
L 64/66 Ash levels within deep deposit
L 65/67 Crust formed by exposure of ash
Transition L 68/69 Lower levels of ash deposit
Phase IV/
Phase III L. 79 Pit 10: small ash pit adjoining deep
ash basin
L 70/73 Crust formed by ash exposure.
L 71 Continuation of ash: top of deep
ash basin dug into Level 72
L 75 Ash level within deep basin
L 77 Lowest level of ash basin [MIXED]
L 80 MIXED: clay level below ash pit
L 72 MIXED: pre-ash deposits
--- Phase III ---
L. 76 Pre-ash deposits
(inferior)
L. 81 Clay lens above Level 78 [MIXED?]
Feat. 48 Burnt day floor extending into
Unit LX-N
---Phase I/II--
L. 78 Classic Phase I/II deposits
Feat. 49 Inhumation into sterile floodplain

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adult skeleton buried in a flexed position, and extending from a depth of x5.09-
x5.11 m (Figure 2.19).

Summary of Depositional Events. Although there was clearly some localized
mixing during excavation due to the many deep shaft pits-most notably Pits 6, 7,
and 8, which were not distinguished from surrounding deposits until 80 cm or
more below their topmost levels-natural and excavated strata otherwise showed a
high level of correspondence. The sequence of depositional events producing the
stratigraphy in this unit could therefore be reconstructed with a fair degree of
confidence. This reconstruction is presented in Table 2.7. Nearly all the deposits
in LX-S contain artifacts from more than one phase, as the numerous pit-digging episodes brought up earlier material, which was incorporated in later deposits as the site was occupied.

UNIT NWS (JENNt-JENO)
A single PO (northeast corner of the Wall Trench Section) was used as datum for all three sections of Unit NWS. This PO was 0.99 m above the site datum at Cement Marker 1 and 502 m at 3310 from Cement Marker 1. In the North and South Test Units, eight levels were excavated, with alternating level numbers assigned to each unit in turn in order to avoid duplication of level designations when the strata were correlated (Appendix A). The North Test contained three excavated levels (Levels 1, 3, and 5), composed primarily of wall melt and wall collapse and terminating beneath the final wall construction level at a depth of 1.31 m. The somewhat deeper (1.75 m) South Test comprised five excavated levels, with the top three (Levels 2, 4, and 6) corresponding to Levels 1, 3, and 5 of the North Test, and the lowest two (Levels 7 and 8) continuing down into the earlier, pre-wall occupational deposits. In the Wall Trench Section, levels were not given individual level numbers, but stratigraphy was virtually the same as in the adjacent North and South Test units. The Wall Trench Section was the deepest of the three sections, reaching a depth of 2 m below the PO.

Descriptions of individual levels in the North and South Test Units and a running description of stratigraphy in the Wall Trench Section are given in Appendix A. Profiles of natural strata and excavated levels appear in Figures 2.43-2.46.

All excavated levels in Unit NWS were datable to late Phase III or early Phase IV, with the construction of the city wall occurring at the juncture of the two occupational periods. The topmost level in all three sections consisted of a thick layer of wall melt which had accumulated following the wall’s collapse. On the north side of the wall, this was underlain by a deep deposit of heavy brick rubble, the result of the initial rapid collapse of the wall toward the north, or exterior, of the wall. On the south side, deposits at the same depth contained far fewer bricks and more artifacts, and showed signs of repeated surface exposure. This material appeared to be composed primarily of wall melt and debris accumulated while the wall was still standing.

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The city wall itself was a solid mass of grayish, cylindrical bricks, measuring 3.7 m across at the base of the wall foundation. Traces of what may have been a deliberate mud coating of the external wall surfaces were found at the bottom of the north and south faces. A covered 30 cm high pot, found at 1.05 m depth in Level 6 of the South Test Unit, had been deliberately placed in an upright position on the original ground surface next to the wall. This pot (Feature 56; see Figure 2.5) contained the remains of a twelve-eighteenmonth-old infant. Beneath this final construction level, the original pre-wall surface consisted of Phase III occupational deposits (brick wall collapse and domestic debris) comparable to material found in a domestic context elsewhere on the site.

Summary of Depositional Events. As the figures show, stratigraphic distinctions were very clear in Unit NWS, and excavated and natural levels showed a high
degree of correlation. Taken as a whole, information from the three test sections provided a clear and detailed history of the city wall's construction and decay. Table 2.8 presents a synopsis of this history.

Table 2.8. Reconstruction of depositional sequence in Unit NWS

<table>
<thead>
<tr>
<th>Phase</th>
<th>Chronology</th>
<th>Level(s)a</th>
<th>Depositional event</th>
</tr>
</thead>
<tbody>
<tr>
<td>----</td>
<td>L. 2 Disturbed wall melt accumulated after collapse of city wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 1</td>
<td>Top of level: same as Level 2. Bottom of level: upper part of rapid wall collapse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>L. 3 Rapid collapse of city wall toward the north</td>
<td></td>
<td></td>
</tr>
<tr>
<td>r</td>
<td>L. 4 Surface formed by slow melt of city wall during use of wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>--- Phase IV --- L. 5 Debris from use-life of wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feat. 56 Infant burial in pot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 6</td>
<td>CITY WALL CONSTRUCTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 7</td>
<td>Ash pit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---- Phase III ---(superior) L. 8 Pre-wall deposits: normal accumulation of wall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trench</td>
<td>collapse and debris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a Related events enclosed by brackets.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Stratigraphy, Features, and Chronology

UNIT WFL (JENN&-JENO)

Unit WFL was a standard 3-by-3 m excavation unit, oriented north-south. Its Point of Origin (northeast corner) was 0.81 m above the site datum at Cement Marker 1 and 496 m distant from Cement Marker 1 at 2990 from magnetic north. At a depth of 2 m below the PO, the dimensions of Unit WFL were reduced to 2 m north-south by 1.5 m east-west.

Unit WFL contained seven archaeological features and seventeen levels of cultural material, covering a time span from early Phase III to late Phase IV. Approximately the upper 2 m of deposits (Levels 1-12) consisted of homogeneous wall accumulation. This material, extending from Phase IV to early Phase III, contained no bricks or brick fragments and significantly less household debris than similar deposits nearer the center of the mound; it may represent some slope wash from other areas of the site deposited at times of less intensive occupation of this sector. The top five levels were characterized by extensive funerary and/or ritual activity, with several large statuette fragments, an infant burial in a small jar (Feature 55), and a large upright funerary urn with associated terracotta pavement (Features 31 and 32) found in the late Phase IV Level 2. Two more funerary urns (Features 35 and 36) and an inhumation burial (Feature 34), also Phase IV, were encountered at the juncture of Levels 4 and 5. An apparently isolated pavement of potsherds and calcite nodules, found at the top of Level 10, was attributed to early Phase III.
Beneath this wall collapse, approximately 1.6 m of overlapping brick rubble and domestic debris, interrupted by a large refuse pit (Levels 13-15), appeared to mark the earliest occupation of the WFL area in early Phase III. These levels were underlain by a deep deposit of nearly sterile clay (Levels 16 and 17), which appeared to represent a deliberate attempt to build up the height of the site periphery before occupation. This clay was excavated to a depth of 4.65 m without encountering sterile floodplain alluvium.

A profile of excavated levels in Unit WFL appears in Figure 2.47, and natural stratigraphic levels are given in Figure 2.48.

Features. Level 2 contained two Phase IV burials, an unexcavated urn burial embedded in the northern wall of the unit (Feature 31), and an infant jar burial in the north center of the unit (Feature 55; see Figure 2.5). Feature 31 consisted of a large funerary urn, 76 cm in width and approximately 1 m in height, encountered at the bottom of Level 2 at a depth of X0.24 m. The urn was covered with a ceramic potlid, c. 44 cm in diameter, fragments of which were scattered around the mouth of the vessel. Adjacent to and clearly associated with this burial was a thin pavement of red burnt earth clods (Feature 32) extending from a depth of x0.32-x0.40 m in the northwestern corner of the unit.

Feature 55, a small slipped urn and cover some 40 cm in height, was encountered approximately 0.5 m south of Feature 31, at a depth of x0.3 m. Also found in Level 2 and possibly associated with these funerary features were three terracotta statuettes. One of these, from a small pit located between Features 31 and 55, was broken at the neck but otherwise complete.

Stratigraphy, Features, and Chronology

Table 2.9. Reconstruction of depositional sequence in Unit WFL

<table>
<thead>
<tr>
<th>Phase</th>
<th>Chronology</th>
<th>Level(s)a</th>
<th>Depositional event</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. 1</td>
<td>Disturbed surface deposits</td>
<td>Feat. 56</td>
<td>Infant burial in globular pot, buried in Level 2</td>
</tr>
<tr>
<td>L. 2</td>
<td>Homogeneous rapid wall collapse containing statuettes; possibly deliberately deposited</td>
<td>Feat. 31/32</td>
<td>Urn burial surrounded by chunks of terracotta, at bottom of Level 2</td>
</tr>
<tr>
<td>L. 3</td>
<td>Wall collapse and domestic debris</td>
<td>Feat. 34/35/36</td>
<td>Two urn burials and inhumation dug into top of L. 5</td>
</tr>
<tr>
<td>L. 4</td>
<td>accumulated above Feats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 5</td>
<td>Slow accumulation of homogeneous wall collapse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 7</td>
<td>Slow accumulation of collapse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 9</td>
<td>Former exposed surface or platform (superior) at top of L. 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 8</td>
<td>Soft debris over potsherd pavement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 9</td>
<td>Former exposed surface or platform</td>
<td>Feat. 41</td>
<td>Potsherd/calcite pavement</td>
</tr>
<tr>
<td>----</td>
<td>Phase III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

...
Related events enclosed by brackets
(see Chapter 4). Level 2 itself contained almost no small artifacts and showed a clear discontinuity with Level 3 below; it may have represented a layer of deliberate fill covering the Feature 31 burial.

At the base of Level 4, some 30 cm below the top of Feature 31, two other urn burials (Features 35 and 36) and an simple inhumation (Feature 34, Figure 2.19) were encountered in the southwestern part of the unit. All had been dug into the top of the underlying Level 5 and dated to Phase IV. Feature 35 was a large upright funerary urn, 89 cm in height and 49 cm in width, set against the southwestern edge of the unit (Figure 2.49). It was covered with an inverted carinated pot and a plate which had fallen to the eastern side of the urn. In the bottom of the vessel were c. 30 cm of whitish-pink sand containing the deteriorated, partially burnt remains of two individuals. Pottery fragments found buried among the bone remains suggested that the overlying carinated pot had been broken at the time of interment.

Feature 36 adjoined Feature 35 from the southeast, and appeared to have been buried simultaneously in the same funerary pit. Like Feature 35, this feature consisted of an upright urn covered with a large ceramic plate. Feature 36 was embedded in the southern wall of the unit and was not opened. Feature 34, extending out from the west central wall of the unit at the same depth as Features 35 and 36, consisted of the lower portion of a semiflexed adult skeleton buried in a shallow irregular trench. Depth of this feature was x0.65--x0.69 m.

Some 80 cm below the top of these three burials, at the juncture of Level 8 and Level 10, was Feature 41, the lowest archaeological feature recorded in Unit WFL. This was an irregular pavement composed of potsherds and calcite nodules, c. 1 m wide and extending across the entire length of the southern half of the unit (Figure 2.50). Feature 41 ranged in depth from x1.29 m at the northern end of the unit to X1.41 m in the center, with an average depth of c. 1.32-1.36 m. It appeared to mark the transition from upper Phase III to lower Phase III in this area. This feature was not associated with any significant change in the surrounding deposits, nor with any discernible funerary or domestic features.

Summary of Depositional Events. Correspondence of excavated and natural strata was high in the upper part of the unit, where deposits consisted of horizontal levels of wall collapse interrupted by large, discrete features. In the bottom half of the unit, delineation of natural levels during excavation was much less precise,
owing to the complex picture presented by irregular, tilted, and overlapping strata (Appendix A). Nevertheless, stratigraphic analysis and pottery seriation permitted a fair degree of confidence in the reconstruction of the probable sequence of events responsible for the deposition of strata. This reconstruction is presented in Table 2.9.

DISCUSSION

The usefulness of the excavated material for reconstructing the history of occupation and growth at Jenn6-jeno is related directly to the integrity of its stratigraphic context and the reliability of established material culture sequences to place it within a relative chronological framework. While we would argue that the pottery sequence for Jennd-jeno (Chapter 3) appears to be extremely reliable for deposits at all three excavated sites, permitting us to place excavated levels within the Jenn6-jeno phase chronology, mixing of deposits from different periods, either by the excavators or by the original inhabitants of the site, remains a confounding factor. Mixing is a major problem in LX-S, where most of the pre-Phase IV deposits were removed.

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during recurrent pit-digging episodes. Earlier material from these pits is demonstrably mixed in the Phase IV deposits outside the pits in LX-S. Other units where mixing may have occurred include NWS, where potsherds from an earlier period may have been used to strengthen the plaster facing of the city wall, and CTR, where numerous funerary and non funerary pits are documented. In these units, assessment of chronology based on relative frequencies of time-sensitive attributes, such as twine roulette patterns, can only be made tentatively, since mixing can produce intermediate frequencies characteristic of neither of the time periods represented. Often, the presence and extent of the mixing can only be identified if diagnostic rim types from different periods are present in an excavated level, which they may not be. With these caveats in mind, we present in Figure 2.51 a summary of the chronological relationships among the deposits of the nine excavated units. For those levels where the pottery sample and stratigraphic data permit identification of sub phases, this has been done. Also, the more detailed correspondences possible for adjacent units LX-N and LX-S are indicated; arrows show stratigraphic units that can be confidently correlated.

Absolute Chronology

details on the collection and context of the twenty radiocarbon dates on wood charcoal from various levels within the excavated deposits are provided in the Description of Excavated Levels and Features (Appendix A). These dates, added to the eight dates from the 1977 excavations, make Jennd-jeno one of the most securely dated Iron Age sites in West Africa (Table 2.10). Nevertheless, interpretive problems with these dates remain significant, largely because of the nature of conventional C14 dating. As we have pointed out elsewhere (S. McIntosh and R. McIntosh 1986b), advances in high-precision radiocarbon dating have made several things clear: (1) the necessity of calibration, using the 2 sigma range for confidence limits at the 95% level; (2) the frustratingly large calendar age ranges (300-500 years) that result
from calibration; (3) the difficulty in dealing with these calibrated age ranges statistically, since the probability distributions are complex and frequently asymmetrical (Ottaway 1983, 1987; Pearson 1987). Since we cannot assume that any point within the calibrated age ranges is more likely than any other to be the true age, interpreting the dates requires a substantial tolerance for fuzziness and lack of precision. One glance at the extent of overlap in the calibrated date ranges for Phase IV and Phase III levels (Figure 2.52) is sufficient to illustrate this. By using stratigraphic information and the relative dating provided by the pottery sequence, however, it is possible to reason our way through the calibrated ranges and decrease the level of uncertainty at several points. We feel that the resulting calendar year chronology is plausible and judicious, but this is no guarantee that it is correct (Figure 2.53). The available radiocarbon chronology would support any number of interpretations for long or short durations of any of the three phases.

We begin with RL1616, which dates the floor of the most recently occupied house in LX-N (House 1). The calibrated range is A.D. 1270-1510.

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Table 2.10. Radiocarbon dates from Jennd-jeno, Hambarketolo, and Kaniana

<table>
<thead>
<tr>
<th>Phase</th>
<th>Unit</th>
<th>Level</th>
<th>Lab. #</th>
<th>Date Calibrated Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>LX-N</td>
<td>4</td>
<td>RL1616</td>
<td>550 ± 100 A.D. 1270-1510</td>
</tr>
<tr>
<td>IV</td>
<td>LX-N</td>
<td>13</td>
<td>RL1617</td>
<td>790 ±100 A.D. 1020-1392</td>
</tr>
<tr>
<td>IV</td>
<td>CTR</td>
<td>5</td>
<td>RL1571</td>
<td>1060±110 A.D. 690-1220</td>
</tr>
<tr>
<td>IV</td>
<td>KAN</td>
<td>4</td>
<td>RL1579</td>
<td>1210 ±110 A.D. 630-1020</td>
</tr>
<tr>
<td>IV</td>
<td>LX-N</td>
<td>25</td>
<td>RL1807</td>
<td>940±1110 A.D. 880-1270</td>
</tr>
<tr>
<td>III</td>
<td>LX-N</td>
<td>36</td>
<td>RL1808</td>
<td>970±110 A.D. 820-1260</td>
</tr>
<tr>
<td>III</td>
<td>LX-N</td>
<td>38</td>
<td>RL1618</td>
<td>1300 ±110 A.D. 550-980</td>
</tr>
<tr>
<td>III</td>
<td>LX-N</td>
<td>42</td>
<td>RL1619</td>
<td>2050 ± 120 B.C. 390-A.D. 220</td>
</tr>
<tr>
<td>III</td>
<td>ALS</td>
<td>5</td>
<td>RL1578</td>
<td>1310 ± 110 A.D. 540-970</td>
</tr>
<tr>
<td>III</td>
<td>WFL</td>
<td>15</td>
<td>RL1809</td>
<td>1310±110 A.D. 540-970</td>
</tr>
<tr>
<td>III</td>
<td>CTR</td>
<td>25</td>
<td>RL1573</td>
<td>1590 ± 110 A.D. 220-660</td>
</tr>
<tr>
<td>III</td>
<td>CTR</td>
<td>35</td>
<td>RL1575</td>
<td>1310 ± 120 A.D. 530-980</td>
</tr>
<tr>
<td>III</td>
<td>HAMB</td>
<td>10</td>
<td>RL1577</td>
<td>1220±110 A.D. 620-1020</td>
</tr>
<tr>
<td>I/II</td>
<td>HAMB</td>
<td>24</td>
<td>RL1580</td>
<td>1750 ± 100 A.D. 60-540</td>
</tr>
<tr>
<td>I/II</td>
<td>LX-N</td>
<td>48</td>
<td>RL1620</td>
<td>2060 ± 110 B.C. 390-A.D. 140</td>
</tr>
<tr>
<td>I/II</td>
<td>LX-N</td>
<td>49</td>
<td>RL1621</td>
<td>1910 ± 110 B.C. 180-AD. 372</td>
</tr>
<tr>
<td>I/II</td>
<td>LX-N</td>
<td>51</td>
<td>RL1622</td>
<td>2090 ± 110 B.C. 400-A.D. 130</td>
</tr>
<tr>
<td>I/II</td>
<td>ALS</td>
<td>11</td>
<td>RL1581</td>
<td>1800 ± 120 B.C. 60-A.D. 470</td>
</tr>
<tr>
<td>I/II</td>
<td>CTR</td>
<td>26</td>
<td>RL1574</td>
<td>1860 ± 120 B.C. 152-A.D. 420</td>
</tr>
<tr>
<td>I/II</td>
<td>CTR</td>
<td>37</td>
<td>RL1576</td>
<td>1790 ± 120 B.C. 40-A.D. 540</td>
</tr>
</tbody>
</table>

Note: Calibrated ranges are calculated at 2 sigma using the calibration curves of Stuiver and Pearson (1986) and Stuiver and Reimer (1986).

However, historical information provided by as-Sa’di (1964) indicates that Jenn&jeno was uninhabited in 1468 when Songhai conqueror Sonni Ali garrisoned his troops there, making the effective range 1270-c. 1450. When we further consider that the date for the floor precedes the abandonment and collapse
of the house, it is possible to attribute the occupation of the house to the
fourteenth century with considerable confidence. Date RL1617 (cal A.D. 1020-
1392) is separated from this first date by the amount of time required to build,
occupy, and abandon the structures we called Houses 5 and 14 in LX-N, and to
accumulate c. 35 cm of deposit below the structures. If 150-200 years seems a
reasonable estimate for these events, then the true date lies in the twelfth century.
The next date (RL1807: cal A.D. 880-1270) from LX-N was recovered from
deposits over 1 m below RL1617. Between them is over 50 cm of material
associated with the construction, lengthy occupation, abandonment and collapse
of House 10. Again, if 150-200 years can be considered a reasonable estimate for
this, then Level 25 would date to the tenth century. According to the pottery
sequence, Kaniana was occupied contemporaneously with LX-N 25. KAN level 4
(RL1579: cal A.D. 630-1020) should therefore also date to the tenth century.

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Moving further down in the LX-N sequence, late Phase III dates RL1808 (cal
A.D. 820-1260) and RL1618 (cal A.D. 550-980) should be nearly
contemporaneous. Since both are separated from the preceding date, RL1807, by
House 11 and 35 cm of other accumulation, an early ninth century date for
RL1808 is reasonable, and RL1618, somewhat earlier, could be placed in the
eighth century. Approximately contemporaneous with RL1618, according to the
pottery sequence, is material from ALS 5 (RL1578, cal A.D. 540-970) and
HAMB 10 (RL1577, cal A.D. 620-1020), which we would also place in the eighth
century.
Dates for early Phase III come from WFL (RL1809, cal A.D. 540-970) and CTR
(RL1573, cal A.D. 220-660; RL1575, cal A.D. 530-980), which we would place
in the sixth and seventh centuries. This would then be the date for House 12 in
LX-N. The date of cal 390 B.C.-A.D. 220 for early Phase III level 42 in LX-N is
dearly wrong, and likely results from mixed deposits.
The Phase I/II calendar chronology is clarified by the LX-N sequence, where
initial occupation is dated by RL1620, RL1621, and RL1622, from 4.6 m, 4.8 m,
and 5 m depth respectively. The respective date ranges are: cal 390 B.C.A.D. 140,
cal 180 B.C.-A.D. 372, and cal 400 B.C.-A.D. 130. Given their
stratigraphic position, this yields an effective date range of 180 B.C.-A.D. 140 for
the deposits between 4.8 m and 4.6 m depth. Later Phase I/II dates from ALS,
CTR, and HAMB cover subsequent centuries to c. A.D. 400.
Figure 2.53 illustrates the calendar chronology, as interpreted above, for dated
levels. The proposed calendar chronology is also indicated for unit LX-N and, by
correlation of depositional events, for LX-S in Figure 2.51.

Site Growth
Initial occupation. In Units LX-N, LX-S, and CTR, as well as in 1977 units M1
and M2, the earliest cultural deposits are very similar. All have abundant pottery
of highly characteristic type, lots of ash, sandstone, bone and fired pieces of clay
daub from burnt pole-and-mat houses in a matrix of olive-to-khaki colored days
with a typically oily feel. Cultural material dating to Phase I/II is also present in
the lowest levels at ALS and HAMB, but in both cases, there are significant
differences from the characteristic initial occupation deposits from other units. HAMB is particularly striking in its complete lack of bone or cultural material other than pottery. ALS has very little. In both units, pottery concentration is greatest immediately above sterile alluvium, after which it drops off rapidly. This differs from other units, in which Phase I/II cultural material is present in notably high concentrations throughout the phase. A possible clue to the nature of these differences is provided by the relative vertical height of the earliest cultural deposits. In Figure 2.54, where height is shown relative to an arbitrarily selected point (the 1981 floodwater level), it is apparent that the early "classic" Phase I/II occupation deposits occurred on a naturally elevated area of the floodplain. Test excavations through up to 1 m of underlying alluvium revealed no evidence for artificial raising of the ground surface under LX, CTR, or M1. As an hypothesis accounting for these diverse facts, we suggest 

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that initial Phase I/II occupation occurred when average flood levels had fallen enough to permit colonization of 1-1.5 m high mounds or banks on the floodplain that are characteristic of the Djenn6 region (Gallais 1967a:103). The earliest deposits in LX, CTR, M1, and M2 represent this initial colonization. The earliest culture-bearing levels in ALS and HAMB are, we suggest secondary deposits of material eroded from occupied mounds and spread by floodwaters along low-lying adjacent areas. This phenomenon is readily observable in the IND today. We further suggest that average flood levels continued to fall in the century or so following initial colonization of the floodplain, making the expansion of permanent settlement onto the lower lying areas represented by ALS and HAMB possible. This hypothesis is summarized graphically in Figure 2.55.

Our initial hypothesis that the earliest settlement zone at the site would be situated to the west and/or south of the extant site, along the Senuba channel, was not supported at WFL and HK, the two units placed to test the hypothesis. In both units, the earliest deposits dated to Phase III. The fact that HK was not occupied in Phase I/II is surprising given that it had the most elevated surface of all the excavated units. One possible relevant fact is that the underlying sterile deposits at HK are not typical floodplain alluvium. It is possible that HK was once part of the large clay levee system of the Nyansanari, whose northern tip is 400 m south of HK. Survey findings confirm that the Nyansanari was avoided for permanent settlement until the second millennium A.D. (S. McIntosh and R. McIntosh 1980, II). How HK might fit into this pattern remains to be explored.

By the second century A.D., Phase I/II occupation deposits were accumulating in LX, CTR, ALS, and HAMB (Figure 2.56). This suggests that the early occupation of Jenn6-jeno and Hambarketolo was quite extensive. At Jennd-jeno, all available evidence suggests that the occupied mound surface was contiguous at this point and not comprised of two or more mounds separated by short expanses of floodplain. The distance between ALS and CTR, the most widely separated units with evidence of Phase I/II deposits, is 375 m. If we figure this as the long axis of an elliptical mound (a conservative assumption), the area of the site at this time would have been at least 7.4 ha. But, in fact, the settlement may have been even
larger. The accumulation of later I/II deposits was most elaborated in CTR, which accords with surface survey data indicating Phase I/II deposits exposed south of CTR and adjacent to JF1, where deposits of Phase I/II slope wash were documented in the lowest 1977 excavation levels. It may be that the most intensively occupied sector of Jenn(-jeno during later Phase I/II was in the southeast quadrant of the site.

Phase III. The greatest depth of accumulation of Phase III deposits occurs in the peripheral units ALS, WFL and CTR, indicating that the site expanded considerably during this phase. There is some evidence that expansion may have been achieved quite purposefully: in WFL, what appears to be early Phase III material is associated with apparently deliberate mounding of clay, perhaps to raise the elevation of that part of the site. The same phenomenon has been described at Togur6 Doupwil, near Mopti, although at a later date (Bedaux et al. 1978:108-113). This concern with raising the site level may reflect a period of higher average flood levels beginning in the mid first millennium A.D. The fact that Jenn-d-jeno had reached its maximum size by Phase III is indicated by the presence of Phase III material in all excavated units and by its widespread distribution over the surface of the site. Although the number of identified architectural features (two) associated with Phase III deposits would seem to indicate that structures were fewer in number, less densely distributed and/or less frequently reconstructed than in Phase IV, with its abundance of excavated mud brick structures (twelve), the difference may have more to do with the shift in building technology between these two phases. Tuft is vastly more difficult than mud brick to detect archaeologically. The depth and areal extent of Phase III deposits suggests that Phase III structures must have been both numerous and widely distributed. Furthermore, the presence in many units of slow accumulation deposits, characterized by light loam, wall wash, and domestic debris, indicates that Phase III was, in Butzer's (1982) terms, a "positive demographic period."

Phase IV. There can be little doubt that late Phase III to early Phase IV (c. A.D. 700-1100 ) marks the floruit of habitation at the site. From the ceramics in the Phase IV levels at peripheral units including ALS and HK, it appears that the deposits may date to the earliest part of the phase, suggesting that either these areas were not occupied much into Phase IV or that later occupation deposits subsequently eroded away. Phase IV deposits in WFL appear to be associated with ritual, not domestic, functions. At Hambarketolo and Kaniana, occupation ends in early Phase IV. All this suggests that occupation at and around Jenn6-jeno decreased significantly partway through Phase IV. Our earlier hypothesis that the residential sector of Jenn6-jeno retreated to the central area of the site is supported by the 1981 excavation results (Figure 2.56). In the face of this information, it may seem odd that late Phase IV appears to inaugurate a flurry of building and pit-digging activity in this central residential sector. The rapidity and exuberance of
building/ rebuilding episodes is illustrated by the top m of deposits in LX-N and LX-S, where at least three such episodes are clearly represented. In some cases, wall foundations are only one to two bricks deep (LX-S House 7), suggesting that deliberate leveling or possibly quarrying of bricks from earlier walls was practiced. Such vigor seems to contradict the idea of a slowly dying town. In fact, many of the possible reasons for this construction activity may be related to the causes of Jennd-jeno's slow abandonment. These include, but are not limited to, inter group hostilities (warfare, slave raiding), rapid change in family structure (due to conversion to Islam or slave raiding) or in land rights, movement of people to or from Jennd-jeno because of mercantile activities or shifts in religious affiliation, and rapid shifts in social status (reflected in changes in size and style of house).

Another interesting aspect of the depositional sequence is the massive ash pit in LX-S dating to the Phase III/IV transition. The presence of a substantial ash layer in the same chronological position in the 1977 sequence in the residential sector (Ml and M2) raises the question of the source and meaning of all this ash. Are the episodes in the different units within the residential sector contemporaneous and related? If so, are they

Stratigraphy, Features, and Chronology
contemporaneous with the construction of the city wall at the end of Phase III? It is not possible with the present evidence to explore the possibility that hostilities (warfare, slave raiding) erupted in the late eighth or early ninth century, involving torching of houses and perhaps brief abandonment. Neither the artifact sequences nor the deposits indicate abandonment of the site for any significant period of time. There are, for example, no layers of laminar clay buildup with heavily weathered "reg" sherds and/or incipient soil formation (Butzer 1982; Rosen 1986:13). A single piece of evidence that occupation constricted to the north of the site or was interrupted in late Phase III is the exposure surface at the top of Level 3 in HK. Nor is there evidence for widespread burning across the site, or for interpersonal violence from the skeletal material. The question of hostile encroachment on Jenn6-jeno at the end of Phase III, possibly occasioning the construction of the city wall, remains open.

Architectural Change
Data from the 1981 excavations confirm the sequence of change in architectural technology and style observed in 1977. Early Phase I/II is characterized by huts constructed of a supporting structure of poles covered by straw or rush mats daubed with clay, as indicated by numerous burnt fragments of pole-and-mat impressed daub. A partial burnt house floor dating to this period was identified (Feature 48), but house area could not be determined from it. Tauf construction appears late in Phase I/II and is the dominant construction technology in Phase III. Partial remains of several curvilinear tauf walls were identified in Phase III deposits, complementing the 1977 discovery of a well-defined tauf wall dating to this period in M1. Cylindrical, sun-dried mud brick technology (i.e., the traditional djeneey-feray still used by masons in Jenn6 today; Prussin 1973; La Violette 1987) appears at the Phase III/IV transition (Table 2.11).
Table 2.11. Summary of architectural features from 1981 excavations

<table>
<thead>
<tr>
<th>Rectilinear Structure</th>
<th>Curvilinear Structure</th>
<th>Curvilinear Pole-and-Mat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylindrical Mud Brick</td>
<td>Cylindrical Mud Brick</td>
<td>Tauf Daub</td>
</tr>
<tr>
<td>CTR</td>
<td>Feat. 12, 13</td>
<td>L.13</td>
</tr>
<tr>
<td>L.32, 34, 36, 37, 39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. 47-49, 52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LX-N Feature 1, 8, 9</td>
<td>Feat. 20</td>
<td>Feat. 37</td>
</tr>
<tr>
<td>LX-S Feature 2, 3, 7,</td>
<td>L. 78</td>
<td></td>
</tr>
<tr>
<td>10,11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NWS CITY WALL
II II

LATE EARLY
Phase IV Phase III Phase I/II

Stratigraphy, Features, and Chronology

In the 1981 excavation, early Phase IV was characterized by brick curvilinear houses 3.4-3.8 m in diameter, with an apparent shift to rectilinear houses in late Phase IV. However, the 1977 excavations in M1 and M2 indicate that rectilinear structures were present somewhat prior to this. M2 had both rectilinear and curvilinear brick walls that were approximately contemporaneous (S. McIntosh and R. McIntosh 1980:106-109). It is likely that round houses continued to be constructed for some time after rectilinear architecture was introduced, since round mud brick houses are still built in the Jenns hinterland today. Based on all available excavated evidence at present, it appears that mud brick technology first appeared at Jennd-jeno in the eighth or ninth century A.D., and rectilinear houses were first built at the site in the eleventh or twelfth century.

Whether these early rectilinear houses were one- or two-story buildings is difficult to know. Although Gallay and Huyscom (1989:29) have suggested based on information given by Monteil (1903:134) and van Gijn (1986) that wall thicknesses under 40 cm are most likely from single story dwellings, the detailed information collected by La Violette (1986:301) leaves the question open. Jennnd masons interviewed by La Violette indicated that the character of the soil around the foundation trench determines the width and depth of the foundation walls. With the rectilinear, molded bricks used today, most walls are two to three bricks thick, but if matrix density warrants, foundation walls are made thicker and deeper. The resulting foundation will bear the weight of one story or two, according to the masons. They do not make thinner walls for single story buildings. The relevance of current practices with rectangular bricks to early use of traditional cylindrical brick is of course debatable.

These shifts in building technology have predictable ramifications for site formation processes. As clay came to represent a greater percentage of the structural materials used (as opposed to organic materials such as wood and thatch), the amount of primary or secondary structural deposits in the sequence increased. We would expect that more labor-intensive building technologies (e.g., mud brick) would correlate with increased durability and longer use-lives for structures. This expectation appears to be borne out by the round houses built
early in Phase IV, which were occupied long enough to have accumulated numerous layers of refacing clay, perhaps as long as 50-100 years. With the introduction of rectilinear houses, however, this expectation is confounded. In LX-S, three different, superimposed building episodes are attested within a span of 100-200 years, perhaps less. The relatively small number of bricks or wall wash represented in the deposits suggests that brick from previous constructions was quickly quarried for subsequent use, a common practice in Jennd today. The short-use life of the early rectilinear houses excavated in LX-N, LX-S, and M2 (1977) may reflect a phase of technological adaptation, in which new techniques for meeting the new structural demands of straight walls were developed by trial and error. The horizontal thrust in straight walls may have resulted in structural weakness until pilasters and buttressing were developed to resist this stress (Prussin 1973:137). Alternatively, increased social mobility, through new opportunities for wealth accumulation and status display, may have

Stratigraphy, Features, and Chronology
prompted frequent rebuilding and remodeling of rectilinear houses at this time. New opportunities for the movement of families into and out of Jenn6jeno could have had a similar effect on building construction.

Burials
The variety of burial treatments and contexts found at Jennd-jeno merits comment. All but one of the burials date to Phases III or IV, and grave goods are rare. The urn burials in Features 23 and 24 both had two iron bracelets, and in 1977, a copper ring fragment was found in an urn. The majority of the urns have no grave goods. During both Phase III and IV, urn burial and simple inhumation in shallow pit graves were practiced contemporaneously. Urn burials generally involved a certain configuration of pottery: the vertically positioned pot containing the remains was either a carinated pot with simple rim (frequently used for infant burials) or a large urn with an overhanging rim; this later type was covered by an inverted carinated pot, and accompanied by a potlid and/or a shallow plate with thickened rim. All of these are common domestic pottery types. Urn burials could be primary interments (recognized by the articulation of the skeleton) or secondary ones.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Unit</th>
<th>Phase</th>
<th>Inhumation (I)</th>
<th>Number, Age of Individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>CTR</td>
<td>III</td>
<td>I</td>
<td>Unable to determine; bones nearly disintegrated</td>
</tr>
<tr>
<td>23</td>
<td>CTR</td>
<td>III</td>
<td>2 I; 1 C</td>
<td>Cremation; unable to determine</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(large urn)</td>
<td>Inhumations;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 adult 45+ years</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 adult 20-25 year</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>CTR</td>
<td>III</td>
<td>I</td>
<td>Probable infant burial; bones nearly</td>
</tr>
</tbody>
</table>

Table 2.12. Urn Burial Summary

The variety of burial treatments and contexts found at Jennd-jeno merits comment. All but one of the burials date to Phases III or IV, and grave goods are rare. The urn burials in Features 23 and 24 both had two iron bracelets, and in 1977, a copper ring fragment was found in an urn. The majority of the urns have no grave goods. During both Phase III and IV, urn burial and simple inhumation in shallow pit graves were practiced contemporaneously. Urn burials generally involved a certain configuration of pottery: the vertically positioned pot containing the remains was either a carinated pot with simple rim (frequently used for infant burials) or a large urn with an overhanging rim; this later type was covered by an inverted carinated pot, and accompanied by a potlid and/or a shallow plate with thickened rim. All of these are common domestic pottery types. Urn burials could be primary interments (recognized by the articulation of the skeleton) or secondary ones.
<table>
<thead>
<tr>
<th>Feature</th>
<th>Unit</th>
<th>Phase</th>
<th>Orientation, Position, Sex and Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>HK</td>
<td>IV</td>
<td>S/N, facing N/NE; on rt. side, legs slightly flexed; Female 20-30 years</td>
<td>rt. hand under cheek, left hand under rt. elbow</td>
</tr>
<tr>
<td>26</td>
<td>LX-N</td>
<td>IV</td>
<td>S/N, facing E; tightly flexed</td>
</tr>
<tr>
<td>34</td>
<td>WFL</td>
<td>IV</td>
<td>S/N, likely facing E (trunk and cranium in section); Unable to slightly flexed on rt. side</td>
</tr>
<tr>
<td>49</td>
<td>LX-S</td>
<td>I</td>
<td>E/W, facing S; semi-flexed</td>
</tr>
</tbody>
</table>

In which fragmentary and disarticulated remains appear to have been placed in urns, sometimes subsequent to one or more earlier burials in the same urn (Table 2.12). The disposition of broken fragments of plates or carinated pots in the urns suggests that these were used to transport fragmentary secondary burials for reinterment in urns. In addition to primary and secondary inhumation in urns, the remains of three cremated individuals were found in urns.

Urn burials generally occurred in two different contexts: specialized cemetery areas (CTR, WFL, JF1[1977]) and residential areas (LX-S, ALS, M1[1977]). Two possible exceptions to this are the urn burials in NWS and HAMB, each of which differs significantly from other urn burials at Jenn& jeno and elsewhere in the Inland Delta. The HAMB urn burial (Feature 51) as an inhumation in two horizontal urns placed rim-to-rim. And the infant burial near the city wall (Feature 56) had been placed in an pot quite different from the usual funerary wares. The most frequent mode of urn burial was single inhumation (thirteen examples total from the 1977 and 1981 excavations). Three double inhumations in urns and one double cremation in an urn were also recovered in the course of the two
excavation seasons. A single example of a double inhumation and a subsequent cremation in a single urn was found in 1981.

Inhumation practices also varied (Table 2.13). Inhumation contexts, like urn burial contexts, included specialized cemetery precincts (WFL, JF1 [19771 as well as residential sectors (LX-N, M2 [1977]). An isolated inhumation into what appears to have been an exposed surface of the site was found in HK (Feature 5). Although the inhumations from the 1981 excavations appear to divide neatly by orientation into the Phase I/II burial, oriented east-west, facing south, and the Phase IV burials, oriented south-north, facing east, the existence of inhumations with quite different orientations from the Phase III deposits in JF1 and the Phase IV deposits in M2 remind us of the wide range of orientations present (Figure 2.57).

The sample of burials identifiable as to sex and age is still too small to permit an attempt to identify systematic differences in burial treatment. Thus far, however, we can state that infant and child burials have only been discovered in urns, and that multiple burials in urns, when they occur, seem to involve adult or subadult individuals of both sexes, in those cases where sex could be determined (Features 23, 35, 47, Urn #6 [1977]). We can also observe a possible gender association along cardinal axes of Phase III and IV burials, with four female inhumations oriented either facing east or with either the face or head toward the east, and a male burial facing west. Much larger samples will be necessary to evaluate this very tentative association.

KEY TO STRATA
Wall Collapse

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cllo</td>
<td>Wall / floor of cylindrical bricks</td>
</tr>
<tr>
<td>Cll ojlo</td>
<td>Light loam; loosely compacted debris; pale / red grey</td>
</tr>
<tr>
<td>Cll loam</td>
<td>Light loam; firmly compacted debris; pale grey</td>
</tr>
<tr>
<td>Loam</td>
<td>Loam; friable to firm; pale grey / pale brown</td>
</tr>
<tr>
<td>Clays</td>
<td>Clays</td>
</tr>
<tr>
<td>Clay</td>
<td>Light clay; firm; pale brown / tan; often much limonite</td>
</tr>
<tr>
<td>Clay</td>
<td>Clay; friable to firm; dark khaki brown; ash; limonite</td>
</tr>
<tr>
<td>Clay</td>
<td>Light clay; friable; gey / red grey; laminated</td>
</tr>
<tr>
<td>Loams</td>
<td>Loams</td>
</tr>
<tr>
<td>Sands</td>
<td>Sands</td>
</tr>
</tbody>
</table>
Heavy loam; firm; Pale yellow-green; homogeneous
Heavy loam; friable; green brown; ash lenses
Light loam; very friable; dark orange brown; gravel
Light loam; very friable; dark grey to brown; fill
Sand; loose; pale or orange grey; much ash and gravel
Loamy sand; very friable; dark brown to black; charcoal
Sandy-gravelly medium -1am
Pure sand-clay mix
Legend for all profile drawings of natural strata
Figure 2.3.

Stratigraphy, Features, and Chronology
= cylindrical bricks and collapse Xo06 = depth in mm
0 1.0 2.0m
Figure 2.4. ALS: House 13 (Feature 50) as it appeared on the surface

Stratigraphy, Features, and Chronology
0 2 10 20cm
0 4 20 40a
0 2 10 20cm
Figure 2.5. Urns associated with Feature 54 in ALS (top), Feature 55 in WFL (bottom left), and 56 in NWS (bottom right)

Stratigraphy, Features, and Chronology
Pof 0A
JENNE-JENO, 1981 CTR
0 m. 1.0 1.5 2.0
xO.45 = depth in mm (XoCO) = depth at bottom of bricks
Figure 2.8. CTR: Features 12 and 13 as exposed in Level Figure 2.
Stratigraphy, Features, and Chronology
PofO A
JENNE- JENO, 1981
CTR
0 m 1.0 1.5 2.0
xl.59 = depth in mm
Figure 2.11. CTR: Features 22, 23, and 24 after excavation

Stratigraphy, Features, and Chronology
m mm -1
Figure 2.12. CFR: Feature 22 burial urn and cover

Pof 0 1
stair xO092
(later removed)
end Level 9 N
Level 10L
A B
Feature 24
0.63
JENNE- JENO, 1981 CTR
0 m 1.0 1.5 2.0
x.92 = depth in mm Figure 2.9. CMR: Bottom of ash pit Level 8, showing emergence of Level 10 and urn burials 22 and 24. In Level 10, A indicates deposits of ash and burnt earth; B indicates deposits of friable ash.

Stratigraphy, Features, and Chronology
PofO A
JENNE - JENO, 1981
CTR
2.0
XI.0 = depth in mm
F. 22, 23, 24 = (Features)
= possible tauf wall Figure 2.10. CTR: Levels 8 and 12 through 15, showing urn burials 22, 23, and 24 and associated levels urn burials
Stratigraphy, Features, and Chronology

Figure 2.13. CTR: Feature 23 main burial urn and associated carinated pot with inverted shallow dish

Figure 2.14. CTR: Feature 23 pots disturbed by the large burial urn in Figure 2.13. The pot at the top contained an infant burial.

Figure 2.15. CTR: Feature 24 burial urn

Stratigraphy, Features, and Chronology
Figure 2.18. HAMB: Feature 51 burial urns

Stratigraphy, Features, and Chronology
0°10.5
0.8-
0.5
I° I
Feature 34
WFL
Feature 26
LX-N
4.
NW
2-10 1.4 1.0
X " 5.10
Feature 49
LX-S

Figure 2.19. Inhumations: Feature 5 (HK); Feature 26 (LX-N); Feature 34 (WFL) and Feature 49 (LX-N)
Feature 5
HK
0
1 1 1
I - "067

@ oi
a>a>
a>.4
0
O
u a>
o
E
E
a>I-

c
0L
ci
U?
C?
e -0

3:
LIJ Ln 91

Stratigraphy, Features, and Chronology
PofOA
JENNE-JENO, 1981
KANIANA

Figure 2.24. KAN: Feature 53 (hearth)
0 m.
X1.36 = depth in mm
Stratigraphy, Features, and Chronology
PofOA
N
Levels 4 & 7 f 018 ).30
0°33
0.0536
eve 3(x.57
*x037 00 2 Level 5
JENNE-JENO (R6p du MALI), 1981 LX-N
0 1.0 2.0m
x.33 = depth in mm (xo.o) = depth at bottom of bricks
Figure 2.27. LX-N: House 1 after excavation

Stratigraphy, Features, and Chronology
Pof 0A
Level 12
0 0.74, X
0000000 o000O°°0 (xO.84.)
oogo° Level 11
A
0.74 0- Feature 8
T0 (x 0.83)
00
00 cjj, 0.67 )
00 ( 0.87 )
000 8 7
079
JENNE-JENO (R6p. du MALI ). 1981 LX-N
0 1.0m. 2.0
x0.74 = depth in mm
(XO.o) = depth at bottom of bricks
Figure 2.28. LX-N: Features 8 and 9 (Houses 5 and 14)
Figure 2.29. LX-N: Emergence of the three ovens (Features 15, 17, and 19) associated with House 10

Stratigraphy, Features, and Chronology
oven (n° 171)

Figure 2.30 LX-N: House 10 (Feature 20) and attached ovens

Stratigraphy, Features, and Chronology

Figure 2.31. LX-N: House 11 (Feature 37) and associated levels

Stratigraphy, Features, and Chronology

Stratigraphy, Features, and Chronology

LX-N Levels 47 & 48

Figure 2.32. LX-N: House 12 (Feature 46) and associated levels

LX-N Level 78

Figure 2.33. LX-N, Feature 48: Burnt earth floor in Units LX-N and LX-S

LX-S Level 78

Figure 2.36. LX-S: Features 2 and 3 (Houses 2 and 3), showing Feature 8 in LX-N and Level 9 and Feature 4 (top of Pit 1)
Figure 2.37. LX-S: Houses 4 and 6 (Features 7 and 10), showing Feature 6 and Level 18

Stratigraphy, Features, and Chronology
'g.'?
N x 3~
mm
0 4 20
I
40a

Figure 2.38. LX-S: Feature 47 burial urn

Stratigraphy, Features, and Chronology
2.0 1.5 1.0 m. 0 X.99 = depth in mm Figure 2.39. LX-S: House 7 (Feature 11) and Feature 4 (Pit 1)

Figure 2.41. LX-S: Feature 42 burial urn

Stratigraphy, Features, and Chronology
N N~\NNNN
w

Figure 2.42. LX-S: House 7 (Feature 11) and Feature 4 (Pit 1)

.20 .90
.0
-.1.1f ** * If I0 . . . . .
Stratigraphy, Features, and Chronology

Figure 2.49. WFL: Feature 35 burial urn
0 4 20 40cm

Stratigraphy, Features, and Chronology JENNE-JENO (Rp. du MALI), 1981
WFL
0 m 0-5
XO.o = depth in mm nodules

Figure 2.50. WFL: Potsherd pavement (Feature 41) at top of Level 10, showing urn burials 35 and 36
I I I
Stratigraphy, Features, and Chronology
LXN CTR ALS WFL HAMB
L. 13
L25 L. 5?
L. 36 L. 38
L. 25 L. 35 L. 26 L .37
L. 10
L. 15
Late Phase IV
Early Late Phase IR Early
Later Phase 1/11
Initial Phase I/II
L .48 L .49 L .51
Figure 2.53. Suggested calendar chronology for radiocarbon dated levels
KAN L. 24
1400 1300
1200 1100 1000 900 800 700
1 0
300
200 100 A.D.
0 B.C.
100
200


Figure 2.56. Chronology of deposits present in excavation units on Jenndjeno and Hambarketolo (white symbols indicate that no deposits dating to the time period were recovered from the excavation unit)

Stratigraphy, Features, and Chronology
Initial

Figure 2.57. Summary of inhumation burial orientations and postures at Jenné-jeno.
POTTERY
Susan Keech McIntosh
INTRODUCTION
In approaching the study of the Jenné-jeno pottery since the first excavations in 1977, I have enjoyed two distinct advantages: the lack of any existing pottery classification or culture-historical typology for the Inland Niger Delta (IND) (indeed, for most regions of West Africa) and access to the abundant literature of the past twenty-five years that has criticized traditional typological approaches (Binford 1965; Clarke 1968; Rice 1976, 1982, 1984a, b; Shepard 1974:306-322), explored theoretical aspects of typology and classification (Adams 1988; Adams and Adams 1991; Dunnell 1971, 1986; Whallon and Brown 1982), and suggested new approaches more appropriate for processually oriented research (Hill and Evans 1972; Redman 1978; Spaulding 1977; Whallon 1972). These two advantages offer the opportunity to set in place an approach to the description, classification, and interpretation of Inland Delta pottery that avoids some of the major pitfalls identified in the literature. My major goal has been to devise an approach that offers flexibility, in the sense that it can be adapted for use anywhere and can address a wide variety of different research questions. Of primary importance is the fact that it can be used in future work to expand and modify the classification and interpretations offered here, as warranted by new data.

In devising this approach, I took two concepts as axiomatic: (1) The major purpose of systematic artifact study is to document artifact variability, which, in the context of chronological and spatial patterning, is the source of all archaeological knowledge (Redman 1978:161); (2) formal variability among artifacts of the same kind (e.g., pottery) can and does occur with respect to many different variables. The key issue, then, is to create a multidimensional data set that allows the archaeologist to search for and document more than one pattern of variability at a time (Redman 1978:191). Dissatisfaction with traditional, typological approaches to pottery study stems specifically from their inability to accommodate such analysis. When sherds are recorded as members of groups defined by a limited number of specific attributes, the resulting data set does not inform us on the extent of variability within the group, nor does it permit us to explore other possible groupings. The simple fact is that recording sherds as members of groups tends to obscure an appreciation of much variability and largely precludes any further analysis. I agree with Redman (1978:160) that "if we, as archaeologists, are to derive the maximum amount of information from recovered artifacts, then basic approaches to classification and analysis must be re-evaluated and

Pottery
overhauled... The derivation of types must be better understood and various forms of attribute analysis integrated with the typological approach."

One way to achieve this is to adopt an approach in which data recording, classification, and analysis are all separate operations, rather than conflated into one, as they are in typological approaches. This involves recording pottery, or a
least some sample of the assemblage, individually, characterizing each sherd in terms of a number of its formal and nonformal properties (S. McIntosh and R. McIntosh 1980: 112-123; Redman 1978). This approach permits multiple different groupings or classifications of pottery to be generated from the resulting data set. It also allows the data to be examined for patterned variability across space and through time with regard to a number of different attributes. This kind of analytical approach has been advocated for many years by Rouse (1939, 1960), although he specifically was concerned with identifying customs or concepts observed by the potter, which he termed "modes." Although Rouse identified dozens of modes of shape, material, and decoration by physically resorting his Antillean pottery collections many times, computerized data bases accomplish the same task in seconds.

The selection of the variables to be recorded is a crucial step in the analytical process. As Adams (1988:48) indicates, variables are selected because they are expected to yield useful information for some specific purpose. This purpose may be the definition of useful classifications (Voorips 1982), or it may be the inspection of the assemblage for a specific pattern of formal variation predicted by a specific model or hypothesis. In both cases, the variables selected will reflect the major concerns and interests of the archaeologist studying the collection. If the questions of interest primarily relate to elucidating space-time relationships, decorative variables and rim form may be prominently featured. Functional aspects of the assemblage, in contrast, would be better illuminated by the study of a number of physical characteristics of the sherds: wall thickness, rim diameter and vessel size, porosity, temper (affecting resistance to thermal stress), and variables such as rim and vessel shape, presence of carbon blackening, and context. Archaeologists interested in the organization of pottery production and distribution, on the other hand, would find paste composition, forming technique (coil, mold, wheel), production context, and firing techniques of special relevance.

In areas where prior information on the utility of particular variables for the investigation of specific questions is not available, the search for significant variability must be conducted from scratch. Variables whose attribute values prove largely invariant (Clarke's [1968:71] "inessential attributes") must be jettisoned and new variables examined. The identification of "essential" variables, that is, those whose values are found to vary with respect to at least one interpretive dimension of the assemblage (Clarke 1968:71), provides the basic data for the classificatory, typological, and interpretive goals of the pottery study. A number of essential variables emerged clearly from my 1977 study of the pottery from the first season at Jennd-jeno (S. McIntosh and R. McIntosh 1980:123-126). I have used this

Pottery knowledge to structure and improve recording protocols for the 1981 pottery as well as to refine its classification and interpretation. For obvious reasons, my approach to the assemblage has emphasized variables of particular utility for the development of time-space systematics in the region. However, I also recorded
variables relevant to questions of function and production technology. The next section of this chapter describes the variables selected and the attributes recorded, along with the procedures followed in collecting and recording the pottery data set.

The subsequent section of the chapter presents the results of the study. First, a general description of the pottery assemblage in terms of its characteristic attribute modalities is presented. Then I describe the major rim sherd classes identified and present data on the variability exhibited in each class with regard to several variables. This provides some excellent insights into patterns of attribute association and covariation (a primary function of paradigmatic classifications, as Dunnell [1971] points out). Although I used loglinear hierarchical analysis in 1980 to identify these patterns statistically, I have not pursued this approach further, since problems with its application to large data sets emerged in the earlier analysis (S. McIntosh and R. McIntosh 1980:150). Instead, I rely on the empirical data from the rim class descriptive tables and on the results of intuitive sorting of the pottery from successive excavated levels in several excavation units to identify a number of "instrumental" ancillary types (Adams 1988:51; Adams and Adams 1991:163)) with consistently recurring attribute combinations that are highly diagnostic of specific occupation phases at Jenn6-jeno. I have not gone to the next step of creating a taxonomic hierarchy, within which these culture-historical types are nested, for several reasons: (1) The current typology represents an initial and very preliminary effort that it would be a mistake to fossilize by incorporation into a hierarchical taxonomy; (2) the types defined comprise only a portion of the total ceramic assemblage in each phase; (3) such a framework offers a possible inducement, scrupulously to be avoided in my opinion, for the future construction of a type-variety system for the Inland Delta.

RECOVERY AND SAMPLING PROCEDURES

Pottery recovery procedures in 1981 were similar to those followed in 1977: all soil was carefully searched for artifacts before being placed in buckets and emptied onto the tip. All potsherds recognized in this process were placed in cloth bags which were labeled with excavation unit, stratigraphic level, date, and level record number. Intact or nearly intact pots, when encountered, were drawn and photographed in situ before removal and labeling. With the exception of funerary urns, complete and completely reconstructable pots were rare at Jenn6-jeno. The bulk of the data for pottery analyses and assemblage description necessarily comes from sherds, then, and not whole vessels.

In view of the enormous number of potsherds recovered from the 1981 excavations, sampling was imperative. The examination of every sherd collected was out of the question, since we intended to record all necessary data for ceramic description and analysis in the field. As in 1977, the only sherds transported to the United States would be a small study collection numbering several hundred. The number of personnel available for this formidable recording task never exceeded four, and fully half the procedure (i.e., the rim sherd study) was solely my responsibility. The use of an unbiased sampling scheme offered an
excellent way to reduce the number of sherds to be examined, while avoiding the use of judgmental selection criteria.

We again used the manual mix-and-divide sampling method that had proven so easy and effective in 1977 (S. McIntosh and R. McIntosh 1980:113). With the small sherd volumes recovered in 1977, we found it necessary to sample only the body sherds in this way; this was done after washing each bag of sherds and removing rim sherds, all of which were retained for recording. In view of the much larger volume of excavated material in 1981, we decided to sample the excavated pottery prior to washing and sorting, and, indeed, even before leaving the site. At the end of each day's excavating, the pottery bags from that day were grouped by excavation unit and level. For any level that had produced more than one but less than four bags of pottery that day, a 50% sample was taken in the following way: each sherd bag from the level was emptied onto a cleared spot and thoroughly mixed with the hands (to counteract any natural sorting of large and small sherds that may have occurred in the bag). The pile was then divided into two approximately equal halves using a small board (a clipboard, it so happens). Each of the two resulting piles was further mixed by hand and then divided into halves in the same fashion. Of the resulting four piles, two were selected for rebagging, washing, and recording. The other two piles were thrown onto the tip. For any level producing four or more bags of pottery in a day, a 25% sample was taken following the same mixing procedure, selecting one of the four piles. Sampling was not attempted for levels that had not produced at least a full bag of pottery in the course of the day's work; in such cases, 100% of the sherds were kept for study. (The sampling fraction for each level is indicated in Table B3 in Appendix B). This decision not to sample levels with small sherd volumes recognizes that meaningful statistical analysis is hindered by small absolute sherd numbers, and it represents an improvement over 1977 procedures (S. McIntosh and R. McIntosh 1980:115).

All the various bags of sampled and unsampled sherds were then transported to Jenn6, where they were washed by our workmen later in the afternoon and left out to dry. In this way, each day's excavated pottery was clean, dry, and ready for further sorting and recording the following afternoon.

We are aware that the mix-and-divide sampling method used has some shortcomings, and we have already commented on some of these (S. McIntosh and R. McIntosh 1980:114). As we noted after employing this method in 1977, it does not allow selection of exactly 50% of the sherd population sampled, since sherd piles are partitioned in an approximate way based on volume. This shortcoming affects our ability to predict absolute Pottery numbers of sherds in the sampled population, but it should not significantly affect our ability to characterize the assemblage in terms of relative frequencies of various attributes.

As compensation for this weakness of the mix-and-divide sampling scheme, it has the benefit of being easy and fast. In addition, our decision to sample the sherds in this fashion at the site, before washing, had two salutary consequences: first, it
virtually eliminated any possibility of selection bias in favor of "diagnostic" sherds (such as particular twine patterns or painted sherds), since the sherd surface was covered with dirt and not clearly visible; second, it spared us the unnecessary transport of large number of sherds to JennC. This latter consideration was in fact quite critical, since our field vehicle was a small donkey cart, already loaded almost to capacity with excavation equipment.

RECORDING METHODS
In 1981, we attempted to streamline and improve considerably the procedures for recording pottery. In 1977, lacking any prior studies of IND ceramics to guide us, we recorded all body and feature sherds individually in terms of a number of formal variables. These data, once coded and entered into a computer, were searched primarily for time-sensitive patterning among these attributes. Through the 1977 study, we gained insights into the properties of the Jennd-jeno ceramic assemblage and into the kinds of patterning and variability within it. We realized that it was possible to characterize salient nondecorative aspects (e.g., paste, color) of the entire assemblage from data recorded on rim sherds alone. This prompted the decision to restrict body sherd description to decorative variables only. It made possible the group-and-count method used to record the majority of the body sherds and rendered the entire recording process vastly more efficient. In addition, we learned that the cost of recording certain variables (e.g., sherd thickness) was unacceptably high for the benefit gleaned from the data. We also discovered the importance of data that we had not recorded-most significantly, the position of decorative attributes on rim sherds (S. McIntosh and R. McIntosh 1980:115).

The 1981 recording system reflects these insights as well as our expanded goals for ceramic analysis. These goals are to describe the gross characteristics of the excavated pottery assemblage; to cross-check and refine the time-sensitive ceramic sequence established in 1977; to study the range of formal and functional variability represented in the ceramic sequence to help define various functional contexts; and to examine the ceramic assemblage in terms of paste, temper, and manufacturing techniques in order to begin assessing spatial and temporal variability in the distribution of pottery. In view of the greater potential of feature sherds (rims, bases, and handles) to inform us on a broad range of points relevant to these goals, these were recorded separately from and in much more detail than body sherds. The flowchart in Figure 3.1 illustrates the operation of the pottery recording system. Below, I describe in

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detail the methods for recording body sherds before going on to discuss methods used to record feature sherds.

Body Sherds
Each bag of washed pottery from the previous day's excavation was emptied, one at a time, and sorted into "feature" sherds (rims, bases, and handles) and body sherds. The feature sherds were rebagged for my later study. The body sherds, on the other hand, were immediately sorted into descriptive groups and recorded. Our experience with the pottery from the 1977 excavations had demonstrated that
most body sherds exhibited only one or two decorative attributes. Most common among these were deep red slip, twine impression (fourteen different patterns recognized), and channeling/grooving. Other, rarer attributes included various plastic motifs (stabbing, incision, stamping, or comb impression) and paint (white, red, magenta, or black). It is worth describing these variables in more detail.

**Slipping.** The slipping process recognized on the Jenns-jeno ceramics comprises the application of a suspension of clay, water, and iron oxide colorant over the surface of a leather-hard pot. The red slip on pots made in Jennd today is preferentially produced from chunk of ochre gathered from the surface of nearby archaeological sites, where the material was imported from outside the IND at some point in the past (LaViolette 1987:245). Slipping may serve a functional purpose, rendering pottery less permeable, especially when well polished (Shepard 1974:191). Slipping can equally well be largely decorative, as it is clearly intended to be on those Jennd-jeno vessels where it was applied only to the rims. The most common color of slip at Jennd-jeno was dark red/orange, described by Munsell values 10 R 4/6, 10 R 5/6, 10 R 4/8, and 2.5 YR 4/6. In almost all cases of slipping, the pot surface had subsequently been burnished to a low luster. On many burnished sherds, the pattern of thin lines created by the process suggests that the burnishing tool was a string of baobab seeds, like that used by potters in the region today (LaViolette 1987:248).

**Twine Impression.** The impression of a twine pattern onto a pot surface, using either a twisted or plaited roulette, was the most common technique used for decorating pot bodies at Jenn&amp-jeno. Among the fourteen different twine patterns recognized at Jenn6-jeno, several groups of closely related twines (Plate 6) may be identified. The largest group (Twines 1, 2, 3, and 10) are variants of plaited (or braided) roulettes (Plates 7 and 8). Hurley's (1979) analysis of cord impressions on pottery clearly shows that the differences in size and pattern among these four variants stem from differences in the thickness and number of the cords braided together, as well as slight variations in the braiding pattern itself (Hurley 1979:84-86). The large herringbone pattern of Twine 2, for example, corresponds to Hurley's (1979:84) Cord 210, created by plaiting together two cords. (However, R. Bedaux and Lange [1983] picture an elaborately woven roulette that Kurumba potters in Burkina Faso use to create this same pattern, Bedaux's Motif 1c2). When the same plaiting technique is used with doubled cords (four in all), the result is Twine 3 (Plate 8; cp. Hurley's [1979:86] Cord 212). Twines 4 and 5 represent a different kind of plaited roulette in which strips of grass frond or reed are pleated back-and-forth on top of one another, accordion style, creating a roulette that is square or pentagonal in cross section (R. Bedaux and Lange 1983: Figure 2[1]; Soper 1985:35-39) (Plate 9). In Twine 4 (R. Bedaux and Lange's Motif 1b), the raised beads of the impression are perpendicular to the rows of beads created, such that the twine appears to run straight up-and-down across the surface of the pot. In Twine 5, the beads are at an oblique angle to the rows. Here, the twine runs diagonally across the pot surface (Plate 10). Twines 6 and 7 are also closely related (Plate 11); both are twisted cord roulettes comparable to
Hurley's (1979:29) Cords 35 and 38, respectively (see also Soper 1985: Figure 3; R. Bedaux and Lange 1983: Figure 2[4]. Motifs icl and 1c3). Twine 12 is a related pattern in which a twisted cord has been looped halfway down the roulette, such that a zigzag pattern is produced when rolled over the clay surface (cf. Hurley's Cord 172; 1979:71). It should be noted that Twine 12 is the same twine pattern referred to as Twine 7 in the report on the 1977 excavations (Table 3.1). The remaining twine patterns are infrequently encountered. Twines 8 and 9 are closely related and seem to have been produced by a counterwrapped cord similar to Hurley's (1979:81) Cords 204 and 205. Twine 11 is somewhat mysterious, since its major characteristic is that it is smeared and vague over large areas. Twine 13 is also poorly understood. Although it is clearly produced by some kind of twine impression (Plate 12), the mechanism producing the regular, deep rectangular indentations is unknown. Twine 14 is created by a stick wrapped with untwisted cord. It is identical to Hurley's (1979:87) Cord 215. In addition to the numbered twines identified at Jenn6-jeno, several twine motifs were encountered only a handful of times. These include the cord-wrapped stick motifs illustrated in Plate 13, which can be compared to Hurley's (1979:89) cords 219, 220, and 221 (see also Soper 1985: Figure 7). Plastic. Loosely following Shepard (1974:70, 194-195), plastic decoration is used here to mean any decorative technique that exploits the plastic properties of clay. At Jenn6-jeno, plastic techniques include channeling, comb impression, stabbing, stamping, incision, fingernail impression, stippling, comb dragging, and appliqu6. Technically, twine impression is a plastic technique, but it was so common at Jenn6-jeno that it was placed in a descriptive class of its own. By far the most common of the plastic techniques, aside from twine impression, was channeling. Grooves between 1- and 2-mm wide with a consistent U-section were incised into clay that was leather-hard, to judge from the clean lines created by the process (see Rye 1981:67). Grooves may occur singly or severally. In the latter case, the grooves are closely spaced and parallel to one another, suggesting the use of a comb. Potters in Jenn6 today use combs fabricated of reeds mounted in clay to achieve this effect (LaViolette 1987:410). A single groove is frequently used to divide zones of decoration-twine from paint, for example. All other plastic motifs are relatively rare. The different plastic motifs exhibited by the Jenn6-jeno pottery are illustrated in Plates 14-18. Table 3.1. Comparison of twine classes identified on Jennd-jeno ceramics in 1977 and 1981 1977 Twine Classes Tw. 1--"Coarse woven" Tw. 2--Tightly woven large chevron" Tw. 3--"Double woven" Tw. 4--"Fishnet" Tw. 5--"Miscellaneous" Tw. 6--"Roulette" Tw. 7--"Incised or alternate" zoned roulette 1981 Twine Classes -- Tw. 1-regular 2- or 3-cord-plaited roulette
Tw. 2-large herringbone 2-cord-plaited roulette
Tw. 3-doubled 2-cord-plaited roulette
Tw. 4-accordion-plaited strip roulette
producing vertical beaded pattern
Tw. 5-multiple-strip accordion-plaited roulette producing diagonal beaded pattern
Tw. 6-twisted cord roulette producing diagonal-indented pattern
Tw. 12-twisted looped cord roulette
Tw. 7-twisted cord roulette producing large "maize cob" diagonal-indented pattern
Tw. 8--counterwrapped cord roulette producing diamond pattern
Tw. 9-counterwrapped cord roulette producing diamond pattern
Tw. 10-small 2-cord-plaited roulette
Tw. 11-smeared twine; method of production undetermined
Tw. 13-twine impression with regular rectangular indent; method of production undetermined
Tw. 14-stick wrapped with untwisted fiber

Paint. The Jenn&jeno potters used four colors of paint: red/brown, black, magenta, and white. In 1977, an additional color, yellow, was recognized in analyzing the ceramics, but we noted in 1981 that yellow paint occurred in exactly the same contexts as white paint. This suggested to us that yellow paint was most likely a white paint (kaolin) tainted with small amounts of ferric oxide impurities. A kaolin source located 6 km north of Jenn6 is used by potters in the town today (LaViolette 1987:246). Scanning electron microprobe analysis of black paint on several sherds demonstrated that the

Pottery mineral colorant was manganese (MacDonald n.d.). All paints appear to have been applied prior to firing, with the exception of some white-on-red-slip ceramics where the partially fugitive nature of the white paint suggests an application immediately after the pots were removed from the fire. Virtually all the painted designs found on the Jennd-jeno pottery are geometric or linear (Plate 19).

The attributes discussed above provided the basis for easy sorting of body sherds into the following mutually exclusive groups: (1.) undecorated, (2.) slipped only, (3.) twine-decorated only (only one twine pattern present), (4.) channeled and slipped only, (5.) channeled only, no slip, (6.) painted only (only one paint color
present), (7.) single plastic motif (other than twine impression or channeling), and (8.) unidentifiable (usually badly weathered). During this sorting process we discarded small sherds measuring less than approximately 2 cm on a side. All multiple attribute sherds not fitting any of the defined categories above were set aside for the moment, since they required more elaborate recording techniques. We then further subdivided groups 3, 4, and 7 into piles representing the different twine patterns, paint colors, and plastic motifs.

At this point, having handled all the body sherds from the bag and grouped them with other similarly decorated sherds, we carefully searched each sherd group for pieces that clearly came from the same pot. All sherds belonging to a single pot were grouped and set to the side, save one which was retained in the pile of sherds to be recorded. Insofar as we could control it, then, each sherd remaining in the attribute piles represented one pot. The number of sherds in each attribute pile could then be counted and recorded on a data sheet like that illustrated in Figure 3.2. Entries to the side of the regular column entries (e.g., 2 fr 1, and 25fr 6) record the number of multiple sherds from single pots which had been set aside in piles. Thus, the entry under Slipped for LX-S Level 30 means that 10 sherds (from 10 different pots) were counted, and an additional 2 sherds from one of those 10 vessels were also noted. And under Twine 5 for LX-N Level 49, 174 sherds from different vessels were counted, and 25 additional sherds belonging to 6 of those 174 pots. In this way, total number of sherds in the sample can be calculated, yet the danger of artificially inflating attribute frequencies by the inclusion of many fragments from a single pot is minimized.

After recording sherd counts, any sherds for which special treatment was desired, such as drawing or photography, were labeled and rebagged; the rest of the counted sherds were discarded. At this point, all body sherds had been recorded, except for a very small number of multiple attribute sherds. As mentioned earlier, these required more complex recording treatment. We described each individual sherd in terms of a number of its formal and nonformal properties, including provenience (excavation unit, level), slip, and other decorative variables. The format used for recording multiple attribute sherds is illustrated in Figure 3.3. After recording, these sherds were also discarded.

By following the procedure outlined above, we were able to record and discard all body sherds brought back from the site the previous day, with exception of sherds added to the study collection. The process was efficient enough to permit the recording in the field of all 40,000 sampled body sherds. Our recording procedure was subject to difficulties in two areas: (1.) Because four people participated in recording, the possibility of interobserver error and lack of consistency inevitably arose. It is certain that inconsistency in the identification of related twines occurred (especially Twines 1, 2, and 10; 4 and 5; 6 and 7), and this is the prime reason these are grouped together for purposes of analysis. (2.) By treating the body sherds separately from the rims sherds, we virtually eliminated the possibility of putting together rim and body sherds from the same vessel, reducing our opportunities to reconstruct vessel form. This problem could be very
easily resolved by rebagging multiple body sherds from single vessels for possible later matchup with rims.

Feature Sherds
For each bag of feature sherds, handles and bases were separated from rims and described individually in terms of shape, size, and decoration. Rim sherds from units LX-N, HK, CTR, ALS, and KAN were described in terms of eighteen formal and nonformal properties, including provenience (site, excavation unit, level); fabric (paste, color); part of vessel represented (rim only, rim and shoulder only, rim, shoulder, and body); rim type; rim angle (with reference to a plane described by the vessel mouth); rim diameter; slip (presence/absence/position on outer surface; presence/absence on inner surface); decoration (twine impression, paint, plastic); and the position of each decorative motif on the sherd. These data were coded and entered on computer sheets for each rim sherd larger than approximately 4 cm² (smaller sherds were discarded). To illustrate the coding system in operation, the rim sherd data from the test excavation at Kaniana are reproduced in Figure 3.4. Prior to recording, all rims from a single excavation level were carefully examined for multiple pieces from single vessels, to ensure that each vessel was represented by only one data entry. Coded rim sherd variables are described below.

Provenience. Provenience was denoted by means of the site number (1 = Jennd-jeno; 2 = Kaniana), the excavation unit number (1 = LX-N; 2 = LX-S; 3 = HK; 4 = CTR; 5 = WFL; 6 = NWS; 7 = ALS), and the number of the level from which a sherd was recovered.

Paste. Paste refers to that combination of clay and nonplastic inclusions that together constitute the fabric of a piece of fired clay. Following the usage of Shepard (1974:25), those classes of nonplastic inclusions which were deliberately added to the clay (e.g., crushed pottery/grog) are called temper, and those whose presence cannot be directly attributed to human manipulation are simply termed nonplastic inclusions. Petrographic studies indicate that virtually all Jenn6-jeno pottery is grog-tempered, even the fine paste ware we believed to be sand-tempered in 1977 (MacDonald n.d.). Paste texture appears to vary largely on the basis of the coarseness and amount of grog present. Also present in some sherds are varying amounts (between 5% and 25%) of hematite-stained quartz sand. It is not known whether sand

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occurred naturally in the day sources used by Jenn6-jeno potters or whether it was deliberately added.

On the basis of visual inspection, the paste texture of each sherd was classified as coarse, medium, or fine. Following Wentworth's size classification for sediments (reproduced in Shepard 1974:118), coarse texture was defined for sherds with a large amount of grog temper in the size range from 1.5 mm to 4 mm. The code for coarse-textured sherds was 1 if the paste was friable and poorly consolidated, 2 if it was hard and well consolidated. Medium texture (coded as 3) has large amounts of inclusions (grog, sometimes with sand included) ranging from 0.5 mm to 2 mm in diameter. Fine-textured sherds (code = 4), on the other
Paste Color. Like paste texture, color was judged by visual inspection of a fresh break. For an inexperienced observer, the color categories established in 1977 for the Jennd-jeno ceramics are easily identified. To ensure accuracy and consistency, however, every fifth sherd coded was matched against a Munsell color chart. Table 3.2 presents the range of Munsell values within each color class recognized and coded.

Table 3.2. Color code and corresponding Munsell values

<table>
<thead>
<tr>
<th>Code</th>
<th>Visual Color Categories</th>
<th>Munsell Color Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Dark orange</td>
<td>2.5 YR 5/6, 5/8; 5 YR 5/6, 5/8</td>
</tr>
<tr>
<td>02</td>
<td>Light orange</td>
<td>2.5 YR 6/6,6/8; 5 YR 6/6,6/8</td>
</tr>
<tr>
<td>03</td>
<td>Buff</td>
<td>10 YR 7/2, 7/3,7/4,8/2,8/3,8/4</td>
</tr>
<tr>
<td>04</td>
<td>Black</td>
<td>5 Y 3/0; 10 YR 3/1; 7.5 YR 3/0</td>
</tr>
<tr>
<td>05</td>
<td>Gray</td>
<td>2.5 Y 5/0,5/2,4/0,6/0; 10 YR4/0, 5/0</td>
</tr>
<tr>
<td>06</td>
<td>Clear orange</td>
<td>5 YR 7/6,7/8; 7.5 YR 7/6,7/8</td>
</tr>
<tr>
<td>07</td>
<td>Rose</td>
<td>10 R 5/8,6/8</td>
</tr>
<tr>
<td>08</td>
<td>Light brown</td>
<td>5 YR 5/2, 5/3,6/2,6/3,6/4; 7.5 YR 6/4</td>
</tr>
</tbody>
</table>

Part Represented. This variable was intended merely to provide a gross idea of what aspects of the original pot were represented by the sherd under observation. The three categories used were rim only (code 1), rim and shoulder (code 2), and rim, shoulder, and body (code 3). Recording this information reflects an awareness that not all rim sherds inform us equally about the vessels from which they came. Sherds that are little more than narrow strips of rim provide limited information on the shape and description of the entire vessel, while sherds that include areas beyond the rim, such as the shoulder and the body of the pot, are potentially richer in information. By noting how many aspects of the original pot are represented by each rim sherd, we retained the ability to partition the rim sherd data according to sherd size for the purposes of analysis. Since code 1 sherds (rims) provide less complete and, in some cases, less accurate information than rim sherds that continue down to the shoulder or body of the pot, we could envision a number of situations where the ability to analyze data only for code 2 and/or code 3 sherds would be useful.

Rim Type. As in 1977, the shape of the rim sherd in radial section (profile) was recorded. Forty-five different rim profiles or types have been recognized now at Jennd-jeno. Each has been drawn and numbered so that similar rims could be described by means of a number code (Figure 3.5). It should be noted here that the numbers used for specific rim types in 1981 may not be the same as those used in 1977.
Rim Angle. Rim angle data are particularly useful for determining whether certain types of rims, especially the large numbers of Type 1 (simple) rims in the Jennndjeno assemblage, come from restricted or unrestricted vessels. Rim angle was coded with the aid of the drawing reproduced in Figure 3.6. To code the angle of any given rim, the drawing was laid on a flat surface, and a rigid plane (such as a clipboard or a hardback book) was aligned along the double horizontal lines, perpendicular to the plane of the drawing. This rigid surface represents the plane of the vessel mouth. The lip of the rim sherd was then placed, with its outer surface facing the left side of the drawing, in contact with the book or clipboard. By rocking the sherd slightly from the outer to inner side of the lip, the position of closest contact with the hard surface (i.e., no gaps visible) can be quickly determined; this is the position of the rim on the original vessel. With the sherd in this position, we observed the angle described by the line of the outer rim profile. If it fell within the region numbered 1 in the drawing, meaning that the angle of the outer rim with the plane of the vessel mouth was less than 450, then the rim angle was coded as 1. In the case of a simple, uninflected rim, this would denote a tightly closed vessel with a highly restricted mouth diameter relative to the maximal diameter of the body. The higher the rim angle code, the more open the vessel, until we reach a code of 6 (> 1800), which is used only for potlids.

Rim Diameter. If the arc on a rim sherd was sufficient to permit determination of the diameter of the pot lip, this was recorded. The lip surface of the rim sherd was placed in contact with a flat piece of paper on which arcs of circles with even diameters from 2 cm to 38 cm had been drawn with a compass. After ensuring that the entire lip edge was flush with the paper, the sherd was moved onto the various drawn arcs to determine which provided the closest fit to the arc of the lip's inner surface. The diameter of the circle described by that arc was then recorded as the diameter of the pot at the lip. The code 00 was recorded when the arc on the sherd was insufficient for measurement. Diameters > 38 cm were recorded as 40.

Outer Surface Treatment. This variable mainly informs us on the presence or absence of slip on the external sherd surface. Absence of slip was coded as 0. The most common color of slip was dark red/orange (code 1), described by Munsell values 10 R 4/6, 10 R 5/6, 10 R 4/8, and 2.5 YR 4/6. A small amount of pottery was slipped with light orange (code 2), which has a Munsell value of 2.5 YR 6/8. Infrequently, an entire sherd surface would be covered with black (code 3) or white (code 6) slip. If the surface of the sherd was severely eroded, such that determining the original presence of any slipping was impossible, then a code of 5 was recorded. In some cases, the original sherd surface was obliterated by a crust of black carbon that had accumulated during direct contact with fire. Such instances were recorded with a code of 4.

Position of Outer Surface Treatment. Since we had observed in 1977 that Jennndjeno pottery was typically not slipped overall but rather had the slip restricted to certain zones of the vessel where other decorative effects might also be concentrated, we wanted to record the position of the slip on each rim sherd. The

Pottery
coding used was as follows: 0 = present over entire outer surface; 1 = rim; 2 = rim + shoulder; 3 = rim + shoulder + body; 4 = shoulder + body; 6 = body; 7 = rim + body. The problems with the coding system for this variable are twofold: first, code 0 may be redundant with 1, 2, or 3, depending on the parts of the vessel represented by the sherd; second, all codes other than 0 and 3 convey the information that some part of the sherd (and hence the original vessel) was not slipped, but to determine which part this is, one often must refer back to an earlier variable, Part Represented, to see what aspects (rim, shoulder, body) of the pot are present on the sherd. If, for example, the position of slip is recorded as 1 (rim) and the part represented by the sherd is also coded as 1 (rim only), this means that slip has been applied as a thin band along the rim and an area without slip directly below this, still on the rim, has been observed. For a sherd representing the rim, shoulder, and body of a vessel, on the other hand, a slip position code of 1 tells us that the shoulder and body are the areas observed.

Inner Surface Treatment. For several classes of pottery, slipping or channeling were important decorative treatments applied to the inside of the vessel. The codes for this variable are 0 = none; 1 = dark orange slip; 2 = light orange slip; 3 = black slip; 4 = channeling; 5 = fire-blackened; 6 = eroded, unable to tell; 7 = white. Position was not recorded for interior slipping or channeling.

Twine Decoration. The presence or absence of twine decoration on a rim sherd was indicated by the code 00 (indicating none present), or a code from 01 to 14, depending on which of the fourteen recognized twine patterns was present. These different twine motifs have been fully described earlier in this chapter and they are illustrated in Plates 6-13. Two additional codes were used: 20 = Twine 6 with parallel incisions drawn through it horizontally; and 99 = unidentifiable twine pattern.

Position of Twine Decoration. The position of the twine decoration on the sherd was recorded using much the same system as I have already described for Position of Outer Surface Treatments, with the addition of a code for decoration found only on the inside of the vessel: 0 = overall; 1 = rim; 2 = rim + shoulder; 3 = rim + shoulder + body; 4 = shoulder; 5 = shoulder + body; 6 = body; 7 = inside; 8 = rim + body.

Pottery Paint Decoration. The various colors of paint used on the Jennd-jeno pottery have already been described in this chapter. They were used either singly or in combination, as indicated by the codes used to record the presence of painted decoration: 0 = none; 1 = white/cream; 2 = black; 3 = red/orange; 4 = magenta; 5 = yellow; 6 = white + black; 7 = white + magenta; 8 = white + red; 9 = white + red + black. The most frequent context for paint decoration is an application directly over or in a series of parallel grooves (channeling). Much less frequently, paint is applied in a geometric design, such as cross-hatched lozenges or triangles. Rather than devise an elaborate computer code for different geometric designs, we recorded these separately, using longhand description and sketches to preserve the details of paint color and design.
Position of Paint Decoration. This information was recorded using the same coding system described for Position of Twine Decoration.

Plastic Decoration. Again, the various modes of plastic decoration have been introduced earlier in this chapter. The code used for plastic motifs is as follows: 00 = none; 01 = single groove; 02 = channeling (parallel grooves); 03 = shallow, nonparallel grooves; 04 = comb impression; 05 = stippling; 06 = stamping; 07 = stabbing; 08 = fingernail impression; 09 = incision; 10 = finger grooves (wide, shallow, linear depressions created by dragging the fingers across wet clay); 11 = parallel ridging; 12 = incised twine; 13 = finger smoothing in arcs (similar to finger grooves except that depressions are less deep, and they are curvilinear); code numbers from 14 to 89 record the presence of two plastic motifs together. For example, 14 indicates the presence of a single groove (code 1) and comb impression (code 4). Code 90 = button appliques (small, round lumps of clay pressed onto the pot surface); 91 = raised relief figures, usually zoo- or anthropomorphic, pressed onto the pot surface; 92 = rocker stamping; 93 = comb dragging in arcs.

Position of Plastic Decoration. Same coding system as Position of Twine and Paint Decoration variables.

Recording sherds individually, rather than as members of classes or types, is extremely time-consuming. In the time available for recording, nearly 3,000 rims from units LX-N, CTR, HK, ALS, WFL and KAN were computer-coded in this manner. The remaining rim sherds from LX-S, HAMB, NWS, and were described and recorded using a typological system that identified a number of distinctive, recurring, time-sensitive pottery types (defined by the co-occurrence of a particular rim form and a particular decorative treatment), whose frequency per stratigraphic level was recorded. The drawbacks of this kind of approach were discussed at the beginning of this chapter. Compensation for the disadvantages of typological recording strategies is that they permit rapid sorting and recording and can be remarkably useful for the limited culture-historical purposes they usually serve. As indicated earlier, the goals and information content of typological and analytical strategies are quite different. They can be profitably used together in any recording system (Rouse 1960; Sabloff and Smith 1969).

After recording the feature sherds in the manner described above, all feature sherds were rebagged and redeposited into the backfill of the excavation units at Jenns-jeno, with the exception of illustrative examples.

Pottery saved for the study collections. Although it would have been desirable to maintain large, permanent collections of these pottery materials, problems of transport and storage space in Bamako could not be resolved, so redeposition or discard became necessary.

RESULTS OF THE ANALYSIS

Many of the essential properties of the Jennd-jeno pottery assemblage are revealed by the use of very simple techniques such as relative frequency tables and graphs (calculated here either by hand or by the Excel software system) and contingency tables. For the latter, we used both Statistical Analysis Systems on
the mainframe computer at Rice, and Statview II software on a MacIntosh SE/30 personal computer. In the discussion of results, I first present a general overview of the entire corpus of excavated pottery from Jennd-jeno, Hambarkatolo, and Kaniana, emphasizing the major artifact modalities through time. I then turn to a description of the major rim classes identified, accompanied by frequency tables illustrating decorative variability within each class through time. This is followed by a detailed consideration of the characteristics of the ceramic assemblage for each of the three chronological phases defined for Jenn6-jeno and its hinterland sites.

Overview of the Assemblages
The major rim/vessel classes identified in the assemblage are summarized visually in Figures 3.7 a-e. Simple rims (from open vessels, closed vessels, and potlids) dominated the pottery assemblage at all three sites in virtually every excavated level (Figures 3.8-3.12). Generally, these simple forms comprise 50-80% of the rims recorded, as was the case with the 1977 assemblage. There is an apparent tendency for simple open rims to decline in relative frequency through time and for potlids to increase. This apparent trend may be due in part to the difficulty of differentiating potlids and open vessels in Phase I/II, given their similarities in rim profile and decoration. By contrast, potlids in Phase IV take on a characteristic bell shape different from open vessels, and their unslipped, twine-impressed surfaces contrast with most of the other rims from the period. Noteworthy among the other classes of rims are simple carinated vessels, which become popular during Phase III and are frequently decorated with channeling and paint decoration above the carination, making them an easily recognizable diagnostic for this phase. Several new rim classes (e.g., beaded carinated, T-rims, inturned acute carinated, and ledged T-rims) appear in Phase IV, contributing to the high level of rim diversity in this phase. Mean rim diameter increases markedly through time.

At all points in time, most vessels had round bases. The ratio of ring, flat, or other bases to rim sherds ranges from 6 to 14 per 100 rims for each excavation unit (Appendix B, Table B1).

Decorated sherds dominate both the rim and body assemblage in all phases. In the earliest levels, plain, undecorated sherds rarely exceed 5% of the rims or body assemblage. (Figures 3.13 and 3.14 illustrate this point with data from LX-N, which produced the largest numbers of sherds.) Although plain body sherds increase in relative frequency through time, averaging 10% in Phase IV, plain rim sherds remain at < 5% throughout the sequence. Sherds decorated with slip alone are more common than plain sherds and increase in relative frequency through time, but they are never a dominant aspect of the assemblage.

Of major importance in the body sherd assemblage at all times is twine impression, which occurs as the sole decoration on 50-80% of the body sherds. Twine is also very common (40-85%) on rim sherds, usually accompanied by other decorative elements (Figure 3.15). For both rim and body sherds, twine occurs in the largest percentages (> 80%) in the earliest occupation levels.
Analysis reconfirms the observation made in 1977 that braided twine roulette exploded in popularity in Phase IV, at the expense of the plaited strip roulettes that had been most common in earlier phases. The consistency of this change in twine popularity is demonstrated by the graphs of the relative frequency of various twine classes on body sherds from units LX-N (Figure 3.16), CTR, ALS, and HAMB, and WFL (Appendix B, Figures B1 a-f, Table B4). Not surprisingly, the same pattern of changing twine popularity holds true for rim sherds (Figure 3.15).

Other types of decoration (paint, plastic) usually occur on < 10% of the body sherd assemblage (Appendix B: Table B3), but are abundant on rim sherds, where the bulk of the potters' decorative efforts were apparently focused (Appendix B1: Table B5). By far the commonest plastic motifs on both rim and body sherds are single or multiple grooves (channeling). In Phase IV, multiple grooves are accompanied by comb-impressed, -incised, or -stamped geometric patterns on 10-20% of the rims. In Phase III, by contrast, geometric and linear designs accompanying channeling are executed in paint, and plastic motifs other than channeling are very rare. Paint may be applied either as a single color-white (most common), red, magenta, or black-or as a combination of white and one or two of the other colors. The incidence of paint decoration peaks in Phase III, where it occurs on 20-50% of all rim sherds. Two general rules for decorating pottery seem to have been observed, with few exceptions, by the Jennd-jeno potters: (1.) Twine and other decorative attributes (paint, slip, plastic) are not superimposed within the same field on the pot surface, and (2.) paint and plastic decoration are placed on or near the rim of the vessel, usually on a slipped surface.

Paste texture is predominantly medium in all phases. However, 10-20% of the rim assemblage in Phase I/Il was very fine-textured, and 10-15% of the sherds from Phase IV were coarse or friable. Approximately half the assemblage in each phase is characterized by the clear red/orange colors that result from full oxidation of ferric oxide clays that have been well fired at moderate temperatures (750-850°C). The unchanging relative frequencies of paste color through time may indicate that firing technology (in open bonfires, as today) did not change through time, and color variation largely reflects the vagaries of open-air firing: half the time position in the fire and wind conditions produce conditions allowing full oxidation and half the time they do not (resulting in gray, light brown/buff, or black paste color).

Pottery

Description of Major Rim Classes

To facilitate discussion, the forty-five rim forms recognized at Jenne-jeno have been grouped into twelve major rim classes. Each rim class comprises one or more rim forms grouped together based on some aspect of morphological similarity. Some classes, such as the two classes of carinated pottery, are far more coherent, and better specified, than others. Groups such as everted rims potentially include a wide variety of vessel shapes and sizes and are relatively poorly specified. Even more problematic are the very large classes of simple open
and simple closed rims, which likely contain rim segments broken off everted or carinated rims at the point of inflection. Nevertheless, these major rim classes are a useful way to describe essential characteristics of the rim assemblage, and to address the issue of formal variation within these classes. Each major rim class is presented by means of a short narrative description of several of its salient characteristics, accompanied by a frequency table showing the range of decorative treatments present within the class, sorted by phase. It is thus possible to ascertain not only how many examples of the rim class were recorded from Phase I/II (early), Phase III (middle), and Phase IV (late) but also how many were decorated with twine, paint, and/or plastic. The tables include data on rim sherds from LX-N, ALS, and CTR, three excavation units where good, unambiguous criteria for phase assignment existed for nearly all levels, and where mixed deposits containing material from more than one time period were rare. Data on the frequency of rim types per level in each excavation unit are provided in Appendix B: Tables B2a-d.

Simple Unrestricted (Open) Rims. The class of simple open rims includes all rim sherds coded as Rim Type 1 with rim angles (of the outer surface with the plane of the vessel mouth) of > 900 and < 1800 (Table 3.3; Figure 3.17a, b).

Table 3.3. Frequency distribution of simple unrestricted (open) rims.

<table>
<thead>
<tr>
<th>Decorative Attributes</th>
<th>Late</th>
<th>Middle</th>
<th>Early</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Twine +PAINT +PLASTIC</td>
<td>20</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>+PAINT -PLASTIC</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>11</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>27</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>Twine +PAINT +PLASTIC</td>
<td>2</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>+PAINT -PLASTIC</td>
<td>15</td>
<td>48</td>
<td>19</td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>8</td>
<td>21</td>
<td>84</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>36</td>
<td>96</td>
<td>93</td>
</tr>
</tbody>
</table>

Levels

Pottery
The distribution of rim diameters within the class is 10-19 cm, 10%; 20-29 cm, 50%; 30-38 cm, 30%; > 38 cm, 10%. There is a great deal of decorative variability within the class. There is a clear predominance in the early phase for twine-decorated rims, either with or without plastic decoration (usually a single groove). But this decorative modality is progressively diluted through time.

Simple Restricted (Closed) Rims. Simple closed rims include all rims coded as Type 1 with rim angles < 900 (Table 3.4; Figure 3.18a, b). Distribution of rim diameters: 10-19 cm, 25%; 20-29 cm, 45%; 30-38 cm, 30%. This class also shows substantial decorative variability, although perhaps not as much as the preceding
rim class. Cell contributions for plastic decoration, with or without twine, are high for Phases III and IV, while twine impression, without paint, is the preferred decorative treatment in the earliest phase.

Table 3.4. Frequency distribution of simple restricted (closed) rims.

<table>
<thead>
<tr>
<th>Levels</th>
<th>Decorative Attributes</th>
<th>Late</th>
<th>Middle</th>
<th>Early</th>
<th>No Twine</th>
<th>+PAINT</th>
<th>+PLASTIC</th>
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<tr>
<td>31</td>
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<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>36</td>
<td>-PAINT +PLASTIC</td>
<td>35</td>
<td>15</td>
<td>5</td>
<td>35</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>-PAINT -PLASTIC</td>
<td>5</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>Twine +PAINT +PLASTIC</td>
<td>11</td>
<td>9</td>
<td>4</td>
<td>11</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>69</td>
<td>+PAINT -PLASTIC</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-PAINT +PLASTIC</td>
<td>16</td>
<td>27</td>
<td>26</td>
<td>16</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>22</td>
<td>-PAINT -PLASTIC</td>
<td>2</td>
<td>11</td>
<td>12</td>
<td>2</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>453</td>
<td>102</td>
<td>107</td>
<td>61</td>
<td>270</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Potlids. Potlids include all rims coded as Type 2 with rim angles > 1800 (Table 3.5; Figure 3.19). Numerous intact potlids were recovered, showing their rounded dome shape in Phase I/II, which evolved to the characteristic bell shape of Phase IV, always with a flat knob handle at the top. Rim diameter distribution is 10-19 cm, 2%; 20-29 cm, 27%; 30-38 cm, 53%; > 38 cm, 18%. In terms of decoration, potlids are perhaps the least variable class of pottery identified. Over 90% of the coded potlids were twine-decorated only, with no paint or plastic.

In addition to the coded potlids, ten small, slipped concave disks with handles, which probably also functioned as potlids, were recorded with the special finds. Because of their small diameter (< 11 cm), we initially interpreted them as potter's tools used either to draw up the vessel wall during forming or to smooth the pot surface afterward. However, examples of similar objects from Killi, El Oualadjji, and elsewhere along the Middle Niger appear to have been lids for tiny pots (Lebeuf and Paques 1970; de Grunne 1983). These ten small potlids are described in Appendix B: Table B6.

Table 3.5. Frequency distribution of potlids

<table>
<thead>
<tr>
<th>Levels</th>
<th>Decorative Attributes</th>
<th>Late</th>
<th>Middle</th>
<th>Early</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Twine</td>
<td>-PAINT +PLASTIC</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>13</td>
<td>3</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>Twine</td>
<td>+PAINT -PLASTIC</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>20</td>
<td>1</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>201</td>
<td>153</td>
<td>55</td>
<td>409</td>
</tr>
<tr>
<td>453</td>
<td>236</td>
<td>157</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>
Beaded Rims. This class includes rims coded as 3, 7, and 12 (Table 3.6; Figure 3.20). Although Rims 3 and 12 look like the same rim with different wall thicknesses, the two differ significantly in other ways. Rim 12 vessels are usually open (94%) and relatively large in diameter (20-29 cm, 30%; 30-38 cm, 52%; > 38 cm, 18%). Rim 3 vessels are also usually open (61%) but tend to be smaller in diameter (12-20 cm, 32%; 20-29 cm, 36%; 30-38 cm, 32%). Rim 7 is quite different from either of these and merits its own class in the future. (It is listed separately on the rim type tables in Appendix B: Table B2). It is generally a closed rim (93%) of small diameter (10-20 cm, 61%; 20-29 cm, 32%). Virtually all the early phase rims in Table 3.6 are Rim 7. They are a diagnostic type for Phase I/II and are discussed in more detail in the next section of this chapter. For Rims 3 and 12, decoration is highly variable.

Table 3.6. Frequency distribution of beaded rims

<table>
<thead>
<tr>
<th>Decorative Attributes</th>
<th>Late</th>
<th>Middle</th>
<th>Early</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Twine +PAINT +PLASTIC</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>+PAINT -PLASTIC</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>8</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>7</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Twine +PAINT +PLASTIC</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>+PAINT -PLASTIC</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>6</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>4</td>
<td>7</td>
<td>15</td>
</tr>
</tbody>
</table>

35 31 51 117

Thickened Outturned Rims (Plates). This class includes rims coded 4, 5, and 6 (Table 3.7; Figure 3.21). It is a coherent class of rims from shallow open vessels (98%) of large diameter (20-29 cm, 9%; 30-38 cm, 41%; > 38 cm, 50%). In a functional typology, this class would be considered to comprise shallow Pottery dishes and plates. These are rare in the early phase. They commonly occur with paint and plastic decoration (channeling) in the middle phase, and with plastic decoration (with or without twine and paint) in the late phase.

Table 3.7. Frequency distribution of outturned thickened rims (plates)

<table>
<thead>
<tr>
<th>Decorative Attributes</th>
<th>Late</th>
<th>Middle</th>
<th>Early</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Twine +PAINT +PLASTIC</td>
<td>9</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>+PAINT -PLASTIC</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>10</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Twine +PAINT +PLASTIC</td>
<td>18</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>+PAINT -PLASTIC</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>15</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>11</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>

69 56 6 131
Everted Rims. The class of everted rims comprises rims coded 8, 9, 10, 11, 13, 17, 37, and 38 (Table 3.8; Figure 3.22a-b). Rim diameters are widely distributed (> 10 cm, 20%; 10-19 cm, 40%; 20-29 cm, 20%; 30-38 cm, 20%). Cell contributions of twine impressed only and of no twine, no paint, no plastic are significant in all phases. Most of the latter group are slipped.

Table 3.8. Frequency distribution of everted rims

<table>
<thead>
<tr>
<th>Decorative Attributes</th>
<th>Late</th>
<th>Middle</th>
<th>Early</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Twine +PAINT +PLASTIC</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>+PAINT -PLASTIC</td>
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<td>1</td>
<td>3</td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>11</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>13</td>
<td>5</td>
<td>16</td>
</tr>
</tbody>
</table>

Twine +PAINT -PLASTIC 1 2 3
-PAINT +PLASTIC 5 7 12
-PAINT -PLASTIC 10 5 10 25
45 17 39 101

Carinated Beaded Rims (Type A). Rims 18 and recognizable diagnostic of Phase IV (Table 3.9; Figure 3.23). between 20 cm and 38 cm in diameter (30-38 cm, 55%) Ninety percent are Fire blackening is frequent, indicating their use in cooking. Plastic decoration, with or without twine, is the preferred decoration.

Table 3.9. Frequency distribution of carinated beaded rims (type A)

<table>
<thead>
<tr>
<th>Decorative Attributes</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Twine -PAINT +PLASTIC</td>
<td>31</td>
</tr>
<tr>
<td>-PAINT -PLASTIC 14 Twine -PAINT +PLASTIC</td>
<td>31</td>
</tr>
<tr>
<td>-PAINT -PLASTIC 6</td>
<td></td>
</tr>
</tbody>
</table>

Carinated Simple Rims (Type B). This class includes Rims 20, 21, and 22 (Table 3.10; Figure 3.24a-b). Distribution of diameters is very similar to the preceding class; 20-29 cm, 40%; 30-38 cm, 52%. Use in cooking is indicated by frequent fire blackening. This type of carinated rim is rare in Phase I/II, but is diagnostic, with paint and plastic decoration, of Phase III. The type persists into Phase IV, where it is decorated with paint and plastic or just plastic motifs. Twine is usually present below the carination, but breakage at the carination is common.

Table 3.10. Frequency distribution of carinated simple rims (type B)

<table>
<thead>
<tr>
<th>Decorative Attributes</th>
<th>Late</th>
<th>Middle</th>
<th>Early</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Twine +PAINT +PLASTIC</td>
<td>19</td>
<td>22</td>
<td>41</td>
</tr>
<tr>
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<td>18</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Twine +PAINT +PLASTIC</td>
<td>10</td>
<td>49</td>
<td>4</td>
</tr>
<tr>
<td>-PAINT +PLASTIC</td>
<td>10</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>-PAINT -PLASTIC</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
T-Rims and Ledged T-Rims. This class comprises coded rims 15, 16, 29, 30, and 33 (Table 3.11; Figures 3.25, 3.26). Distribution of diameters is 20-29 cm, 45%; 30-38 cm, 45%; > 38 cm, 10%. The rims, usually decorated with plastic motifs (no paint) on the horizontal surface of the T, are diagnostic for Phase IV. Their occurrence in earlier phases (in Unit CTR) is likely due to mixing of deposits or data entry error.

Pottery

Table 3.11. Frequency distribution of T-rims and ledged T-rims

<table>
<thead>
<tr>
<th>Levels</th>
<th>No Twine</th>
<th>+PAINT +PLASTIC</th>
<th>+PAINT -PLASTIC</th>
<th>-PAINT +PLASTIC</th>
<th>-PAINT -PLASTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late</td>
<td>13</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bottles. This is a morphologically diverse group (rims coded 24, 25, 26, 27, 28, and 29) defined by small rim diameter (< 10 cm) (Table 3.12; Figure 3.27). Commonly, these rims were not decorated with twine, paint, or plastic but were slipped. Examples with elaborate paint decoration or multiple flanges do occur, however.

Table 3.12. Frequency distribution of bottles

<table>
<thead>
<tr>
<th>Levels</th>
<th>No Twine</th>
<th>+PAINT +PLASTIC</th>
<th>+PAINT -PLASTIC</th>
<th>-PAINT +PLASTIC</th>
<th>-PAINT -PLASTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Middle</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overhanging Rims. Comprising rims coded 14, 42, and 44, this is a class of rims from vessels large enough to be used for storage (Figure 3.28). This is also the class of rims used for funerary urns (see Chapter 2 for description of intact urns; Table 3.13 includes only rim fragments). Rim diameters exceed 38 cm in 45% of the sherds, and fall between 30 cm and 38 cm in another 40%. Decoration is variable, but commonly there is no paint or plastic.

Pottery

Table 3.13. Frequency distribution of overhanging rims

<table>
<thead>
<tr>
<th>Levels</th>
<th>No Twine</th>
<th>+PAINT +PLASTIC</th>
<th>+PAINT -PLASTIC</th>
<th>-PAINT +PLASTIC</th>
<th>-PAINT -PLASTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>14</td>
<td>17</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Inturned Rims. This class includes Rims 35 and 45, both marked by an acute carination (the angle of the inturned rim to the body is > 90°) (Table 3.14; Figure 3.26). Rim diameters are distributed as follows: 20-29 cm, 25%; 30-38 cm, 35%; > 38 cm, 40%. They tend to be decorated with plastic, with or without twine, and occur only in Phase IV.

Table 3.14. Frequency distribution of inturned rims

<table>
<thead>
<tr>
<th>Decorative Attributes</th>
<th>Levels</th>
<th>No Twine</th>
<th>-PAINT +PLASTIC</th>
<th>Twine</th>
<th>-PAINT +PLASTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22</td>
<td>7</td>
<td>29</td>
<td>29</td>
</tr>
</tbody>
</table>

Several minor rim classes (N < 20) were also identified. Two kinds of trilobate pot rests or braziers were found, represented by Rim Type 40, with lobed pot supports internal to the rim, and 41, with lobes integrated as part of the rim. Some of the latter may have been the rims of trilobate steamers, one complete example of which was recovered (Figure 3.29). Perforated fragments of steamers were recovered from deposits of all phases, as were Rims 40 and 41. Other rims recognized included the miscellaneous ledged rims (31, 32, and 36) closely related to carinated forms, thickened Rim 43, and Rim 23, an everted rim with carination (Figure 3.30). In each case, the total number of examples did not exceed ten. It is also appropriate to mention that twentyeight small, cuplike pinchpots, some very crudely made, were found during excavation (Appendix B: Table B7). Additionally, single examples of a painted pottery cylinder, a ceramic drainpipe, and a funnel were recovered (Figure 3.31), as well as a brazier with internal lobes to support a pot above a small fore in the bottom of the brazier (Figure 3.32, lower right).

Summary Description of the Jennd-jeno, Hamarketolo, and Kaniana Assemblages, by Phase

Phase I/I (c. 250 B.C.-A.D. 350). The pottery assemblage in the earliest levels consists primarily of simple rims from ovoid-shaped open bowls, restricted globular jars (Rims 1 and 7), and domed potlids. Together, these constitute 70-100% of the rim sherds in early occupation levels. Rims from more complex forms (everted rims, carinated forms) are rare. Many of the Phase I/I vessels must have had rounded bottoms, since the ratio of base to rim sherds is 12.5/100 (calculated for the LX-N sample). Ring bases predominate, but flat and pedestal bases are also found (Figure 3.27). Several fragments of cylindrical potlegs were
also recovered. Rim diameters are generally small (Figure 3.33), and there are remarkably few sherds with demonstrable signs of use as cooking pots.

In general, Phase I/II pottery was very well made. Paste was predominantly medium textured, with grog tempering. Occurring in variable frequencies was a distinctive category of thin-walled, finely prepared pottery we nicknamed "chinaware" (because of the high-pitched clicking, reminiscent of fine china, made when two sherds were knocked together). Its fine fabric is responsible for its high-pitched sound and refined appearance: the paste includes clay, variable amounts of quartz sand, and a small quantity of finely ground grog. Sherds with medium-texture paste have larger amounts of coarser grog. This fineware was produced only in Phase I/II. The care with which it was produced is evident not only in the fineness of the paste and the thin walls but also in the exceptionally smooth and even surface finish (Plate 20). From the fine surface lines, it is clear that a tournette was used to turn the pot slowly during manufacture, just as it is by Jenn6 potters today. The careful smoothing was probably done with a piece of leather. One fineware rim and several others in the Phase I/II study collection had the characteristic dimpled surface created by the hammer-and-anvil technique, which is usually used on a formed vessel to obliterate irregularities, thin the walls, and smooth the surface, among other reasons (Rice 1987:137).

The dominant decorative mode in Phase I/II is twine impression. Over 75% of the body sherds are decorated with twine alone (plain sherds = < 5% of the body sherds; slipped = 10-15%). Impression with a plaited strip roulette (Twine 4/5) accounts for 70% of the twine-decorated body sherds. Rim sherds have smaller relative frequencies of Twine 4/5 and larger frequencies of twisted twine rouletting (Twine 6/7) due to the popular practice in Phase I/II of placing a zone of Twine 6/7 impression near the rim, directly above the Twine 4/5 impression covering the greater part of the pot surface. In addition to using Twines 4/5 and 6/7 on the same pot, other decorative modes unique to Phase I/II include rockering, fine horizontal incision superimposed on

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Twine 6 or 12 (e.g., Plate 20), cord-wrapped stick roulette, and red paint applied in cross-hatching on an unslipped zone below the lip of simple open bowls. Black and white paint and channeling (multiple grooves) are virtually nonexistent in the early part of this phase. They appear at the end of the phase, foreshadowing the explosion in popularity of paint-and-channeled pottery in the succeeding phase. With the exception of single grooves and incision (on twine), other plastic motifs are largely absent throughout Phase I/II, although two examples of raised appliqué were recovered, both on singular objects that may not have been used in a domestic context (Figure 3.32).

Three diagnostic types have been recognized for Phase I/II, which together constitute between 30% and 50% of the rim assemblage. These types are defined broadly as particular rim forms consistently associated with specific decorative attributes. For each recognized type, the rim form and decorative characteristics associated with it are described. Since there is variation within each type, the
variables accounting for much of the observed variation are noted under the rubric "major axes of variation within the type."

Type IA. Simple unrestricted twine-impressed vessels with slipped rims (Figure 3.17a, top; Plate 20).

Type 1B. Simple restricted twine-impressed vessels with slipped rims (Figure 3.18a, top; Plates 21-22). For both of these types of Rim 1, the associated decorative attributes are identical: they are unslipped with twine impression over most of the vessel surface, with the exception of a zone at the lip that is either slipped or painted with a red cross-hatch design. Major axes of variation within Types IA and 1B are width of slipped or painted zone below lip, paste (some fineware), presence or absence of a single groove demarcating the boundary between twine and slipped zones, presence or absence of incision superimposed on twine immediately below slipped/ painted zone, and presence or absence of ring or pedestal base.

Type IC. Restricted twine-impressed globular vessel with slipped, slightly everted and rolled rim (Rim Types 7-8, Figure 3.20; Plates 21-22). This type, too, is unslipped and covered with twine impression over most of the vessel surface, excepting a zone of slip at the lip. The slipped zone and the twine-impressed zone are immediately adjacent. Red cross-hatched paint does not occur. Major axes of variation are width of slipped zone (may extend onto shoulder of vessel), paste (some chinaware), and presence or absence of incision superimposed on twine immediately below slipped zone.

Late in Phase I/II, small relative frequencies of channeling and black or white paint occur within each of these types (Plates 23-24). Chinaware becomes less frequent and finally disappears by the end of the phase.

Phase III (c. A.D. 350-850). Simple unrestricted and restricted vessels and plus potlids continue to dominate the rim assemblage, together accounting for 50-70% of all rims. Simple restricted rims with carination become popular in this phase and account for 10-30% of the rims in the phase. Thickened outturned rims from shallow dishes and plates also become important. Mean rim diameter increases rapidly fairly early in the phase (Figure 3.33). The distinctive curved tripod legs of Tellem bowls (R. Bedaux 1980) occur in small numbers, usually painted and, so far, always broken off the vessels of which they were a part (Figure 3.27) Bases (ring, flat, pedestal, and Tellem ) occur in the ratio of 16 bases/100 rims. Twine decoration continues to be the dominant decorative mode. Between 60% and 75% of the body sherd assemblage is twine-impressed; plain sherds remain infrequent (< 10%), and slipped sherds account for 10-15% of the body assemblage. Early in the phase, plaited strip twines are extremely popular, as they were in the preceding phase. But braided twines grow in popularity, increasing from 10% to 50% of the twine-decorated body sherds at the end of the phase. The most significant decorative characteristic of Phase III pottery is the high incidence of paint decoration. Paint occurs on 20-50% of the rim assemblage and 2-5% of the body assemblage, either in monochrome (black or white) or
polychrome (white, black, and/or red/magenta) application. Paint is often superimposed on channeling, which is the only plastic decorative motif of any importance in this phase. We have recognized several different, but related, styles of paint decoration (Plate 19). Most common is monochrome or polychrome on channelled and slipped pottery. Here, one or more colors of paint are applied in or over the channels on deep-red slipped rims. This application can be linear (parallel to the channels), which is by far the most common occurrence, or it can be geometric, with lines painted both parallel and perpendicular to the channels or with cross-hatched triangles or lozenges painted over or adjacent to the channeling (Figure 3.34, Plate 25). Within this latter class is the rare and interesting geometric white on red slip, where elaborate designs (lozenges, triangles, cross-hatching) accompany linear paint on channeling over large areas of the surface of red-slipped vessels (Plate 26). From the partially fugitive nature of the white paint, it appears that the white paint was applied just after firing. These pieces could not, therefore, be washed without removing much of the design. Geometric white on red has been recovered only from late Phase III deposits. A small number of geometric red- or black-on-white designs were also found, where part of the surface of the pot had been painted white, with cross-hatching executed in black or red/brown paint over the white. Early in the phase, linear white on unslipped twine is fairly common, in which a horizontal band of white paint is applied over twine impression, usually at the lip of unslipped rims. All of these paint styles occur in Phase III deposits; only linear monochrome on channel and slip continues into Phase IV.

Three pottery types diagnostic of Phase III have been recognized, two of which have early and late variants, designated by letters from the first and second halves of the alphabet, respectively.

Type III A. Simple unrestricted twine-impressed rims with white linear paint. These are unslipped and decorated with twine impression over the entire surface of the vessel. A thin band of white paint is applied over the twine just below the lip of the vessel. Major axes of variation: twine motifone or two may be present; paint-red lines superimposed on the white zone and perpendicular to it (rare) (Plate 19).

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Type III B. Thickened outturned rims with channeling and paint (Figure 3.21). This type includes Rims 4, 5, 6, and 12 with rim angles > 1350. They are shallow vessels usually termed dishes and plates. Consistently associated decorative attributes are slip and one or more grooves on the lip and interior of the vessel, paint applied over channeling, and twine impression on the unslipped outer surface of the vessel below the rim. Major axes of variation are number and exact placement of grooves on lip and interior, and paint color and style (linear or geometric on channel). Later Phase III variant is IIIR, which is Type IIIB with a zone of shallow channeling and paint on the outer surface between the rim and the twine impression.

Type III C. Simple carinated rim with channel and paint (Figure 3.24a). This type includes Rims 20, 21, and 22 with the following decorative attributes: slipping
and channeling on rim above the carination, paint applied over the channels, and twine impression on the unslipped outer vessel surface below the carination. Major axes of variation are color and style of paint (linear or geometric, monochrome (white) or polychrome) and twine motif. A later Phase III variant is IT, which adds to IIIC a zone of shallow channeling and paint between the carination and the twine impression (Figure 3.24a, Plate 25).

Phase IV (c. A.D. 850-1400). Unrestricted simple rims decline significantly in relative frequency in nearly all levels attributable to this phase. Potlids, however, appear to increase, such that the three classes of simple rimsunrestricted, restricted, and potlids-still account for 50% of the rim assemblage. Thickened outturned rims from shallow dishes and plates remain a significant part of the assemblage. New rim forms appear, most of which are related to, or variants of, carinated forms: beaded rims with carination (Rims 18 and 19), T-rims and their variants, ledged rims, and inturned acutely carinated rims. Flanges appear on bottle rims, and tabular potlegs appear as a new kind of pot support.

Twine decoration remains a dominant decorative mode, occurring on just over 50% of the body sherd assemblage and 40-60% of the rims. Braided twine accounts for 60-80% of the twine-decorated sherds. Relative frequencies for paint decoration on rims decrease to around 10%. Among the painted sherds, distinctive geometric white-on-red ware continues into the early part of this phase, then disappears. In contrast, frequencies for plastic motifs other than channeling shoot up to 10-25%. Indeed, the combination of channeling and other plastic motifs (especially incision, comb impression, and stamping) in geometric patterns such as cross-hatching, chevrons, and triangles is the dominant decorative mode for rim sherds in this phase (Figure 3.35). Particularly appealing examples of this mode include numerous sherds of finely channeled, red-slipped pottery with intricate geometric or zoomorphic designs incised in geometric style over the channeling (Plates 16 and 27). Incision and comb dragging in arcs over Twine 1 also occur in this phase, as does fingernail impression, often placed on a carination. Appliqued of raised-relief zoomorphic or anthropomorphic figures to the pot surface also appears to be restricted to Phase IV (Figure 3.36; Appendix B: Table B8).

Diagnostic types recognized are as follows:

Type IVB. Thickened outturned rim from shallow dish or plate (Rims 5, 6, and 12)-Figure 3.21. The form of this type is virtually identical to Type IIIB, but the decoration differs. Rims of type IVB are red-slipped and channeled inside and on the lip, are not painted, and have braided twine decoration on the unslipped outer surface below the rim. Major axes of variation are number and fineness of channels, and presence or absence of other geometric plastic motifs.

Type IVC. Beaded carinated rims (rims 18, and 19)-Figure 3.23, Plate 28. Above the carination, these rims have red slip, and channeling in one or two zones with another plastic motif (Twine 1, comb impression, incision) adjacent; below the carination, they are unslipped with braided twine decoration. The carination is fingernail-impressed.
Type IVD. Inturned acute carinated rims (Rims 35 and 45)-Figure 3.26. Red-slipped and plastic-decorated at rim, unslipped with braided twine impression below carination. Major axes of variation are presence or absence of channeling at rim, presence or absence of other plastic motif at rim, and presence or absence of fingernail impression on carination.

Type IVE. Ledged T-rims (Rims 29 and 30)-Figures 3.25, 3.26. Identical decorative attributes to IVD.

DISCUSSION

Although some authors have used the phrase "diachronic homogeneity" in describing the ceramic traditions of the IND (Gallay and Huysecom 1989; Gallay 1986), the detailed analysis described in this chapter has documented a number of fundamental changes in ceramic technology, form, style, and diversity over the course of the Iron Age sequence at Jenn6-jeno. At the same time, it is true that these specific changes occurred within a generally conservative ceramic tradition, in which the overall approach to pot shape and decoration showed remarkable continuity in some aspects over a millennium or more. In the last section of this chapter, I attempt to move beyond description and culture-historical considerations to discuss some of the implications of both change and continuity in the ceramic assemblage for our understanding of society at Jenn6-jeno.

Let us first consider one of the most striking changes that occurs in the pottery, namely, the increase in average rim diameter by almost 40% between early Phase I/II levels and Phase III (Figure 3.33). In LX-N, where sample size is large enough for meaningful analysis, the average for all sherds with measurable diameters was between 21.5 cm and 23.5 cm in initial occupation Levels 48-51. In early Phase III Level 41, it shoots up to 32 cm, and an average of 31-32 cm is the mode throughout the rest of the sequence. Breakdown of these data into major rim groups demonstrates that this phenomenon of a significant increase in rim diameter between Phase I/II and Phase III occurred in all of them (Figure 3.37).

Recent ethnoarchaeological work on pottery in areas within and adjacent to the Inland Delta provides an indispensable context for interpreting this size shift.

Research on the pottery of the Dogon (R. Bedaux 1986; Gallay 1980), the Bambara (Raimbault 1980), and the Sonink6 (Gallay 1970) has affirmed the significance of size in reflecting the function of domestic pottery. Gallay's plots of maximum circumference and height for a sample of modern Dogon and Sonink6 pots shows how pots used for storage of water and, sometimes, grain form a discrete group on the basis of size alone (Figure 3.38). Another major morphological criterion relevant to pot function is orifice size relative to the maximum diameter of the vessel. Extremely restricted orifices (often less than one-third the size of the maximum body diameter) are characteristic of vessels used to transport liquids. Orifice size for other functional pot categories is proportional to the frequency of access to or changeover in the contents of the vessel (M. Smith 1985). Since most of the functions served by African domestic pottery, other than transport and storage of liquids, involve repeated access to
vessel contents (e.g., cooking of grains and sauces, washing, drinking, preparation of beer), most vessels have orifices that are proportionately large, 66% to >100% of the maximum body diameter. Their size typically reflects the size of the job for which they are used. Based on the criteria of vessel size and orifice diameter relative to maximum body diameter, the common functions of African pots can be assigned as follows:

<table>
<thead>
<tr>
<th>VESSEL SIZE</th>
<th>RELATIVE ORIFICE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMALL</td>
<td>SMALL Beer storage, Water transport, Water storage ablutions beer storage Sauce bowl, sauce Cooking pots (sauce, LARGE pot, frying beignets, millet, rice), washing Water storage, washing drinking, oil storage, storage, beer fermentation and dyeing cloth, other ablutions tation and storage storage</td>
</tr>
</tbody>
</table>

This size-based classification is generally applicable to a wide range of West African pottery, regardless of the specific vessel and rim shapes involved (see Figure 3.39). As a general functional principle, rim shape on cooking pots and water pots, where dropage is dangerous in one case and wasteful in both, usually incorporates features allowing a sure grip. Among these, one finds everted, carinated, and collared rim forms, as well as cordonage, lugs, and handles. The rarity of cooking vessels with unrestricted simple rims lacking any of these latter features is notable.

In light of these ethnoarchaeologically derived principles, the Phase I/II pottery assemblage appears to be very different functionally from the later assemblages at the site. Foremost, the simple unrestricted rims comprise over half the assemblage, a composition that is unparalleled in any West African ethnographic pottery assemblage of which I am aware. Three-quarters of the recorded simple open rims from LX-N were large enough sherds to show clearly the shape of the vessel past its midpoint, demonstrating that these are not fragments of everted rims broken off at the neck. The majority of these pots are shallow, small-volume bowls. Whatever the function of these bowls, it did not involve fire, since very few showed fire blackening. Indeed, the general rarity of fire blackening throughout the Phase I/II assemblage raises the question, Where are the cooking pots? Based on the functional principles discussed earlier, only three rim groups-everted, Rim 7, and simple restricted-are possible candidates. We must reject the Phase I/II everted rims immediately; their low average rim diameter of 11 cm is more consistent with a function as water pots. The other two groups also have small average diameters (16 cm and 17 cm, respectively), but the presence of fire blackening on a number of simple restricted rims suggests that some were used for cooking. Two aspects of the cooking pot issue are very puzzling: the very small size of those vessels that demonstrably were used on or near the fire and the scarcity of cooking pots in the assemblage.
Ethnoarchaeological studies repeatedly have shown that cooking pots tend to have a very short use-life and thus should be one of the highest-frequency components of the domestic pottery assemblage (R. Bedaux 1986; David 1972; David and Hennig 1972; Rice 1987:296). On the other end of the use-life continuum are large storage jars, which are rarely moved and thus endure longer than perhaps any other component of the assemblage. We would thus expect rims from large storage pots to constitute a small proportion of the total assemblage. In fact, such jars are absent from Phase I/II, a third interesting aspect of this puzzling assemblage.

How can we account for these intriguing characteristics of the Phase I/II pottery, and for the rapid changes that occur in early Phase III? Several possibilities come to mind. It is always possible that the excavated Phase I/II assemblage is a skewed sample and does not represent the entire ceramic assemblage used during this phase. Poorly represented or absent categories, such as cooking pots and storage jars, may be present in greater numbers in other, as yet unexplored, parts of the Phase I/II deposits. However, the basic similarity of the Phase I/II pottery assemblage from all the excavated units on Jennd-jeno and Hambarketolo, as well as from Dia, 50 km to the northwest, where the same early assemblage was found, suggests that this is not the case. Alternatively, if these deposits at Jennd-jeno represent intensive seasonal occupation of the site annually, the full range of pottery used by the inhabitants during Phase I/II may not be present at Jennd-jeno. Again, available facts contradict this interpretation. That some pains were taken to improve the durability of the thatch-and-pole dwellings of the period by facing them with daub is more consistent with an interpretation of extended occupation at the site at that time. If, then, it is possible that the excavated assemblage does to some reasonable degree represent the major aspects of the Phase I/II pottery assemblage, what accounts for the scarcity of cooking vessels, the small dimensions of the pottery, and the abundance of small open bowls? And why do these characteristics change so dramatically in early Phase I? The most likely explanations concern food preparation preferences and family size, both of which seem to have changed significantly from early Phase I/II to early Phase III. It is likely that these changes indirectly reflect significant shifts in population size and density, as well as social organization at the site.

In Soninké, Dogon, and Bambara societies, where ethnoarchaeological work has documented pottery assemblages broadly comparable in size and functional categories to the Phase III and IV assemblages at Jenn -jeno, the culinary mainstay is the vegetable sauce or stew, with meat or fish, served over boiled or steamed grain. The cooking pots associated with stewing and boiling are generally rare in Phase I/II. Steamers, while present, are also rare. The importance of grains, meat, and fish in the Phase I/II diet is, however, demonstrable. Rice and Brachiaria ramosa are abundant in the paleobotanical samples. Millet and sorghum are also present. Sandstone grinders suitable for processing these grains are particularly abundant in Phase I/II deposits. I suggest that a primary food preparation technology based on baking and roasting or grilling is consistent with
the recovered ceramic assemblage. Under this hypothesis, grains would have been consumed primarily in the form of unleavened bread pancakes, which can be prepared successfully without either formal ovens or ceramic utensils, as Nicolaisen’s description of the Ahaggar Tuareg’s method of baking such bread demonstrates:

A heavy fire is lit in a shallow depression (about 25-30 cm in diameter and 8-10 cm deep) made into fine-grained sand. When this fire has burnt down, the embers and most of the ashes are moved [to the edge of the depression] .... and a thin porridge or gruel of flour and water is poured out into the depression ... a bunch of dry grasses . . . [is lit] over the gruel [to harden its surface], and it is then covered with hot fine-grained sand, ashes and embers.... The gruel bread . . . is taken out after about twenty minutes to be turned and baked in the same way on the other side for a few minutes. . . . [The bread] is finally removed to be washed with water. It is broken into pieces and eaten from a large wooden bowl with liquid butter. (cited by Lewicki 1974:159, n. 246)

If cereals were routinely being prepared in this fashion by the earliest inhabitants of Jennd-jeno, we might expect to find high concentrations of grass ash, wood charcoal, and burnt earth in the deposits, all of which are characteristics of classic early Phase I/II deposits.

Given the small size of the cooking pots in Phase I/I, sauces, if prepared, were not made in any considerable volume. This suggests that meat and fish were not added to sauces as the major mode of their consumption, nor would they likely have been boiled or fried, unless they were prepared in very limited quantities. I suggest, rather, that meat is likely to have been grilled or roasted, and fish grilled or smoked. This hypothesis must remain extremely tentative, since no positive evidence in support of it can be cited at present. As larger faunal samples become available from Phase I/II in the future, evidence for cooking practices may ultimately be adduced. While the evaluation of faunal material for clues to these practices is tricky, since bone can be secondarily charred after the meat is prepared and consumed, and the use of meat chunks cut off the bone for stewing or grilling on skewers potentially produces indistinguishable bone assemblages, nevertheless, careful study may provide insights.

Small vessel size in Phase I/II may also reflect small family size and/or limited capacity or requirement for storage. Rims large enough to come from water storage pots with the over-twenty-gallon capacity common in the area today first appear in Phase III. If, as I have suggested, early settlement at Jennd-jeno was adjacent to the perennially flowing Senuba, water would have been easily accessible to all inhabitants of the site. As the late Holocene drying trend continued, and the Senuba retreated approximately to its present position at the end of Phase I/II, the longer transport distance involved may have made it desirable to restrict water fetching to one part of the day, resulting in a need for vessels able to hold a whole day's water requirement for a family.
The increase in the size of all major rim groups in Phase III may indicate change, not only in the way food is prepared but also in the size of the group for whom it is prepared. Conceivably, these two are related. I suggest that the proposed shift from consumption of baked grains in Phase I/II to boiled grains in Phase III is in part a response to the high labor costs of milling flour for bread with hand-held grindstones (particularly since the grindstones had to be imported from a considerable distance). As family size increased, a shift to boiling of whole or pounded and broken grains would have been a natural response. In Phase III, the quantity and size of sandstone grinders diminishes, carinated cooking pots appear, and potlids become a significant component of the ceramic assemblage. Large, shallow dishes and plates (average diameter 38 cm) also appear in Phase III, possibly used as the communal serving dish from which a whole family would eat. (Although such plates are reported ethnographically as potter's tournettes [Musée de l'Homme collections from the Mission Dakar-Djibouti, Item 31.74.1256 from Koutiala], the number of such plates from excavations is too large to permit this interpretation for all of them.) Wooden dishes and calabashes commonly fill this function today. It is noteworthy that the Phase IV pottery assemblage is very similar to that from Phase III in all these respects. The major functional shift in the Jenné-jeno pottery occurs between Phase I/II and Phase III. This functional shift accompanies a notable change in pottery production techniques for a significant component of the assemblage: fineware disappears at the end of Phase I/II. Fineware, it will be recalled, is characterized by extremely thin walls (3-6 mm, on average) and a fine, homogeneous paste tempered with quartz sand and finely crushed grog. While the increased quantity and size of cooking vessels in Phase III predictably results in an increase in the amount and size of temper, both to improve resistance to thermal shock and to keep large vessels from collapsing under their own weight during forming (Rye 1981:27), it does not explain why fineware ceased to be produced. The results of physical analyses (petrographic examination of thin sections, calculations of apparent porosity) undertaken by K. MacDonald (n.d.) indicate that fineware and coarseware are made from the same clays. Pairing of stylistically similar fineware and coarseware rim sherds for analysis revealed no systematic differences in apparent porosity that might indicate functional distinctions. Pending further studies on larger samples, it would appear that the differences between fineware and coarseware at Jenné-jeno are due exclusively to the greater coarseness and quantity of grog temper added to the latter. No likely functional correlates of these differences in temper have yet been identified within the assemblage. Since stylistically identical fineware occurs in great abundance at Dia, the possibility that the fineware at Jenné-jeno was produced in Dia was explored. However, the samples analyzed indicate that the pottery at both sites was made locally. Given the oral tradition recorded at Jenné by Monteil (1903, 1971) that Nono (Soninké) from Dia settled among Bozo autochthones at the founding of Jenné-jeno, future studies of Phase I/II pottery might profitably focus on paste preparation and pot-forming techniques to examine further the possibility...
that two different potting traditions were present. Arnold (1985:236) points out that, since pot-forming patterns and their associated motor habits are probably the most conservative aspect of a ceramic complex, they can be used to identify macropopulations in time and space. The differences in forming techniques among Somono and Peul potters in the IND today underscores this point (Gallay and Huyscom 1989; LaViolette 1987). Recent work by Gosselain (1992) in Cameroon provides additional empirical support for the assertion that the pot-forming process, which is neither externally constrained nor sensitive to innovation, provides a reliable index of cultural diversity.

Another aspect of diachronic change in the Jenn6-jeno pottery assemblage is an increasing tempo of stylistic shifts in rim form and decoration, such that each succeeding phase encompasses a significantly more diverse array of pottery. The Phase I/II assemblage, dominated by three major rim groups, each of which displays considerable decorative homogeneity, is remarkable for its lack of diversity. If we count the number of major rims types represented more than ephemerally (N > 2 in each excavation unit) in Phase I/II, there are only seven. This number rises to eleven in Phase III, with the appearance of new forms such as plates, carinated rims, and the overhanging rims of funerary urns, and to fourteen in Phase IV. More significant, the amount of within-group variation increases substantially through the last two phases, both in terms of rim morphology and decoration. Bottles, for example, present with simple rims since Phase I/II, display a wide variety of collared and flanged forms from late Phase III through Phase IV. Maximum diversity in the shape of carinated cooking pot rims also peaks in Phase IV. Subsequent to Phase I/II, in which members of a major rim group such as simple unrestricted rims were virtually all twine-decorated, within-group decorative modes increase in number to include slipping, slipping and painting, and channeling, alone or in combination with twine impression. This increased assemblage diversity suggests an increasingly heterogeneous Pottery population as well as changes in the pottery production system at Jenn6-jeno, which merit detailed, problem-oriented studies in the future along the lines suggested by Rice (1984).

The diachronic changes documented in the Jenn6-jeno pottery assemblage are summarized in Figure 3.40. It is worth noting that very little of the observed change correlates in an easy or convincing way with the major cultural changes that affected the region, including conversion to Islam, political instability following the fall of the empire of Ghana, and incorporation of Jenn6 into the empire of Mali (a point also made by Gallay 1986:140). All these changes occurred during Phase IV. While it is true that certain kinds of decoration, such as geometric white on red (terminal Phase III) and pattern stamping ( late Phase IV) may reflect North African influence (see, e.g., the rosette and square-stamped pottery from contemporary levels at Qsar es-Seghir, Redman 1986:71, 117), these novelties appeared on a very small proportion of the pottery. The possibility that the wholesale shift from geometric paint to geometric plastic decoration at the beginning of Phase IV reflects a change in potting practices, such as the discovery
or adoption of postfiring "trempage" in a vegetable decoction to obtain a shiny, deep-red surface (as reported by Raimbault [1980] for Bambara potters at Kalabougou), should be investigated as an alternative to invocations of external agencies. It is now clear that certain types of pottery that were earlier assumed to reflect North African, Islamic influence, including painted pottery, bottles, and carinated pots, have a lengthy pre-Islamic history at Jenné-Jeno.

The flip side of the changes observed in the Jenné-Jeno pottery is the tremendous conservatism displayed by the assemblage through time. If we look beyond the specific changes in rim form and decoration that occur, we find a general approach to pot shape and the placement of design elements on a pot that changes very little over more than a millennium. Throughout the sequence, pots are predominantly round-bottomed with simple or composite contours and a rarity of inflected or complex contours (following Shepard's [1974:231] general system of shape classification). In important functional sectors of the assemblage, such as cooking pots, it is possible to trace the evolution and elaboration of form (Figure 3.41). If we then go on to consider the design syntax employed in decorating these pots, the magnitude of the conservatism underlying outward modifications in form becomes apparent. Following Hardin's (1984; Friedich 1970) approach to the structure of decorative style, it is possible to identify the decorative zones filled by the Jenné-Jeno potter and some of the rules observed in placing design elements within these zones. For cooking pots, perhaps one of the most conservative aspects of a ceramic assemblage (Rice 1984a:245), we can see that the decorative grammar governing placement of design elements (twine impression, channeling or incision, paint, plastic) does not change. Zone A, the area between the carination and the mouth of the vessel, is the focus of paint and/or plastic decoration and slip. Zones B and C, below the carination, are normally filled with a continuous field of twine impression and remain unslipped. The only exception to this is in late Phase III, when paint and channel elements were sometimes placed in zone B on a certain kind of Pottery carinated rim. In Phase IV, the traditional design grammar is reasserted.

Approached in this way, it is possible to see how much more similar the Jenné-Jeno pottery is in its decorative grammar to modern Soninké pottery over 300 km away in Nara than it is to modern Bambara pottery 100 km away near Sdgou (cf. Raimbault 1980; Gallay 1970).

It is almost certainly this conservatism in decorative grammar and general vessel form that led Gallay (1986) to describe the ceramics of the Upper IND as "diachronically homogeneous." Finding little reflection of major historical events in the ceramics, Gallay concludes that the relationship between pottery and the wider culture producing and using it is only partial. Ceramics do not reflect equally all aspects of that culture. In 1979, Adams drew similar conclusions from Nubian ceramic data and sensibly pointed out the dangers of over interpreting change or its absence in a pottery sequence. We can certainly agree that pottery is not a perfect mirror for society and that expectations for material expressions in pottery of historically significant events are regularly confounded. Yet, let us also
admit the dimensions along which archaeologists have traditionally measured change are very limited. Initially, archaeologists thought the pottery throughout the Inland Delta all looked the same because of the high frequency of twine rouletting. Later studies, including the present one, showed that roulette motifs changed significantly in popularity through time. It is reasonable to expect that future research on unstudied aspects of IND pottery, such as paste texture, composition, and preparation, will reveal periods of change of which we are now totally unaware. Rice (1984a) has very elegantly laid out for us the complexity of pottery production systems, with their technical and socioeconomic subsystems and a multiplicity of factors influencing ceramic stability and change. Her formulation reminds us that change and stability are equally interesting aspects of a ceramic sequence; both occur for reasons that are potentially knowable. And both can occur simultaneously in a given assemblage, as when new pottery forms appear within an unchanging production technology, or new decorative motifs appear within a stable stylistic system of decorative grammar and pot forms. With IND ceramic studies still in their infancy, it is fair to say that we are probably still a very long way from being able to fully characterize stability and change in the Upper IND pottery sequence. Already, however, certain intriguing examples of change within the Jenn6-jeno sequence have us posing a series of "why" questions. Why does fineware disappear? Why do the functional categories of larger cooking pots and large storage vessels appear only in Phase III? Why does the decorative repertoire undergo a fundamental and rapid shift from painted geometric decoration to impressed geometric decoration, marking the beginning of Phase IV? Why does paste texture get generally coarser through time? Equally valid are questions regarding the stability of pot form and decorative grammar through Phase III and IV, and the apparent resistance of the Jenn6-jeno assemblage to North African forms, such as oil lamps and gargoulettes. Providing the answers to these questions, in addition to raising new ones, will keep us busy for years to come.

Pottery

POTTERY FROM FIELD
sampling by
mix-and-divide method
if >1 bag / level
transport to Jenne
wash
divide into body
+ feature sherds
BODY SHERDS
divide into decorative classes
- search for pieces of same vessel
dvde into
FEATURE SHERDS
rebag for later study
lat later
Figure 3.1. Flow chart illustrating the 1981 pottery recording system.
Pottery
potlid
1
SIMPLE RIMS
THICKENED OUT-TURNED
/7
3 12
BEADED RIMS
OTHER THICKENED
2
7 8 9 10 11 13
EVERTED
LEDGED T-RIMS
31 32 36
OTHER LEDGED RIMS
Figure 3.5a. Jenn6-jeno rim types

(B) (B)
(B) (type C) 22 23
CARINATED
DOWNTURNED CARINATED
24 25 26 27 28
BOTTLES
39
14 42 44
OVERHANGING
15 16 33
T-RIMS
Figure 3.5b. Jenn6-jeno rim types
Pottery
K
(type A)
(type B) 20

Pottery
Figure 3.6. Drawing used to determine rim angle for coding (codes 1-6)

Pottery
POTLIDS
PA
PLATES
Figure 3.7a. Major rim/ vessel classes identified at Jennd-jeno

Pottery
Figure 3.7b. Major rim/vessel classes identified at Jennk-jeno

Pottery
(V
7 /-
-. I

Figure 3.7c. Major rim/vessel classes identified at Jennd-jeno
I
I

Pottery
I
CARINATED

Figure 3.7d. Major rim/vessel classes identified at Jenn&jeno

Pottery
77
I
T-RIMS & VARIANT
BOTTLES
STEAMERS

Figure 3.7e. Major rim/vessel classes identified at Jenn6-jeno

Pottery
ALS
0 10 20 30 40 50 60 70 80 90 100
PERCENTAGE
HK
1
2 5/6/Feat.5
0 10 20 30 40 50 60 70 80 90 100 PERCENTAGE
M All others IM Potlids
I Simple closed U Simple open

Figure 3.8. ALS and HK rim assemblage composition, by major rim classes
L 6
E V 7
E L 8/9
10
11
<table>
<thead>
<tr>
<th>Pottery</th>
<th>177</th>
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</thead>
<tbody>
<tr>
<td>CTR</td>
<td></td>
</tr>
<tr>
<td>2/3</td>
<td></td>
</tr>
<tr>
<td>4/5</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9 10</td>
<td></td>
</tr>
<tr>
<td>L 11/14/15/19 E 13</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td></td>
</tr>
<tr>
<td>E 16</td>
<td></td>
</tr>
<tr>
<td>L 17/18/20/24 21/22 25 27/29/33 :</td>
<td></td>
</tr>
<tr>
<td>23/26</td>
<td></td>
</tr>
<tr>
<td>35/37/39</td>
<td></td>
</tr>
<tr>
<td>32/34/36</td>
<td></td>
</tr>
<tr>
<td>0 10 20 30 40 50 60 70 80 90 100</td>
<td></td>
</tr>
</tbody>
</table>

**PERCENTAGE**

U All others  | I Potlids | L Simple closed | M Simple open |

Figure 3.9. CIT rim assemblage composition, by major rim classes

<table>
<thead>
<tr>
<th>Pottery</th>
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<tbody>
<tr>
<td>LXN</td>
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<tr>
<td>-mm</td>
<td></td>
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<tr>
<td>mu~</td>
<td></td>
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<tr>
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Pottery

NWS
2
L E
V4
E
L
0 10 20 30 40 50 60 70 80 90 100

PERCENTAGE

WFL
1/2
3/4
L
E
v 5/6
E
L
10/1112
13/14/15
0 10 20 30 40 50 60 70 80 90 100

PERCENTAGE

M All others [H Potlids EJ Simple closed U Simple open

Figure 3.11. NWS and WFL rim assemblage composition, by major rim classes

Pottery
HAMB
9/10
11/12/13
14
L 15
E 16/17
V
E 18/19
L 20/21
22/23
24 25
THI 11111 Iu I
0 10 20 30 40 50 60 70 80 90 100

PERCENTAGE

KAN
L 1/6
E
V 2/4
E
L 3/5/7]
Figure 3.12. HAMB and KAN rim assemblage composition, by major rim classes

Figure 3.13. LXN plain, slipped and twine decorated body sherds
Figure 3.14. LXN plain and slipped rim sherds

Pottery  183
LXN
4/7  8/9
12/13
14/15
16/17/18
23/24
25/26/27 L  29
E   31/32
V   35
E   36
L   38
39
40/41
42  44
45
46/47
48/49
50/51/52
0  10  20  30  40  50  60  70  80  90  100
PERCENTAGE
U All other  9 Plaited strip U Braided
Figure 3.15. LXN twine-decorated rim sherds

Pottery
LXN
40  60
Percentage of Classes of Sherds
Legend: Twine Classes
* Braided Twines 1, 2, 3, 10 o Plaited strip Twines 4, 5 * Twisted Twines 6, 7
* All other twines
80  100
Figure 3.16. LXN Twine-decorated body sherds
LEVEL
1
2/3
4  8  9
10/11
12  13
Figure 3.18a. Simple Restricted (Closed) Rims
LXN 45
CTR 36
0 2 10 20 an

Pottery
LXN 49 1-B
CTR 29 1-B
CTR 35 1-B

0@ e
mfi
m Ho
CNCD
Figure 3.18b. Simple Restricted (Closed) Rims

Pottery
ALS 7
S- LXS 66
LXN 45
- =
0 2 10 20cm

Figure 3.19. Potlids

Pottery
LXN 49
m " I
0 2 10 20cm

Figure 3.20. Rim 7 (Beaded, slightly everted)

Pottery
HI-B

III-R LXN 36
IV-B LXN 26
WFLM 2
0 2 10 20cm

Figure 3.21. Thickened, outturned rims (plates)

Pottery
I
II
Figure 3.22a. Everted rims

Figure 3.22b. Everted rims

Figure 3.23. Carinated beaded rims (Type A)

Pottery
Figure 3.24a. Carinated simple rims (Type B)

Figure 3.24b. Carinated simple rims (Type B)

Pottery

Figure 3.25. Ledged T-rims
A 2 20cm
Figure 3.27. Pot handles, bottle neck fragments, and pot bases. Bottom: pedestal bases; bottom right: Tellem tripod base
4D fR 11 A M 4 rA

Pottery 0 2 10 20cm
Figure 3.28. Overhanging Rims
LXN 15
LXN 13

Pottery 201
LXS 52 1'
maso§iL^ LXN 18
0 2 10 20cm
Figure 3.29. Trilobate pot rest and steamers
0
-0
hn
\= w-
r\-in

Pottery 0@ R Ii u i i i I T 0 ®
/ i"iii"ii"i"ii i'T -- LXS Feat. 4
ALS 10
0 2 10 20cm
Figure 3.31. Pottery cylinder (top), drainpipe (bottom left) and funnet

204 Pottery
LXN L.49 LXN L.49
JAI Sa, d6 S.- 4 .
LXN L.42
Figure 3.32. Miscellaneous pottery from LXN (scale 1:2)
Figure 3.34. Geometric white-on-red painted motifs on pottery from LAXN Levels 29-38

Figure 3.35. Plastic motifs on Phase IV sherds. Fine channeling (each groove c. 1 mm wide) is characteristic. Other common elements include comb impression, round stamping, triangular punctate and pattern incision. All from LAXN, Levels 4-27

Figure 3.36. Anthropomorphic and zoomorphic relief decoration (scale 1:2)
Pottery

<table>
<thead>
<tr>
<th>Proportions of vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIDEI (water storage)</td>
</tr>
<tr>
<td>DEIDI (cooking pots)</td>
</tr>
<tr>
<td>PHERE (washing, drinking)</td>
</tr>
<tr>
<td>SAMA (carrying water)</td>
</tr>
</tbody>
</table>

Figure 3.38. Plots of maximum circumference and height for modern Dogon (top) and Soninkë (bottom) pottery (adapted from Gallay 1980:81; Raimbault 1970:27).

Pottery
SARAKOLE (MALI) DOGON (MALI) PEUL (CAMERON) HAUSA (NIGER) DIOLA (SENEGAL I
Water jars for carrying
Water storage
Drinking vessels
Washing, soaking, tinting, tanning
(A60)

Ablutions
Cooking cereals
Cooking sauces
Steamers

Figure 3.39. Principal functional categories for West African pottery (adapted from Gallay and Huyscom 1989:80)

Pottery
212
140C 130(
1200 1100 1000 900 800 700 600
Rise and floruit of Empire of Mali
Period of power struggles, probable population movements
(Convrxion
to Islam
begins)
Empire of
Ghana
????????
Body sherds:
15–20% plain
20–25% slip
50% twine impressed
10–15% coarse fabric, grog temper
medium textured,
grog temper dominates
course textured sherds appear
medium texture,
grog temper
fineware disappears
medium texture, grog tempered
wares predominantc
10–15% fineware:
IV
IV inf.
IVIUI
transition III Sup.
Ill
Ill
Inf.
I/I'
Typical Forms
/-M I.0
0%V
Historical Surface
Events Phase Fabric Finish
Mali's decline I
<10%
50% of rims
20% of rims
T
in red on <10%
of rims

Figure 3.40. Summary of major diachronic changes in Jenn6-jeno pottery

Body sherds:
5-10%
plain
10-15% slip
60-75%
twine impressed
0-5% paint
<10%
0.

Body sherds: <10% slip <5% plain
>80%
twine impressed
Plastic
25 1
30%
" anthropomorphic
raised relief comb dragged
over twine 10%
20-25%
single groove button appliqued cord wrap stick rocker comb
500 F

Pottery
aHWL
SPhase III
Phase I/II

Figure 3.41. The evolution, accompanied by increasing diversity through time, of carinated (sharply inflected) rims from simple Phase I/II bowls. A conservative decorative grammar is maintained over time. Channeling (CR) with paint (P1T)
and channeling with plastic (PL) is largely confined to the area above the carination, and twine impression occurs below.

A
- -- - Generalized view of

B decorative zones

C

OTHER CERAMIC AND FIRED CLAY ARTIFACTS
Susan Keech McIntosh
STATUETTES AND FIGURINES
A total of seventy-two whole or fragmentary modeled clay representations of animals or humans were recovered (Table 4.1). Of the pieces that were complete enough to be identifiable, the most common were small, relatively crudely made (sometimes unfired) figures of humpless cattle (Figures 4.1-4.3). These were found throughout the sequence at Jenn6-jeno. Stylistically, these are similar to other cattle figurines found throughout the Sahel from the Late Stone Age into the Iron Age. The pointed legs and smooth elongated body outlines of the Jenn6-jeno figures recall similar stylistic traits of animal figures from Iron Age levels at Daima (Connah 1981:182-3). Similar modeling of the head can be noted at Late Stone Age sites in the Tilemsi Valley (Gaussen and Gaussen 1988:132) and at early Iron Age sites in Niger (Grdb6nart 1985:314). A single, fragmentary figure of what appears to be a horse (the high tail, long neck and mane are clearly modeled) was recovered from late Phase III deposits in unit ALS (SF [Small Find] 1537) (Figure 4.4). Another figure (SF 1172) appears to represent a manatee (Figure 4.5).

A number of incomplete statuettes of human subjects in a variety of styles were also found. The fragmentary pair (male and female?) of kneeling statuettes discovered in situ within the wall foundation of Feature 20 (House 10) were of special interest, since they further support the evidence from the 1977 excavations that this kind of statuette is associated with domestic ritual contexts (SF 696, Figure 4.6). Another fragment of a kneeling statuette (SF 538) with a string apron and hand resting on the knee, was found in Feature 21, which we interpret as directly associated with House 10. These features date to approximately the eleventh century, which is completely consistent with the date assigned to the 1977 statuette (R. McIntosh and S. McIntosh 1979). From the overlying levels representing the rapid collapse of House 10, we recovered the head of a statuette (SF 265) in a relatively crude, openmouth, bug-eyed style similar to that of the head found at Kaniana in 1933 (Vieillard 1940).

From WFL, Level 2, four pieces were recovered, three of which are of substantial interest. The bearded head (SF 468) with incised eyelids and broken top-knot is virtually identical to the head pictured in Plate 11.27 of de Grunne (1987), save for the temple scarifications, which do not appear on the WFL head (Figure 4.7). The statuette torso (SF 468a) and head (SF468b) from

Other Ceramic and Fired Clay Artifacts
WFL were found adjacent to each other, with the head deposited touching the torso's buttocks; however, they are clearly not part of the same original statuette (Figures 4.8 and 4.9; Plates 29-30). The torso is a particularly fine example of the Inland Delta terracotta tradition. It is so carefully modeled, so fastidious in its realism, and so finely finished that it is an atypical exemplar, however. The many published photographs of Inland Delta terracottas show that a more stylized, linear, and, to a certain extent, rigid treatment of the body is the norm. Frequently, the details of extremities and jewelry are rather carelessly rendered. The surface may be rough and the slip unevenly applied. The WFL torso, by contrast, is finely executed in all these aspects. The semireclining posture of the figure is also unusual (de Grunne 1987:75). A male is depicted, with a sheathed dagger strapped to the upper left arm, and the patterned breeches and kirtle familiar from statuettes of mounted horsemen (de Grunne 1980:76; 80). The figure is wearing a bead necklace, an amulet, anklets, and several armlets, two of which appear to represent snakes, a common motif on Inland Delta statuettes. On the lower back are four incised button appliques.

The associated head is highly characteristic of the Inland Delta style, as Evrard (1980:290; 1977) has defined it: "La tante est allongée, au crâne ovoïde, . . . Les éléments du visage sont très saillants, appliqués. Les yeux sont souvent très larges, en amande, pro-minentes, avec ruban concentrique entourant l’œil. Le nez est long en triangle ou en entonnoir. La bouche est large, ovale ou trapézoïdale, appliquée, aux lèvres saillantes, en plateau, très prognathe." The cheeks are covered with oblique scarification, and three snakes encircle the neck (Figure 4.9, Plate 31). Unfortunately, all these pieces from WFL appear to be from a secondary deposition context. They were buried or deposited in WFL at some point in time after they were originally used. Thus, excavation provides no reliable information on the chronology of the figures. They may have been deposited in WFL at the end of Jenn6-jeno's occupation, or after its abandonment.

All statuettes and figurines were deposited at the Institut des Sciences Humaines. The torso (SF 468a) may be seen at the Musée National in Bamako.

**FIRED BRICK**

A total of sixty-nine rectangular or loaf-shaped objects identified as fired bricks were recovered from excavation (Table 4.2). Most were red or orange slipped, with the remainder unslipped or twine-impressed. The twine-impressed fragments numbered only four, and there is considerable doubt as to whether these are really bricks. Fired bricks were found in deposits associated with round houses (LX-N Levels 16, 25, 27) and rectilinear houses (LX-N Level 11, LX-S Feature 7). While they clearly were not used as primary construction material, they may have been used to reinforce areas subject to extreme wear (door sills) or for decorative effects. They are currently used at JennL to pave inner courtyards (LaViolette 1987:266). In 1933, C. Daître, a teacher at Jennd, reported finding numerous bricks at Kaniana, which he suggested were used to hold down the corners of mosquito nets, a practice still

Other Ceramic and Fired Clay Objects
observable at that time (C. Daire, letter of 16 February 1933 to the inspector general of IFAN, Dakar). The twenty-nine bricks from Level 4 at Kaniana were in a secondary deposit (a pit) and thus provide no information as to their original function or use. Of the unambiguously identifiable fired bricks (i.e., the slipped bricks), all but one postdate Phase III.

BURNT DAUB

In the lowest Phase I/II levels of three of the 1981 excavation units (ALS, CTR, and LX-N), we encountered numerous chunks of burnt clay with the clear impressions of mats (rare), twigs, and poles (Table 4.3). We believe that these represent the remains of accidentally fired wattle-and-daub huts. In addition to the excavated burnt daub, we also collected a large sample from the southeast sector of Jenn6-jeno where Phase I/II material (fineware, burnt daub) was eroding from the surface (Plate 32).

CERAMIC BEADS/SPINDLE WHORLS

Sixty-four black incised or impressed spindle whorls were recovered, all from late Phase IV deposits (Table 4.4, Plates 33-34). The bulk of these came from a small pit (Feature 16) within Level 27 in unit LX-S (all recorded as SF 336, Plate 33). They appear to have been deliberately placed together in the pit, whose reddened earth indicated burning. It is possible that the spindle whorls were fired in the pit, which could have been covered by large potsherds (also found in the pit) to provide a reducing environment to blacken the spindle whorls. Undecorated round, tubular, or lenticular clay beads were found in small numbers in deposits of all phases (Plate 36). In this category, SF 27 (LX-S 3) and SF 458 (WFL 1, listed in Table 4.7) are of particular interest. They are almost certainly an example or an imitation of the sevensided beads that are prominently featured on some terracotta statuettes, hung either around the neck (e.g., de Grunne 1980: cover photo, 73) or the upper arms (de Grunne 1980: 85).

LABRETS AND EAR PLUGS

Seventeen squat ceramic spools were recovered, mainly from Phase I/II deposits (Table 4.5, Plate 35). The majority were red or orange slipped and had a diameter of approximately 2 cm. We have interpreted these as either earplugs, worn in the earlobe much as Jennd women today wear brightly colored plastic plugs, or labrets worn in the lip.

CERAMIC BRACELETS AND PENDANTS

Five fragments that appear to be from ceramic bracelets were recovered from Phase IV deposits (Table 4.5). Several perforated disks and rectangular plaques were also found in Phase IV deposits. (Tables 4.6 and 4.7, Plate 37). The rectangular plaques are not uncommon on the surface of Phase IV sites around Jenn6. Their geometric decoration on one surface only suggests that they may be imitations of metal amulet cases, similar to those worn by Tuareg today (e.g., Bravmann 1983:39). A complete example of a plaque is pictured in de Grunne (1983:73).

CERAMIC DISCS, GOLD WEIGHTS, AND TEARDROP WEIGHTS
A total of eight discs created by chipping and grinding fragments of pottery were found individually in late Phase III and Phase IV contexts at Jennd-jeno (Table 4.8). It is possible that some of these discs were used as weights. At Begho and Gao, pottery discs conforming to the weight system based on the Islamic ounce (uquiya) of 27.3 g have been identified (Garrard 1982). Although the discovery in WFL of a potsherd pavement constructed from rounded pottery discs (Feature 41) demonstrates another function for these discs, the possible use of isolated discs as weights must be considered. Garrard (1975:64-65) provides a table showing the equivalent weight in grams for a number of Islamic weight measures based on an ounce (uquiya) of 27.3 g.

<table>
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<th>Islamic Equivalent Grams</th>
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<tr>
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<td>1.5</td>
</tr>
<tr>
<td>1/2 mitkal</td>
<td>2.3</td>
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<tr>
<td>1 dirhem</td>
<td>3.0</td>
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<tr>
<td>1 mitkal</td>
<td>4.5</td>
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<tr>
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<td>9.1</td>
</tr>
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<td>18.2</td>
</tr>
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<td>36.4</td>
</tr>
<tr>
<td>1.5 ounce</td>
<td>41.0</td>
</tr>
</tbody>
</table>

Four of the excavated discs have weights with convincing Islamic equivalents, if variation of up to 5% around the standard is accepted. Figures reported by Monteil (1903:253) for a series of weights used for weighing silver in Jennd indicate that deviations of 2-4% from the standard could be expected as recently as a hundred years ago. Even greater deviations might be expected when wear and damage to the archaeological specimens is taken into account (T. Garrard, personal communication, 5 May 1982). The descriptions of the excavated discs appear in Table 4.8, and two are pictured in Plate 37.

Sixteen small "teardrop" or roughly conical ceramic objects were found, the majority of which, in Garrard's opinion (personal communication, 5 May 1982) might also be weights based on the Islamic ounce or mitkal. All but one of these possible weights were recovered from deposits dating to Phase III or later (Table 4.9).

Other Ceramic and Fired Clay Objects

NET WEIGHTS

A handful of perforated fired clay cones and cylinders that might have been used as net sinkers were found (Table 4.10).

MISCELLANEOUS CERAMIC OBJECTS

"Spoons". The two "spoons" found had handles at one end and a scooped out area at the other (Table 4.11). Similar objects have been recovered from previous excavations at Jenn6-jeno (S. McIntosh and R. McIntosh 1980:160) and El Oualadj (Lebeuf and Pacques 1970:31).

"Cones". These six enigmatic objects have only their conical shape in common (Table 4.12). Three of the cones are hollow with perforations all around the base. We have suggested that these might have been used as incense burner lids. One of these was fire-blackened on the interior.
Other miscellaneous. In this category, a large red-slipped ceramic disc with a 57-mm-diameter central hole is intriguing (Table 4.13). Its use is unknown (Plate 37).

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Other Ceramic and Fired Clay Artifacts
SF 1038
SF 235
Figure 4.1. Cow figurines

Other Ceramic and Fired Clay Objects
SF 1251
SF 917
Figure 4.2. Cow or sheep figurines

Other Ceramic and Fired Clay Artifacts
SF 1165
SF 502
Figure 4.3. Quadruped figurines

Other Ceramic and Fired Clay Objects
SF 1537
SF 1078-1

Figure 4.4. Horse (?) figurines

Other Ceramic and Fired Clay Artifacts
SF 1172

Figure 4.5. Manatee figurine

Other Ceramic and Fired Clay Objects
1:2 SF 696
1:1 SF 488

Figure 4.6. Kneeling statuette fragments

Other Ceramic and Fired Clay Artifacts
SF 234
SF 468

Figure 4.7. Statuette heads, bearded and "Nok" style

ri2 244

Other Ceramic and Fired Clay Artifacts
1.5:1 SF 56 1:2 SF 468B
1:1 SF 496

Figure 4.9. Statuette heads. Top right was found adjacent to statuette body SF 468A.

STONE, GLASS, AND BONE
Susan Keech McIntosh
with a contribution by R. H. Brill
The Corning Museum of Glass
SANDSTONE
A total of 633 pieces of sandstone weighing more than 136 kg in all were recovered from the excavations (see Appendix C). Approximately two-thirds of these pieces fell into a limited number of shape categories: rectangular (Figure 5.1), quadrilateral (truncated triangle) (Figure 5.2), triangular (Figure 5.3), cylindrical, or spherical (Figure 5.4). Many within these shape classes had been pecked to smooth and round one or more edges on one surface, apparently to make the stone fit more comfortably in the hand. The shape categories recognized by R. J. McIntosh are summarized in Figure 5.5. All sandstone pieces received a small find (SF) number, and were described in terms of color, texture, presence or absence of staining (red hematite stains were relatively common) and fire cracking or blackening, measurements, and weight. The distribution of sandstone pieces by phase in each excavation units is presented in Figure 5.6, which shows
that the largest number of sandstone pieces in all phases come from units LX-N and LX-S. This fact is hardly surprising, since these two units were so much larger than the others. Examining the amount of sandstone as a standardized measure of weight of sandstone in grams per cubic meter of deposits is a much more meaningful way to compare sandstone frequencies in different units at different times. When we do this (see Figures 6.5 a-c, where sandstone is plotted with iron and slag), we see that most units produced an average of 50-400 g of sandstone per m³ of deposit in all phases and contexts. Exceptions, where the amount of sandstone is much greater, include Phase I/II deposits in CTR, LX-N and LX-S, transitional III/IV deposits in LX-S (representing considerable admixture with Phase I/II material), and Feature 21 in LX-S, which produced 178 pieces of sandstone weighing over 34 kg.

The importance of sandstone in Phase I/II domestic contexts may be significant, indicating that some uses and activities involving grinders and hammer stones may have disappeared or been accomplished with other technologies from Phase III onward. Food preparation technology comes immediately to mind. Grinding of cereals may have been accomplished with stone mortars in Phase I/II, which may then have been replaced by the wood mortar-and-pestle technology characteristic in the region today. The red staining on many of the stones from all periods indicates frequent grinding of ochre, likely used not only for pottery but also for painted decorations on mud walls as well as the human body.

The tremendous concentration of sandstone in Feature 21 has already been remarked upon in Chapter 2. The various layers of grinders and the position of the larger sandstone slabs are illustrated in Figure 2.40. The serpent motif pot that appeared to be the central element of the feature was filled with thirty-eight spherical sandstone hammers plus a ground granite handax (SF 579, Figure 5.7). Other important elements of Feature 21 were a round piece of red quartzite under the rim of the serpent motif pot, two iron rods, a statuette fragment, and a fragmented bottle placed just adjacent to the pot. The configuration was immediately identified by our workers as toru, a ceremony in which round stones of several different types (revolving around the idea of "thunder stones") are amassed as an offering, and consecrated with chicken or goat blood, to bring rain. The ceremony is performed by a blacksmith. Deposits associated with Feature 21 produced elevated quantities of smithing slag (see Chapter 6).

The sandstones used vary in color and texture: white, gray, yellow and pink are present in textures ranging from very coarse to fine-grained. The source of these stones is unknown, but it certainly lies outside the Inland Niger Delta, since no stone outcrops within the alluvial zone. It appears that stone grinders and hammers were used for a variety of purposes throughout the occupation sequence, with notably elevated relative frequencies during the earliest phase of settlement. The absence of any sandstone chips or flakes in the deposits suggests that the regularly shaped, pecked grinders that account for one-half to two-thirds of the
sandstone assemblage were manufactured somewhere else, possibly at the source. The earliest inhabitants appear to have arrived with established connections to sources outside the IND.

Other stone artifacts were rare, with the bulk of those present coming from Phase I/II deposits. During this early phase, stone imports other than sandstone included beads in basalt, "Hombori marble" granitoid stone, and quartz, quartz pebbles, and pieces of hematite (Plate 35). Later imports include a carnelian bead, fragments of a basalt ring, and the granite handax in Feature 21 (Tables 5.1-5.3).

**BONE**

Only two bone artifacts were found: a pendant, possibly manufactured on a crocodile plate (LX-N, Level 45, Phase I/II) and an ovoid bone pendant 40-by-19-by-8 mm with three drilled holes (LX-N, Level 42) (Plate 36).

**GLASS**

Twelve glass fragments were recovered from the 1981 excavations, all from the deep, centrally located Units CTR, LX-N, and LX-S. Ten of these items were glass beads (Plate 38), one was a fragment of vessel glass, and the twelfth...
Stone, Glass, and Bone

Two glass objects (SF 250 and SF 1281) were examined for stylistic and technological variables by Robert H. Brill and Sidney Goldstein of The Corning Museum of Glass. Chemical analysis by the same institution were performed on eight of the specimens, and the results are summarized in a report by Brill appended to this chapter. Because of the fragmentary nature and small size of the collection, few glass items could be precisely identified either as to date or region of origin. Most were recovered from Phase IV levels and appeared to be datable on stylistic grounds to the period after A.D. 900. Three beads from Phase I/II and III levels were identified as having stylistic or technical similarities with beads manufactured in the Mediterranean and Near East in Roman and Hellenistic times. Descriptions of glass finds and summaries of Brill's and Goldstein's comments on technology and chronology are given below in descending chronological order.

SF I (Brill specimen 5526) Unit LX-N Level 1: Phase IV sup.
Small cylindrical bead, 6 mm diameter and 6 mm long, with eight longitudinal grooves around the circumference. Color is transparent medium blue with a silvery iridescent patina. This bead was identified by the Coming Museum as a cylindrical "melon" type, probably from the Islamic period.

SF 2 Unit LX-N Level 1: Phase IV sup.
Elongated cylindrical cane bead, 16 mm in length and 4 mm in diameter, with layers was tentatively identified as either a button or glass vessel fragment. All but of red opaque, white opaque, and dark-blue transparent glass visible in cross
section. The external layer is made up of longitudinal bands of red, white, and blue. This bead is a possible Dutch export, manufactured from the sixteenth through the twentieth centuries.

SF 217  (Brill specimen 5522) Unit LX-N/LX-S Baulk 0-1 m: Phase IV
Cylindrical glass bead, orange opaque with longitudinal red opaque and white opaque threads. White opaque thread looks bubbly and "fried" like an enamel. Length is 12 mm and diameter is 8 mm.

SF 79  (Brill specimen 5525) Unit LX-S Level 1O:Phase IV sup.
Fragment of pale olive-green vessel glass with dull black crust and manganese dioxide deposits. Length is 28.3 mm, width is 18 mm, and thickness is 2.5 mm. Probably of European or Islamic manufacture, c. eleventh through sixteenth centuries.

SF 250  Unit CTR Level 3:Phase IV inf.
Small cylindrical light blue opaque bead of same type as SF 573 below. Length is 3 mm and diameter is 3 mm.

Stone, Glass, and Bone

SF 151  (Brill specimen 5531) Unit LX-S Level 19: Phase IV
Fragment of aquamarine glass with drilled hole visible at edge. Length is 16.9 mm, width is 9 mm, and thickness is 2.5 mm. Edges are ground, possibly subsequent to firing. This item was identified by The Corning Museum as either a fragment of a two-hole glass button or a fragment from an irregularly shaped glass vessel.

SF 573  (Brill specimen 5527) Unit LX-N Level 24: Phase IV
Small cylindrical light-blue opaque glass bead, 4 mm in length and 5 mm in diameter. No indication of weathering. Beads of this type have been recovered from archaeological sites in various parts of the world and from widely varying time periods.

SF 400  Unit LX-S Level 33: Phase IV
Two fragments of a turbid white opaque glass cylinder with longitudinal dark-blue transparent threads. Combined length of fragments is 7 mm, diameter is 7 mm. This item exhibits some weathering and is heavily spalled as though it had been in a fire. Date uncertain.

SF 907  (Brill specimen 5528) Unit LX-N Level 38: Phase III sup.
Crudely made doughnut-shaped blue transparent bead, 4.8 mm in height and 10.2 mm in diameter. Matrix is light-blue transparent glass, with many spherical bubbles and trains of bubbles parallel to the bore axis and some five to fifteen "squared-off" swirls of darker-blue transparent glass visible in cross section. This bead appears to have been made by rolling a broad ribbon of glass around a wire or other thin cylinder, after the glass had cooled enough that rolling on a flat surface would produce a slightly flattened shape. The outside of the bead has been ground extensively to produce rounded edges. The crudity of workmanship raises the possibility of local manufacture, but beads of similar manufacture have been dated to approximately the first century B.C. through the first century A.D. in western Europe.

SF 1031  (Brill specimen 5529) Unit LX-S Level 68: Phase III sup.
Two fragments of a pale-blue transparent eye bead with a dense white opaque eye and slightly darker "pupil." Height of bead is 8 mm, perforation diameter is 3 mm, and total diameter is 13 mm. The white opaque eye is heavily weathered with black deposits, possibly manganese dioxide, on the surface. The dark "pupil" is completely weathered to a turbid bluish color but may originally have been a thin white opaque or transparent blue-green. The pale-blue base glass contains many spherical bubbles and is now spalled, as if by fire or hydration. Although composite eye beads of this type were made as early as the fifth and sixth centuries B.C. in the Near East and Europe, the light-blue matrix suggests a slightly later date.

SF 1281 Unit LX-S Level 78: Phase I/II Fragment of mottled blue cylindrical bead. Diameter is 9 mm, length of fragment is 14 mm. Unidentified.

Stone, Glass, and Bone

SF 1100 (Brill specimen 5530) Unit CTR Level 37: Phase I/II Fragment of poorly shaped cylindrical dark-blue transparent bead with large center perforation. Height is 8.9 mm, glass thickness is 4 mm, and total diameter is 12.8 mm. Glass is filled with many spherical bubbles of various sizes and colored with cobalt. Top and bottom surfaces are ground flat. Analysis unexpectedly identified the bead as of potash-silica composition, currently known only from India to East Asia.

CHEMICAL ANALYSIS OF SOME GLASSES FROM JENNE-JENO

Robert H. Brill
The Corning Museum of Glass

At the request of Susan and Roderick McIntosh, we have carried out chemical analyses of eight glass finds excavated at Jenne-jeno in Mali. The glasses include six beads of different types and two fragments. Of the latter, one is probably a vessel fragment and the other a piece of scrap glass fashioned into a button or bead. The eight samples span a long interval of time. One is dated to the last two centuries B.C. two are dated A.D. 300-800, and the others A.D. 900-1400. The main questions involving the beads are where they were made and how they reached sub-Saharan West Africa. The six beads may not necessarily be representative of all the beads excavated at the site, but the excavators have made an excellent selection for analysis. Among the six specimens, we have found examples of four distinctly different glass-making technologies which, at first glance, suggest that this particular selection of beads points to four different and far-flung places of manufacture.

The analyses were carried out by a combination of atomic absorption (yielding quantitative data for the major and minor ingredients) and emission spectroscopy (for trace elements). Silica was estimated by difference from 100%. The analyses are reported in Table 5.4, along with reduced compositions. Reduced compositions are calculated by normalizing the data for seven major and minor oxides to 100%. The resulting compositions provide a somewhat sounder basis for comparing glasses with one another because the calculation offsets some of the
compositional variability accompanying the addition of colorants, opacifiers, decolorizers, fining agents, etc.

The most intriguing result of the analyses is the composition of specimen 5530, from a fragment of a medium-sized, dark-blue bead. The only major components of this glass are potassium oxide (K2O) and silica (SiO2). Thus, this glass is of the potash-silica type, a relatively rare compositional family. In order to understand the significance of this analysis, it is necessary first to explain in some detail where these glasses are generally thought to have been made.

Stone, Glass, and Bone
Table 5.4. Chemical analyses of some glasses from Jennh-jeno

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</tr>
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</table>

BiU2 Na2O CaO K2O
MgO A12O3 Fe2O3 TiO2 Sb2O5
MnO CuO CoO
SnO2 Ag2O PbO
BaO SrO Li2O Rb2O B2O3 Cr2O3
NiO ZnO ZrO2
SiO2* Na2O* CaO* MgO* A12O3* Fe2O3* T*
Note: Major and minor oxides were analyzed by atomic absorption, trace elements by semiquantitative emission spectrography. All analyses are by Brandt A. Rising and coworkers at Umpire and Control Services, West Babylon, New York.

* Reduced compositions calculated by normalizing data for seven major and minor oxides to 100%

850.13 0.93
8.4 13.0 0.32 1.9 1.71 0.08
Stone, Glass, and Bone

Glass artifacts having this type of composition have so far been found mainly (perhaps exclusively) in East and Southeast Asia. Shi et al. (1986) have reported about sixteen examples of such glass found in China (seven small objects and nine beads). They generally date from the Han dynasties (206 B.C.-A.D. 220). However, they were not necessarily made in China. We have found six examples of this family of glass among beads excavated in Korea (Brill 1993; Lee et al. 1993). All are small or medium sized, blue transparent, drawn beads. They were found at six different sites, all in the southeastern part of the Korean peninsula, within about 150 km of one another. They are believed to range in date from the first to the fourth or fifth centuries. We have also analyzed three large biconical beads from Ban Chiang (all surface finds) which have this same composition.

Very recently, we analyzed several glass samples from Arikamedu in India. Although they came from unstratified excavations, the glasses are thought to date from the first century or somewhat later. Among these samples, which were submitted to us by Dr. E. M. Stern, there are six potash-silica glasses (Stem 1987). They are all the more interesting because they are pieces of cullet (raw, unshaped nuggets of glass), or manufacturing waste. These analyses are in agreement with analyses of Arikamedu glasses reported earlier by Dr. B. B. Lal, an authority on Indian glass (Lal 1986). Such evidence strongly suggests that glass objects, and possibly the glass material itself, were being made nearby. Hence, the range of places where potash-silica glasses were being made and/or used in ancient times must now be extended westward to include southern India.

One hesitates to make too much of the analysis of a single bead, or to generalize too much from it. Nevertheless, evidence based even on a single bead cannot simply be ignored; it does beg for some sort of explanation. The Jenn6-jeno bead, an isolated find, is dated to 250 B.C.-A.D. 50, which falls within the range spanned by the potash-silica glasses described above. Among Shi’s Han glasses are five round blue beads ranging from 4 mm to 9 mm in diameter. One cannot be sure from the illustrations in Shi’s paper whether the beads were drawn or wound. The Korean beads are drawn and range from about 3 mm to 7 mm in diameter. All are dark blue. The Ban Chiang beads are considerably larger, appearing to have been shaped while hot and later drilled. One is aqua, one is green transparent, and one is blue.
All of the dark blue potash-silica beads discussed here, including the Jenn6-jeno bead, are colored with cobalt. They contain manganese but no copper. Although not impossible, it seems unlikely that the glass from which the Jenn6-jeno bead was manufactured could have been made locally, if for no other reason than that it is colored with cobalt. Hence, from all of the above observations, it seems almost inescapable (unless some other ancient source of potash-silica glasses comes to light) that the dark blue bead 5530 (SF 1100) was made somewhere in India, East Asia or Southeast Asia. Whether it found its way into West Africa by some series of direct, well-established trading contacts, or by some fortuitous meandering, perhaps from an East African entrepôt, remains to be determined. In any event, it probably left India, East Asia or Southeast Asia along a westbound maritime route some 2,000 or more years ago.

Another bead from Jennd-jeno, specimen 5522 (dated 900-1400), might also have traveled a comparable distance. Its chemical analysis closely resembles a particular variant of soda-lime glasses (Na2O:CaO:SiO2) which we associate with glasses from India. Although soda-limes were ubiquitous throughout the ancient world (except East Asia), they occur in two or three major types, depending on whether they were made with natron or plant ash as their source of soda. (This difference is illustrated by some of the other glasses from Jenn&jeno, as discussed below). However, there are a few recognizable chemical sub-groups of soda-limes, one of which is characterized by low levels of lime (CaO), high levels of alumina (A1203), and often rather high levels of titania (TiO2). The examples we know were found in India and also were probably made there. They date from Roman or Hellenistic times up through the medieval period (Brill 1987, McKinnon and Brill 1987).

The case for specimen 5522 is not quite as compelling as that for the earlier blue bead discussed above, because occasionally, colored glasses went off composition upon being worked and reworked during manufacture. Nevertheless, our feeling is that this turbid yellowish bead could very well have originated in India. From sketches in our notes, it seems that the Jenndjeno bead may resemble certain beads and bangle fragments from India (Brill 1987; McKinnon and Brill 1987). Because of the results of these analyses, it would be well worthwhile to run additional analyses of similar or related specimens from Jenn6-jeno, if such can be located. The finding on the two beads are of sufficient importance that corroborating evidence should definitely be sought.

The analysis of the other four beads proved to be more like what one would have expected. Specimen 5528, dated A.D. 300-800, might have been made locally from scrap glass. It is doughnut-shaped, flattened on the ends, and was probably ground into its final shape. It could have been reworked from a square-sectioned, drawn bead, because squared-off striations and cords are visible around the bore when viewed end on. Alternatively, it might have been rolled out while very viscous, with the attendant "bumping" generating the squared-off striations. In any event, we feel that it was made by someone not very experienced in the
handling of hot glass. Its chemical composition is that of a soda-lime of the plant-ash variety, although the soda value (9.87%) is notably low. The glass contains not only cobalt but also copper as a blue colorant. The analysis suggests that the copper colorant was introduced in a form derived from a bronze having a composition 82% Cu: 3% Sn: 15% Pb, which is within the compositional range of late Roman bronzes.

Specimen 5529, also dated 300-800, corresponds to a typical Roman glass made with natron. (Note the relatively low K2O and MgO in Table 5.4). It contains an additive level of antimony (0.52% Sb2O5) suggesting it could have been made in Egypt or Italy. The use of antimony declined in about the second century, and it was not widely used in medieval Europe, except, perhaps, in Italy.

Stone, Glass, and Bone
The two remaining beads (specimens 5527 and 5526) are both later (900-1400) and are both plant-ash type soda-limes. (Note the relatively high K2O and MgO). Their compositions could be Islamic (Brill 1989; forthcoming). Specimen 5527 is heavily leaded and is opacified with tin oxide (SnO2).

Specimen 5525, a fragment of vessel glass, could be Islamic. However, its appearance and pale-olive color make it look more like a somewhat later European glass, but it is difficult to tell for sure. Specimen 5531, dated 900-1400, is peculiar. It seems to be a bit of broken vessel glass (or flat-glass?) worked into the form of a button or bead. Its composition is that of a natron-type soda-lime. One might guess that it is more likely to have come from Fustat than medieval Europe, but that is also difficult to judge. Because it is a natron-type glass, it is unlikely to have come from anywhere east of the Levant.

In summary, the analyses of the glasses from Jennd-jeno show wide compositional variation. At least one of the two beads of A.D. 300-800 date has a composition consistent with Roman origins, while two others probably have more exotic origins. The small blue bead dated 250 B.C.-A.D. 50 seems most likely to have come from India or Southeast Asia, and the cylindrical turbid yellow bead could well have been made in India. The two latter findings come as something of a surprise and might shed light on important questions regarding trade connections involving Asia and sub-Saharan Africa. We strongly recommend following up these initial findings with additional chemical and lead isotope analyses of other glass beads judiciously selected from among those excavated at Jennd-jeno. Lead isotope analyses in particular offer an independent method of distinguishing between Asian and Western glasses.
A large quantity of data relevant to the use of metals and the practice of metallurgy was recovered from the three sites excavated. Three types of metals are present: iron, copper-based metals, and gold. Also present is debris from production activities, including the smelting and smithing of iron and the melting of bronze in a crucible.

COPPER AND GOLD

A total of thirty-eight pieces of copper-based metal weighing 85 g in all was recovered from four excavation units on Jenn6-jeno and Kaniana. In addition,
eight pieces of copper from the surface of Jenn6-jeno were catalogued. All are described in Table 6.1, and their distribution in time is summarized in Figure 6.1. It is interesting to note that copper-based metals are sufficiently rare at the sites that they are only represented in significant quantities in the large excavation unit, LX. Generally, copper-based artifacts are found in domestic contexts (in deposits associated with Houses 1, 5, 6, 10, and 11 in LX-N; and with Houses 4 and 10 and a series of ash-filled pits in LXS). They were absent from funerary contexts in 1981, although a copper ring fragment was recovered from a funerary urn in 1977. Nearly all identifiable copper-based objects are decorative in function, ranging from bracelets and rings to pendants, beads, and hair ornaments (Figure 6.2a,b).

Compositional analyses were undertaken on nine of the copper artifacts by Peter Loos of the Research Laboratory of Hughes Tool Company, in Houston, Texas. Determination of the percentage by weight of basic constituent elements was determined by X-ray fluorescence, using a semiconductor-type energy dispersive X-ray analyzer. The results are summarized in Table 6.2 and Figure 6.3. Here we can see that the analyzed copper-based objects from Phase III and the Phase IV/Im transition are either tin bronzes with tin in amounts varying from 5-17% or arsenical copper (SF 1460). In the early part of Phase IV, brass appears, with zinc in percentages ranging from 3.5% up to 22%. A single specimen (SF 549) from Phase IV is arsenical copper. In addition, residues on the interior of a crucible dating to the Phase IV/III transition proved to be tin bronze, indicating that copper alloys were worked at the site at least by the eighth century A.D. (Further details on crucibles are given in the section on slags and metallurgical debris.)
Metals

Table 6.2. Compositional analysis of copper alloys from Jennd-jeno

<table>
<thead>
<tr>
<th>PHASE</th>
<th>PROVENIENCE</th>
<th>SF</th>
<th>Cu</th>
<th>Zn</th>
<th>Sn</th>
<th>Pb</th>
<th>Fe</th>
<th>As</th>
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<tr>
<td>IV sup.</td>
<td>LX-N 2</td>
<td>29</td>
<td>88</td>
<td>5.9</td>
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<td>4</td>
<td>0.4</td>
<td>0</td>
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<tr>
<td>IV sup.</td>
<td>LX-N 9</td>
<td>115</td>
<td>80</td>
<td>7.1</td>
<td>0.6</td>
<td>5</td>
<td>0.35</td>
<td>0.01</td>
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<tr>
<td>IV</td>
<td>LX-N 23</td>
<td>549</td>
<td>92</td>
<td>0</td>
<td>0</td>
<td>0.3</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>LX-S 31</td>
<td>453</td>
<td>77</td>
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<td>0</td>
<td>3.5</td>
<td>0.15</td>
<td>0.01</td>
</tr>
<tr>
<td>IV inf.</td>
<td>KAN 4</td>
<td>1496</td>
<td>79</td>
<td>18</td>
<td>0</td>
<td>6.3</td>
<td>0.2</td>
<td>0.01</td>
</tr>
<tr>
<td>IV inf.</td>
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<td>704</td>
<td>68</td>
<td>3.5</td>
<td>25</td>
<td>7</td>
<td>0.2</td>
<td>0</td>
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<tr>
<td>Trans.</td>
<td>LX-S 67</td>
<td>1013</td>
<td>93</td>
<td>1.2</td>
<td>5.4</td>
<td>3</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td>0.4</td>
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<tr>
<td>II</td>
<td>ALS 6</td>
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<td>0.7</td>
<td>2.6</td>
<td>0.4</td>
<td>2.5</td>
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</table>

A single gold artifact was recovered from excavation: SF 1433 is a hammered gold earring (see Figure 6.2b), weighing 3.9 g, that was found immediately under the city wall during the sectioning of that feature (unit NWS trench). The pottery contained in the deposits underlying the wall indicate a late Phase III date. A question of particular interest is the source of the gold arriving at Jennd-jeno at such an early date. Unfortunately, compositional analyses on West African gold sources have not been undertaken. In the absence of such data, and in view of the uniqueness of the gold earring, we decided against seeking permission to export the earring temporarily for compositional analysis.

IRON

Iron, both in the form of identifiable objects and unidentifiable pieces, occurs in low frequencies in four excavation units on Jenn6-jeno (ALS, CTR, LX-N, and LX-S) and at Hambarketolo and Kaniana. It is virtually absent from units HK, NWS, and WFL. A total of 476 pieces of identifiable and unidentifiable iron, weighing 3,600 g in all, was recovered. Their distribution by excavation unit and phase is illustrated in Figure 6.4. At first glance, the iron frequencies in Figure 6.4 raise some interesting questions. There is the fact that despite major differences in volume of excavated deposits in ALS (19 m³), CTR (36 m³), and LX-S and LX-N (150 m³ each), all produced similar quantities of iron. Close examination, however, reveals that a single piece of unidentifiable iron weighing 525 g (from ALS Level 6) is responsible for the high weight total from that unit (see Appendix D, Table 1). Similarly, a large iron bracelet weighing 275 g (from Level 23) contributes almost half of the weight totals for CTR (Table 6.3). In terms of absolute frequencies of iron, LX-S is the only other unit to have produced > 200 g of iron from a single depositional context. Here, the deep ash pit comprising Levels 63-71, 75, and 77 produced 380 g of iron dating to the Phase IV/III transition. In Figure 6.4, this material is included in the Phase IV weight totals, where it accounts for almost one-half of the Phase IV iron. A more reliable way of evaluating differences in
Metals

frequencies of iron takes volume of excavated deposit into account and presents the average weight of iron per cubic meter. The results are illustrated in Figures 6.5a-c, where five relative peaks of iron frequency (exceeding 20 g/m³) can be seen: ALS Phase III and CTR Phase I/II (these peaks result from the presence of single, heavy pieces of iron, as discussed above), LX-S transition Phase IV/III (trash/ash deposit), LX-N Phase IV (Levels 23-24; house decay and trash accumulation) and HAMB Phase I/II (classic early occupation deposits). With these exceptions, iron occurs in the deposits in frequencies under 10 g/m³ of deposit. The average weight of the iron in all excavation contexts (except ALS Phase III and CTR Phase I/II, as above) is less than 10 g per piece. The presence of iron in such low frequencies and in such small pieces suggests that it was a valued commodity that was reused, recycled, and conserved in general. The identifiable iron objects demonstrate the use of iron for both decorative and utilitarian purposes: it was fashioned into wire as thin as 3 mm in diameter, knife blades, fishhooks, spear and harpoon points, "spoons," hoe or adze blades, bracelets, rings, and pendants. In all, 300 identifiable objects weighing 1.85 kg were found. (Table 6.3).

A number of iron artifacts were submitted to R. F. Tylecote for analysis. All but one proved to be fully mineralized. The single sample with sufficient iron remaining was a square rod or nail, 6 mm in diameter from LX-N Level 52 (SF 1409, Phase I/II earliest occupation levels). Based on his analysis of this specimen, Tylecote (personal communication 28 December, 1982) reported that it was "steel, predominantly pearlite with a fine granular structure (sorbitic). Some grain boundaries contain a small amount of ferrite so that the carbon content is in the range of 0.7-0.9%. The hardness is 275 HV1, which is fairly typical of unhardened steel of this composition. The structure is fairly uniform, but there are some large slag inclusions in the center". Subsequently, a sample of this same specimen was further analyzed by Peter Loos. His results confirm and amplify those provided by Tylecote. After sectioning, mounting, and polishing the specimen and examining it with both a light microscope and an electron microscope and an energy dispersive X-ray analyzer, Loos concluded that carbon, present in quantities of 0.8-1.2% by weight, and iron have formed a microstructure that is primarily fine pearlite. Two additional phases can be seen along the prior austenite grain boundaries. The inner phase is assumed to be iron carbide and the outer one ferrite. The small grain size present (average grain diameter of the prior austenite is c. .0015 inch) indicates that the material was mechanically worked at low to moderate temperatures. After final forging it was annealed at temperatures above the austenitizing temperature of 730' C, and then air cooled at a moderate rate, probably between 103 and 105 seconds, producing a fine pearlite microstructure. Cooling probably was carried out in air (P. Loos, personal communication, 12 January 1984, and P. Craddock, personal communication, 13 August 1992).

Metals

Table 6.3. Identifiable iron artifacts
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<th>UNIT</th>
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<th>MEASUREMENTS</th>
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<td></td>
<td>(mm) WEIGHT</td>
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<td>Wire/nail (4 pieces)</td>
<td>Wire/nail (2 pieces)</td>
<td>Bracelet fragment</td>
<td>Wire/nail (3 pieces)</td>
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<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bracelet fragment</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Wire/nail Wire/nail</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bracelet (4 pieces) Bracelet (5 pieces) Bracelet (2 pieces) Bracelet (4 pieces) Plate folded on itself Wire/nail (3 pieces)</td>
<td>Wire/nail</td>
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<td>Elliptical bracelet</td>
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<td>Wire (3 pieces) Wire/nail</td>
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<td>ALS</td>
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<td>10</td>
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<td>23</td>
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<td>6</td>
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Long axis: 120
Short axis: 60;
Thickness: 10.4
Diameter: 6
Diameter: 7
Length: 71;
Width large end: 30;
Width narrow end: 19;
Thickness: 2
Thickness: 5
Length: 54;
Width: 15;
Thickness: 4
Diameter: 7
Diameter: 10
Diameter: 80;
Thickness: 9
(7) Diameter: 13;
(7) Diameter: 6
Length: 5
Diameter: 6
Length: 79;
Head width: 34;
Head thickness: 6;
Shaft Diameter: 8.5
Length: 87;
Width: 30;
Thickness: 4
Length: 37.5;
Diameter: 4
Length: 38;
Width: 15;
Thickness: 5
Length 31;
Diameter: 6
Diameter: 3-4
Diameter: 9
Length: 23;
Diameter: 4
Length: 25;
Diameter: 5
Length: 428;
Diameter: 6.8
Diam: 40;
Width: 12;
Thickness: 5;
Flange length: 16;
Flange thick: 6
Length: 30;
Diameter: 7
Length: 5&7;
Diameter: 6.2
Diameter: 5 & 7
Length: 25;
Diameter: 7
III sup. 321
III sup. 382
II sup. 444
III sup. 577
III sup. 564
III sup. 565
III sup. 490
III sup. 491
III inf. 463
III inf. 970
III inf. 1017
III inf. 519
II inf. 838
I/I 1189
IV 1377
Hafted scraper (2 pieces)
Ring
Blade fragment
Wire/nail
Wire/nail (2 pieces)
Bracelet
Wire/nail (14 pieces)
20
0
Fishhook (2 pieces) Spear point (2 pieces)
Knife blade (2 pieces)
6
Wire/nail
Possible knife blade Wire/nail
Wire/nail (3 pieces) Wire/nail (2 pieces)
Wire
Nail fragment
Wire
1/4 circle with flange
Wire/nail
Nail/arrowhead shaft
Wire (2 pieces)
Wire/nail
IV  1398
III inf. 1456 III inf. 1484 III inf. 1488 I/I 1527
II  1561
IV inf. 1496a IV inf. 1533
IV inf. 1534
IV sup. 21
IV sup. 28
IV sup. 35
IV sup. 82
IV sup. 114
IV sup. 143
IV sup. 144
IV sup. 160
IV sup. 178
IV sup. 179
IV sup. 194
IV sup. 233
IV sup. 242

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<td>Feat. 15</td>
<td>IV</td>
<td>Semilunate blade fragment</td>
<td>1</td>
<td>Length: 123; Max. width: 29.7;</td>
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<td>Blade</td>
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<td>Length: 54; Width: 15</td>
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<td>Feat. 15</td>
<td>IV</td>
<td>Wire/nail</td>
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<td>IV</td>
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<td>Knife blade</td>
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<td>IV</td>
<td>Spike fragment</td>
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<tr>
<td>--------</td>
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<tr>
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<td>IV inf.</td>
<td>Wire/nail</td>
<td>Length: 28; Diameter: 9 6</td>
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<td>LX-N</td>
<td>IV inf.</td>
<td>Small hoe/adze blade</td>
<td>Length: 62; Width: 31.5; Thickness: 5.3; Handle Diameter: 8 19</td>
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<td>IV</td>
<td>Wire/nail</td>
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<td>Coiled wire (2 pieces)</td>
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<td>LX-N</td>
<td>Trans. IV/ I1</td>
<td>Corrugated plate</td>
<td>Length: 47.2; Width: 20; Thick: 5.4</td>
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<td>Width individual corrugation: 8 10</td>
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<tr>
<td>LX-N</td>
<td>III sup.</td>
<td>Arrowhead (2 frag.)</td>
<td>Length: 101; Head width: 16; Shaft Diameter: 8 8</td>
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<tr>
<td>LX-N</td>
<td>III sup.</td>
<td>Wire/nail (4 pieces)</td>
<td>Length: 130; Diameter: 10 7</td>
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<tr>
<td>LX-N</td>
<td>II sup.</td>
<td>Wire/nail (2 pieces)</td>
<td>Length: 80; Diameter: 7 6</td>
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<td>LX-N</td>
<td>Feat. 44</td>
<td>Spike</td>
<td>Length: 74; Thickness: 8 8</td>
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<tr>
<td>LX-N</td>
<td>II1 sup.</td>
<td>Wire/nail (8 pieces)</td>
<td>Diameter: 7 38</td>
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<tr>
<td>LX-N</td>
<td>III sup.</td>
<td>Wire loop (eye-bolt&quot;)</td>
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<td>III sup.</td>
<td>Wire</td>
<td>Length: 36; Diameter: 7 4</td>
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<td>III inf.</td>
<td>Wire/nail (2 pieces)</td>
<td>Diameter: 5 3</td>
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<td>LX-N</td>
<td>III inf.</td>
<td>Plate (folded on itself)</td>
<td>Length: 30; Width: 18; Thickness: 6 7</td>
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<td>LX-N</td>
<td>II inf.</td>
<td>Square nail</td>
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<td>DX-N</td>
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<td>Bracelet (4 pieces)</td>
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<td><strong>Table 6.3 - continued. Identifiable iron artifacts</strong></td>
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<td>UNIT</td>
<td>LEVEL</td>
<td>PHASE</td>
<td>SF NO.</td>
<td>DESCRIPTION</td>
<td>MEASUREMENTS (mm)</td>
<td>WEIGHT</td>
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<td>II/II</td>
<td>I/II</td>
<td>1186</td>
<td>Wire (2 pieces)</td>
<td>Diameter: 7 8</td>
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<tr>
<td>LX-N</td>
<td>49</td>
<td>II</td>
<td>1303</td>
<td>Plate/disc</td>
<td>Length: 44; Width: 38; Thickness: 6 15</td>
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<tr>
<td>LX-N</td>
<td>49</td>
<td>II</td>
<td>1304</td>
<td>Bracelet</td>
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</tbody>
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- Metals
- Unit II/II II/I' 1/III
- Level II
- Phase IV
- SF No. 2 IV
- Description: Wire (2 pieces)
- Measurements (mm): Diameter: 7 8
- Weight: Not specified

- Unit II/II II/I' 1/III
- Level II
- Phase IV
- SF No. 3 IV
- Description: Plate/disc
- Measurements (mm): Length: 44; Width: 38; Thickness: 6 15
- Weight: Not specified

- Unit II/II II/I' 1/III
- Level II
- Phase IV
- SF No. 11 IV
- Description: Bracelet
- Measurements (mm): Diameter: 80; Thickness: 10 9
- Weight: Not specified
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<th>Width</th>
<th>Thickness</th>
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<td>4</td>
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<tr>
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<td>1</td>
<td>Diameter: 9</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
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<td>Length: 47; Diameter: 6</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>Bracelet</td>
<td>1</td>
<td>Diameter: 54; Thickness: 9</td>
<td>25</td>
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<tr>
<td>Semicircular plate w/ hole</td>
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<td>Width: 17; Diameter: 60</td>
<td>82</td>
<td>6</td>
<td>26a</td>
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<td>Possible knife blade (2 pieces)</td>
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<td>Length: 57; Width: 19; Thickness: 5</td>
<td>12</td>
<td>26a</td>
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<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Wire (4 pieces)</td>
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<td>3</td>
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<td>Diameter: 4</td>
<td>33</td>
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</tr>
<tr>
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<td>1</td>
<td>Diameter: 30; Thickness: 12</td>
<td>3</td>
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</tr>
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<td>Wire/nail</td>
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<td>Length: 26; Diameter: 5</td>
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<td>Ring fragment</td>
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<td>Length: 55; Diameter: 6</td>
<td>Head</td>
<td>thickness: 8</td>
<td>5</td>
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<tr>
<td>&quot;Spoon&quot; (3 pieces)</td>
<td>3</td>
<td>Length: 38; Handle Diameter: 5; Lip width: 13; Lip thickness: 3</td>
<td>3</td>
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<tr>
<td>Ring fragment</td>
<td>1</td>
<td>Diameter: 31; Thickness: 7</td>
<td>6</td>
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</table>

Possible arrowhead Spike (2 pieces) Nail (2 pieces) Triangular plate Wire
Wire/nail
Wire Wire
Wire (5 pieces)
Tear-shaped pendant
Triangle Wire/nail
Pointed knife blade Pointed knife blade Linked ring ends Oval ornament w/
reinforcing bar
Wire/nail
Possible knife
Wire/nail
Hook-shaped fitting Wire/nail (2 pieces) Barbed projectile point
Wire/nail
Blade
Wire/nail
Hook fragment Wire (9 pieces) Wire/nail (3 pieces) Wire
Arrowhead
Arrowhead
Length: 31; Thickness: 6; Head
Length: 120; Thickness: 10 16
Length: 55; Diameter: 9 8
Base: 45; Height: 42; Thickness: 4 11 Length: 29.5; Diameter: 10.5 3
Length: 32; Diameter: 9 4
Length: 29; Diameter: 8 2
Length: 15; Diameter: 6 1
(3) Diameter: 2; (1) Diameter: 5;
(1) Diameter: 6 10
Length: 40 Max. width: 18; Min.
width: 4; Thickness: 9 6
Length: 25.3; Base: 12; Thickness: 3.2 2
Length: 65; Diameter: 12 10
Length: 42; Width: 11; Thickness: 4 3 Length: 31; Width: 10; Thickness: 3 3
Diameter: 24; Thickness: 10 4
Length: 53; Width: 31; Thickness: 13 21
Length: 55; Diameter: 9 8
Length: 31; Width: 21; Thickness: 5 6
Length: 55; Diameter: 10 11
Length: 32 Width: 13 8
Diameter: 6 6
Length: 65; Width: 15; Thickness: 6 8
Length: 57; Diameter: 10 7
Length:37; Width: 12 Thickness: 3 3
Length: 42; Diameter: 5 2
Length: 16; Width: 4 1
Diameter: 7 35
(1) Diameter: 4; (2) Diameter: 5 8
Length: 42; Diameter: 6 4
Length: 37; Shaft Diameter: 6; Head
width: 13 7
Length: 47; Shaft Diameter: 8; Head width: 13 9
24 57 [Pit 6] Feat. 11
27 27 27 31
31
31
31
43
39 [Pit 41 39 [Pit 41 48 [Pit 51
36

Metals
Table 6.3 - continued. Identifiable iron artifacts

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<th>LEVEL</th>
<th>PHASE</th>
<th>SF NO.</th>
<th>DESCRIPTION</th>
<th>MEASUREMENTS</th>
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<td>(mm)</td>
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<tr>
<td>69</td>
<td>69</td>
<td>69</td>
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<td>69</td>
<td>69</td>
<td>69</td>
<td>69 69 69</td>
<td>69 69 69 69</td>
</tr>
</tbody>
</table>
Handle
Harpoon point
1 V 584 Wire/nail
4 IV inf. 683 Oval plate
1
Total SF 1074
Length: 75; Diameter: 5 Length: 32; Diameter: 6
(3) Diameter: 6; (3) Diameter: 3 Length: 43; Width: 14; Thickness: 11
Diameter: 7
Neck width: 11; Shaft width: 6
Length: 60; Diameter: 5
Diameter: 6
Length: 23-40; Diameter: 4 Length: 86.4, Width: 27.4; Thick: 6.8 Length: 80; Hook width: 120;
Thickness: 58
Length: 28; Diameter: 3 Length: 33; Diameter: 5 Length: 30; Diameter: 3
Total SF 1138
Length: 35; Width: 24; Thickness: 5 Length: 43 Width: 23; Thickness: 5
Length: 62; Diameter: 6 Length: 32.3; Diameter: 6 Length: 61; Max. width: 13; Min. width: 8
Length: 53; Head width: 13; Shaft Diameter: 8
Length: 19.5; Diameter: 4
Length: 37; Width: 24; Thickness: 3.5
SITE TOTAL 300 1856
79 791
LX-S TOTAL
NWS
NWS TOTAL
WFL
WFL TOTAL

Metals
SLAG AND OTHER METALLURGICAL DEBRIS
An impressive amount of slag was recovered from the excavations: 62 kg in all, mainly concentrated in centrally located units LX-N, LX-S, and CTR (Figure 6.6; see Appendix D, Table D2 for slag counts and weights per unit and level and Figures D1-4 for graphs of total slag weight per level in units LX-N and LX-S). The distribution in time clearly shows that the vast majority of the recovered slag dates from the Phase IV/HI transition through the end of Phase IV, but then so
does the bulk of the excavated deposits in the large exposure (LX), where these slag quantities are so impressive. In examining the relative frequency of slag per unit volume of deposit (Figure 6.5a-c), we see that in LX-N slag quantities do not vary greatly through time or from one depositional context to another. In LX-S, slag frequencies are more variable, with a notable peak in Phase IV (Level 31), and very low frequencies in both Phase I/Il and the late Phase IV pits. In the other excavation units, slag frequencies are low, and relatively invariant, with the notable exception of the Phase I/Il pit in CTR represented by Levels 37 and 39. This depositional context provides the highest frequencies of slag per unit volume of deposit from any excavation unit.

Analysis of slag samples from the excavation by R. F. Tylecote reveals that both smelting and smithing residues are present at Jenn6-jeno. We also submitted an ore sample from CTR Level 39 for analysis, which proved to be of the same type that was smelted at the site. Tylecote's (personal communication, 28 December 1982) comments on these samples were as follows:

Ore sample SF 1580: High-grade iron ore; red and non-magnetic. An electron microprobe analysis (EMPA) gave the analysis shown in the accompanying table [here, Table 6.4]). The ore contains 54% Fe2O3 (hematite) and would be quite good enough for the bloomery process. It is fairly typical of the lateritic iron ores of West Africa. The alumina is a very typical component of lateritic iron ores. It is possible that some of the alumina and silica can be removed by careful washing and the ore up-graded.

Iron smelting slag SF 1581.: A typical smelting slag consisting of fayalite and a glass phase with wüstite in dendritic form. There were no non-ferrous metals present. There is no doubt that this is the product of iron smelting by the bloomery process. An EMPA analysis was carried out using the raster technique on areas 200 pxn2 giving the results shown in columns B, C, and D [of Table 6.4]. The alumina content shows clearly that this slag was produced by an ore of the type represented by SF 1581. In the slag the silicon has been increased and the iron decreased, which is what one would expect for the bloomery process which rarely gives a yield of iron greater than 20% of the iron available. The potash and lime come from the ash in the charcoal fuel. The fact that the AL2O3 has been decreased slightly suggests that the ore was washed to remove some of the clayey material.

The bulk of the structure is formed of fayalite laths which have the typical composition given in column E. The glass phase contains most of the alumina and alkalies and usually approximates to the mineral anorthite. Occasionally one sees crystals of the spinel mineral hercynite, the composition of which is given in column G. The interesting feature of this is the chromia content. It would seem that most if not all of the chromium is concentrated in this phase and is barely detectable in the overall composition. This element may help in determining ore source, but I suspect that most lateritic ores contain it, even if it is not reported.

Other samples of slag and furnace linings examined by Tylecote are less certainly identifiable as to the type of process (smithing versus smelting) that produced
them, in the absence of detailed analyses. He has, however, identified a sample of slag and furnace lining from LX-N Feature 28 as probably a smithing furnace bottom.

Table 6.4. Composition of Ore and Slags from Jennd-jeno

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<tr>
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<th>A</th>
<th>B</th>
<th>C</th>
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<tr>
<td>Ore</td>
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<tr>
<td>Smelting Slag</td>
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<td>SF1581</td>
<td>SF1580</td>
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<tr>
<td>-</td>
<td>45.4</td>
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<table>
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<th></th>
<th>E</th>
<th>F</th>
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<tr>
<td>SF1580</td>
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<tr>
<td>Fayalite Glass Spinel</td>
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<td>68.6</td>
<td>29.5</td>
<td>42.7</td>
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Note: Figures for Raster analysis represent results of scanning three separate areas 200 umm2. Analyses were carried out by R. F. Tylecote.

Fe 0
SiO2
MgO K2O
CaO MnO
Cr2O3

Metals
The presence of smithing activity (non-ferrous, in this instance) at the site is confirmed by the presence of a number of crucibles (see Table 6.5, Figure 6.7), one of which (SF 1166) had greenish residues on the interior, which proved, upon analysis, to contain copper, tin, and iron. Lead and zinc were absent. This
crucible, which dates to the Phase III/IV transition, indicates that melting of bronze took place at the site (R. F. Tylecote, personal communication, 28 December 1982). Two mold fragments were recovered from the same depositional context (SF 981, SF 1108). The presence of crucibles from Phase III to later Phase IV suggests that copper alloys were melted and worked at Jenndjeno throughout this time period.

The distribution in time of slag, crucibles, tuyre fragments, and furnace parts (see Table 6.6 for description of tuyres and furnace parts recovered) indicates clearly that metallurgical activity took place at Jenn6-jeno throughout its occupation. Smelting slag associated with probable furnace parts come from the earliest Phase I/II deposits in CTR. Slag and tuyre fragments were also recovered from Phase I/II deposits at Hambarketolo. The Phase III deposits at CTR produced furnace parts and tuyres, and small amount of slag. Evidence for metallurgical activity is particularly pronounced and varied beginning with the Phase III/IV transition. The vast ash pit that dominates the lower half of the LX-S deposits and dates to this transition has produced two molds, three crucibles, and several tuyre fragments. Early Phase IV deposits in LX-N yielded two crucibles and more furnace parts. Pits 4 and 5 in LX-S, dating to the middle part of Phase IV, contained two crucibles. Perhaps most interesting is the evidence for a smithy operating near House 10 in LX-N, which would have been responsible for the elevated amounts of slag (7.5 kg) in associated Level 31 in LX-S. Within Level 31, the discovery of Feature 21, an elaborate arrangement of sandstone slabs (see Chapter 2, and Figure 2.40), was immediately recognized by our workers as an ironsmith's rain shrine. While one can and should remain reticent to accept uncritically the conclusions of local informants on the meaning or purpose of features created over a millennium ago, nevertheless, the fact of the high slag density in Level 31 lends this interpretation some credence. In addition, the average size of the slag, both in Level 31 and associated with House 10, is the smallest from any excavated context (see Figure 6.8a-c), which is perhaps what we would expect in an area of active ironsmithing, which generates mostly small pieces of slag from working the bloom. The similarly small size of the small amounts of slag present in the early Phase IV levels at Kaniana might by the result of localized smithing activity, or of the accumulation of eroded material. Given that the slag is distributed through several levels, and shows no obvious patterning, I am inclined to favor the latter explanation. Since Kaniana is a broad flat mound, erosion would have moved only very small pieces of slag. Nevertheless, its presence does indicate that metals were worked at Kaniana during Phase IV. Evidence for metallurgy continues into the later part of Phase IV in LX-S, with crucibles, tuyres, and furnace parts present, the majority of them associated with the brick houses occupied during this time.
DISCUSSION

Several apparently time-sensitive trends can be emphasized. First is the development of metallurgical production and use at Jenn-t-jeno, beginning with the smelting and use of iron by the earliest inhabitants of the site. To iron production, copper and bronze melting, molding, and hammering are added in Phase III, and gold is present by the end of the phase. Brass comes into use in Phase IV and was likely also worked on the site up until the end of site occupation, given the presence of crucibles throughout the phase. The increasing availability of copper alloys for ornaments and jewelry from Phase III onward may be related to another apparent chronological trend: a shift in the function of iron artifacts from primarily decorative to primarily utilitarian. If we consider those artifacts in Table 6.3 whose purpose was identifiable as either decorative or utilitarian (and excluding, objects identified as wire/nail, since their function is unknown or at least ambiguous) the resulting lumped data show a definite trend through time:

<table>
<thead>
<tr>
<th></th>
<th>IV</th>
<th>1V/III</th>
<th>III</th>
<th>I/II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilitarian</td>
<td>38</td>
<td>9</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Decorative</td>
<td>8</td>
<td>3</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>

If we posit the null hypothesis that function of iron artifacts did not change through time and set the level of statistical significance at \( p = .01 \), the observed chi-square value of 17.848 (3 d.f., \( p = .0005 \)) causes us to reject the null hypothesis. Function changes through time. Of course, the relatively small sample sizes involved oblige us to treat this as a tentative conclusion. It should also be recalled that the tested hypothesis refers to that subset of all iron artifacts produced and used at Jenn-t-jeno that found their way into the deposits of our excavation units. Deposition patterns do not necessarily, or perhaps even logically, reflect production patterns. We cannot conclude, from the figures above, that iron was fashioned exclusively into jewelry and other ornaments in Phase I/II. The sample size from this phase is far too small to permit any such conclusion in the first place. Beyond that, there is the very real possibility that the cost of iron was sufficiently high that heavier utilitarian items were assiduously reused, resharpened, and reforged, and thus were unlikely to find their way into the archaeological record. They may have been more likely to be deposited, after extensive reuse, as objects whose form and function are not identifiable. This could partially account for the high ratio of unidentifiable-to-identifiable iron in Phase I/II. This ratio could also reflect the increasing effect of corrosion as a function of time.

Whatever the reason for the lack of utilitarian iron in the very earliest levels, the overwhelming predominance of utilitarian iron in Phase IV merits explanation. I
suggest that the introduction of exotic and highly desirable copper and copper alloys in Phase III offered an immediate and more attractive alternative for the production of personal ornaments. The excavated data suggest that copper alloys became increasingly available in

**Metals**

Phase IV, resulting in a shift away from the use of iron for decorative purposes. In this case, I am clearly arguing that deposition patterns do reflect production patterns during Phase IV, and I could thus be accused, quite rightly, of inconsistency on this topic. The crux of the matter is to devise hypotheses that can account for the contrary case: behaviors that would differentially discourage the deposition of iron ornaments, but not iron tools, in the ground. Thus far, I have not come up with any compelling hypotheses. But the field remains open to informed speculation.

A second trend involves the possibility for change in the nature and location of metal production at the site through time. The presence of significant quantities of iron slag in all levels of all excavation units within the central precinct (defined as the original central core of the site, including LX, CTR, and ALS) indicates that metallurgical activity was occurring within this zone at all times, resulting in a steady movement, through erosion or other processes, of slag pieces over the site surface. Against this background noise of slag, however, several clear production zones have been identified on the basis of exceptionally high volumes of slag and/or the presence of other production debris, such as tuyers, crucibles, and furnace parts. During Phase I/II, Levels 37-39 in CTR clearly contained the debris of nearby iron smelting and, perhaps, smithing. The large quantities of charcoal, furnace parts with tuyers, slag, and ore fragments suggest that this was a waste pit for a nearby smelting locale. It was likely used for a relatively brief period of time. Subsequent Phase I/II deposits produced only low background levels of slag and no other metallurgical debris. The presence of slightly elevated slag volume, and of tuyer fragments at HAMB in Phase I/II, suggests that metallurgical activity also was taking place at the site adjacent to Jenn6-jeno. The evidence for early Phase III production is skimpy to nonexistent. The background slag levels continue, but convincing production locales cannot be identified within the excavated units. This situation changes dramatically in the later part of Phase III, when crucibles, tuyer fragments, and slag are concentrated in LX-N, Levels 36 and 38, and especially in the transition from Phase III to IV, when the tremendous ash pits of LX-S signal the nearby presence of iron and bronzesmiths, who dumped their slag, molds, crucibles, and furnace debris into the pits. From this point on, smithing is a quasipermanent fixture in the LX neighborhood, represented by crucibles and furnace parts in LX-N early Phase IV deposits, by crucibles, iron smithy debris, and a possible ironsmith's rain shrine in middle Phase IV deposits in LX-S, and by crucibles, tuyzers, and furnace parts throughout the upper Phase IV LX-S deposits (summarized in Tables 6.5 and 6.6). It is reasonable to ask if we are not seeing some kind of fundamental reorganization of either metal production or town structure, or both, between Phase I/II and late Phase III, involving a change from short-term, shifting
production centers to the longterm installation of smiths in specific locales or
quartiers, perhaps as members of organized specialist producer groups.
With regard to this latter possibility, the lack of apparent increase in iron
production, as extrapolated from slag and iron per unit volume of deposits, is
surprising, if not downright astonishing, given the evidence that both

Metals
economic prosperity and population density increased through time at the site.
One would expect that a likely result of both these trends would be an increased
consumption of iron. It is always possible that environmental circumstances, such
as climatic degradation or progressive deforestation, during Phase IV raised the
"cost" of iron production, resulting in lower consumption through increased reuse
and recycling. Testing of this
hypothesis will require larger samples of Phase III deposits for comparison with
the significant Phase IV sample already in hand, and a research design
specifically targeted at reconstructing environmental change during the period of
site occupation. There is also the possibility that shifts in the location of smelting
areas to the periphery of or away from the site could be responsible for an
apparent lack of increase in slag production. (Laurence Garenne-Marot, personal
communication, 10 April 1992). Nevertheless, the notably low frequencies of iron
in Phase IV still require explanation. For the present, the apparent lack of growth
in iron consumption through time at Jennd-jeno remains puzzling.

The nature of the iron production technology at Jenn6-jeno merits some comment.
Initially, the realization that the iron rod from the earliest occupation levels at the
site (SF 1409) was in fact steel led to a brief flirtation with the idea that it was a
product of the "direct steel process" as described by Schmidt and Avery (1978,
1983 ) and van der Merwe (1980). However, euphoria over the idea of a highly
sophisticated African technology in deceptively simple bowl furnaces has waned
in the wake of criticism that the baseline studies were methodologically flawed (Rehder 1986; Eggert 1987), drew conclusions that would seem to require
suspension of the known laws of the physics of heat transfer (Rehder 1986;
Killick in press), and did not take adequately into account the known variability of
carbon content within blooms produced by the bloomery process (Killick in
press). While the final evaluation of the direct steel process and its technical
relationship to the bloomery process (subset of? related variant?) remains to be
made by a qualified archaeometallurgist, I see no reason at present to question
Tylecote's conclusion that SF 1409 and, by extension, other Phase I/II iron
artifacts, were produced by the bloomery process, which has historically proven
capable of producing steel with a carbon content of up to 1.67% (Tylecote 1976:
47). The production process involved air cooling, as at Taruga, where quenching
in water was apparently unknown.

Metals
TOTAL COPPER
Surface
IV sup. IV/IV inf. IV/III trans.
Figure 6.1. Surface distribution by phase of copper from excavations and Jenn-jeno

SF 317
SF 29
SF 115
SF 1575

Figure 6.2a. Copper-based artifacts from Jenn-jeno (scale 2:1) For composition of analyzed specimens, see Table 6.2.

SF 1426
SF 1460
SF 1569
SF 1572
SF 1541

Figure 6.2b-continued. Copper-based and gold artifacts from Jenn-jeno (scale 2:1, except SF 1433, 1541, and 1570 shown 3:1). For composition of analyzed specimens, see Table 6.2. SF 1433 is gold.

Metals
SF 704
SF 1570
SF 1433

Figure 6.3. Composition of excavated copper artifacts

0 Cu ElZn M Sn N Pb 0 Fe *As

Figure 6.4. Total weights of recovered iron, both identifiable and unidentifiable, by unit and phase

ALS
CfrR
HK
LX-N LX-S NWS WFL HAMB
KAN

Figure 6.5. Iron weight in grams
G/m³ - iron
0
00
200
Cc rouolwpIms puc RuTs - £tU/g
2?83

G1m³ - iron
0 1;w d bo
0
>
t4
0
u l)
8 8 8 8
00 t
auoispus puu guls - £IU/£)

UOII - sl/O
>4
z U)
LfW
DUOISpuLS pUP ärIs - £W/£)

biD
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nomL CD
IINfl

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1 1
i-EI
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0
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CD IB
S
.5
S
0
C
2
0
ANALYSIS OF THE MAMMALIAN, AVIAN, AND REPTILIAN REMAINS
Kevin C. MacDonald
Cambridge University

MAMMALIAN REMAINS
Along with fishes, mammals from Jenn6-jeno formed the dominant class of fauna within the site's assemblage. The mammalian assemblage from the 1981 field season is especially important, as it is one of the first large West African Iron Age assemblages to be treated quantitatively across space and time (c. 250 B.C.-1400 A.D.). As such, it provides tantalizing insights into an early urban economy of the Inland Niger Delta, and some potentially interesting lessons on spatial factors in faunal sample bias.

As could be expected, analysis of the Jenn(-jeno assemblage revealed a large quantity of both wild and domesticated bovid remains (domesticated cattle, sheep/goat, and at least four species of antelope) as well as smaller quantities of other wild mammals such as hippopotamus (Hippopotamus amphibius), warthog (Phacochoerus aethiopicus), and aardvark (Orycteropus afer). An equid (probably horse) and domestic dog were also present, as were felids of questionable domestic affinity. Descriptions of these faunal remains, the methodology for their identification and quantification, and the interpretations drawn from them are presented below.

Methodology
The 1981 mammalian assemblage was analyzed with the aid of the extensive comparative collections of the Field Museum of Natural History in Chicago. The African bovid collection at the Field Museum has recently been augmented by extensive acquisitions of skulls and associated complete postcranial remains from the Milwaukee Public Museum. This is significant, as careful attention was paid to postcranial morphology in the identification of Bovidae.

In the analysis of the 1981 material, all fragments of all mammalian taxa identifiable to part (with the exception of ribs) were identified to the most precise possible level and treated quantitatively. Any elements of Bovidae that could not confidently be taken to subfamily, genus, or species on the basis of morphology-in most cases fragments of the upper limb or appendicular skeleton-were identified only to size class, regardless of probable affinities.

Mammalian, Avian, and Reptilian Remains
Following Brain (1974), I have utilized a size class system based on the categories "small," "small-medium," "large-medium," and "large." However, since Brain originally devised his system only for wild South African species, I have created a revised size class system to include the wild and domestic bovids of West Africa (Table 7.1). In comparison with Brain's system, my system is approximately similar in the smallest three categories, but broader in
regard to the large category. Divisions were drawn between categories at approximate "gaps" in the bovid size continuum, and at points which allow easiest sorting based upon past experience with comparative collections. Size data on which the system is based were derived from Haltenorth and Diller (1980) and Epstein (1971).

Problematic differentiations, particularly those between the African buffalo (Syncerus sp.) and cattle (Bos sp.), were aided by morphological criteria supplied in Peters (1986), Gentry (1978), and Guerin and Faure (1983). Of Peter's (1986) extensive postcranial morphological criteria for the differentiation of Bos and Syncerus, those for the first and third phalanges proved to be especially reliable. For all taxa, "nondiagnostic" fragments were taken to precise taxon only when they were clearly associated with diagnostic elements (e.g., separated tooth rows).

The assemblage is presented both in terms of minimum number of individuals (MNI) and number of individual specimens present (NISP). The latter is the more conservative estimate.

MNI was calculated as follows: All elements attributable to species, or to a single unknown member of a family, were checked for the duplication of elements of the same side (if relevant) by unit level. The number of such duplications was treated as the MNI. (Elements which are not determined to side [e.g., phalanges], or which are not sided [e.g., vertebrae], were simply divided by their maximum total number per taxon.) MNIs were further augmented by instances of significant size differences between elements of opposite sides, and by the presence of immature individuals versus mature specimens.

NISP was calculated as follows: All remains determinate as to element, and attributable to species or other taxonomic grouping by morphology or association, were counted. Separated fragments of a single element possessing fresh breaks were treated as one fragment. Separated fragments without fresh breaks were counted as the number of fragments which could have been taxonomically identified, or associated, individually.

In addition, I present measurements for elements attributable to the various domestic bovids present at Jenn6-jeno. These measurements were guided by the procedures presented in von den Driesch (1976). Following von den Driesch, measurements are presented only for elements or portions of elements listed by von den Driesch as having moderate to very good value for the estimation of sizes within mature living populations. Unfortunately, few such elements from the Jenn6-jeno assemblage were intact enough for proper measurement. The results of such measurements as were possible are presented in Appendix E, Tables E1-2 and below. It should be stressed that until such measurements are commonly presented by all researchers of early

Mammalian, Avian, and Reptilian Remains

Table 7.1. Extant bovid size classes for South and East Africa and those proposed for West Africa.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extant bovid size class systems for South and East Africa</td>
<td></td>
</tr>
<tr>
<td>Brain (1974) and Klein (1976)</td>
<td></td>
</tr>
</tbody>
</table>
I (small) 0-23 kg
II (small-medium) 23-84 kg III (large-medium) 84-296 kg IV (large) 296 kg+
(Very large) ?
Gifford et al. (1980)

**CATEGORY** | **DIMENSIONS**
--- | ---
very small | 5-15 kg
small | 16-35 kg
medium | 40-60 kg
large | 70-250 kg
very large | 300-850 kg

**Bovid size class system for West Africa**

**CATEGORY** | **MEAN** | **LARGEST SPECIES INCLUDED** | **SPECIES INCLUDED**
--- | --- | --- | ---
Small | 25-90 kg | Ourebia ourebi | Cd
Small-Medium | 90-270 kg | Gazella dorcas d' |
Large-Medium | 270 kg+ | Ammotragus lervia | CT
Large | | Kobus kob | 9

**Mean**

**Large**

**Very large**

**Ourebia ourebi**

**Gazella dorcas**

**C. sylviculor**

**Syncerus caffer**

**Neotragus pygmaeus**

**Dwarf ovicapridae**

**Tragelaphus scriptus**

**Cephalophus sylviculor**

**Dwarf cattle**

**Taurotragus derbianus**

**Hippotragus equinus**

**Addax nasomaculatus**

**Oryx dammah**

**Alcelaphus buselaphus**

**Damaliscus lunatus**

**Gazella dama**

**Dwarf cattle**

**Non-dwarf cattle**

**Mammalian, Avian, and Reptilian Remains**

West African domestic stock, it will be difficult to synthesize data on the origins, spread, and general types of domesticated animals within this region. Furthermore, until the remains of modern African livestock are more commonly collected and measured, information from more recent archaeological assemblages cannot be correlated with information concerning existing breeds and their cultural/environmental associations.

The difficulties encountered in screening at Jenn6-jeno have important implications for sample recovery (R. McIntosh and S. McIntosh 1984:165). This is an important factor to keep in mind. Inspection of the microfaunal remains from Jenn6-jeno reveals that few very small fragments were recovered; indeed, less than five elements from mammalian microfauna were recovered during the 1981 season. Furthermore the quantity of relatively small bird and reptile remains from
the four 3-by-3m units of the 1977 Jennd-jeno campaign (M1, M2, JF1, and JF2),
and a 10-by-6m and seven smaller exposures from the 1981 season (LX-N/LX-S, ALS, CTR, WFL, HK, HAM, KAN, and NWS), are almost comparable in
number to those recovered from a single 3-by-3m unit (also not screened) from
the 1986 excavations at Dia (MacDonald 1989). I can only conclude that the scale
of excavations at Jenn6-jeno has strongly affected sample yield from smaller
fauna, and the birds and reptiles from those excavations should be understood as
only a small sample of a larger faunal reality.

Results and Discussion
Preservation within the Jenn(-jeno assemblage was highly variable. While
remains from certain strata seem to have suffered from profile compaction or
calcium leaching, this appears to be predictable in terms of manner of deposition.
As might be expected, specimens from trash pits or ash layers were particularly
well preserved, while those from levels of gradual accumulation, which had
suffered substantial surface weathering, were less SO.
Charring, perhaps from roasting of carcasses or from chance association with
fires, was common throughout the assemblage. Of greater interest was a high
proportion of elements that had been cleaved in two by metal implements, leaving
a telltale clean stroke. Such occurrences were common throughout the Jenn6-jeno
sequence, from first occupation to abandonment. Especially common were
cleaved vertebrae, cut both craniocaudally and mesiolaterally, presumably for the
division of carcasses. As is typical, few long bones were left even moderately
intact. This practice, of course, leaves a notable sample bias favoring elements not
smashed for marrow, such as dentition, carpals, tarsals, and phalanges.
In no case was sample size large enough to construct a mortality profile for any
taxon. The limited data available, however, suggest that incidence of deciduous
dentition, unerupted dentition, and unfused epiphyses was much higher among
domestic bovids than among their wild counterparts (Appendix E: Tables E3-10).
This is probably an indication of the culling of

Mammalian, Avian, and Reptilian Remains
young males and unhealthy infants from domestic herds, as opposed to the
selection of more mature wild game.
A summary of the mammalian remains identified from the 1981 excavations, with
data lumped by phase within each excavation unit, is presented in Table 7.2. MNI
aggregations for each phase per unit were calculated by determining MNIs from
depositionally coeval levels and adding MNIs from the clustered levels to for a
total for deposits representing each phase within the unit. Body part provenience
data for each unit are presented in Appendix E, Tables E3-10.
Wild Bovidae. Of at least four species of antelope present in the Jenn6jeno
assemblage, one clearly dominated in quantity. This was the kob (Kobus kob).
Like all wild bovids recovered from the 1981 excavations, the kob was especially
common in levels dating from Phase I through Phase III, and in Units LX-N, LX-
S, CTR, and HAMB. The kob is a small-medium to largemedium waterbuck that
is a short-grass grazer common to riparian habitats and adjoining fire-climax
grasslands, and it requires a constant source of water (Kingdon 1982). Also
present in smaller quantities was another member of Reduncinae, Redunca redunca, or the Bohor reedbuck, and a Tragelaphine, the bushbuck (Tragelaphus scriptus). The reedbuck is morphologically similar to the kob, but approximately two-thirds its size and thus easily differentiable. The bushbuck is morphologically distinctive from both the kob and the reedbuck. Both the Bohor reedbuck and the bushbuck share the kob’s strong need for a constant source of water, however, they require high grass or light woodland cover not necessary for the success of the kob (Haltenorth and Diller 1980; Kingdon 1982).

Specimens from an indeterminate member of the subfamily Alcelaphinae (hartebeests) were also present. These specimens (represented by distinctive phalanges and dentition) almost certainly represented Alcelaphus buselaphus (the hartebeest) or Damaliscus lunatus (the topi) rather than Connochaetes sp. (wildebeests), highly migratory Alcelaphines indigenous to East and South Africa. The hartebeest and the topi both have wide ranges of environmental tolerance and are known from Sahelian climates to inundated regions.

All antelope species identified may still be found along the Middle Niger today. It is unclear why the kob should have predominated over the other antelope species in the Jennd-jeno assemblage. It is possible that the kob was once locally more common in the Jenn6 area, or was preferred for other reasons such as ease of hunting.

Upon observing the distribution of antelope species in Table 7.2, it is at once remarkable that they appear strongly in Phase I/II and decline rapidly in quantity from Phase III to Phase IV. To assure that this trend was not a result of biased distribution of more-or-less diagnostic elements over time, numbers were also observed in size classes that could be expected to be associated with wild fauna. For this purpose, it was considered that the small size category probably comprised predominantly dwarf sheep/goat with some additional wild fauna (e.g., duikers); the small-medium size class probably comprised predominantly bushbuck, reedbuck, and female kob, along with nondwarf...
**Table 7.2-continued. Mammalian remains by unit and phase**

<table>
<thead>
<tr>
<th>TAXA WFL HK I HAMB KAN</th>
<th>TOTAL ALL UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>III IV III I IV II III IV I/II III IV</td>
<td>x/125 x/31 x/117 x/166 x/66 x/8 x/39 x/1 x/63 x/15</td>
</tr>
<tr>
<td>Phacochoerus aethiopicus</td>
<td>1/1 2/4 1/1 II/11</td>
</tr>
<tr>
<td>(warthog)</td>
<td></td>
</tr>
<tr>
<td>Hippopotamus amphibius</td>
<td>1/1</td>
</tr>
<tr>
<td>(hippopotamus)</td>
<td></td>
</tr>
<tr>
<td>Kobus kob</td>
<td>1/18 11/58 3/12 2/2</td>
</tr>
<tr>
<td>(kob)</td>
<td></td>
</tr>
<tr>
<td>Redunca rubrunca</td>
<td>1/1</td>
</tr>
<tr>
<td>(bohor reedbuck)</td>
<td></td>
</tr>
<tr>
<td>Tragelaphus scriptus</td>
<td>1/1</td>
</tr>
<tr>
<td>(bushbuck)</td>
<td></td>
</tr>
<tr>
<td>Alcelaphinae gen. et. sp. indet.</td>
<td>2/4</td>
</tr>
<tr>
<td>(hartebeests)</td>
<td></td>
</tr>
<tr>
<td>Ovis/Capra -- dwarf</td>
<td>1/3</td>
</tr>
<tr>
<td>(dwarf sheep and goat)</td>
<td></td>
</tr>
<tr>
<td>Ovis/Capra -- non-dwarf</td>
<td>1/1</td>
</tr>
<tr>
<td>(non-dwarf sheep and goat)</td>
<td></td>
</tr>
<tr>
<td>Bossp.</td>
<td>1/2 1/1</td>
</tr>
<tr>
<td>(domestic cattle)</td>
<td></td>
</tr>
</tbody>
</table>
(domestic cattle)
Small bovid  
- x/1  x/7  x/9  x/13
Small-mediumbovid  
- x/5  x/1  x/2  x/48  x/29  x/12
Large-mediumbovid  
- x/1  x/6  x/34  x/30  x/26
Largebovid  
- x/1  x/7  x/2  x/37  x/54  x/30
Equus cf. caballus  
- 1/1 (equid, probably horse)
Orycteropus afer  
- 1/1 (aardvark)
Cricetidae gen. et. sp. indet.  
- 1 / 1  1 / 1  1 / 1  1 / 1 (indet. cricetine rodent)
Lepus sp.  
- 2/2 (indeterminate hare)
Canis cf.familiaris  
- 1/5  1 / 1  6/25  1 / 1 (mostly domestic dog)
Felis lybica/catus  
- 5/23 (wild cat/domestic cat)
Viverridae gen. et. sp. indet.  
- 2/2  1/3  2/2 (mdet. civet cat)
TOTAL  
- x/3  x/1x/x/2  x/41  x/6  x/6  x/248  x/259  x/193

Note: First number is MNI (minimum number of individuals), second number is NISP (number of individual specimens present): x = indicates present.

Mammalian, Avian, and Reptilian Remains
sheep/goat; the large-medium size class probably comprised predominantly male kob, hartebeest, and possibly some smaller cattle; and the large size class probably comprised predominantly cattle along with possible wild taxa such as African buffalo and eland. Thus, in the most speculative sense, the small and large size categories are classified as primarily domestic bovids, and the small-medium and large-medium categories are classified as primarily wild bovids. Table 7.3 compares the incidence of these size classes over time. The figures in Table 7.3 correlate closely with those from Table 7.2, showing a dramatic fall in small-medium and large-medium Bovidae from a large presence in Phase I/II to near absence in Phase IV, with a concurrent rise in the small and large "domestic" classes.

Table 7.3. Wild versus domesticated bovids over time from all 1981 excavation units

<table>
<thead>
<tr>
<th>Phases</th>
<th>I/II</th>
<th>III</th>
<th>IV</th>
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</thead>
<tbody>
<tr>
<td>Cumulative Wild Bovidae</td>
<td>65</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Probable Wild (Sm-med + Lg-med)</td>
<td>82</td>
<td>59</td>
<td>38</td>
</tr>
<tr>
<td>Total Wild + Probable NISP</td>
<td>147</td>
<td>76</td>
<td>40</td>
</tr>
<tr>
<td>Bos sp.</td>
<td>29</td>
<td>62</td>
<td>47</td>
</tr>
<tr>
<td>Ovis/Capra -- dwarf</td>
<td>19</td>
<td>18</td>
<td>32</td>
</tr>
<tr>
<td>Ovis/Capra -- nondwarf</td>
<td>-</td>
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<td>1</td>
</tr>
<tr>
<td>Probable Domestic (Small + Large)</td>
<td>44</td>
<td>63</td>
<td>43</td>
</tr>
</tbody>
</table>
Two hypotheses can be adduced to explain such a change. The first is that the territoriality of antelope species around Jenn6-jeno combined with significant increases in the human population to reduce the number of antelope within easy hunting distance of the city. All antelopes identified at Jenn6-jeno are of a territorial nature, particularly the male kob, which has a territorial range of usually less than 1 km² (Kingdon 1982; Haltenorth and Diller 1980). Kingdon (1982: 381) notes, “The attachment of the Kob to a locality is so strong that human settlement can proceed with the kob attempting to go on living almost in the new villages, where of course they do not last long.” With the rapid rise of population in and around Jenn6jeno during Phase III, it seems extremely likely that local breeding populations of antelope would have been severely depleted and that hunters would have had to travel farther and farther afield for rarer and rarer kills. The second hypothesis, closely related to the first, proposes that the coming of human populations on a large scale to Jenn6-jeno significantly altered the natural habitat, diminishing the light woodland cover and high grasses required by the reedbuck and the bushbuck. Especially considering the heavy fuel requirements of metallurgy, there seems little reason to doubt that these environments were altered detrimentally.

Other wild mammals. Present in limited quantities in the Jenn6-jeno assemblage were other wild mammals, including hippopotamus (Hippopotamus amphibius), warthog (Phacochoerus aethiopicus), and aardvark (Orycteropus afer), as well as indeterminate hares (Lepus sp.), cricetine rodents (Cricetidae gen. et. sp. indeterminate), and civet cats (Viverridae gen. et sp. indeterminate). The temporal and spatial distribution of their remains is shown in Table 7.2. Environmentally, all these animals would be at home in the Jenn area today, most preferring open grassland habitats. It is likely that most of these animals were victims of the hunt except the cricetine rodent, which is of a small species and probably intrusive. The hippopotamus, which is rare in the Inland Delta today due to human predation, is attested by a single molar root from Unit LX-S Level 71 (Phase In).

As noted above, few microfaunal remains were recovered during the 1981 season at JennL6-jeno. This is attributed to soil conditions which precluded fine screening, resulting in a significant bias against the recovery of smaller mammalian specimens such as rodents or lagomorphs. Domestic Cattle. Domestic bovids at Jenn-jeno were represented by a preponderance of cattle (Bos sp.), and by both dwarf and nondwarf sheep and goats (Ovis/Capra). Cattle and dwarf ovicapprines were present at Jenn6-jeno and Hambarketoto from initial occupation through abandonment. On the Jenn6-jeno mound they were particularly concentrated in the north-central Units LX-S and LX-N.

From available evidence it has not been possible to positively determine whether the breeds of cattle present at Jenn6-jeno were composed primarily of humped, drought-resistant varieties (various Zebu and Sanga breeds) favored by...
transhumant Sahelian pastoralists, or the humpless, comparatively tsetse resistant breeds preferred by sedentists in the savanna and forest zones (such as the N'dama and West African dwarf shorthorn). Such a determination is of course complicated by confusion stemming from Grigson's (1991) provocative assertion of the possible independent taxonomic status of Sanga breeds from indigenous North African cattle domesticates. It is important to review the taxonomical classification of African cattle in light of this recent publication before proceeding.

Traditionally, it has been thought that cervico-thoracic humped Sangas stemmed from crosses between humpless (Bos taurus) and thoracic humped Asiatic Zebu breeds (Bos indicus) (cf. Epstein 1971; Baker and Manwell 1980; Epstein and Mason 1984). The Sanga shared (with modification) many of the osteological traits referred to Bos indicus and were indicative of contact with pure Zebu stock. However, mounting evidence for an indigenous North African domestication of cattle (cf. Gautier 1987b; Clutton-Brock 1989) has led to Grigson's (1991) assertion that the unique hump and cranial characteristics of Sanga breeds could be the result of descent from a similar native North African ancestor and not from indicus taurus cross-breeding. A putative new cervico-thoracic humped taxon, termed Bos africanus, could thus be

Mammalian, Avian, and Reptilian Remains invoked to account for a great deal of modern and prehistoric African cattle. Grigson's "Sanga hypothesis", if accepted, would significantly alter our interpretations of all known African cattle assemblages. It should be strongly stated, however, that at this point there is insufficient evidence to support her claims. Indeed, there are a number of reasons to reject them, which are outlined below.

First, a great deal of Grigson's argument depends upon the shape of complete cattle metapodials, as expressed metrically. Her osteological data for putative early African Bos africanus come predominantly from Egypt, and entirely from Northeast or East African contexts, dated to after ca. 1500 B.C. She ignores Neolithic material from the Maghreb, such as the complete cattle metacarpals and metatarsals recovered from the site of Grand Rocher, Algeria (cf. Pomel 1894; Gautier 1988:46). When plotted against her data (Grigson 1991:131) these fall well within the range of taurine (humpless) cattle. If Grigson's Sanga hypothesis were true, we should expect Neolithic specimens from deep within the Maghreb to be local domesticates or to have bred with them at some point. These remains exhibit no traits indicative of Bos africanus as defined by Grigson.

Second, minimal morphometrical differences between the metapodials of ancient Egyptian and East African cattle (Sangas?) and Indian Zebu (cf. Grigson 1991: Figure 6), as well as the biochemical status of modern Sangas as intermediate between indicus and taurus (Manwell and Baker 1980) are still more parsimoniously explained by the invocation of cross-breeding than by the existence of a cervico-thoracic humped Bos primigenius subspecies in North Africa for which no paleontological evidence yet exists (Gautier 1988).
Finally, Epstein (1971,1:533-534) explained conclusively that breeding experiments between humpless cattle and humped Zebu cattle resulted in a cervico-thoracic shift of the hump as well as a resulting change in muscle structure. There is no need to invoke a separate taxon to explain the nature of this hump. Additionally, all Egyptian artwork and fossil evidence utilized by Grigson as possible pure indigenously domesticated Sanga (Bos africanus) are within time ranges (post-1500 B.C.) where mixture with Zebu breeds through importation would have been possible, if not probable (Marshall 1989). Thus, on the preceding grounds, I disagree with the notion of Bos africanus as proposed by Grigson (1991). I suggest that one would perhaps be better advised to examine humpless West African breeds such as the dwarf shorthorn and the N'Dama in a search for the remaining ancestors of putative indigenous African domesticates. These breeds, while exhibiting no external or osteological traits indicative of humped cattle (Epstein 1971,1:201204, 277-280) are genetically distinct from both Bos indicus and Bos taurus on the basis of blood chemistry (Braend 1979) and have been significantly affected by long-term natural selection in African tropical environments. So, in returning to the assumption that Bos indicus and its humped characteristic were introduced into Africa, there remains a great deal of uncertainty over the approximate date of its introduction and its subsequent development on the continent. Epstein and Mason (1984) have suggested that the Asiatic Zebu did not reach Africa until the fourth century A.D., and

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that an indigenous cross-bred form of humped cattle (the Sanga) evolved in East Africa during the first millennium A.D. Others, including Marshall (1989, 1990), have argued on the basis of early textual evidence for an earlier introduction of Zebu from the east through Egypt, perhaps as early as 1500 B.C., with possible fossil evidence from Crescent Island, Kenya, 800-400 B.C.; and more certain evidence from Ngamuriak (Kenya) by as early as 200 B.C.. The arrival of humped cattle in the West African Sahel, where they have virtually replaced humpless cattle today, remains almost completely undocumented. The earliest evidence for humped cattle in West Africa is from the northern Nigerian site of Daima (Daima III, Spit 1, c. A.D. 1150) in the form of a humped clay figurine (Connah 1981). It is entirely possible, however, in the light of Marshall's (1989, 1990) evidence, that humped cattle could have been present in West Africa from the beginning of the sequence (c. 250 B.C.) at Jennd-jeno. Osteomorphologically, Bos indicus (whether Zebu or Sanga) can usually be identified by certain cranial characteristics (Grigson 1980, 1991) and by the presence of bifurcated thoracic vertebral spines. In the Jennd-jeno assemblage, only two potentially diagnostic cranial fragments were recovered. Of these, one (a basal horn core from Unit LX-S, Level 22) was too fragmentary to allow any definitive conclusions on the variety of cattle represented. The second, a jugal from Unit LX-S, Level 48 (Phase IV, c. 850-1200 A.D.), possesses the flat rim distinctive of Bos indicus (Grigson 1980) (Plate 39). Unfortunately, immature and young mature Bos taurus also have been demonstrated to possess this
characteristic (Grigson 1991). Thus, this flat-rimmed jugal should be regarded with caution, as it is only a single instance, unsubstantiated by bifurcated spines or other cranial fragments (cf. Grigson 1984).

As none of the vertebral spines recovered at Jennd-jeno were bifurcated, and all identifiable clay figurines were humpless (cf. Chapter 4), it is strongly suggested that humpless cattle were kept at Jennd-jeno, although the additional presence of humped varieties, of which the jugal from Phase IV may be an example, cannot be ruled out.

Metric data on the Jennd-jeno cattle, however, allow some interesting if inconclusive insights regarding the cattle populations at Jennd-jeno (see Appendix E: Table E1). While no limb bones were sufficiently intact to estimate withers height, measurements of intact first and second phalanges allowed for direct comparison with other African subfossil cattle populations (Ngamuriak: Marshall 1990; Adrar Bous: Carter and Clark 1976; Kintampo: Carter and Flight 1972; Dhar Tichitt: Holl 1986). Some of these published assemblages yielded sufficiently intact remains for the estimation of withers height, and so through comparison we may be able to obtain a relative estimate of cattle size at Jennd-jeno. It is unfortunate, however, that only phalanx breadth measurements (which reflect robusticity more than height) are available from Kintampo and Dhar Tichitt.

Temporally, the results are surprising (see Figures 7.1 and 7.2). The cattle population at Jennd-jeno during Phase IV may be seen to be quite metrically discrete in comparison to that of Phase III. This would not appear to be an artifact of a limited sample, since assemblages of first and second phalanges from different contexts display similar metrical patterning. Not enough data are present from Phase I/II to make a statement concerning that period. It would appear from the metric variation in Figures 7.1 and 7.2 that during Phase III (c. 450-850 A.D.) several breeding populations of cattle were consumed at Jennd-jeno, while during Phase IV (c. 850-1400 A.D.) consumption centered upon a single breeding population. It is metrically possible that the same type of cattle population exploited during Phase IV was also present during Phase III. In size the Phase IV cattle population is smaller than the celebrated humpless Adrar Bous cow (Carter and Clark 1976), which has been shown to have a withers height of between 104 cm and 107 cm (Gautier 1987a:290), and the same size or larger than the dwarf varieties thought to be represented at Kintampo (Carter and Flight 1972) and Dhar Tichitt (Holl 1986). The Adrar Bous remains would just exceed the upper end of the range for the modern West African dwarf shorthorn (withers heights 90-105 cm) and fall well within that of the modern humpless longhorn N'Dama (withers heights 95-125 cm) (Epstein 1971, I). Thus, it would appear that the size of cattle remains represented at Jennd-jeno during Phase IV were analogous to those of the N'Dama and dwarf shorthorn breeds kept by the sedentists of the Inland Delta area today. Remains from Phase III are, however, more diverse and in some cases exceed the size of the Adrar Bous cow and are more analogous to putative Bos indicus (Zebu and/or Sanga) remains identified from the Inland Delta area today.
by Marshall (1990) at Ngamuriak, Kenya (c. 200 B.C.-A.D. 100). A single intact cattle metatarsal from Ngamuriak allowed the reconstruction of a withers height of 137.5 cm. Analogously sized modern breeds in West Africa would include Tuareg and Maure Žebu and Fulani and Bambara Sanga breeds (Epstein 1971, I). It is thus possible that the higher variation in cattle size during Phase III may have been due to heavier commodities exchange with transhumant Sahelian pastoral groups or populations from the east possessing Žebu, Sanga, or now disappeared large humpless longhorn breeds.

Domestic Ovicaprines. Ovicaprines at Jenn6-jeno were primarily of a dwarf variety. These animals were particularly prevalent in the LX-S/LX-N sequence, with some occurrences in the Phase III levels of Unit ALS and the Phase I/II levels of Unit HAMB. It is of special note that fully dwarf sheep/goats were present at Jenn6-jeno from the time of its initial occupation (e.g., Unit LX-N Levels 51 and 52). There has not been sufficient osteological study of the osteomorphological properties of dwarf goat versus dwarf sheep to confidently differentiate between the two. Today, dwarf goats of various breeds are common throughout Sahelian, savanna, and tropical West Africa, while dwarf sheep are more common in tropical zones (Epstein 1971).

Dwarf oovicaprines were distinguished from nondwarf varieties by metric criteria derived from the extensive Ovis/Capra cranial and postcranial series housed at the Field Museum of Chicago, and from cranial specimens housed at the British Museum of Natural History in London. Epstein (1971, II: 218-219) has noted that studies of Nigerian dwarf varieties show bones of the appendicular skeleton to be retarded in growth in a ratio almost double that of the axial skeleton. Thus, dwarfism is relatively easy to detect even in

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fragmentary limb bones, but more difficult to distinguish in dentition. Where possible, I separated dwarf and nondwarf dentitions on the basis of size range agreement with Nilotic dwarf and other African comparative specimens curated at the British Museum (Natural History), and contextual association with appendicular element. A single complete metatarsal from Unit LX-S Level 46 (Phase III) suggests a withers height of approximately 48 cm (GL 9.04 cm multiplied by a factor of 5.34 [von den Driesch and Boessneck 1974]). This measurement is well within the withers height range of modern dwarf populations, placed by Epstein between 40 cm and 60 cm (Epstein 1971, II: 53-55, 277). For other metric data on oovicaprines from Jenn&jeno, see Appendix E:Table E2 and below.

As regards the few nondwarf oovicaprines remains recovered from Jenn&jeno, it can be said that both domestic sheep (Ovis aries) and goat (Capra hircus) were present. This is on the basis of comparison with Boessneck's (1969) classic criteria for the osteomorphological separation of sheep and goat. Not all elements were separable with confidence, however, and both differentiated and nondifferentiated elements are lumped as nondwarf oovicaprine in Table 7.2. Those that were able to be positively differentiated include: an astragalus (LX-S 79, Phase III), a scapula (LX-S 72, Phase III, GLP/BG = 29.4/20.4), and an atlas.
vertebra (ALS 7, Phase III, GB = 72.3 mm) = Ovis aries (domestic sheep), and
two humeri (LX-S 51, Phase III, Bd-28.9 and LX-N 4, Phase IV, Bd = 29.6) =
Capra hircus (domestic goat) (measurements as per von den Driesch 1976). It is
interesting to note that based on available samples, nondwarf ovicaprids do not
seem to appear at Jennd-jeno until after the beginning of Phase III.
Other domestic mammals. A domestic equid at Jenn6-jeno was
represented by a single right first incisor from Unit LX-S Level 36 (early Phase
IV, c. 850-1200 A.D.). This tooth was attributed tentatively to Equus caballus
(domestic horse) on the basis of size. Other domestic animals possibly represented
in the assemblage were domestic dog (Canis familiaris) and domestic cat (Felis
catus).
Canis was present in all phases in the LX sequence, with additional fragments
present in Phase III levels from Units ALS and HAMB. In only two instances
(Units LX-S and LX-N, Phase III) were any of these remains charred. Canids
present in the Middle Niger area today include Canis aureus (golden jackal),
Canis adustus (side-striped jackal), and Canis familiaris (the domestic dog).
Recent metrical studies of jackal, hunting dog, and African domestic varieties
have led to the construction of certain metric ranges and indices for the
differentiation of these species (R. MacDonald and K. MacDonald in prep). In the
few cases where remains could be measured, the canids from Jennd-jeno
conformed well with measurements of modern African pariah dogs. The only
Canid molar recovered from Jenno-jeno is almost certainly that of a domestic dog
(Mandibular M2, LX-S Level 77, Phase III) (see Figure 7.3). Unfortunately, no
intact Canid long bones were recovered from Jenn6-jeno (the relative shape of
limb bones, expressed as metric indices have also shown to be useful for the
differentiation of domestic and wild African Canids (R. MacDonald and K.
MacDonald in prep). Distal radius

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measurements from the Jennd-jeno remains, however, exceeded all available
measurements for jackals and may be taken to represent domestic specimens
(Radius [Bd]: 19.3 mm [ALS Level 7, Phase III], 20.7 mm [LX-S Level 76, Phase
III] and 22.1 mm [LX-N Level 52, Phase I/I]). The presence of domestic dogs
from the beginning of the sequence at Jenn6-jeno (c. 250 B.C.) should not,
however, be viewed as surprising in light of recent evidence for the inhumation of
domestic dogs at the Saharan site of Chin Tafidet in Niger (c.1500-1300 bc) (Paris
1984). These domestic dogs could have been used in preIslamic society for
hunting, for furs, or for meat, as they still are today in some non-Islamic regions.
Today, pariah dogs, essentially feral domesticates scavenging on human refuse,
are the only "indigenous" domestic dogs present in West Africa. Their origins
remain unclear, but they appear most likely to be descended from early imported
dogs descended from Canis lupus stock, and not from local jackal species
(Epstein 1971, 1; Clutton-Brock 1984).
Felis remains at Jenn6-jeno occurred in Phase IV levels from Units LX-N and
LX-S, and included the remains of at least one immature individual. These
remains were certainly those of either Felis catus or Felis lybica, the African wild
The separation of these two species, which may still interbreed, is notoriously difficult and requires nearly complete cranial material which has not yet been recovered from Jenn&jeno (the characteristics of domesticates are shortened facial regions and reduced brain size; Clutton-Brock 1988). None of the Felis bones was charred, raising the possibility that these may have been specimens of wild cat raised in a domestic context, or perhaps true domestics introduced through Arab trade contact.

AVIAN AND REPTILIAN REMAINS
The analysis of avian and reptilian remains, from which a wealth of environmental, cultural, and subsistence information can be drawn, has generally been overlooked in African archaeology. Birds in particular may provide detailed environmental information, comparable to that provided by antelope species clusters, with in most cases less time investment and uncertainty in taxonomic assignment to the species level. Additionally, domestic birds such as Gallus gallus may provide insights into early trade contacts.

Methodology
Identification of the birds and reptiles of Jennd-jeno (1977 and 1981 seasons) was undertaken at the Department of Zoology, Field Museum of Natural History (Chicago). Identifiable material was taken to the nearest possible taxonomic level on the basis of morphological and metric criteria. Remains that were impossible to separate with certainty among contentious taxa (e.g., Numida [guineafowl], Gallus [chicken], and Francolinus [francolins]) are in some cases listed as a combination of two potential taxonomic groups (e.g., Francolinus/Gallus). Nondiagnostic elements or remains too fragmentary for firm individual identification, but associated by unit and level with...

Mammalian, Avian, and Reptilian Remains
diagnostic remains identified to a morphologically and metrically agreeable taxon, were identified as that taxon (e.g., otherwise indeterminate costal plate fragments associated with an intact neural attributable to the black terrapin would also be identified as Pelusios castaneous).
The birds and reptiles from Jennd-jeno are presented quantitatively both by MNI and NISP. I feel this combination is preferable to the utilization of either separately and helps to overcome some of their inherent individual biases. Quantitative results are represented by two separate aggregations, one by occupation phase/unit (Table 7.4) and another by level/unit (Appendix E: Tables Ell and E12). MNI aggregations by occupation phase are presented by unit and were calculated by determining MNIs from depositionally coeval levels and adding MNIs from these "level clusters" to form a total for a single occupational phase (considered grossly in this case as Phases I/IL, III, and IV). For a discussion of methods used in calculating MNI and NISP, see Mammalian Remains section above.

Results and Discussion
Preservation of recovered bird and reptile remains from Jenn&jeno was remarkably consistent. While some remains, particularly those from the lower levels of MI (1977 season) suffered from subsurface calcium leaching, the
majority were relatively unweathered—this perhaps attesting to the better preservation or protection of these fragile bones in their predominantly ash accumulation/trash pit contexts. Charred elements were fairly common, overtly butchered ones less so although we would hardly expect hack marks on the long bones of what are predominantly very small individuals. It is, of course, difficult to say whether charring took place during roasting, or by exposure to fire after deposition.

Ayes. The predominant avifauna of Jen6-jeno are water birds. Most abundant are the diving birds Phalacrocorax africanus (the long-tailed shag or African cormorant) and Anhinga m. rufa (the African darter or "snake bird"). The presence of these birds in the Jennd-jeno assemblage, in preference to other commonly available birds of the Niger River which remain almost absent (cranes, herons, etc.) asserts the importance of these two species as a recognized "secondary" resource in the ancient Inland Niger Delta. Cormorants and darters are diving birds, birds that swim with strong thrusts of their webbed feet to moderate depths under water to catch their fish prey. Thus, these birds are very oily indeed, so as to better repel water (although they are certainly not waterproof, often having to dry their wings for some time after immersion before prolonged flight; Brown et al. 1982). While this would not seem to make their flesh the most desirable of commodities, it would seem from their scattered remains—often charred and in association with other food refuse—that they were food items. While I have not encountered their reportage from other West African sites (with the exception of Dia, Mali; MacDonald 1989), this may be more due to paucity of

Mammalian, Avian, and Reptilian Remains
Table 7.4. Avian and reptilian remains by unit and phase

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Mammalian, Avian, and Reptilian Remains
Table 7.4-continued. Avian and reptilian remains by unit and phase
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<td>Kinixys belliana (Bell's hinged tortoise)</td>
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<td>cf. Trionyx triunguis (probably Nile soft-shelled turtle)</td>
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<td>Pelusios adansonii (Adanson's terrapin)</td>
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Mammalian, Avian, and Reptilian Remains

analyzed avian remains than to the distribution of their predation by man. I would rather assert that such remains may be expected in association with a fishing subsistence regime, as these birds would probably be most accessible to fishers. To this day, these birds continue to be widely distributed in subSaharan freshwater lakes, rivers, and swamps. The cormorant and anhinga have as their primary prey the same species encountered in the fish assemblages of Jenn6-jeno and other African Holocene sites (e.g., Tilapia, Lates [immature individuals]; and siluriformes in general; Brown et al. 1982: 118, 120). It is not difficult to imagine that such birds may become entangled in fishermen's nets, trapped in open fish traps while seeking the captured fish within, or captured during their daily association with fishermen on the waterways. Thus, I attribute their presence more to their status as an easily acquirable supplementary meat source than to their desirability as a culinary item.

Other water birds include two large indigenous species of waterfowl: Plectropterus gambensis (the spur-winged goose) and Sarkiodornis melanotos (the knob-billed goose). Today, these permanent residents of the Inland Niger Delta are frequenters of Malian rice fields. It would be interesting to see from larger quantities of faunal data if either was perhaps the "domesticated" goose or duck mentioned by Mansa Musa in Cairo during his pilgrimage to Mecca during the fourteenth century (cited by Lewicki 1974: 90). No smaller members of Anatidae (swans, geese, and ducks) were identified from Jenn6-jeno. Isolated elements attributable to Egretta alba (the white egret) and Ciconia episcopus (the white-necked stork) were also identified. Both these large species are common to the banks of West African rivers. It is interesting to note that the only element attributable to Ciconia, a right tibiotarsus (Unit LX-N Level 45, early Phase III), looks to have been neatly sawed in half.

Nonwater birds identified from Jennd-jeno include the pied crow (Corvus albus), two predatory species, a quail species (Coturnix sp.) and terrestrial fowls. Remains of the pied crow were differentiated from the larger brownnecked raven (Corvus rufficollis) on the basis of size. The predatory species include Milvus migrans (the black kite) and Accipter sp. (an indeterminate hawk). It is not surprising that the pied crow and the black kite are both scavengers especially common to farmlands and urban areas (Serle and Morel 1977). Either the indigenous harlequin quail (Coturnix delegourgei) or the migratory common quail (Coturnix coturnix) is represented in Unit LX-S Level 46. Both of these species are common to open grasslands.

Perhaps the most dramatic discovery of this analysis, however, is the identification of the domestic chicken (Gallus gallus) from early in the Jenndjeno
sequence, the earliest definite evidence being spurred tarsometatarsi from Unit LX-N Level 38 and Unit LX-S Level 71, both Phase III, c. A.D. 500850 (pictured in MacDonald 1992a:306). These remains, which continue through the rest of the site's sequence, were positively separated from those of the guineafowl (Numidinae) and francolins (Francolinus) by means of criteria for differentiation established with the comparative collections of the Field Museum of Natural History (Chicago) and the British Museum of 

Mammalian, Avian, and Reptilian Remains
Natural History (Tring) (MacDonald, 1992a). The motivation to establish these criteria was supplied by the presence of anomalous, large, spurred tarsometatarsi in the Jennd-jeno assemblage (there being no spurred birds of an equivalent size present indigenously in West Africa, only smaller birds such as francolins and the lightly spurred, deep-forest-dwelling Agelastes sp.). As only a few skeletal elements could be utilized with confidence to separate these taxa morphologically, two other taxonomic groupings were formed as identification for nondiagnostic Phasianidae (terrestrial fowl) remains: Gallus /Numidinae (material inseparable between chicken and guineafowl, not francolin due to size) and Francolinus/Gallus (material attributable to small chicken or to francolin, but not to guineafowl based on size). Curiously, no material definitely attributable to the domesticated helmet guineafowl (Numida meleagris, the only member of Numidinae present today in the Inland Niger Delta region) was identified, although it is suspected that some material classed as Gallus/Numidinae probably belongs to that species.

The chicken from Jenn6-jeno is of a small size-close to that of undomesticated junglefowl and modern (dwarf) Bantam breeds (for metric data, see MacDonald 1992a). It should be noted that the lightly spurred (young mature?) tarsometatarsus from Unit LX-N Level 38 was positively differentiated from the West African deep-forest genus Agelastes by its short length and lack of a hypotarsal ridge as is present on spurred individuals of Agelastes.

The presence of chicken in Jenn6-jeno, and West Africa in general, is worthy of further comment in three respects: the early date, the small size, and the lack of hypotheses presently formulated to deal with these issues.

The Jenni-jeno chicken. The presence of domestic chicken (Gallus gallus) at Jenn6-jeno before 850 A.D. raises interesting questions as to the origins of that animal's introduction into Africa and its subsequent dispersion. These origins have been surprisingly neglected in Africa's archaeological studies. The chicken (Gallus gallus) was first domesticated in Southeast Asia from the wild junglefowl indigenous to that region, at a period well before the sixth millennium B.C. (West and Zhou 1988). Subsequently, these domesticated fowl were dispersed westwards through Russia into Europe and the Near East, reaching modern Iran and Greece by as early as 4000 B.C. (West and Zhou 1988). The earliest osteological evidence in proximity to Africa is from the site of Sweyhat in northern Syria dating to 2400 B.C. (Buitenhuis 1983, cited in West and Zhou 1988). Epstein (1971, II: 347) has cursorily noted that chicken was "originally domesticated in southeast Asia, [after which] it was introduced into Egypt around
1450 B.C. and independently into East Africa over one thousand years later." The earliest osteological evidence for chicken in Africa is from Egypt and dates to the Eighteenth Dynasty (c. 1567-1320 B.C.) (Darby et al. 1977).

Compared with data available from the Near East and Europe, however, the record from sub-Saharan Africa is sparse. The earliest historical reference to chicken south of the Sahara comes from Ibn Battuta in A.D. 1352, who cited the presence of chickens "for sale" en route from Walata to the capital of Mali.

**Mammalian, Avian, and Reptilian Remains**

(Lewicki 1974:90). The earliest archaeological evidence from East Africa is of the presence of "domesticated fowl" at the end of the first millennium A.D. at the southern coastal site of Chibuene (modern state of Mozambique) (Sinclair 1982). In Central Africa remains have been identified from Akameru and Cyinkomane in Rwanda dating to between the ninth and twelfth centuries A.D. (Van Noten 1983, Van Neer 1990). From West Africa, I have been able to find little archaeological discussion of domestic chicken. Exceptions to this include a cryptic reference to "two domestic fowls" (chicken or guineafowl?) from the site of Daima, northern Nigeria (spits 3-4, Daima III, c. A.D. 950-1150; Connah 1981:193); the definite identification of Gallus gallus by Mees from late in the occupation of the sites of Togudr6 Galia and Togu–r6 Doupwil in the Inland Niger Delta (c. A.D. 1400-1600; Bedaux et al. 1978); and a tentative identification of Gallus gallus at Koyom in Southern Chad, dating to no earlier than the eighteenth century A.D. (Rivallain and van Neer 1983). Additionally, there is my own identification of chicken from Akumbu Mound A (c. A.D. 1000-1280), located in the M–ma region of Mali (MacDonald 1992b). The chicken from Jennd-jeno (c. A.D. 500-850) is thus, to the best of my knowledge, the earliest yet known from a sub-Saharan African archaeological site.

The next question one must then ask is how did it get there? As with most things introduced into West Africa before the sixteenth century, there are essentially two possible routes: south from the North African littoral or from the east along the Sahelo-Sudanic environmental belt. The origin of chicken from the former is certainly possible, as Phoenicians, who colonized the North African coast as early as 800 B.C., were known to be early keepers of chickens, and archaeozoological data from the Phoenician trading port of Moyta, Sicily, suggest that they tended to bring their fowl with them (Ryder 1975). I consider this possibility unlikely, however (unless a coastal route was followed), due to the difficulty of transporting relatively fragile chickens over the arduous trans-Saharan route. The latter possibility is much more appealing, as chicken from the east would coincide with other Southeast Asian introductions into East Africa, such as Zebu cattle (Bos indicus) (Marshall 1989), domestic pig (Sus scrofa) (Sauer 1952), and Asian rice, coconuts, bananas, and sugarcane (Connah 1987). The origin of these commodities into East Africa through Egypt and coastal trade could have occurred as early as 1500 B.C. (at least in the case of Zebu) and continued into the present millennium. Marshall (1989) has identified possible Bos indicus stock from as early as 500 B.C. at the site of Crescent Island in the East African Central Rift Valley (Kenya). It is not inconceivable that Zebu (and thus perhaps chicken)
could have also reached West Africa by that date. Thus, I believe that the origins of chicken in Africa may date to appreciably before the c. A.D. 500-850 dates for the Jenn&jeno chicken and have potential to shed light on early East African/Near Eastern/Southeast Asian trading contacts as well as early relations of peoples spread across the African Sahelo-Sudanic belt. Much more excavated data are needed, however, before either of these hypotheses can be adequately tested.

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Two questions that remain are why earlier peoples would prefer chickens over indigenous guineafowl (which are kept in conjunction with chicken in Africa today and have been introduced to America), and why the Jenn6-jeno chicken appears to have such a diminutive size. The first question is more easily answered. Even today, after years of domestication, guineafowl remain much more difficult to control than their Gallus counterparts (i.e., they are more likely to go feral). Ashbrook (1951) notes that it takes considerable effort to make guineafowl stay in hen houses (as opposed to roosting in trees) and that guineafowl tend to fly more often than chickens (which tend to stay in the same general "home" area). Thus, chickens may more easily "take care of themselves" and would thus be preferable. In regard to size, West African chickens are generally considered to be much smaller than their American or European counterparts, although I know of no formal studies to this effect. Due to warmer environmental conditions in West Africa, and possibly less advantageous nutritional circumstances, it would be a favorable adaptation for such chickens to have a smaller body size than is normal in more temperate conditions. Epstein (1971, 11:230) states that adverse environmental conditions generally favor domestic animals of a diminutive size. Under unfavourable conditions dwarfed individuals are more highly adapted than the bulk of ordinary stock, the pressure of selection bringing about a gradual alteration of the stock by the slightly higher survival rate of small animals. Owing to the breeders' experience of the greater hardiness and better condition of the smaller animals in their flocks, natural selection has, under adverse environmental conditions, doubtless been frequently supported by artificial selection of diminutive animals for breeding purposes.

Although Epstein was addressing the origin of dwarf goats in sub-Saharan Africa, the same could be said to apply to the diminutive African chicken. Additionally, he indicates that domestic chickens-like the domestic dogs of Africa-are not fed but rather are left to find their own food (Epstein 1971, I: 28). This feral activity could result in the selection of characteristics which over time would have kept the African chicken closer to the size of the wild junglefowl.

Reptilia. The reptile assemblage from Jenn6-jeno closely resembles, with a few exceptions, the same assortment of species which may be readily found in the Inland Niger Delta today. Dominating this fauna is the species Cyclanorbis senegalensis (Senegal softshell turtle) and the family Pelomedusidae (freshwater terrapins). Also present are monitor lizard (Varanus sp.), fragments of indeterminate smaller lizard taxa (Sauria indet.) and crocodile (Crocodylus sp.)
species. As might be expected, almost all reptilian species present throughout the Jennd-jeno sequence are aquatic. The only definite exception to this is an isolated occurrence of two marginal fragments from Bell's hinged tortoise (Kinixys belliana) from Unit LX-S Level 22.

The Senegal softshell turtle (Cyclanorbis senegalensis), common today throughout the Niger River, was identified morphologically to genus and

Mammalian, Avian, and Reptilian Remains contextually to species (Cyclanorbis elegans, a second species, being present historically only in denser West African forest zones of Togo and Nigeria to which it may be a regional adaptation [Villiers 1958, de Broin 1983]). Although Cyclanorbis occurs most commonly in Phase I/II levels, this trend is probably just a sampling artifact of a continual exploitation. The identification of Cyclanorbis was facilitated by numerous mesial portions of costal plates and plastron fragments. One of these diagnostic fragments, a left hypoplastron, had two holes drilled near one of its margins (Unit LX-S Level 72) (Plate 40). It is speculated that these holes may have held this hypoplastra as a pendant. Similarly pierced turtle shells have been noted from numerous North African N(olithique de Tradition Capsienne sites by Camps-Fabrer (1966).

Worthy of note is a fragmentary Trionychid humerus from Unit WFL Level 15 (Phase III, c. A.D. 400-850) which intact would measure more than 90 mm in length. Based on comparison with softshell turtle humeri from specimens of known length, it is believed that this specimen is from an individual whose size would exceed that of the largest recorded Senegal softshell turtle (carapace length 35 cm) and could possibly belong to a larger species (i.e. Trionyx triunguis, whose carapace length may exceed 95 cm). Trionyx and Cyclanorbis have both been identified from the early Holocene deposits of Saharan northern Mali (Villiers 1958; de Broin 1983). Today, Trionyx has not been observed in the Niger, although de Broin (1983:211) concedes that il n'est pas impossible toutefois que leur r-partition totale au Mali soit mal connue et que Trionyx triunguis existe encore dans le fleuve Niger." The known modern distribution of the Nile softshell turtle in West Africa is the Senegal River, Lake Chad, and numerous smaller rivers in the West African forest zone (Villiers 1958; Loveridge and Williams 1957). Due to a lack of diagnostic carapace or plastron remains attributable to Trionyx, however, and the slight possibility of the humerus belonging to an extralimitally large Cyclanorbis senegalensis, the humerus has been identified as "cf. Trionyx triunguis."

Other turtles identified from Jennd-jeno include the previously mentioned land turtle Kinixys belliana, and three Peleomodusid species: Pelomedusa subrufa (the marsh terrapin), Pelusios adansonii (Adanson's terrapin), and Pelusios castaneus (the black terrapin). This list essentially summarizes the primary smaller turtle species (i.e., of a carapace length usually less than 20 cm) living in and along the Niger River today. The large body of material identified simply as "indeterminate Peleomodusidae," constitutes undiagnostic materials that cannot be further differentiated among these closely related species. As with Trionychidae, all of the above are popular in Africa today both for their food value and for the
functionality and/or decorative uses of their shells (Loveridge 1941; Loveridge and Williams 1957). Such turtles would probably be easily available to fishermen, as Loveridge has cited the propensity of the black terrapin to be caught in fish traps (Loveridge 1941:500). Of environmental interest, it should be noted that Smith (1975) was in error when he stated, in reference to the Malian Neolithic site of Karkarichinkat, that the presence of Pelusios sp. was

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unlikely there, due to its restriction to large lakes. This is not at all the case, as the habitat of Pelusios in modern Mali is usually "rivers outside the rainforest" (adansonii) and "papyrus swamps, stagnant pools, ricefields, lakes, rivers outside the rainforest" (subniger aka castaneus) (Loveridge 1941: 485, 501).

As previously stated, also present in the Jenn&jeno reptile assemblage were a species of monitor lizard (Varanus sp.) and a crocodile species (Crocodylus sp.). The monitor lizard, represented by a number of vertebrae from Unit LX-N Levels 18 and 49, may be one of two species: either Varanus niloticus (the aquatic Nile monitor), or Varanus exanthematicus (the larger, land-based Savannah monitor). Both of these species are present in the Jenn6 region of Mali today (Welch 1982). While, due to its context, it would be easy to believe these remains belong to the Nile monitor, the substantial size overlap of these species, and a lack of more diagnostic material, precludes such an assumption. Crocodile remains (belonging to either of the large Nile or long-nosed crocodile species) are represented by clavicles, cranial fragments, several vertebrae (some of which are charred) and a single dorsal scute predominantly from levels of trash and ash from upper Phase III. The crocodile has historically been an object of the hunt in West Africa (Villiers 1958).

CONCLUSION

West African archaeology, and particularly archaeozoology, are areas of inquiry still very much in their formative stages. Much basic information on the introduction of domestic species and the prehistoric exploitation of wild species is lacking due to a dearth of systematic investigation in this field. Thus, there are few data from adjoining regions with which to compare the findings outlined in this report. It is hoped that this situation will change rapidly in the coming years. In summarizing the importance of the mammalian fauna at Jennd-jeno, several points bear emphasis: (1) domestic cattle and domestic dwarf ovicaprines were present from earliest occupation at Jenn6-jeno and Hambarketolo; (2) nondwarf ovicaprines occurred only sporadically and may not have been present at first occupation (their earliest documented occurrence is in Phase III); (3) during Phase III it appears that two or more breeding populations of cattle were consumed at Jenn6-jeno; during Phase IV the size range of cattle is more restricted and it is probable that a single breeding population of cattle predominated; and (4) wild bovids, particularly Kobus kob, were common during Phase 1/II but declined radically in number over time, perhaps due to human population increase and subsequent overhunting in the Jennd area.

The dominance of dwarf ovicaprines in the Jenn6-jeno assemblage is particularly interesting. Dwarf cattle and ovicaprines are thought almost certainly to represent
indigenously African developments, but their mode and time of development remain ill-defined (Epstein 1971; Smith 1984). Dwarf ovicaprines are especially tsetse resistant but do not travel well over long distances. According to Fulani/Peul pastoralists whom I have

Mammalian, Avian, and Reptilian Remains interviwed, dwarf sheep and goats cannot travel for more than a few days consecutively and must have water each day. Non-dwarf savanna goats, on the other hand, may travel up to three or four months consecutively and can go without water for three or four days. Thus, dwarf goats are of little use to migrating Sahelian pastoralists and today are kept almost exclusively by farming sedentists in well-watered and forest zones.

The key to discovering the cultural significance of the dominance of dwarf ovicaprines at Jenn6-jeno and the presence of a small (dwarf?) cattle type from at least Phase III lies in understanding the origin of the breed. If ovicaprines and cattle were originally naturally selected or bred for their tsetse resistance, we must suppose that this stock was somehow reproductively isolated from modern, coexisting nondwarf breeds. This raises the following question: were dwarf breeds bred by southern "sedentists" with stock imported from northern "nomadic" pastoralists, or were dwarf stock and possibly their herdsmen as well descended from early groups of mixed agriculturists who entered the Inland Delta from the desiccating Sahara? Today, the Inland Niger Delta economy is one of symbiosis between fishermen, farmers (who are also small-scale owners of predominantly dwarf stock), and transhuman pastoralists. The emergence of this pattern of subsistence specialization and internal trade remains poorly understood. Issues such as the origin of dwarf breeds may shed further light on the origins of this relationship. This will require, however, a significant accumulation of metric data on West African domestic animals over space and time.

As regards the avian and reptilian assemblage of Jenn6-jeno, a recurring theme is the predominantly aquatic nature of these "secondary" fauna. Although the site's sampling may have been biased by collection techniques, I believe even such biases would have resulted in a more significant content of small animals (e.g., hares and large rodents) if such creatures were being exploited as heavily as reptiles and birds. Thus, I am tempted to explain this pattern of exploitation by the activities of fishermen. The larger sample of Jenn6-jeno has borne out suspicions from the analysis of fauna from Dia that such "secondary" fauna as would be easily accessible as a dietary and functional (e.g., turtle shells) supplement to fishers during their daily labors, occur consistently in the Inland Ni ger Delta (MacDonald 1989). Such a pattern of broad-spectrum aquatic resource exploitation by African fishing peoples is not uncommon. In an ethnoarchaeological study Gifford (1980:96), notes that the gal dies fisherfolk of the Dassanetch people (Lake Turkana, Kenya) "regularly caught ... crocodile, soft-shelled turtle, terrapin, Nile Perch, Tilapia, and catfish."

A final note concerns the horizontal patterning of the Jenn6-jeno assemblage. It should be immediately evident from Table 7.2 that the taxonomic composition of excavated deposits varied widely across units and within units over time. A good...
example of this variation can be found in the directly adjoined but taxonomically quite distinct Units LX-N and LX-S. In Unit LX-N, ovicaprids were abundant in Phases I/II and IV, and absent in Phase III. In Unit LX-S, ovicaprids were abundant in Phase III, but absent in Phases I/II and only marginally present in Phase IV. This discrepancy

Mammalian, Avian, and Reptilian Remains
undoubtedly had a great deal to do with differences in site formation processes, most notably the pit-digging activity and deposition of ash and domestic refuse that were responsible for massive deposition at the very end of Phase III in Unit LX-S (see Chapter 2). These units were not small test units, but rather "large exposures" measuring 6-by-4.75 m each. This underlines the severe problems produced by limited sampling in quantitative faunal analysis, particularly in non-spatially restricted sites. Such culturally randomized horizontal patterning of waste disposal may render the economic analysis of insufficiently sampled sites meaningless. Even observations of "meaningful" intrasite variability can be made suspect by such sampling considerations.

The largest amounts of faunal remains were recovered from Units LX-N, LX-S, CTR, and HAMB, all large, fairly centrally located units on Jenn6-jeno and Hambarketoto. (Total weight of bone recovered from each unit and a summary of the average amount of bone in g/m3 from each unit is presented in Appendix E: Figures E1-6.) Bearing the above sampling considerations firmly in mind, we may still note some possibly significant taxonomic differences among the Phase I/II assemblages of these units. In LX-N, the Phase I/II assemblage was mixed, containing domestic cattle, ovicaprids, and wild antelope. In CTR and HAMB, however, wild antelope—particularly Kobus kob—dominated assemblages in which ovicaprids and cattle were either absent or marginally present. Unit LX-S provided no faunal remains at all from Phase I/II but furnished an assemblage broadly analogous to LX-N (Phases I/II and W) during Phases III and IV. All of the above units contained substantial amounts of fish remains (see Chapter 8). It is noteworthy that WFL (waterfront location), while containing little mammalian, reptilian, or avian material, provided a significant amount of fish remains from Phase III contexts. Units ALS, HK, and KAN, however, yielded comparatively little faunal material. The most abundant of these was Unit ALS, whose faunal composition appeared to be similar to that of Units LX-N and LX-S. Unit NWS produced no identifiable fauna at all.

In closing, it has been demonstrated that the mammalian, avian, and reptilian remains of jenn6-jeno raise many tantalizing questions. Their answers will only become more apparent with further excavation and careful analysis at Jennd-jeno and other West African archaeological sites.
ANALYSIS OF THE FISH REMAINS
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INTRODUCTION
This faunal report deals with the fish remains found during the 1981 excavations on the settlement mounds of Jenn&jeno, Hambarketolo, and Kaniana in the Inland Niger Delta of Mali. The majority of the fish bones come from Jenn&jeno, the site on which the chronology of the Iron Age occupation of the region is based. On archaeological and stratigraphic grounds, three unbroken phases of occupation were defined between about 250 B.C. and A.D. 1400, which represents one of the longest Iron Age sequences in West Africa (S. McIntosh and R. McIntosh, 1980; Chapter 3, this volume). At the beginning of Phase I/II, during the last centuries B.C., the area was colonized by iron-using immigrants. At the end of Phase I/II (around A.D. 400) the areal extent of Jenn&jeno is estimated at 12 ha. Geomorphological work suggests that the climate was similar to or more arid than today (R. McIntosh 1983). During Phase III (A.D. 400-850) the climate improved, and by the end of this phase the settlement mound reached its maximum size (33 ha). Phase IV covers the period between A.D. 850 and 1400. During the late first millennium and possibly continuing into the early part of the present millennium, a period of high water is indicated by geomorphological and sedimentological work. Thereafter, a dry period started, which was perhaps one of the reasons for abandonment of Jenn6-jeno and adjacent sites by A.D. 1400.

The analysis of the fish remains is concentrated on the reconstruction of diet, place, and season of capture of the fish, fishing and preparation techniques, and on finding indications of hydrological changes that took place through time. The material is suitable for quantitative analysis since sufficient identifiable remains are available for the different phases. Earlier work on the small sample from the 1977 excavations was qualitative in nature and mentions the presence of four catfish taxa (Clarias, Synodontis, Auchenoglanis, and a possible other bagrid),
Nile perch (Lates niloticus) and probable Heterotis (Howes, 1980). A similar qualitative look at the 1981 material added to this list Chrysichthys, Hyperopisus, and Tetraodon (R. Travers, personal communication to S. McIntosh, 30 May 1984).

DESCRIPTION OF THE REMAINS
The material described here was identified by comparison with the reference collections stored at the Royal Museum of Central Africa (Tervuren, Belgium). These collections comprise disarticulated dry skeletons of most freshwater fishes of economic importance in the large North African basins (Nile, Chad, Niger, Senegal). All common genera are represented in the comparative material, although some species of certain large genera are not available yet. Usually, this is not a major problem since isolated bones can seldom be identified beyond genus level. A guess about the probable species living near the site can be made on the basis of the present-day distribution. Such data are available in Daget (1954), a work which also contains detailed information on the ecology and behavior of certain species. Another monograph with useful information on the biology of freshwater fishes is Blache (1964). Data from both works are used throughout this chapter without further reference to them. The systematic nomenclature used for the different taxa follows the suggestions published in the Check-list of the freshwater fishes of Africa (CLOFFA; Daget et al., 1984-1986).

Table 8.1 gives an overview of the fish fauna found at Jennd-jeno, Hambarketolo and Kaniana (see Figure 8.1 for illustrations of the diagnostic material present). The number of unidentified fragments is also indicated, as well as the mean weight per unidentified fragment. The latter figure gives important indications on the state of preservation or efficiency of recovery in the different units. For each species, the represented skeletal parts are mentioned (Tables 8.2-8.7) and where possible, an estimation of the reconstructed fish lengths is indicated (Figures 8.2-8.7). These lengths are estimated by direct comparison with the reference material. For the most frequent fish taxa, the bones were lumped in corresponding size classes of 10 cm. The distribution of the length classes is given separately for each phase in order to detect possible shifts in size through time.

Protopterus annectens
Family Protopteridae
Order Lepidosireniformes

Lungfish are represented by a single lower-jaw fragment (Figure 8.1[11 belonging to an individual of about 65 cm standard length (SL). In the Niger, only Protopterus annectens occurs. Lungfish are able to use atmospheric oxygen and can, in case of drought, make burrows in the flood plain (Wasawo 1959). They form a kind of cocoon in which they can survive until the next floods. During this period of estivation, lungfish are often dug out of their burrows. Capturing these fishes in their shallow water habitats is common as well.

Polypterus sp.
Family Polypteridae
Order Polypteriformes
Of this primitive fish mainly vertebrae and scales were found (Figure 8.1[2] and 8.1[3]). The latter are easily recognizable by their sturdy, well ossified appearance, their rhomboid shape, and the ganoine (a bright enamel-like substance) on the external surface. A few skull bones could be identified on the basis of their finely granulated outer surface. Additionally, one dorsal spine was also represented. This element is well ossified and is bifid distally. The size of the fishes corresponding to these remains is between 30 cm and 50 cm SL (30-40 cm: seventeen specimens; 40-50 cm: twenty-four specimens). Four species of Polypterus have been described from the Niger, but they can not be distinguished in the bone remains found at Jennd-jeno. Polypterus prefer shallow habitats with sandy bottoms and can be found on the flood plain or in marginal environments of the main river.

Heterotis niloticus
Family Osteoglossidae
Order Osteoglossiformes
This osteoglossid is represented by precaudal and caudal vertebrae, and by preoperculars and operculars (Figure 8.114]). Confusion of heavily fragmented dermal bones is possible with cranial roof fragments of certain siluroids or with carapace elements of soft-shelled turtles (Trionychidae), since the outer ornamentation is not very different. Reconstructed standard lengths of the Heterotis from this site vary between 20 cm and 70 cm (20-30 cm: three specimens; 30-40 cm: five specimens; 40-50 cm: four specimens; 50-60 cm: three specimens; 60-70 cm: one specimen). Heterotis niloticus is abundant in regions where both muddy bottoms and much aquatic vegetation occur. Spawning takes place on the flood plain in more or less circular nests of 1-1.5 m diameter, constructed with plant material near the shore of small lakes or ponds. After hatching of the eggs, one of the parents guards the young. It is obvious that Heterotis is very vulnerable to human predation during this period.

Family Mormyridae
Order Mormyriformes
Hyperopisus mormyrus
Among the mormyrid bones two taxa could be identified. Hyperopisus bebe is represented by a parasphenoid bearing big, rounded teeth that form a grinding surface. The corresponding individual had a standard length of approximately 35 cm. All the other mormyrid remains are vertebrae. Most individuals measure between 40 cm and 70 cm SL (40-50 cm: one specimen; 50-60: six specimens; 60-70 cm: six specimens), whereas two specimens are from fishes between 20 and 30 cm SL. Apart from Hyperopisus which can grow as long as 50 cm, only Mormyrus and Mormyrops among the mormyrids attain big
sizes in the Niger basin. Two well-preserved precaudal vertebrae could be assigned to Mormyrus on the basis of the shape of the ventral part of the centrum (Figure 8.1[5]). Discrimination of Mormyrus and Mormyrops from caudal vertebrae was not possible. Mormyrids feed mainly on insects and other small invertebrates living near the bottom. These fish can be captured in the main channel, but can also occur in large numbers in isolated waterbodies on the flood plain.

Gymnarchus niloticus
Family Gymnarchidae
Order Mormyriformes
This fish, with its eel-like appearance, is represented by one articular and by seven vertebrae. The vertebral centra of Gymnarchus are very typical: haemal and neural arches do not fuse with the centrum. Fossilized vertebra mostly show the empty sockets in which the bases of the arcualia rest during life (Figure 8.1[6]). The size of the Gymnarchus found at Jenn6-jeno varies between 70 and 120 cm SL, with a majority of specimens over 1 m (six out of eight). When the flood plain is inundated, this species also builds very conspicuous floating nests, measuring about 1.5-by-0.8 m. The nests are constructed of stalks of Echinocloa stagnina and usually float near the edges of ponds or pools.

Hydrocynus sp.
Family Characidae
Order Cypriniformes
Two premaxilla and a dentary of tigerfish were identified (Figure 8.1[7]). They belong to individuals of 30-40 cm SL (two specimens) and 50-60 cm SL (one specimen). Four species are known from the Niger, but the jaw fragments from Jenn6-jeno could only be identified to genus level. Tigerfish prefer open water, but certain species enter the flood plain for spawning and feeding. Hydrocynus are captured today mainly with drift nets or they are hooked with live bait.

Family Distichodontidae and Family Citharinidae Order Cypriniformes
Four vertebrae were found which belong to either citharinids or distichodontids (Figure 8.1[8]). Because of their size (40-50 cm SL) the corresponding individuals can belong to only three of the genera known from the Niger: Distichodus, Citharinus, or Citharidium. These fishes are essentially plant and detritus feeders, living by preference in slow running waters (KAihsbauer 1962). The larvae develop on the floodplain, where the stay until their second year of growth. Fishes of two years and older are usually captured in the main river (Daget and Stauch 1963).

Labeo
Family Cyprinidae
Order Cypriniformes
The cyprinid family is represented by one hyomandibular, six dorsal pterygiophores (Figure 8.1[9]), four precaudal and ten caudal vertebrae. The size
of the corresponding individuals is as follows: 40–50 cm SL (seven specimens) and 50–60 cm (fourteen specimens). Hence, the bones can only belong to the genera Barbus or Labeo. On the basis of the number of trabeculae, one of the precaudals could be identified as Labeo and two caudals as Barbus. Fishes of these two genera occur both on the floodplain and in the main river. Because of their large size, it is more likely that the individuals found at Jenn6-jeno represent fishes taken from the main river.

Arius gigas
Family Ariidae 4
Order Siluriformes
This catfish is represented by a precaudal vertebra of one individual of some 40–50 cm SL and by a dorsal spine fragment (Figure 8.1) of an animal of approximately 1 m. Criteria for the identification of the spines of this and other African catfishes are described in detail in Gayet and Van Neer (1990). This species has become very rare in the Niger and its biology is not well known. Arius gigas remains have been found before in Neolithic context from the Taoudenni-Arawan basin in Mali (Van Neer and Gayet 1988) and from the Azawak in Niger (Van Neer, in preparation).

Bagrus sp.
Family Bagridae
Order Siluriformes
Bagrus remains constitute 5% of the total number of identified fish bones. The skeletal elements by which they are represented are given in Table 8.2. Size distribution is indicated in Figure 8.2. Three species are known from the Niger: Bagrus docmak, Bagrus bajad, and Bagrus filamentosus. There exist clear osteological differences between the first two species (Boessneck and Driesch 1982, Plate 8). All well preserved skull roof fragments (5), articulars (17), dentaries (21), hyomandibulars (2) and ceratohyals (6) belong clearly to the Bagrus bajad type. Not a single element typical of Bagrus docmak was found. However, since no reference skeleton is available of the rare Bagrus filamentosus, the specimens cannot be assigned with certainty to species. This is especially so since Pellegrin (1926) mentions that B. filamentosus is close to B. bajad. Bagrus are typical of open and rather deep waters, but they enter the flood plain for spawning.

Fish Remains
Chrysichthys sp.
Family Bagridae
Order Siluriformes
This catfish is only represented by three cleithra of individuals of some 20 cm SL. These elements can easily be distinguished from cleithra of other taxa by the rather short and sharp humeral process (Figure 8.1[11]). An attribution to one of the three species known from the Niger is, however, impossible. Chrysichthys occur both on the floodplain and in the main river.

Clarotes laticeps
Order Siluriformes
Family Bagridae
Of this bagrid the following elements were found: thirteen pectoral spines, five dorsal spines, five dentaries (Figure 8.1[12]), nine cleithra and one coracoid. The size of the corresponding individuals was reconstructed as follows: 10-20 cm SL (one specimen), 20-30 cm (four specimens), 30-40 cm (twelve specimens) and 40-50 cm (twelve specimens). Two species, Clarotes laticeps and C. macrocephalus, have been described. The latter species has a much wider head than C. laticeps individuals of the same size. It was demonstrated, however, that this phenomenon of macrocephaly is a modification which occurs in C. laticeps with the onset of the reproductive season. It is more pronounced in males than in females. C. macrocephalus has now been synonymized with C. laticeps (Risch in press).

Auchenoglanis sp.
Family Bagridae
Order Siluriformes
This catfish constitutes about 5% of the total number of identified fish remains. Skeletal part distribution is indicated in Table 8.3 and the reconstructed sizes are given in Figure 8.3. Two species, A. occidentalis and A. biscutatus, are known from the Niger, but an identification beyond genus level seemed impossible on the bones (Figure 8.1[13]). Both species prefer muddy bottoms and occur in the main river as well as in the floodplain. It is, however, likely that the larger specimens were captured in the main channel.

Family Clariidae
Order Siluriformes
Clarias
More than 20% of all the identified fish remains are from the Clariidae catfish family. Table 8.4 indicates the skeletal part distribution and estimations of sizes are given in Figure 8.4.
Fish Remains

In the Niger two genera of Clariidae are present: Clarias and Heterobranchus. On the basis of certain isolated bones, it is possible to distinguish both genera (von den Driesch 1983). The articulation of the pectoral spine can be used most frequently and showed in the case of Jennd-jeno that both genera are present. Of the 127 pectoral spines, only 2 belong to Heterobranchus (Figure 8.1114).

All clariids have an accessory breathing organ enabling them to use oxygen from the atmosphere. This ability and their high tolerance to elevated temperatures explain why they can survive in adverse conditions. Clariids are most vulnerable to human predation at the very beginning of the floods when they spawn in marginal areas of the inundated floodplain and, later on, when residual pools are formed (Bruton 1979). This seasonal exploitation has also been demonstrated on prehistoric sites (Van Neer 1986; Gautier and Van Neer 1989).

Synodontis sp.

Family Mochokidae
Order Siluriformes

This catfish belonging to the family of the Mochokidae is well represented at Jennd-jeno. From the Niger basin at least fifteen species of Synodontis are known, the most common one being S. schall. On the basis of the shape and the external ornamentation of the humeral process it is often possible to identify the cleithra to species level. The majority of the well preserved cleithra belong to S. schall, which has a very typical pointed humeral process. At least three other species are present: S. filamentosus (Figure 8.1[15]), S. sorex (Figure 8.1[16]), and another species with a pointed, but higher humeral process than S. schall. An overview of the skeletal parts is given in Table 8.5 and the size distribution is indicated in Figure 8.5. Synodontis are mainly open water species, but small individuals can be found in large numbers in pools on the floodplain.

Lates niloticus

Family Centropomidae
Order Perciformes

The Nile perch is the best-represented species at Jenn6-jeno. Its large size helps to separate Lates from the other perciforms (Tilapiini and Hemicichromis). However, the smaller specimens are easily distinguished as well on a morphological basis, even the fin spines (see Gautier and Van Neer 1989:126). In Table 8.6, the represented skeletal parts are indicated and the size distribution is given in Figure 8.6. Lates niloticus is an open water species which lives in permanent, deep, and well-oxygenated waters. Presence of large individuals on a site are an indication of fishing in the main river.
Fish Remains
Table 8.6. Skeletal part distribution by excavation unit and phase for *Lates niloticus* LX-N  Lx-s  ALS  CrR  HK  WFL  HAM  KAN  I/If  III  IV  III  IV  I/II  III  I/II  III  IV  I/III  ITV  IV
Neurocranium fragments Premaxilla Maxilla Dentary Articular Quadrate Hyomandibular Ectopterygoid Opercular Preopercular Interopercular Epihyal Ceratohyal Hypohyal Interhyal Basihyal Urohyal Hyoid fragment Branchiostegal Ceratobranchial Hypobranchial Branchial fragments Gill raker Supracleithrum Cleithrum Scapula Dorsal pterygiophore Dorsal finray Anal pterygiophore Anal fin ray Basipterygium Ventral fin ray Precaudal vertebra Caudal vertebra Vertebra Rib
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Fish Remains
Smaller individuals, up to a size of 25-30 cm SL can be found on the floodplain.

Tribe Tilapiini
Family Cichlidae
Order Perciformes

Tilapia remains constitute about 20% of the total number of identified fragments (Figure 8.1[17]). The skeletal part distribution is given in Table 8.7. A detailed osteological study on isolated bone elements has not been done yet. It is therefore not established whether there exist osteomorphological differences allowing the separation of the three genera Sarotherodon, OreochromisL, and Tilapia, living in the Niger today. From the size distribution (Figure 8.7), it is clear that larger individuals predominate. It is likely that the biggest specimens represent Oreochromis niloticus which is the largest species in the Niger. Although tilapia have no accessory breathing organs, they are very resistant to adverse hydrological conditions. They are very vulnerable to human predation since they prefer shallow waters. Tilapia can be captured near the shore of large waters, but they are also caught in large numbers on the floodplain during the spawning season.

Hemichromis fasciatus
Family Cichlidae
Order Perciformes

This cichlid is only infrequently found on archaeological sites. It is known from a Neolithic site in Wadi Howar, Sudan (Van Neer 1989), and Hemichromis sp. was reported from a Holocene lake deposit in the Malian desert (Van Neer and Gayet 1988). At Jenn6-jeno, Hemichromis fasciatus is represented by only three specimens: a palatine (Figure 8.1[18]), a dentary, and a second precaudal vertebra. They all belong to specimens of about 15-20 cm SL. H. fasciatus is a widespread species of fresh and brackish waters in Africa. It reproduces on the floodplain during the yearly inundation.

Tetraodon lineatus
Family Tetraodontidae
Order Tetraodontiformes
This puffer fish, which can inflate its body when disturbed, is represented by
vertebrae (Figure 8.1[191]), premaxillae and dentaries. These jaws are very heavy
and form a kind of beak used to crush mollusk shells. The size of the specimens
from Jenn6-jeno varies between 10 cm and 30 cm SL (10-20 cm: ten specimens;
20-30 cm: eleven specimens). Because the liver of this fish is toxic,

Fish Remains
it must be removed soon after capture for safe consumption of the meat. T.
lineatus occurs in the main river as well as on the floodplain.

Unidentified Remains
The unidentified material consists mainly of fragments of fin ray, ribs,
branchiostegals, distal fragments of silurid spines, and skull roof fragments. For
small remains of catfish skull roof, it was not always possible to distinguish
between clariids and Auchenoglanis. It was also difficult to separate incompletely
preserved dorsal and pectoral spines of small Synodontis and Auchenoglanis.

INTERPRETATION

Nature Of The Fishing Grounds
Although geomorphological work in the Inland Niger Delta (S. McIntosh and R.
McIntosh 1980; R. McIntosh 1983) has shown that there have been fluctuations
through time in the maximum height and the length of the annual floods, it is
useful to consider the present-day environment of the sites in order to have an
idea of the possible waterbodies the inhabitants may have exploited.
The settlement mound of Jenno-jeno rises up to 8 m above the presentday
floodplain. It rests in an abandoned channel of the Bani River, which flows
approximately 5 km to the southeast of Jenn&jeno (Figure 1.1). Immediately west
of Jenn6-jeno lies the SCnuba, a seasonal channel which retains water throughout
the dry season. At about 1 km east of the site lies the Hut6, an affluent of the
Bani. The Hut6 holds water all year round. Just north and east of Jenn6-jeno lie
the Sakombo and Farankombo, two large seasonal ponds (S. McIntosh and R.
McIntosh 1980, 1:65). Originally they may have been less deep, since it is
possible that they have been exploited by mud brick manufacturing activities. These ponds dry up completely toward the end of the dry season. Hambarketolo lies just north of Jenn6-jeno and is separated from it by the Sakombo pond. Kaniana lies approximately 4 km northwest and is situated at the southern bank of the Mayo Manga channel. From late September through January all these sites are completely surrounded by floodwaters.

At least twenty-five different fish taxa are present in the Jenn6-jeno, Hambarketolo, and Kaniana assemblages. This is a rich fauna, taking into account that several species may be absent because of the fragility of their bones or sampling bias. The wide spectrum indicates a good knowledge of different fishing methods practiced in different aquatic environments. With the knowledge of the ecological preferences and the habits of the fishes, it is possible to more or less determine where they were caught. It can safely be assumed that fishing was practiced in three different environments: main river, seasonal pools, and more permanent but swampy waters on the floodplain.

Fish Remains
The large numbers of Lates and Bagrus indicate that the main channel of the Hut6 (and possibly also the more distant Bani) was exploited. Adults of these fishes prefer open, deep water and only seldom leave the main river. If they come onto the floodplain at all, it is only for a very short period at the moment when the floodwaters reach their maximum level. The large numbers of clariids and tilapia indicate exploitation of shallow-water habitats, whereas the presence of particular species such as Heterotis niloticus and Gymnarchus niloticus indicate a marshy, well-vegetated aquatic environment (Sdnuba and the ponds). Of course, it should be kept in mind that this division into main river and floodplain species is arbitrary. It is most probable that the fishes were captured in the corresponding ecotopes, but it is not excluded that occasionally large Nile perch or Bagrus were fished on the floodplain. It is even more likely that shallow-water species such as clariids and tilapia were taken at the main river margins.

Fishing Techniques and Seasonality
An enumeration of all possible fishing methods would lead us too far afield, but it seems likely that most of the techniques discussed in Blache and Miton (1962) may have been in use. These include very simple techniques such as grasping by hand or deoxygenation of pools by stirring up the mud. Other techniques involve the use of different kinds of wounding gear (spears, arrows, harpoons), lines with hooks or gorges, and a great variety of nets and traps. Many techniques or fishing gear are unlikely to leave archaeological traces. Still, three kinds of fishing implements were found on the site: the ceramic material includes five probable net weights coming from Phases I/IIIIV. In addition there were three iron fishhooks (all Phase IV), and one iron harpoon head (transition Phase I/IV). The use of nets, which select fish only by size, is probably the major reason for the great variety of species represented by the fish remains.

The location of the fishing grounds suitable for successful exploitation varies seasonally. At the beginning of the floods, clariids are the first fish migrating laterally. During their spawning run, clariids (and also other fish) are captured
today with the aid of barriers, mostly fences, set on the channels through which the floodwaters enter the floodplain. Once the clariids arrive in the marginal shallow waters that serve as spawning grounds, they are easily captured with clubs, spears, and even by hand (Bruton 1979). A few days later, the adult Clarias migrate to the deeper waters of the inundated floodplain and are more difficult to capture. Other fish, especially tilapia, also breed in shallow water. Tilapia are very vulnerable during their breeding season, since several species make circular nests in which they spawn and care for their young. Again, rather simple techniques allow the capture of the adults in their nests. Once the waters on the floodplain start receding, the adult fish and part of the juveniles migrate to the main river. During this period, fishing with barriers and all kinds of traps set on the channels leading to the main river is very successful. Not all the fish return to the main river, however. A considerable number of them stay in isolated

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waterbodies on the floodplain. In the case of the Jennd-jeno region, these are the S-nuba channel and the two seasonal pools. As the dry season continues, water evaporates and access to these waterbodies becomes easier. Once the S-nuba channel and the Sakombo and Farankombo ponds become wadable, large groups of people can thoroughly exploit these shallow waters. A wide variety of fish-catching methods is used in such an environment today. They include grasping by hand, all kinds of striking and wounding gear (clubs, thrown stones, spears, arrows, etc.), stupefaction of the fish by stirring up the mud or by ichthyotoxic plants, hooking, and all kinds of nets, traps and baskets (i.e. cover pots) (Blache and Miton 1962; Sundström 1972; von Brandt 1984). The yield of these seasonal ponds is often enormous (Holden 1963) and today the fishing rights over them are well established. Additional fishing grounds during the dry season are the main rivers, access to which is easiest during this period. Seine nets (both beach seines and boat seines) are used today in those permanent waters. As already stated above, the great variety of fish species indicates that nets were used, which is further confirmed by the presence of net weights. Moreover, the presence in all phases of large numbers of big Nile perch, living in deeper parts of the river, indicates that boats were regularly used for fishing. Summarizing, it can be said that fishing may have been successful at Jenn(-jeno all year round, except during the flood maximum, when fish were very dispersed.

Changes in Ichthyofauna through Time
The foregoing interpretations were based on the totality of the recovered fish fauna. Comparison of the species composition and the size distributions through the different phases may indicate differences which can be explained in terms of paleoecological or paleoecononical events. Before doing so, it has to be ascertained that comparison of different phases or loci is done on assemblages sampled in a comparable way.
It has been established experimentally that many remains, especially fish bones, are missed without sieving (Payne 1972; Meadow 1980). During the excavations, sieving had to be omitted for practical reasons. Blocks of sediment were systematically broken up and artifacts and bone fragments picked out. Since the
hardness of the sediment varied sometimes from one level to the other, it is possible that the degree of fragmentation of the bones and the rate of their recovery differed accordingly. A possible method of evaluating sampling bias is to compare the ratio of unidentified to identified bones. A bias in favor of larger, more-or-less complete bones results in a low ratio of unidentified remains. From Table 8.1 it can be seen that the percentage of unidentified bones is rather low in the small samples from Hamarketolo, Kaniana and ALS, HK, and WFL at Jenn6-jeno. Unidentified bones are smaller on the average than identified ones. Therefore the mean weight of the bones in every assemblage can indicate the efficiency of recovery as well. There is a wide variation in the mean weight of the bones in the different phases of the different loci. However, in LX-S and CTR the mean weight is the same in the different phases of each locus. At LX-N only the

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earliest phase has yielded smaller bones, whereas Phase III and IV are comparable. For those reasons, I believe that it is permissible to compare the different phases within each of those loci. An additional difficulty is that several samples are very small, and also that only at LX-N are fish remains from all phases are present in considerable numbers. For that reason, the material from the different phases is lumped in Table 8.8. However, the observed trends in the frequencies of the most common species are also seen in LX-N, the only locus with samples of significant size throughout the whole sequence (Table 8.9). Table 8.8 gives an overview of the absolute and relative frequencies of the six most common fish through the different phases. Clarias and Lates are the largest and also the two best represented taxa. Their bones are relatively sturdy, and larger on the average, and therefore preserve well and are easily recognized during excavation. I assume that of all species, they are the least affected by sampling errors or differential destruction. Those two fishes show a potential trend in their relative importance through the different phases (of LX-N and all loci grouped). The relative importance of the clariids decreases from Phase I/II through IV, whereas Nile perch increases in LX-N (although decreases may be noted in LX-S, CTR, and HAM [see Tables 8.1 and 8.8]). Moreover, Polypterus, Gymnarchus, and Heterotis show a marked decline in Phase IV (Table 8.1). The rarity of those fishes in Phase IV and the lower number of clariids might indicate that shallow-water habitats were less numerous than before. Higher flood levels and longer flood seasons may also explain why Nile perch become more abundant. Instead of drying up seasonally, certain waterbodies may have been permanent all year round, and Nile perch may have had suitable habitats closer to the site (the Sdnuba channel?). This corresponds roughly to the hydrological changes indicated by the geomorphological research except that the data do not inform us on aridification during the second half of Phase IV.

Certain trends in the species distribution cannot be explained very well. In archaeological context, Bagrus and Synodontis (and maybe also Auchenoglanis) are often found in large numbers when Nile perch is abundant (Van Neer 1989), since the capture of the adults of these fishes is usually done in the mid-river. Table 8.8 shows that Synodontis increases in number from Phase I/II to III, but
that there is a sudden decrease in Phase IV. Normally, I would expect a simultaneous increase with Lates. It seems also improbable that the high frequency of Synodontis in Phase II and III results from exploitation of ponds, since the fish are too large to come from such a shallow environment. Bagrus and Auchenoglanis show no significant changes through time; moreover, their numbers of fragments are rather low. The relative frequencies of the tilapia are not easy to explain either. Usually large numbers of tilapia coincide with large numbers of Clarias. Therefore, the high number of tilapia in Phase IV is rather surprising. Maybe an explanation in terms of the changing environment is possible. A higher water level may result in a decline of suitable spawning grounds for Clarias, but tilapia are not affected to the same degree, since their breeding is not restricted to shallow waters (Bruton and Bolt 1975). A similar phenomenon has been observed in the High Dam Lake in Egypt. As the lake filled, the

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number of species drastically declined. The landings contain almost exclusively tilapia and Lates; Clarias has become rare (personal observations 1983, 1984). All the observed trends have been explained in terms of the major hydrological changes. The material is not suitable to detect shorter variations of high and low flood periods but represents the sum of a number of different phenomena. Factors other than environmental ones may also account for the observed variations in the relative frequency of the species: a shift in the fishing techniques, the division of the fishing grounds, preferential exploitation of a different part of the catchment area, or the depositional context. One of these factors or a combination of them is possibly responsible for the lack of evidence for the aridification during the second half of Phase IV. The ichthyofauna from Phase IV represent the smallest sample, compared to Phase I/II and Phase III and, moreover, cover the largest time span. It is possible that the fishes from Phase IV mainly represent individuals caught during the wetter period. It is not excluded either that trade in Nile perch, during the arid period marking the end of the occupation, masks to a certain extent the exploitation of shallow waters.
Today, there is a division of the fishing rights over the seasonal ponds and the main river between the Bozo, the earliest inhabitants of the Inland Niger Delta according to the legend, and the Somono, who came later, probably in the thirteenth century (Gallais 1967a). The fauna do not show that such a regulation existed or came into use during the time of site formation. It is certain that the fish consumed by the inhabitants of Jenn6-jeno came from both environments.

Besides the changes in the relative frequencies of the species, possible shifts in the size of the fishes have been investigated as well. The juveniles and adults of most species live in different environments, and length reconstruction therefore may allow us to demonstrate in what kinds of waters fish were captured during each phase. A decrease in overall size through time can indicate overfishing, a phenomenon which is conceivable at a quickly growing settlement like Jenn6-jeno. Figures 8.2-8.7 do not show significant shifts through time in the size distributions of the fish. The general pattern consists of relatively few small and very large fishes and many medium and large specimens. In all six taxa considered, the smallest length classes are better represented in Phase I/II. More small fish could result from more fishing on the floodplain and in the residual ponds, but I believe that this is not the reason in this case. I consider it an effect of smaller remains being generally better preserved or more completely sampled in the oldest phase, as suggested earlier in my discussion of the representativeness of the samples. Despite these problems inherent to the sampling, it is possible to state that no overfishing occurred as Jenn6-jeno grew. Remains of big fish, which have less chance of being overlooked during excavation and more chance of preservation, do not decrease in number in the later phases.

Fish Remains
Preparation Techniques
Indications of the techniques for preparation or preservation of the fishes are only rarely found at archaeological sites. At Jenn6-jeno, two bones bear cut marks: in Phase I/II of CTR a left posttemporal of a large Bagrus (55-60 cm SL) presents two deep parallel cut marks as well as a series of smaller incisions on its dorsal surface (Figure 8.1120). This bone connects the posterior part of the skull to the top of the cleithrumb. Examination of recent fish demonstrates that the posttemporal lies mediolaterally at the boundary of the bony skull and the fleshy body of the fish. The cut marks may be related to decapitation of the specimen (Wheeler and Jones 1989:68). However, such practices are uncommon in Africa today. Another likely explanation for the cut marks is that they result from filleting prior to drying. Most dried catfish that I have seen so far were split open longitudinally except for the head, which remained attached to the body. In the Jenn6-jeno specimen, the left side of the body may have been cut loose along the length of the vertebral column in order to lay the flesh flat. Although this is only a weak indication of drying fish, I believe that it may have been a common practice. In Sahelian countries, the semiarid conditions are very suitable for sun-drying fish, even without the use of salt.

Another bone that gives indications of fish processing is the interhyal of a large Nile perch (approximately 150 cm SL) found in Phase IV of LX-N. This bone,
which connects the hyomandibular with the hyoid arch (epihyal), bears many cutmarks on the external side (Figure 8.1[21]). In Nile perch of this size, the head represents a great amount of food, which has to be further processed in order to obtain portions manageable for cooking. Cutting the fish head in the region of the interhyal makes it possible to remove the hyoid and branchial arch as one unit. The branchial is discarded since it bears almost no meat and because the gills spoil very rapidly.

- For each phase, the amount of burnt bone was calculated. Certain trends in vessel size over time in the Jenn6-jeno ceramic assemblage were thought to be potentially related to changing preparation techniques of the fish (stewing versus grilling). While stewing does not leave macroscopic traces on the remains, bones of grilled fishes exposed to fire may be recognized. When bone is subjected to the action of fire its color changes (Franchet 1933). It first becomes yellowish (below 1000 C), then turns light brown to dark brown (1003000 C). At about 3000 C, the bone turns black, and still higher temperatures result in a blue gray to white color (600-7000 C). Bone shrinks, deforms, and splits, and at still higher temperatures (9000 C), vitrification occurs, giving the bone a white china porcelain aspect. A difficulty with the Jenn6-jeno material is that the general color of the remains is brownish. With the exception of certain levels such as those from LX-N Phase I/II, where the bones are yellow to light brown, the remains are usually dark reddish brown to blackish brown. Therefore, only the black, white, and gray bones could be identified with certainty as charred. The amount of burnt bone does not change significantly over time: 2.3% for Phase I/I, 5.6% for Phase III, and 5.4% for Phase IV. These figures are minimum values, since bones charred at temperatures below 3000 C are not included. Moreover, it should be kept in mind that traces of fire are not necessarily the result of intentional processes. It is likely that a great amount of it results from postdepositional and accidental exposure to fire from hearths.

CONCLUSIONS
The 1981 excavations at Jennd-jeno yielded about 5,000 identifiable fish bones of at least twenty-five taxa. The species richness of the assemblage results from the great variety of fishing techniques used, including nets set out with boats. Based on number of remains and meat yield, the Nile perch and the clariids were the most important aquatic food resource. Fishing was an almost all year round activity on the floodplain, in residual pools and in the permanent waters of the Hutd and maybe also the Bani River. The semiarid climate likely allowed easy sun drying of fish and thus permitted the population to overcome periods of food shortage when fishing was less successful during the flood maximum. Over time, an increase of Nile perch is observed as well as a decrease in clariids, Polypterus, Heterotis and Gymnarchus. This is believed to be related to a decrease in number of shallow-water habitats in Phase I and the first half of Phase IV as a result of the higher and longer floods during that part of the occupation.

Caption for Figure 8.1a-b (overleaf)
Illustrated boney elements of various fish: (1) left lower jaw of Protopterus annectens, lateral view, LX--N IV; (2) ganoid scale of Polypterus sp., external view, CTR m; (3) vertebra of Polypterus sp., anterodorsal view, CTR I/II; (4) incomplete left opercular of Heterotis niloticus: (a) internal view and (b) external view, HAM I/II; (5) precaudal vertebra of Mormyrus sp., ventral view, CTR I/II; (6) precaudal vertebra of Gymnarchus niloticus: (a) dorsal view and (b) ventral view, LX-S II; (7) right premaxilla of Hydrocynus sp., internal view, CTR I/II; (8) caudal vertebra of Citharinidae or Distichodus sp.: (a) caudal view and (b) lateral view, LX-N IV; (9) dorsal pterygiophore of Cyprinidae, anterodorsal view, LX-N IV; (10) dorsal spine of Arius gigas, anterior view, CTR III; (11) right cleithrum of Chrysichthys sp., lateral view, CTR I/II; (12) right dentary of Clarotes laticeps, lateral view, LX-S III, p = typical process; (13) mesethmoid of Auchenoglanis sp., dorsal view, LX-S III; (14) left pectoral spine of Heterobranchus sp., dorsal view, CTR III; (15) left humeral process of Synodontis filamentosus, lateral view, LX-N I/II; (16) right humeral process of Synodontis soro, lateral view, LX-S III; (17) vomer of Tilapini, dorsal view, CTR I/II; (18) incomplete right palatine of Hemichromis fasciatus, internal view, CTR III; (19) vertebra of Tetraodon lineatus, lateral view, CTR I/II; (20) left posttemporal of Bagrus sp. with cut marks, dorsal view, CTR I/II; (21) interhyal of Lates niloticus with cut marks, LX-N IV. All scale bars = 5 mm.
Figure 8.2. Length distribution of Bagrus at Jennd-jeno, by phase AUCHENOGLANIS size classes
10 20 30 40 50 60
cm SL

Figure 8.3. Length distribution of Auchenoglanis at Jennd-jeno, by phase
20 30 40 50 60

Fish Remains
CLARIIDAE SIZE CLASSES
1/11 III IV
n=139 n=125 n=43
10 20 30 40 50 60 70 80 90 100
20 30 40 50 60 70 80 90
20 30 40 50 60 70 80 90 100
cm SL

Figure 8.4. Length distribution of Clariidae at Jennd-jeno, by phase SYNODONTIS size classes
10 20 30 40
10 20 30 40
cm SL

Figure 8.5. Length distribution of Synodontis at Jennd-jeno, by phase
%40
35 30 25 20 15 10
%50
70
60
40
10 20 30
1/11 III IV
n=182 n=490 n=34
PALEOBOTANICAL AND HUMAN
OSTEEOLOGICAL REMAINS
Susan Keech McIntosh

PALEOBOTANICAL REMAINS

The recovery of paleobotanical material was an important goal of the 1981 excavations, as indicated in chapter 1. Ten-liter samples of excavated soil from nonstructural contexts in Units LX-S, LX-N, and CTR were collected for manual flotation. Brick walls, brick rubble, and wall wash were not sampled because the necessary mechanical breakup of this material risked serious damage to any paleobotanical material (we were unaware of chemical means for deflocculating day peds, such as those described by Pearsall 1989:86-87). A variety of different functional contexts, such as occupation floors, areas outside houses, pits, hearths, and funerary urns, is represented among the 126 samples.

Identifications of paleobotanical material were kindly undertaken by Jack Harlan (University of Illinois, Urbana-Champaign) and by John Scheuring, Youssouf Boré and Abdoulaye Sow (International Crops Research Institute for the Semi-Arid Tropics [ICRISAT], Bamako, Mali). Harlan identified material from 26 samples; the ICRISAT team worked on the other 100 samples. In both cases, the absence of an extensive reference collection precluded identification of much of the material. Partway through the analysis, the ICRISAT team traveled to Kew Gardens and was able to positively identify significant portions of the remains. Approximately 50 of the flot samples, therefore, have a much wider range of plant genera and species represented in the analysis. These samples were almost exclusively from unit LX-S (Table 9.1). The flot samples from LX-N and CTR were analyzed without benefit of reference collections. These results are presented in Tables 9.2 and 9.3.

Results

From both sets of analyses, the fact emerged that in most of the samples, seeds of a particular wild grass predominated. Harlan comments, "It is by far the most common seed . . . You have gobs of them. Almost every sample has some and a few samples are almost entirely of this grass seed" (personal communication, 24 June, 1982). Scheuring, Boré, and Sow were able to make a positive identification of this seed at Kew Gardens: it is Brachiaria ramosa (J. Scheuring, personal communication, 29 January 1983), an annual grass.
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Paleobotanical and Human Osteological Remains
encountered in marshy zones (Hutchinson and Dalziel 1972, I1(2):445). The two other most common elements identified were rice (Oryza sp.) and the seeds of sedges (Cyperaceae). With regard to the latter, it seems likely that the seeds were brought to the site as weedy and unwanted additions to other grains (J. Scheuring, personal communication, 2 August 1984). One of the two genera identified, Rhyncospora, is a weed of rice paddies. While the other, Scleria, has widespread medicinal usages in West Africa (Burkill 1985: 642-5), the fact that Cyperaceae in the samples most frequently co-occurs with rice suggests that it was transported to the site as a weedy addition to food crops.

Brachiaria ramosa occurs in such high frequencies throughout the sequence of samples that it is difficult to dismiss it as a weedy addition, especially since it is actively collected in the IND today (Bor6 1983). During a six-week trip on the Niger between Jenn6 and Gao in 1982, Bor6 documented the continuing importance of wild cereal collection all along the Middle Niger. Contrary to the belief that wild cereal collection is a subsistence strategy of last resort in times of famine, certain wild grasses are staple foods at all times for particular groups (Bore 1983; Harlan 1989). Bor6 found that Panicum laetum, Echinochloa colona, Oryza barthii, and Brachiaria ramosa are collected on a large scale along the Middle Niger, with sufficient surplus available for sale in the markets and storage in underground silos. While none of these plants is cultivated, certain husbandry practices (e.g., the placement of thorn bush around promising swards of wild grass seedlings to protect them from animals) have been documented (Bor6 1983). Cultivation at some point in the past cannot be ruled out. Porteres (1951; 1976) reported the cultivation of Brachiaria deflexa, a species with close affinities to B. ramosa, in the Futa Jallon.

Attempts by John Scheuring to unambiguously identify the taxon of the Jenn6-jeno Brachiaria led to the discovery that the plants collected by Porteres in the Futa Jallon were in fact Panicum subalbidum. Scheuring grew out some of the Futa Jallon grains, and the plants were identified as P. subalbidum by Steve Renvoise at Kew. Renvoise also discovered that the cereal described by Porteres (1951) is P. subalbidum, but the photograph is of B. deflexa. Porte-res's confusion may have stemmed from the fact that both B. deflexa and P. subalbidum are cultivated in the Futa Jallon under the Bambara specification of fini. This finding was made by Youssouf Bord on a research trip to the Futa Jallon in August 1991 (J. Scheuring, personal communication, 17 October 1991).

The rice in the samples is largely 0. glaberrima Steud., but its wild annual form, 0. barthii A. Chev., (Syn. 0. breviligulata A. Chev. & Roehr.) is also present (J. Scheuring, personal communication, 28 December 1981 and 16 February 1983). A wild perennial form of African rice exists, 0. longistaminata, but it has not been reported at Jennd-jeno. Some idea of the relative frequency of 0. glaberrima and 0. barthii through time at the site would of course be useful, but few specimens are well preserved enough to show whether or not awns were present (J. Harlan, personal communication, 24 June 1982; the domesticated form is awnless). 0. barthii is common in
shallow standing water along the Middle Niger. Its roots penetrate the soil more deeply than the farmers' hoes can reach, ensuring that it is omnipresent in rice fields today, and can displace domesticated rice plants in a relatively short time (Gallais 1967: 218).

Other identified domesticated cereals include Pennisetum glaucum (L.) R. Br. (synonyms include: P.americanum (L.) Leeke, P.typhoides (Burm. f.) Stapf & C. E. Hubb, P. typhoides Rich., and P.spicatum (L.) Koern.; Purseglove 1972), Sorghum sp., and Digitaria exilis, but these constitute a very tiny proportion of the identified material. The sorghum is of two types, "one small-seeded and probably a bicolor race, the other a caudatum or halfcaudatum" (Harlan, personal communication, 24 June 1982). In addition, two watermelon seeds (Citrullus lanatus) were identified.

The remaining genera and species identified are all wild, and all are Graminae, with the exception of Portulaca (probably P. oleracea, or purselane). This latter is sometimes grown in gardens for the oil in the seed. Harlan reports that "it is also used as a cress in salads, a pot herb, and as a spice. It is a bit hot eaten alone and raw but is great diluted with lettuce or other greens" (personal communication, 20 August 1990). It has been harvested in the wild on a considerable scale in Australia, Africa, Europe, and Asia. The seeds from the flots could therefore represent part of the diet, or just weeds (J. Harlan, personal communication, 24 June 1982). Among the remaining Graminae, Echinocloa stagnina, E. colona, and Panicum laetum have been the object of intensive collection in historical times (Harlan 1989; Bor6 1983; Gast 1968). Panicum laetum is collected along the Niger by swinging baskets into which the shattered grains fall (Bore 1983; Busson 1965:476; Caillié 1824, cited in Busson 1965). Seeds are also swept up from the ground. It can be collected on a scale large enough to permit trade by caravan (Gast 1968) and sale in the markets (Dalziel 1937). Bor6 (1983) found that Echinocloa colona was the most important nondomesticated cereal harvested in the region between Aka and Gao (bend of the Niger). It was sold in the markets under the same name and price as Pennisetum millet. This appears to contradict Busson's (1965:462) report that it is strictly a famine food. Echinocloa stagnina (bourgou in Bambara) is collected all along the Middle Niger for various purposes. The leaves are used to caulk canoes, the ash to make soap, the stems for matting and thatching, the seeds for food, and the sugar decocted from powdered stems for confections (Chevalier, reported in Harlan 1989:92).

Discussion

Among the most significant aspects of the flotation material is the documented presence of domesticated rice, millet, and sorghum in the earliest occupation levels. The absence of domesticated cereals from the 1977 samples dating to the earliest occupation is now understood as a sampling artifact. The earliest settlers at Jenn6-jeno arrived with these three domesticated cereals, suggesting that they moved into the area from a similar ecotope possessing both floodplain basin soils for rice and levees for the ddcruce cultivation of millet and sorghum. The pattern of preferential
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exploitation of floodplain basins for the cultivation of domestic rice and wild Brachiaria, augmented by limited cultivation on the levees, is consistent throughout the site sequence. This diversified approach, well suited to the unpredictability of the flood regime, was already part of the subsistence strategy of these first inhabitants.

Two aspects of the paleobotanical assemblage are somewhat surprising. First is the strong and continuing presence of both wild Brachiaria and domestic rice. Of course, since the analysis of the botanical material did not indicate quantities of grain present, changes through time in the relative importance of these two cereals cannot be determined. Nevertheless, the fact that Brachiaria is present in substantially more samples than Oryza suggests its considerable importance at the site. Second is the extraordinary consistency of the paleobotanical assemblage through time, in terms of the species and ecotopes represented. It is an unrelentingly African assemblage, with not a single species present that is not indigenous to the continent, even in the most recent levels. It is also a locally produced assemblage, with all the identified wild species native to the IND floodplain, and all the domestic cereals readily grown within 1 km of Jennd-jeno. While recalling that much larger samples are needed before we can claim to really know anything approaching the full range of plants exploited by the inhabitants of Jenn& jeno, the lack of evidence for widely traded fruits such as dates is surprising.

HUMAN SKELETAL REMAINS

Fourteen burial features, containing the remains of at least twenty individuals, were excavated at Jenn6-jeno and Hambarketolo. Unfortunately, nearly all the skeletal material uncovered was in extremely poor condition, such that even tooth enamel was friable or powdery. Removal of any of the material for laboratory study was virtually out of the question. Either there was no consolidated bone to lift, or the bone fragmented hopelessly upon removal. As a consequence, all studies were conducted at the site with the bone in situ after painstaking exposure. Urn burials were excavated by cracking and removing the sides of the urn, thus exposing the urn fill so that it could be excavated in from the sides as well as the top, to expose the bone in three dimensions. This strategy made it much easier to detect and reconstruct multiple burials. The results of excavation have already been described (see Chapter 2). Here I present the data on the skeletal material from each burial feature.

Feature 5 (Inhumation, Unit HK). This burial was in poor condition, since it was a shallow inhumation in a cement-like matrix of indurated clay. Only teeth could be recovered. The premolars and M1 showed polishing and some wear, although enamel creases were still clearly visible. Left M1 had a tiny carious lesion in the occlusal surface. M2 was well polished, but not worn, and M3 showed slight polishing on cusps. The generally unworn condition of the molars contrasted with heavy wear on the incisors and canines. Here the dentine was well-exposed, suggesting heavy use of the anterior dentition for some activity. A series of five closely spaced
hypoplasias on the lower half of the two lower canines (beginning 4.3 mm from the cemento-enamel junction and continuing to it) suggests that several episodes of growth disruption occurred in early childhood. Using Goodman et al.’s (1980) approach to estimating the etiological ages for these hypoplasias, the growth disruptions would have occurred between the ages of three to six years.

Observations were made in situ on the cranium and postcranium: very gracile skull, with no supraorbital tori and small mastoid processes; large greater sciatic notch.

Based on the above observations, these appear to be the remains of a female, aged twenty to thirty years.

Feature 22 (urn inhumation, Unit CTR). The bottom 10 cm of this urn contained bone in a highly fragmented and almost totally disintegrated state. No identifiable fragments or teeth were found. The presence of two iron bracelets with diameters of 53 mm and 58 mm suggests that this may have been a child.

Feature 23 (urn inhumation, Unit CTR). A carinated pot disturbed by the burial of the urn described below contained a very small amount of almost entirely disintegrated bone. The small amount of bone and the small size of the pot suggest the possibility of an infant burial.

The urn contained the remains of a cremated individual in the top 7-30 cm. of the urn fill. No identifiable bones or teeth were recovered. Below the ceramic plate fragments that marked the lower boundary of the cremation burial, the remains of two inhumed individuals were found, consolidated together in a mass within the bottom 15 cm of the urn. The condition of these remains was very poor, with even the teeth in a disintegrating state. The recovery of two fragmentary mandibles demonstrates that at least two individuals are represented. The posterior dentition (M3, M2, M1, PM2, and PM1) on both sides had been lost ante-mortem, with complete alveolar resorption. The anterior portion of the mandible was broken, and only 1 extremely worn incisor stump was found. The state of this mandible argues for an individual of advanced age (over forty-five years).

The other mandible was intact with all teeth present. First molars were worn, with enamel creases smoothed, but no dentine exposed. Third molars were slightly polished, but creases were still sharply defined. This individual was likely between twenty and thirty years of age. No carious lesions or hypoplasias were noted.

Feature 24 (cremation in urn, Unit CTR). Fragmented, burnt bone was found in the bottom 10 cm of the urn. Several highly friable molar shells and large fragments of long bones indicate that this was an adult or subadult individual. Two iron bracelets, diameters 76 mm and 60 mm, are consistent with this conclusion.

Feature 26 (inhumation, Unit LX-N). A complete mandible and maxilla were recovered. Posterior dentition was extremely worn, with dentine exposed over the whole surface of the first molars, and third molars worn flat. Right M2, M1 and PM2 were lost ante-mortem, with complete alveolar resorption. The retreat of the alveolar process around the roots of the
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posterior dentition indicates that periodontal disease was present. Anterior
dentition also showed advanced wear, with dentine exposed on all teeth. The
small size of the teeth and the dental arcade, together with the small mastoid
processes, sharp orbital margins, and gracile cranial vault, suggest that this was a
female over forty years of age.

Feature 34 (inhumation, Unit WFL). Only the lower legs of this inhumation
extended into the excavation unit. Length of the tibia from medial condyle to
medial malleolus was 402 mm.

Feature 35 (cremation in urn, Unit CTR). These burials are represented by
partially burned bone in very poor condition in the bottom 30 cm of the urn. At
least two individuals are present (four femoral heads inventoried). The only intact
bones were blackened phalanges and bones protected from the fire by surrounding
tissue (i.e., innominates and femoral heads and shafts). Extremely worn PM, C,
and I, as well as moderate osteophytosis on cervical and lumbar vertebrae, suggest
that at least one of the individuals was relatively advanced in years. The recovery
of a partial innominate with a large greater sciatic notch indicates that one of the
individuals was an adult female. An os pubis with no ventral arc, no subpubic
concavity, and an eroded symphyseal face with broken down ventral margin
suggest that one individual was a male over forty-five years of age (Phenice 1969;
Todd 19201921).

Feature 42 (urn burial, Unit LX-S). The bones in this inhumation burial were in
fair condition covered by 20 cm of earth in the bottom of the urn. The fact that the
urn cover was still intact may have contributed to their relative lack of
disintegration. Unfortunately, the urn broke upon lifting from its pit, scattering
and breaking the bones. Nevertheless, it was clear from the bones that remained
together (ribs and vertebrae, femora, tibiae and fibulae) that they had been at least
partially articulated in the urn. The body had been placed in a tightly flexed fetal
position with the hands in the pelvic basin. The following observations were
recorded: os pubis, no ventral arc, no subpubic concavity; symphyseal surface too
damaged to assess; acetabulum diameter: 53.8 mm; humerus: diameter of head:
46.4 mm vertical; 44.7 transverse. No osteophytosis was observed on recovered
thoracic or lumbar vertebrae. The individual buried was an adult male.

Feature 47 (urn burial, Unit LX-S). This urn contained two superimposed,
articulated inhumations in the bottom 40 cm. The overlying skeleton was in fair
condition. It was tightly flexed, with arms folded under the torso, knees splayed to
either side of the shoulders, and the skull facing the side of the urn, with chin
jutting out. The presence of a deep preauricular sulcus and a very gracile skull
suggests that the individual was female. M2 was lost antemortem on both sides,
with total alveolar resorption. M3 was missing on the left, but present on the right,
where it showed considerable wear. The degree of tooth wear and attrition
suggests an adult over thirty years of age.

The second skeleton was in poor condition, soft and friable like rotting wood.
This original burial in the urn was tightly flexed, crouching, with both knees to
the left side, hands across the chest, elbows in the pelvic basin. The cranium had
dropped into the pelvis, where it rested on the forehead. This
Paleobotanical and Human Osteological Remains

Individual had a very robust cranium, with a rugose nuchal area, medium mastoid processes, and large supraorbital ridges and nasal aperture. The angle of the greater sciatic notch was small. All of these characteristics strongly indicate that the individual was male. The advanced wear and attrition on the teeth (M1 worn to a stump, M2 lost ante-mortem) suggest an age of over forty years.

Feature 49 (inhumation, Unit LX-S). This burial had been placed in a shallow pit dug into the sterile floodplain alluvium. The skeleton was oriented east-west, facing south, with knees flexed at a 90° angle to the trunk and both hands under the left cheek. The bones were in very poor condition in the cement-like matrix of the floodplain clay. The innominate were completely disintegrated, as were most of the other bones of the trunk and of the extremities. In situ observations on the skull, which fragmented upon lifting, included the following: very robust, with a large nasal aperture, large zygomatics, blunt (rounded) orbital margins, very large mastoid processes, and small supraorbital ridges with protruding glabella. In view of these robust cranial characteristics, the small size of the teeth was surprising. This contradiction raises the possibility that the individual displayed characteristics of the robust Mechtoid populations that have been documented from North Africa to the Sahel during the Holocene (Petit-Maire and Dutour 1987). The presence of shoveling on the upper incisors and canines of the individual in Feature 49 is further evidence in support of this conjecture. Burials of Mechtoid individuals have recently been documented at Kobadi, a terminal Late Stone Age site in the M~ma (Raimbault and Dutour 1990).

A complete dentition was present. General characteristics included the presence of shoveling on the upper anterior dentition; pronounced interproximal wear; one or more carious lesions at the cervical margin on virtually every tooth, and retreat of the alveolar process well down the roots of the posterior dentition, accompanied by substantial calculus deposits below the cemento-enamel junction. These latter conditions indicate that periodontal disease was present. Anterior dentition was worn (extremely so in the case of the lower dentition) in a sloping pattern away from the midline, such that the canines were the most worn and the mesial incisors the least worn of the anterior teeth. Dentine was exposed on all the anterior dentition; the lower canines were worn down to stumps. On the posterior dentition, carious lesions on the occlusal surface were common. Premolars were worn flat, with dentine exposed. First molars were worn flat, with dentine exposed on the lingual aspect only. Second molars were worn, but grooves between cusps were still visible. Third molars were well polished with slightly rounded cusps. The upper canines show three small enamel hypoplasias between 3.1 mm and 3.6 mm from the cemento-enamel junction, suggesting that multiple growth disruptions occurred between three and one-half and four and one-half years of age.

Age and sex estimates for this individual cannot be made with much certainty. A suitable age estimate would be twenty-five to forty years, and the small tooth size suggests that this was a female, despite the robustness of the cranium.
Paleobotanical and Human Osteological Remains
Feature 51 (urn burial, Hambarketolo). Two horizontal urn burials found at approximately the same level constitute this feature. Only one of these could be excavated, however, since only a small portion of the other protruded from the north wall of the unit. The excavated burial revealed that the head and trunk had been placed in the southernmost urn and the northern urn was then drawn up around the legs. The overlapping fit of the two urn mouths created, in effect, a sealed coffin. The body was on its right side, facing northeast, with upper legs slightly flexed at a 1450 angle to the trunk, and the lower legs tightly flexed at the knees. The feet were drawn up against the buttocks. The right arm lay across the chest, and the left arm rested across the waist. The bones were almost entirely disintegrated, with even the teeth decayed and crumbling. It was possible to observe that the molars were very worn, and M3 had been lost antemortem, with total alveolar resorption. It is possible to say only that this was an adult over thirty years of age.
Feature 54 (urn burial, Unit ALS). This carinated pot, covered with a potlid, contained the almost entirely disintegrated remains of at least two children in the bottom 10 cm of fill. The recovery of an unerupted permanent lower incisor, a canine, two partially calcified upper premolars and upper and lower first molars indicates that one of the children was four to five years old. A canine, two upper incisors, and three molars, all deciduous and unerupted, indicate that the other was a six-to twelve-monthold baby.
Feature 55 (urn burial, Unit WFL). This red-slipped urn contained extremely fragmentary bone in the bottom 5 cm of the fill. The presence of an erupted deciduous molar and incisor, and unerupted permanent first molars and canines, all partially calcified, indicates the remains belonged to a child three to four years of age.
Feature 56 (urn burial, Unit NWS). This 30-cm-high urn contained disintegrated bone in the bottom of the fill. Several teeth were recovered: deciduous dentition-incisors, canines, first molar (all erupted), unerupted second molar; permanent dentition-unerupted, partially calcified M1, mesial and lateral incisors. Age at death was twelve to eighteen months.
Discussion
The excavated burials represent the remains of thirteen adults, four infants or children, and at least three individuals whose remains were in such a state of disintegration that I could not ascertain whether they were children or adults. The poor condition of the material, which is due in great part to burial practices that included cremation and secondary interment, precluded determination of age and/or sex for over half of the adult individuals. Under these circumstances, the number of conclusions that one can draw about this group is limited. One aspect of the sample stands out clearly, however, and that is its poor state of dental health. Of the nine adult individuals for whom dental remains were present and recorded, seven exhibited dental pathology. Dental pathologies were by far the most frequently encountered pathologies.
This frequency of dental pathology is substantially higher than that encountered among the 1977 skeletal sample, in which four of twelve individuals exhibited pathologies. Both the 1977 and the 1981 samples are too small to permit speculation on the reasons for this apparent difference. The only other studies of dental pathology in the Inland Delta were conducted by Huinziga on similarly fragmentary remains from funerary urns at several sites between Jenné and Mopti; notably high incidences of dental pathology were also encountered in this limited sample (Bedaux et al. 1978:163-165).

TABLE 9.4. Summary of pathologies recorded for skeletal remains from Jennd-jeno and Hambarketolo.

<table>
<thead>
<tr>
<th>UNIT FEATURE</th>
<th>PHASE</th>
<th>PATHOLOGY</th>
</tr>
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<tbody>
<tr>
<td>HK</td>
<td>5 IV</td>
<td>carious lesion left M1, unusually heavy wear on anterior dentition, series of five enamel hypoplasias on lower canine</td>
</tr>
<tr>
<td>CTR</td>
<td>23 InI</td>
<td>L and R M3 through PM1 lost ante-mortem, complete alveolar resorption</td>
</tr>
<tr>
<td>LX-N</td>
<td>26 IV</td>
<td>R M2M1pM2 lost ante-mortem, complete alveolar resorption, alveolar lysis around roots of remaining posterior dentition</td>
</tr>
<tr>
<td>WFL</td>
<td>35 IV</td>
<td>osteophytosis on cervical and lumbar vertebrae</td>
</tr>
<tr>
<td>LX-S</td>
<td>47 IV</td>
<td>L and R M2 and L M3 lost ante-mortem [first individual] M2 lost ante-mortem [second individual]</td>
</tr>
<tr>
<td>LX-S</td>
<td>49 I/II</td>
<td>one or more carious lesions on every tooth at cervical margin, series of three enamel hypoplasias present on upper canines.</td>
</tr>
<tr>
<td>HAMB</td>
<td>51 III</td>
<td>M3 lost ante-mortem</td>
</tr>
</tbody>
</table>

Future research may recover larger samples, permitting assessment of the true nature of variability in the incidence of dental pathology. We will want to know, for example, if frequencies change through time, or with reference to burial location and context. For example, is the striking pattern in the single Phase I burial of multiple carious lesions at the cervical neck, a pattern which has not been found in burials of later periods, widespread or rare among the earliest occupants at Jennd-jeno, and does its frequency change subsequently? Since the dental health of populations is determined by the abrasiveness, texture and chemical composition of foods consumed, oral hygiene practices, as well as several other exogenous and endogenous factors, studies of dental pathology can provide important data relevant to shifts in diet and nutritional status (Powell 1985). These may be particularly useful in revealing whether differentials in diet and nutritional status emerged as society became more hierarchically organized. Unfortunately, the available data from Jennd-jeno are too limited to permit investigation of these important questions.

CONCLUSION:
THE SITES IN REGIONAL CONTEXT
Susan Keech McIntosh
The preceding chapters have focused on presenting the data from the excavation and interpreting them within the context of the site itself, addressing important
issues such as sampling and representativeness, apparent change through time, and reliability of relative and absolute chronology at the sites. Now it is time to cast the net more widely, moving to a higher level of interpretation that examines these data and their interpretation in the context of other sites, both within the Upper Inland Niger Delta (IND) and beyond (see Figure 10.1 for sites and regions mentioned in the text).

THE UPPER INLAND NIGER DELTA AS A DISTINCT "CULTURE AREA": DESCRIPTION AND AFFINITIES

In our earlier monograph on Jenne-Jeno, I suggested (S. McIntosh and R. McIntosh 1980, 11:451-2) that the entire upper IND constituted, during Phase IV (A.D. 900-1400), a "culture area" characterized by a uniform style of pottery and art, similar settlement patterns, and common funerary rituals. It is now possible to expand and refine these comments in the light of the 1981 excavations as well as subsequent work elsewhere in the IND, particularly at Dia. After summarizing the three major ceramic phases identified for the IND and discussing what is known of their distribution within the Delta, I consider the wider affinities and cultural relationships suggested by ceramic analysis, focusing particularly on neighboring areas of the Middle Niger.

As indicated in Chapter 3, the presence of three distinctive, yet clearly related, time-successive ceramic assemblages at Jenne-Jeno and Hambarketolo has now been firmly demonstrated. Subsequent work has shown that these assemblage distinctions can be usefully applied to other toggur (mound) sites within the Upper IND, including Tiebala (Curdy 1982), Dia (Haskell et al. 1988), Doupwil and Galia (Bedaux et al. 1978, discussed in S. McIntosh and R. McIntosh 1980, 1:451), where one or more of the three assemblages are also present. These observations lead me to propose a cultural-stratigraphic terminology for the Iron Age to A.D. 1400 of the Upper IND comprising three phases documented from excavation (Figure 10.2). Following the recommendations of the 1965 Burg-Wartenstein symposium on "Systematic Investigations of the African Later Tertiary and Quaternary" (Bishop and Clark 1967:893-899), I identify these as phases (having the meaning of 360

Conclusion

industrial facies, i.e., a morphologically distinctive, geographically circumscribed subset of the West African Iron Age), largely occurring within the Upper IND, and identifiable by their single most distinctive characteristic.

Upper IND Fineware Phase (=Phase I/II at Jenne-Jeno and Hambarketolo). This phase is the earliest occupation phase known in the Upper IND and is characterized by twine-rouletted simple open and simple closed rims, a variable percentage of which are executed in a distinctive, fine fabric ("chinaware") that gives off a high-pitched chinking sound when knocked against another sherd. Fineware disappears by the end of this phase, dated c. 200 B.C. to A.D. 350.

Rockered motifs and cord-wrapped stick are present in small numbers initially but soon disappear. The simple closed forms evolve into simple carinated forms that are distinctive of the following phase.
Upper IND Painted Ware Phase (=Phase III at Jennd-jeno and Hambarketolo). The application of white and/or black paint in linear bands or geometric designs is characteristic of this phase, and the simple carinated bowl with painted channeling above the carination and plaited twine (Twine 4) below is a diagnostic type for most of the phase. For the terminal aspect of the phase, elaborate geometric designs executed over the entire pot surface in white on red-burnished slip are diagnostic, although relatively rare, as are carinated pots with broad, painted channels both above and below the carination.

Upper IND Fine Channeled and Impressed Ware Phase (=Phase IV at Jenn6-jeno, Kaniana, and Hambarketolo). This phase is identifiable by the presence of very fine, closely spaced channeling, and an abundance of geometric impressed decoration, including comb, punctate, and stamped impressions. Channeling and impression are characteristically placed above the carination on carinated rims and their variants, T-rims and ledged Trims, which appear in this phase. Paint is rare.

In addition to these phases established from excavated pottery, a subsequent phase was identified during survey from surface assemblages associated with tobacco pipes. Characteristic decoration includes coarser, larger versions of the channeling, stamping, and comb impression popular during the Fine Channeled and Impressed Ware Phase. Channeling is often relatively large and executed by multiple, non parallel single incisions, rather than by use of a comb. Starburst stamping arrayed in large triangles and lozenges is diagnostic, as are oblique arrays of sawtooth comb impression. Also characteristic is the careless (with drips and splashes) application of red slip in broad zones over a yellowish paste. All of these are present and well illustrated in Gallay et al.'s (1990) report on the excavations at Hamdallahi.

Distribution and Affinities of Upper IND Fineware Phase Pottery (cal 250 B.C.-A.D. 400)

Pottery attributable to the Fineware Phase is found on the surface of sites in the eastern Upper IND only rarely. The best example is Jenn6-jeno, where it is eroding from a low-lying part of the southern sector of the mound. Excavation demonstrates that Fineware Phase pottery is present more widely.

Conclusion

within Jennd-jeno and Hambarketolo, but its rarity on the surface reflects its deep burial by subsequent deposits. I have identified several sherds from Soy6, between Jennd and Mopti in the canton de Sdbara as late Fineware Phase pottery (IFAN, Dakar, accession numbers SO 47.31). In the western Upper IND, by contrast, Fineware Phase pottery is present on three-quarters of the sites surveyed around Dia (Haskell et al. 1988), indicating an early occupation of considerable density. Excavations at Dia demonstrated, however, that Fineware Phase sherds were frequently incorporated in wall material from later occupations. Thus, their presence on the surface cannot be taken as a reliable guide to the extent of Fineware Phase occupation, although the sheer quantity of pottery involved suggests that it was an occupation of significant intensity. Comparisons of the relative extent and density of Fineware Phase settlement in the western and
eastern Upper IND will not be possible without much more excavation in both areas.

The site of KNT 2 in the Lower IND yielded pottery clearly related to the Upper IND Fineware Phase. Simple open bowls, many of which closely correspond in form and decoration to early types recognized at Jenn6-jeno and Dia, are common in the lowest 1.5 m of deposits at KNT 2 (Raimbault 1991:324-328). Some of these have a fine chinaware paste (personal observations, March 1993, on the KNT 2 collections housed in Bamako). The use of black and white linear paint designs is similar to (although more frequent than) that found on late Phase I/II pottery at Jenn6-jeno. Based on ceramic similarities, I would expect the lowest deposits (8-9.5 m) at KNT 2 to date to the third or fourth century A.D. Radiocarbon dates for these deposits indicate that the earliest occupation dates precisely to this period of time. Elements that differentiate the early KNT 2 assemblage from the Upper IND Fineware tradition include continued use of cord-wrapped stick decoration, elevated frequencies of everted rims, heavy use of organic temper accompanying grog, and a decorative grammar that frequently employs one or more zones of shallow channeling throughout the wide area above the maximum diameter of the vessel. In the upper IND, by contrast, the channeling is most frequently found in a narrow area less than 5 cm below the lip. The origins and affinities of Fineware Phase pottery are not yet clear, owing to the relative paucity of work on terminal Late Stone Age (LSA) sites in surrounding areas. However, it is possible to say that its affinities are, generally speaking, Saharan, in view of the dominance of simple rims and round bottoms. I expect that closely related, antecedent assemblages would have a similar range of shapes, a predominance of twine-rouletted decoration, although with larger relative frequencies of rockering and cordwrapped stick motifs than we find in the Fineware Phase. Slip on the rims and on the interior of bowls should be relatively common, and paste will be fine and tempered with finely crushed pottery. While it is likely that the most closely related antecedent assemblage comes from an area yet to be investigated, the LSA sites of both Dhar Tichitt and Kobadi have produced assemblages with significant similarities to Fineware Phase pottery. The Tichitt sites of Munson's Goungou, Nkhal, and Chebka phases (late second-

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early first millennium B.C.) have similar twine-decorated simple open and simple closed bowls and jars (types 2-4; Munson 1972:194-197; see also Holl 1986:60-6) dominating the assemblage, although the paste is chaff-tempered and very different in appearance from Fineware Phase paste. Many of the sherds from Kobadi, an LSA midden in the Mima that has produced radiocarbon dates of the second and first millennium B.C. (Raimbault and Dutour 1989), are similar in paste, form, and decoration to the pottery of the Fineware Phase. Kobadi has produced many thin-walled sherds, made in a fine, sandy paste with finely crushed grog. There are many simple open and simple closed forms among the rims, and twine rouletting over the whole pot surface is common. Rockering, cord-wrapped stick and slipping are also present, although the severely eroded surface of many of the sherds makes analysis difficult. These observations are
preliminary, based on my own study of the Kobadi sherds collected by Mauny (1967) and housed at IFAN, Dakar, and sherds collected by K. MacDonald and T. Togola in 1989. These observations await must confirmation from the description and analysis of the material excavated by M. Raimbault. It is interesting to note in passing that LSA pottery from the Tilemsi Valley, especially the sites of "facies K" (type sites Karkarinchinkat Nord et Sud - Gaussen and Gaussen 1988) displays a range of forms similar to the Fineware Phase, but the decorative grammar is quite different from that at all the sites discussed thus far, with a significant number of pots with impressed decoration concentrated on the rim and an empty zone below (Gaussen and Gaussen 1988:127-128; Figure 99, 102, 104-107). This is so contrary to the enduring decorative grammar of the IND that it weakens any case for the Tilemsi final LSA as a precursor of fineware pottery. However, it should be recalled that the more recent deposits at Kobadi have yielded a pot with clear affinities to the Saharan Neolithic in the southern Air of Niger as described by Grébénart (1985:28-53; Raimbault and Dutour 1990). Thus, the currently strong case for northwestern origins for Fineware Phase pottery may require substantial modification. The Tichitt-Kobadi connection has the advantage of mirroring oral tradition for the movement of people into the Upper IND. Monteil (1971:31) recorded a tradition in Jenné that the earliest Nono (Soninké) in the IND came from Bassikounou via the Mdma, first founding Dia, then Jennd. Bassikounou, in southeast Mauritania, is located along one of the many drainage basins leading from the upland plateaus of Dhar Tichitt and Dhar Oualata.

As a final observation on the affinities of Fineware Phase pottery, I note the striking similarity in form and decorative grammar of the earliest Iron Age assemblages identified in the Middle Senegal Valley and the Middle Niger from the upper IND to the Niger Bend. All of these assemblages have, as their dominant component, simple open and simple closed rim forms decorated with twine rouletting extending over the whole surface, either right up to the lip or stopping no more than 3 cm from the lip. Twisted and rolled twine (Twine 6) is the most common twine motif, although it is frequently combined with a second pattern applied in a zone near the lip. While other components of the assemblage vary from region to region, these

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aforementioned elements are constant in the earliest Iron Age assemblages from the Middle Senegal valley (S. McIntosh et al. 1992), the Mama (Togola 1993; Togola also reports observing "chinaware" on the surface of Boundou Boubou in the M~ma, personal communication, June 1992), the IND (Haskell et al. 1988; McIntosh, this volume, Chapter 3), the Bandiagara Falaise (Bedaux and Lange 1980: Table 5), Rim in Burkina Faso (Wai-Ogusu 1973, Andah 1978), and the Niger Bend near Timbuktu (S. McIntosh and R. McIntosh 1986a). The extent to which these assemblages resemble one another is underscored by a comparison with both the Cuivre II and Fer I pottery from the southwestern Air (Gr-b-nart 1985), which are quite different in dominant forms and decorative motifs. While the preceding terminal LSA is practically unknown in these and neighboring areas
west of the Niger Bend, making culture historical pronouncements about the possible relationships among these assemblages premature, the commonalities over such a wide area of the earliest Iron Age manifestations are intriguing. They suggest to me the possibility of large-scale population movements into the Sahel from a set of related source areas in the southern Sahara in the first millennium B.C. At present, both archaeological data and oral traditions from the Middle Senegal and the Middle Niger suggest that the Hodh of southern Mauritania and its bordering plateaus of the Tagant, Dhar Tichitt, Dhar Oualata, and Dhar N~ma are a likely source for such population movements in the early Iron Age. However, the presence in the M~ma of ceramics with affinities to the Saharan Neolithic of AYr indicates that populations from several different areas to the north were attracted to the Middle Niger in the first millennium B.C.

Distribution and Affinities of Painted Ware Phase Pottery (cal A.D. 400-900)

Our knowledge of the Painted Ware Phase has been greatly increased by the 1981 excavations and by survey and excavation in 1986 at and around Dia. The Dia region is rich in Painted Ware Phase sites, with pottery from this phase present on the surface of 86% of the twenty-one surveyed sites. Fineware phase and Painted Ware Phase pottery co-occur on many sites, and we know from excavation of the city wall at Shoma that Painted Ware Phase mud architecture often incorporated Fineware Phase sherds, probably as a binder and consolidant. It is also possible, however, given the apparent localization of this practice around Dia, a town revered throughout the western Sudan as the starting point of a Sonink6 diaspora stretching from the Middle Senegal to the Niger Bend (S. McIntosh 1981), that the practice was commemorative or ritual, using sherds from eponymous fineware sites identified in painted ware times as original settlements by ancestral groups. Beyond the use of characteristic painted pottery, common elements of the culture of this phase, as known from excavations at Jenns-jeno, Hambarketolo and Dia are use of fired brick, banco architecture, and potsherd pavements associated with burials in funerary urns. At Jenns-jeno, several examples of round house foundations in banco have been excavated and the stratification of cylindrical mud brick over earlier tauf architecture is

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the Phase III/IV transition (c. A.D. 850-900). Fired rectangular bricks of varying dimensions, decorated with slip or twine impression, first appear in the Painted Ware Phase at Dia and Jennd-jeno, but their use is unknown. They may have been used as weight of some kind or as wear-resistant doorsills, rather than constituting a significant architectural element. Extremely common on the painted ware sites around Dia are potsherd pavements, made by stamping large pottery fragments underfoot to break them into small, contiguous fragments embedded in the ground surface. These are associated with funerary urns, which can often be seen eroding out of nearby gullies, and circular features between 1 m and 2 m diameter made of cylindrical mud bricks, filled with brick and clay rubble to the interior, or, occasionally, enclosing a square feature of cylindrical mud brick. These clay features are very hard and erosion resistant and can be found by the dozens on the surface of former occupation sites in the immediate environs of Dia. Potsherd
pavements are often adjacent to and associated on the surface with classic Phase III (Painted Ware) funerary wares: carinated, channeled, and painted pots, potlids, and the large canaris or water pots that also served as funerary urns. The chronological and functional relationship of the clay features to the urns and pavements is unknown, since none was excavated. The presence of slag, grindstones, and abundant pottery visible in sections exposed by erosion demonstrates the original function of the site as residential. Sometime in Phase III, or in some cases at the Phase III/IV transition, these sites were put to secondary use as cemeteries. The Phase III/IV transition clearly marks a turning point in the settlement history of Dia, since the number of sites with Phase IV surface material drops to eight (out of twenty-one surveyed) from eighteen with Phase III material.

A potsherd pavement similar to the Dia pavements was found in upper Phase III deposits at Jennd-jeno (Feature 41 in WFL). It, too, was located in a cemetery precinct, although no funerary urns or burials were found directly associated with it. The pavement disappeared into the wall of the excavation unit, however, so it could not be exposed and investigated in its entirety. It should be noted that no pavements were found in the two main Phase III cemeteries excavated at Jennd-jeno (Units JF1 and CTR), nor were any circular clay features. Future excavators should be alert to the possibility of pavements, since they are easy to miss in excavation. The strongest case for a common culture at Jennd-jeno and Dia in the Painted Ware Phase comes from a shared burial ritual in large funerary urns, covered with inverted carinated pots and accompanied by domestic pottery including large plates, potlids, and carinated cooking pots, construction of potsherd pavements, and extremely similar pottery assemblages. At both sites, channeled and painted carinated pots are significant elements of the assemblage, as are potlids, plates, and bottles, and plaited twine (Twine 4) is far and away the most common twine motif. It is clear, however, that the Jennd-jeno painted ware assemblage is much more varied than Dia's, with a broader range of rim forms and the appearance of geometric white-on-red "luxury" wares. It is not possible to say whether this reflects a population at Dia that was less

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heterogeneous, wealthy, or cosmopolitan than the Jenn6-jeno population, or whether it is merely an artifact of the much more limited Dia sample. The distribution of the Upper IND Painted Ware Phase beyond Jenn& jeno and Dia is difficult to plot at present, since so little excavation or description of surface material has been undertaken outside of these two sites. It is present on the surface of thirteen of thirty-four sites surveyed (out of sixty-eight sites total) within a 4 km radius of Jennd, and is also present in Sdbara canton at Temouna (SO 47.28) and Toggu6 Danewal (MAL 46.3), and further north at P&e Dinde (MAL 45.72) according to my observations on the Mali collections at IFAN, Dakar. (SO and MAL number are catalogue numbers of the collections examined.) In nearly every case, it co-occurs with material from the subsequent phase, indicating that occupation often continued into the early second millennium in the eastern Upper IND. Just the opposite is true in the western IND,
where half of the Painted Ware Phase sites around Dia have no later material present on the surface. To the southwest, the site of Ti-bala now sits some 20 km from the flood zone, although in the sixth and seventh centuries A.D., when it was occupied, it likely was within the alluvium. Painted ware phase pottery, including carinated, channeled, and painted pots, has been described from the site by P. Curdy (1982) from the material originally collected in 1964 by A. Gallay. The occupation site, F, is bordered by a cemetery with funerary urns. Curdy (1982:78) concludes that the ceramic forms present at the site are similar to those at Jenné-jeno, but certain decorative motifs, particularly the popular fish-spine roulette, reflect local fashions. Ti-bala can perhaps best be characterized for the time being as a peripheral site of the Painted Ware Phase, sharing dominant pottery forms and burial ritual, but with significant stylistic differences in the ceramic assemblage.

Moving downriver north of Lac Debo, we encounter in some of the mound sites that line the west side of the Niger and its many distributary lakes a pottery assemblage with clear affinities to the Upper IND painted ware assemblage, but significantly different from it (Raimbault 1991: 369). I propose to call this the Lower IND Painted Ware Phase, best documented at present by Raimbault at the site of KNT 2 near Sumpi, where it is present in at least 7 m of a 9 m sequence and dates to the period cal A.D. 400-680. Salient characteristics of the assemblage are organic temper, a predominance (two-thirds) of everted rims, a paucity of carinated rims and potlids, and the common use of channeling and paint for decoration. Twine rouletting is common on the vessel bodies, with plaited twine (Twine 4) the most frequently used motif. This same assemblage is documented from excavation at the nearby sites of Toubel (GMB 1), dating to cal A.D. 340-605, and KWZ 1, representing a slightly later manifestation dated cal A.D. 655-1015, and it is common on many of the Lower IND Lakes Region sites. This has prompted Raimbault (1991:370) to propose the existence of a "complexe culturel protohistorique de la zone lacustre". The phase terminology proposed here both formalizes that suggestion and indicates the strong affinities of the ceramic assemblage to that of the contemporaneous Upper IND Painted Ware Phase. Typical of this phase in the Lakes Region are intense mound occupations that result in extremely rapid accumulation of deposits. Irregularly shaped mud bricks are present early in the phase at KNT 2 and Toubel, and banco is attested later (Raimbault and Sanogo 1991: 317, 320, 396). Pottery, slag, and iron are the principal and practically the only artifact categories represented thus far. Beyond the common use of channeling and polychrome paint, the presence of the same, elaborately painted geometric white-on-red ware in both the Upper and Lower IND (e.g., at KNT 2 dated to the eighth century A.D.; Raimbault and Sanogo 1991:321, 341) suggests close contact among at least some groups within these two regions during the late first and early second millennium A.D. The tumulus of Kouga, dated cal A.D. 900-1250, and a neighboring occupation site excavated by Mauny (1961:108111; 1964) in 1954 have yielded notable
concentrations of geometric white-on-red pottery. The fact that geometric white-on-red is virtually absent (one recorded vessel, Desplagnes 1951; Lebeuf and Paques 1970) from the funerary tumulus at El-Oualadjí, some 50 km away and dated to cal A.D. 1010-1180, indicates that this type of pottery had largely disappeared from the Lower IND by A.D. 1000-1100. At Jennd-jeno also, geometric white-on-red is common in the Phase III/IV transition (A.D. 850-900) and continues into the early part of the final occupation phase at the site before disappearing by A.D. 1000-1100. It is relevant to note that geometric white-on-red is known from Kumbi Saleh (Berthier 1983; personal observations of collections housed at IFAN, Dakar). Berthier’s (1983) description of the Kumbi Saleh painted wares is clear on the point that paint is usually monochrome, and co-occurrence of paint and channeling is rare. It would thus appear that the Kumbi Saleh and IND painted wares generally belong to two different ceramic traditions.

The dominant burial ritual for the Painted Ware Phase in the Lakes Region is not yet known, although Raimbault and Sanogo (1991:315; 396) did uncover simple inhumations at KNT 2, Toubel (GMB 1), and KWZ 1. At the latter site, burial was associated with elongated, painted bottles, which presage the popularity of bottles in the funerary tumuli of the terminal first and early second millennia A.D. in the Lakes Region.

West of the IND is the "dead Delta" of Mâma, which was hydrologically active, similar to the present Inland Niger "live" Delta, as recently as the first millennium B.C. With a description of the pottery recovered from excavations at the mound of Akumbu now completed (Togola 1993), it is possible to outline salient features of the pottery in the western Mdma during the seventh century, when the locale excavated as Akumbu 1 was first occupied (there is, however, considerable evidence that occupation in the Mâma continued without interruption from the Late Stone Age through the Iron Age). The Mdma assemblage at this time has formal elements of the Upper IND Painted Ware Phase and a greater number of elements of the Lower IND Painted Ware Phases, but it does not closely resemble either. It is a related assemblage, but the evidence it offers of close contacts with the IND is limited. Prominent pot forms include everted, simple open, simple closed, some carinated rims, and potlids. Temper is organic. Paint is present, but very rare, and is usually applied over channeling. Plaited twine, so common in the IND at this time, is infrequent, with braided and twisted twines the

Conclusion most commonly encountered. It is noteworthy that Togola (1992) encountered several “jarfields”-cemetery sites with numbers of funerary urns eroding from the surface-especially around Akumbu. Elsewhere in the Mâma, the highly selective group of pots (now housed in the MusLe des Arts Africains et Ocâniens) recovered by Christofoff from Kolima in the 1930s shows a high frequency of paint decoration over channeling on everted and simple rims like those of the Lakes Region (personal observations of Kolima collections, Paris, January 1992; Schmit 1984-1985). The actual relative frequency at Kolima of painted vessels related to IND ceramic traditions cannot be determined without additional excavation.
Distribution and Affinities of Fine Channeled and Impressed Ware Phase (cal A.D. 900-1400).

I pointed out in Chapter 3 that one of the most significant differences between Phase III and Phase IV at Jenné-jeno was the replacement of linear and geometric painted decoration in the former by plastic-impressed decoration arrayed geometrically in the latter. Often, these stamped, punctate or comb-impressed motifs were applied in conjunction with channeling. The use of a new type of very fine-toothed comb allowed the creation of extremely fine channeling on some of the pottery, a design device that is highly diagnostic for the phase. Pottery of this type is abundant on the sites around Jenne, including Toggu-r6 Galia, dated to the eleventh and twelfth centuries A.D. (Bedaux et al. 1978:123). It is present near Mopti at Toggu4r6 Doupwil, dated to the thirteenth to fifteenth centuries (Bedaux et al. 1978), Fatoma (Szumowski 1954), Danewal (MAL 46.3, IFAN, Dakar) and Kami (MAL 50.86, IFAN, Dakar). It occurs 80 km northwest of Mopti at Pere Dinde (MAL 45.72, IFAN, Dakar).

From the excavations at Jenné-jeno, Hambarketolo, Kaniana, Galia, and Doupwil, we are beginning to have a detailed idea of the common elements of material culture that accompany this pottery in the Jenné-Mopti region of the eastern Upper IND. The most salient aspects are cylindrical mud brick architecture; terracotta statuettes and raised anthropomorphic and zoomorphic relief on "ritual" (i.e., non domestic) pottery; perforated rectangular terracotta plaques; slipped, fired bricks; ceramic cylinders, drainpipes and bedrests; and a continuing tradition of burial in large funerary urns, frequently found isolated in domestic deposits (below house floors, in pits adjacent to houses), in addition to cemetery precincts. As best we can tell, djenni-feriy (cylindrical mud bricks) first appear at the Jennd-jeno Phase III/IV transition when the city wall was erected. Djenni-feriy are reported from Fatoma (Szumowski 1954), Galia and Doupwil (Bedaux et al. 1978:109, 121), and Dia (Haskell et al. 1988) and are visible on many of the sites in the Jenné-jeno hinterland.

Terracotta statuary is undoubtedly the single most widely known aspect of this phase, due to its popularity on European and North American art markets. The presence within the Upper IND of a coherent tradition of terracotta statuary has long been assumed, but since nearly all the known pieces result from clandestine excavation, their find spots are claimed, rather than documented. A provenience claim of "the Jenné region" benefits the seller and might reasonably be expected to enjoy a rather broad usage. The fact is, the actual areal extent of the production of the "Jennd" statuette style is unknown. The few pieces with documented provenience demonstrate that statuettes in similar, sometimes identical styles were produced in the area from Jennd to Mopti (summarized in S. McIntosh and R. McIntosh 1980 11:452; R. McIntosh and S. McIntosh 1986). Kneeling statuettes, complete or fragmentary, have been found in wall niches (R. McIntosh and S. McIntosh 1979; this volume, Feature 20, LX-N), beneath floors (S. McIntosh and R. McIntosh 1980, I: 108), and in a "rainmaker's shrine" (Feature 21, LX-N). In the latter two instances, they were
associated with ritual pottery decorated with serpent and other relief decoration (Appendix B, Table B8). Nearly identical ritual wares have been found around Jennd and Mopti: hollow spheres with raised snake motifs (S. McIntosh and R. McIntosh 1980, 11:452; Masson-Detourbet 1953:101; Szumowski 1955; de Grunne 1980:101); small pedestalled bowls with snakes climbing the sides (this volume, LX-N Feature 21; R. McIntosh and S. McIntosh 1986:54; Bedaux et al. 1978:215); terracotta "pestles" with a single perforation below the neck (S. McIntosh and R. McIntosh 1980, 1:251; Bedaux et al. 1978:215; Masson-Detourbet 1953), and potlids with headless-torso relief motifs (S. McIntosh and R. McIntosh 1980 1:249; this volume, Appendix C; Bedaux et al. 1978:214). DeGrunne (1983:27) points out that a statuette excavated near Mopti by Sarr provides insights into the ritual use of the spherical serpent pots. The statuette pours some kind of liquid from a spherical pot into a bowl held in the other hand. Two snakes are drinking from that bowl.

Funerary urns in very similar style, with braided twine impressions, covered with an inverted pot, are also common at sites between Jennd and Mopti in the Fine Channeled and Impressed Ware Phase. Slipped, fired bricks are common in Phase IV deposits at Jennd-jeno and Kaniana (this volume, Chapter 4) and have been noted at Toggurd Galia (Bedaux et al. 1978:143), Pere Dinde (MAL 45.72), and Twokhelo (between Diafarab and Kouakourou, MAL 55.26 IFAN, Dakar). Short pottery cylinders (probably used as pot rests) and longer cylindrical drainpipes are present at Jenn6-jeno, Galia, and Doupwil (Bedaux et al. 1978:204, 211, 213). Bell-shaped, bicornuate bedrests decorated with braided twine impression are documented at Jennejeno and Kami (Szumowski 1955). Slipped rectangular plaques 4-5 cm wide with geometric incised patterns on one side and perforations at all four corners have been found at Jennd-jeno, Galia (MAL 81.10 IFAN, Dakar), and Tiebala (surface find, Curdy 1982:156). A complete plaque is illustrated in de Grunne (1983:73). The use of these plaques is unknown.

It appears that the lines of cultural influence flow strongly along the Bani River (Jennd-Mopti) axis in the Fine Channeled and Impressed Ware Phase. Ties with Dia are markedly less pronounced. The substantial overlap in material culture that Jennd-jeno and Dia manifested in earlier phases decreases significantly. Deposits of this period at Shoma reveal a pottery assemblage with the characteristic forms of the Fine Channeled and

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Impressed Ware Phase (carinated bowls with beaded rims, T-rims, ledged rims, shallow plates) but a very limited subset of the impressed motifs common at Jenn6-jeno. There are almost no finely channeled, combimpressed, or stamped sherds at Dia. Also, the braided twines that account for 50-80% of the twine-decorated pottery at Jennd-jeno in Phase IV never predominate at Dia. Plaited Twines 4 and 5 remain the most popular there. While djenni-ferey and funerary urns are present at this time around Dia, no statuettes or raised relief pottery were recovered from survey or excavation in 1986, nor were any of the other classes of material culture that characterize this phase in the eastern IND. Again, it is possible that we are dealing with an artifact of sampling. It remains to be seen
whether the impression of decreasing interaction through time between Jenn&jeno and Dia, insofar as it is reflected in the ceramic assemblages, is sustained when a larger sample from more extensive excavations is available.

In the Lower IND Lakes Region, the domestic pottery assemblage for the period A.D. 900-1400 is still poorly known. The bulk of the published data comes from the funerary tumuli of Killi and El Oualadji, dug by Desplagnes early in this century. El Oualadji has been dated to cal A.D. 1010-1180 (Rainbault and Sanogo 1991: 520), and we see in the ceramics that the shift away from paint to impressed geometric decoration on slipped and highly burnished surfaces has taken place. The geometric comb-impressed vessels at both monuments are especially striking (Lebeuf and Paques 1970). A third tumulus, Kouga, dated to cal A.D. 900-1200, gives us a glimpse of the pottery assemblage at what I argued above was the earliest part of the phase, with geometric white-on-red painted ware still present. At Kouga, we note among the ceramic finds a number of small, carinated "minipots" and an emphasis on slipped and burnished bottles, carafes, and beaker-sized vessels (SO 54.48 IFAN, Dakar). These same elements are also present at Killi and El Oualadji (Desplagnes 1903, 1951), as though the presentation and serving of some kind of beverage became significant in the Lakes Region at that time. A highly schematic style of terracotta horseman figures has recently been reported from the Guimbala area of the Lakes Region, with the appearance of these figures on the international art market (personal communication, P. Ravenhill, November 1988). To my knowledge, no example has ever been recorded from a legitimate excavation. But it is certainly plausible that terracotta statuary in a style derived from the Upper IND was produced in the Lakes Region. Recent excavations at Toubel (GMB 1) produced an elongate, bicornuate bedrest in upper levels dated to cal A.D. 1215-1430 (Rainbault and Sanogo 1991:400). All the available evidence suggests that the Lower IND was a cultural province separate from but closely related to the Upper IND. Clearly, the Niger River constituted a major axis for the transmission of styles, trends, and influence.

In contrast with the significant shifts that occur in the pottery assemblages of the Upper and Lower IND between A.D. 400 and 1400, the pottery in the western M-ma appears to remain curiously static. At Akumbu 1, the pottery dating to the seventh and eighth centuries was not demonstrably different in form, decoration, or decorative grammar from the pottery dated to the final occupation period ending between cal A.D. 1200-1400 (Togola 1993). Undecorated carinated "minipots" are present, as are bottles and a carinated beaker very similar in form and decoration to ones reported from near Goundam (Avinen 1942, fig.1) and Kolima (Schmit 1984-1985, IFAN So 49.29.2). Togola (1993:160) also reports bicornuate bedrests. In 1980, I observed (S. McIntosh and R. McIntosh 1980, 11:452-453) that the material recovered by Szumowski at sites in the southern M-ma, such as Pdhd, differed from the Upper IND in the absence of carinated forms and in the large numbers of footed cups and pedestal bowls, which clearly point to contacts with the Lakes Region. It is noteworthy that this
phase sees the arrival of a new twine impressed motif, "sabot," which is well known from the Middle Senegal valley (Thilmans and Ravisid 1980:102), but has rarely been documented elsewhere (sabot-decorated vessels are reported by Togola [1993] at Akumbu and by Schmit [1984-1985] at Kolima.)

On the eastern flank of the IND, the pottery of the Tellem period, dated largely to the eleventh through the fourteenth centuries, has little in common with the pottery of the Upper IND Fine Channeled and Impressed Ware Phase. A convincing source area for the distinctive Tellem assemblage has yet to be identified. The Tellem assemblage comprises a large percentage of outturned or everted rims, many from footed bowls with a zone of large channels at the rim, and a significant number of tripod "Tellem bowls" (Bedaux and Lange 1983). The widespread distribution of this type of tripod vessel from Niani and Dogo to Fatoma, El Oualadji, and Kumbi Saleh has been documented by Bedaux (1980). The presence of these distinctive tripod bases at Jennd-jeno continuously from early Phase III (when they are decorated with paint) through late Phase IV indicates the longevity of this pot type in the Upper IND. The existence of contacts between Bandiagara and the Upper IND is demonstrated not only by the presence of these tripod bowls but also by the common use of large, septagonal faceted beads. Two executed in fired clay were excavated from Phase IV deposits at Jennd-jeno (Chapter 4, Table 4.4). A carnelian bead of the same form found in Cave C at Sanga, Bandiagara dates to the eleventh-twelfth century A.D. (R. Bedaux, personal communication, 11 June 1992). Beads of this type are frequently depicted as amulets worn around the neck on seated statuettes (de Grunne 1980:39, 61, 73) or above the elbow on horseman statuettes (de Grunne 1980:84). De Grunne (1987:127) claims to have established that a group of wooden and terracotta statues found in the IND and Bandiagara and dated between the eleventh and the fourteenth centuries are so stylistically similar that they were likely produced by related workshops. Provenience uncertainties will always bedevil hypotheses based on pieces obtained by dubious means, but it must be admitted that the available sample of material culture from the Bandiagara escarpment is still very small. While nothing from the archaeologically documented Tellem period suggests stylistic affinities between the escarpment and the Upper IND, perhaps future work will reveal other contemporaneous assemblages. For the time being, the Tellem period remains intriguing for its conservative material culture, which scarcely changed over the course of five centuries, and its apparent resistance to stylistic borrowing from the neighboring region of the Upper IND.

Conclusion
Overall, the fired clay artifacts of the Upper IND provide abundant insights into the distribution of closely interacting settlements as well as the intensity of contact between neighboring regions. While understanding that all conclusions must be provisional, pending much more extensive work throughout the Middle Niger, I offer the following broad interpretations of the ceramic evidence as it is currently known:
1. The Iron Age ceramic sequence to A.D. 1400 in the Upper IND can be reliably divided into three time-successive phases that are broadly homogeneous throughout the Upper IND.

2. The initial movement of population into the eastern Upper IND and Jenn6-jeno very plausibly originates from the western Delta at Dia, as indicated by oral tradition.

3. The Dia-Jenn6-jeno axis continues to be important through the first two phases (c. 250 B.C.-A.D. 900), but late in the Painted Ware Phase, widespread abandonment of sites around Dia may be correlated with new episodes of population movement into the eastern Upper IND between Jennd and Mopti.

4. Early in the following Fine Channeled and Impressed Ware Phase, there is a breakdown in influence transmission or intensity of contact along the Dia-Jenn6-jeno axis. Dia becomes a peripheral participant in this phase. The M(ma become increasingly isolated from the Upper IND culture sphere at this time, while retaining closer affinities to the Lower IND.

5. The Lower IND constitutes a separate culture area with extremely close connections to the Upper IND from A.D. 400 to 1400.

HUMAN RESPONSE TO CHANGING ENVIRONMENTAL CONDITIONS

Despite the suspicions of an earlier generation of scholars that the swampy regions of the Middle Niger would reveal Late Stone Age secrets, it is becoming increasingly certain, after extensive surveys in both the Upper and Lower IND, that no LSA sites are visibly present within the current floodplain. Work in adjacent regions, such as the M~ma, has documented the presence of sometimes extensive LSA sites, such as Kobadi, on the margins of an inundation zone that extended up to the present Mauritania border as late as the mid-first millennium B.C. (Raimbault and Dutour 1989). Raimbault and Dutour (1989) see the Kobadi LSA as essentially a later, southward extension of the LSA at sites such as Hassi-el-Abiod (7000 B.P.) in the Malian Sahara. Resemblances include the prominence of the bone industry, especially harpoons, the incidence of stone rings and similar types of grinding stones, the importance of fishing and hunting in the economy, and the prominent secondary use of middens as cemeteries. Additionally, the physical types documented at Hassi-el-Abiod and Kobadi share certain archaic features first identified at the North African site of Mechta-Afalou. These features include a robust facial architecture, as indicated by mandibular breadth and height and bi-zygomatic breadth, pronounced gonial eversion.

Conclusion

and a high incidence of shoveling on the upper incisors (Raimbault and Dutour 1990; Petit-Maire and Dutour 1987). These similarities in physical features, economy, and material culture suggest to Raimbault that Saharan fisher-hunters, such as those at Hassi-el-Abiod, were forced to move southward in search of other lacustrine biotopes as aridification became pronounced c. 4500-4000 B.P. Saharan lakes that dried up totally included Tichitt by 3000-2900 B.P. (Munson 1976). Kobadi provided a lacustrine biotope between 3300-2400 B.P. (1750-1550 to 790-390 cal B.C.). Vertebrates represented in the Kobadi middens include abundant hippopotamus, warthog, the swamp-loving sitatunga antelope, Bos taurus,
crocodile, tortoise and numerous Siluriform and Perciform fish (Raimbault et al. 1987).

Around 2000 B.P., there is evidence from across the Sahel for a major dry period. Rainfall is estimated at below -20% of the 1930-1960 average; lakes in the Lake Chad basin drop or disappear for all time and the Senegal discharge is so low that sea water invades the Lower Senegal valley and Ferlo (Brooks 1986; Leziene and Casanova 1989; Monteillet et al. 1981). It appears that this severe climatic pejoration extended into the humid zones further south, opening up the forest to rapid penetration by iron-using peoples (Maley 1992; Schwartz 1992). It is at about this time that the first permanent colonization of the Upper IND at Dia and Jennd-jeno occurs by iron-using populations, at least some of whom have archaic "mechtoid" features similar to the population at Kobadi (Chapter 9). It is unclear exactly where and when the precursor populations of the first Jenn6-jeno colonists began using iron, although sites that appear to span the Late Stone Age/Iron Age transition are reported from the M-ma and preliminary investigations of them are underway (Togola 1993). Nor do we know for certain why no traces of LSA exploitation of the IND have been detected. As we suggested earlier (S. McIntosh and R. McIntosh 1980, 11:434), it may be that traces of seasonal exploitation are buried under alluvium, or the present IND may have been flooded nearly year-round, a relict of the earlier, vast paleolake D~bo (Nicholson 1976:52, 70-71; Tricart 1965:25-27; the Paldod~bo hypothesis is discussed fully in R. McIntosh 1983). In the latter case, the floodplain may have been rendered uninhabitable by waterborne diseases. Whatever the case, it appears that permanent settlement was not possible until the waters reached approximately their present level c. 300 B.C. (see Figure 2.55). At that time, Jenn6-jeno's position on the edge of the red dune, yet near to the channels etched into that dune by the Souman-Bani, would have been doubly advantageous. It would have been above most floods during this dry episode, yet near sources of water that were probably available year-round. By the first century A.D., floodwaters may have dropped even lower (Figure 2.55), and the clay channel on which Jenn6-jeno is located may have resembled an open plain more than it does today's complex and well-watered fabric of channels. If so, Rosen's (1986:16) prediction that an unwalled tell developing on an open topography tends to expand outward rather than upward may help explain the rapid Phase I/II areal expansion of Jenn6-jeno. By A.D. 350, we estimate its size to have been at least 12 ha. The advantage of iron tools for working the heavy clays of the IND, for farming and digging wells and clay

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pits for architectural material should not be underestimated. They offered new opportunities to intensify subsistence production that likely resulted in population increases.

Humid conditions increased in the first millennium A.D.; from A.D. 300700, precipitation rose to +20% of the 1930-1960 average and rains were generally good until A.D. 1000 and perhaps as late as 1200. Lake Chad was moderately high in the second half of the first millennium A.D., but declined at A.D. 1000-1150, rose again, but declined severely c. 1300 (Maley 1973:177). This optimum
period from just after A.D. 300 until A.D. 1000 certainly increased the productive potential of the Upper IND, as indicated by the surging population of Jennk-jeno and its hinterland during Phase III. Both excavation and extensive surface study at Jenn6-jeno and Hambarketolo indicate that the sites reached their maximum expanse of 33 ha and 8.8 ha, respectively, by the end of Phase III (A.D. 900)(Figure 10.3). This involved purposeful mounding of earth to expand Jenn6-jeno at its periphery near the WFL excavation unit. Extrapolating from the 50% random sample survey of the sixty-four sites within a 4 km radius of Jennd, it appears that over three-quarters of them were occupied by the end of Phase III. Translating settlement data into population size is a difficult proposition. But if we take the population density of Jenn6 (9,900 people living on 44.8 ha = 221 persons/ha), and contrast it with the densities at both a traditional hinterland town lacking Jennd's vast non-residential spaces, such as Gomitogo (2,751 persons on 7.8 ha = 389 persons/ha) and a western Sonink6 town (Yaguin6) with only single-story dwellings (146 persons/ha; data from Brasseur 1968:196-199), we can attempt to get a range of estimates for Jenn6-jeno's population at the end of Phase III. Of course, whether population density at Jenn6-jeno fell within this range is open to debate. But the fact is that we have too little excavation data to attempt to devise any other kind of population index: any formula using floor area or compound size is out of the question. The three density factors here can only provide a set of possibilities, all reflecting the high residential densities characteristic of the Soninkd throughout their wide distribution, for Jennd-jeno's population (Table 10.1).

The population of Jenne-jeno alone may have been between 7,000 and 13,000. But our calculation really ought to take into account the site of Hambarketolo, which was occupied at the same time as Jennd-jeno and is connected to it by a narrow causeway. It is very likely that the two sites functioned together as a unit. However, Hambarketolo is only one of twentyfive satellite sites clustered around Jenn&jeno within a 1 km radius. Tradition in Jennd today maintains that all these sites together were called Jennd in the distant past, suggesting that all the settlements (and Jenn6-jeno) constituted a single entity. Thus, depending on how Jenn6-jeno is defined, population estimates could range from around 7,300 persons for JennS-jeno in isolation up to almost 27,000 for the "town complex" in late Phase III/ early Phase IV. The evidence of site expansion and site density in Phase III is accompanied by changes in the domestic pottery that may reflect the need to cook food and store water for larger numbers of people (Chapter 3).

Conclusion

Table 10.1. Possible range of population at Jenn6-jeno

<table>
<thead>
<tr>
<th>AREA</th>
<th>DENSITY FACTOR (in persons/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jenn -jeno (33 Ha.)</td>
<td>4,800  7,300  12,800</td>
</tr>
<tr>
<td>Jennd-jeno and Hambarketolo (33 + 8.8 = 41.8 ha)</td>
<td>6,100  9,200  16,260</td>
</tr>
<tr>
<td>Jennd-jeno cluster (includes</td>
<td></td>
</tr>
</tbody>
</table>
satellite sites within 1 km)  
(33 + 35.7 = 68.7 ha)  

10,000 15,200 26,700

Populations elsewhere along the Middle Niger also appear to peak during this first millennium optimum. The first systematic survey of the M~ma has shown a substantial number of large tells (up to 80 ha in area), all of which have a similar ceramic surface assemblage, dated at Akumbu to between the seventh and the thirteenth centuries cal A.D. (Togola 1993). Surface deposits with this same assemblage at Kolima date to cal A.D. 1270–1290. By A.D. 10001200, an earlier wild fauna associated with nearby permanent water has disappeared at Akumbu in the M~ma, indicating increasingly dry conditions (MacDonald 1992b). In the lower IND, intense occupations resulting in extremely rapid accumulation of mound deposits (9 in in 400 years at KNT 2) dating to the fourth to eighth centuries A.D. (KNT 2 and Toubel) and perhaps later (Raimbault and Sanogo 1991). On the Niger Bend, many large permanent settlements dating to the middle to late first millennium A.D., or so it would appear from the prevalence of paint on their surface pottery, flank the wadis traversing the dunefields north of the Niger. These wadis served as embayments filled by far higher and longer Niger floods, or they held ponds supported by a far higher water table (S. McIntosh and R. McIntosh 1986a). These wetter conditions presumably must be implicated also in the location of the Ghana Empire so far to the north in the late first millennium A.D. The stone ruins and terraced fields attributed to the Sonink6 Gangara in the Tagant, Adrar, Assaba, and Affol6 in central Mauritania (Daveau and Toupet 1963) may date to this first millennium optimum also.

Indeed, the only exception to the picture of maximum population densities along the Middle Niger from A.D. 400 to 1000 is Dia, where half of the sites occupied during Phase III were abandoned before the beginning of Phase IV (A.D. 900). The possibility has been considered that abandonment was related to strangulation of the marigots on which various site clusters were located (Haskell et al. 1988:114-118). However, the fact that new sites do not arise along other still flowing marigots at this time suggests that site

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abandonment at Dia was not related to environmental factors affecting the subsistence base. Rather, I suspect, it was related to the rapid and widespread appearance, between A.D. 850 and 950, of new commercial opportunities resulting from the installation of Berber and Ibadite merchants in southern Saharan trade entrep6ts such as Tegdaoust. It is likely, in my opinion, that the establishment of these centers disrupted centuries-old trade networks, some predominantly east-west oriented, into which Dia was tied. The famed diaspora of Sonink6 merchant clans from Dia could well date to this period, as traders quickly fanned out to position themselves strategically in relation to these new opportunities. The diaspora may have continued into the early second millennium, but by A.D. 1200 it was essentially over. Very few sites outside of the present-day town of Dia were occupied after that point. The mantle of commercial activity passed, at the time of the diaspora, from Dia to Jenn6-jeno within the Upper IND.
I expect that more than a few families emigrated from Dia to Jenn6-jeno to take advantage of that fact.

Population remains at its peak in and around Jenn6-jeno until mid-Phase IV (A.D. 1100 or 1200), at which point the site is actively declining, with settlement shrinking to the originally inhabited central core (Figure 10.3). Many sites in the hinterland are also declining and ultimately abandoned between A.D. 1200 and 1400. The restructuring of population evident in these trends included the abandonment of the ideal rice-producing soils near Jenn6-jeno that had been favored for settlement since initial colonization. Settlement preferences shift, for the first time, to the high sandy features (levees and dunes) favored by Bambara millet growers, who became a significant presence in the Upper IND between 1500 and 1800. Although it is in the early part of Phase IV that we should expect to see any perturbations or the absorption of refugee populations related to the political instability of Ghana to the north, nothing of the kind is apparent in the excavations we have accomplished thus far. The many radiocarbon dates of the eleventh through thirteenth centuries from Berthier's excavations at Kumbi Saleh (Berthier 1983; discussed in S. McIntosh and R.J. McIntosh 1986b) support Conrad and Fisher's contention that Ghana continued to be important into at least the twelfth century, as indicated by sources between al-Bakri and Ibn Khaldun (Fisher 1982; Conrad and Fisher 1982). Berthier's work indicates that occupation continued at Kumbi Saleh until extremely dry conditions settled in c. 1300.

Further west, signs of water problems show up at Tegdaoust after the eleventh or twelfth century in the form of a dramatically lowered water table (Devisse et al. 1983: 383). This evidence is consistent with al-Bakri's eleventh century account of Awdaghust as a flourishing oasis town and al-Idrisi's account a century later describing the town as a small market with little water (cited in McDougall 1985:8). Elsewhere along the Middle Niger, the M~ma appears virtually depopulated by c. A.D. 1300, prey to the same arid conditions that provoked the final abandonment of Kumbi Saleh. In the Lower IND Lakes Region, it is unclear the extent to which tell accumulation continued into the second millennium A.D.. The bulk of the tell evidence thus far comes from the first millennium A.D. Early second-millennium A.D. dates from the tells of Tissalaten, Bawa, Galou, and Toubel (Raimbault and Sanogo 1991) suggest that tells were occupied, although perhaps at significantly lower densities than before. The appearance of richly appointed funerary tumuli, such as El Oualadji, by the eleventh or twelfth century indicates that groups near the Niger Bend were strategically positioned to accumulate wealth, probably from the trans-Saharan trade passing through the area, as al-Bakri described it.

Conclusion
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SUBSISTENCE ECONOMY
The 1981 data on the subsistence economy through time at Jenn6-jeno are both more abundant and more thoroughly studied than the flora and fauna from the 1977 excavations. In 1977, the total evidence for Phase I subsistence, for example, came from the lowest deposits in a single 3-by-3 m excavation unit. As
a consequence, it was unclear whether any domesticated cereals had been grown during the initial occupation, prior to the first century A.D. The absence of domesticated rice was puzzling, since it was long thought to have been initially domesticated in the IND at a much earlier date (Portres 1976). Bulrush millet, too, had a documented history at Tichitt extending back to almost 1000 B.C., so its absence at Jenn-jeno also raised questions. We now understand the apparent absence of these plant species from the 1977 excavated deposits as a sampling artifact.

In the much larger 1981 samples, domesticated rice (O. glaberrima), bulrush millet (Pennisetum glaucum) and sorghum are all present in the earliest occupation levels. They occur as part of a diversified subsistence economy that also included large amounts of the wild millet, Brachiaria ramosa (possibly cultivated), domestic cattle (Bos taurus), domestic ovicaprines, wild bovids, and abundant aquatic resources, including fish, turtle, and crocodile (MacDonald, this volume; van Neer, this volume). Perhaps the most remarkable aspect of this economy is its stability through time at the site, despite major demographic changes and significant climatic variability. The above elements are consistently present throughout the 1500-year occupation of Jenn6-jeno. In view of the staggering population increase that took place in the immediate vicinity of Jennd in the first eight centuries of our era, the lack of any sign of subsistence intensification is astonishing. One might expect, for example, that morphologically altered forms of Brachiaria would arise from new selective pressures as a result of more intensive production techniques. This does not occur. One might also expect that overfishing would have reduced the size of the fish caught and consumed by Phase IV. This also does not occur. Nor do more "marginal" crops, such as millet and sorghum, increase in frequency at any point, indicating increased pressure on the staple crops, rice and Brachiaria ramosa, grown in the deep floodplain. There are several possible answers to this conundrum. One is that population density in Phase III/early Phase IV never came near the carrying capacity of the Jennd floodplain environment under the nearly optimal conditions of A.D. 300-1000. While this is quite possible, we would still expect that if intensification was not increasing the yield/unit cultivated,

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more units at greater distances would have to be placed under cultivation to feed the growing town population, setting up pressures to reduce distance and improve efficiency through intensification, as the standard formalist argument goes. However, because transport costs are low on the floodplain and the social benefits of "going to market" high for rural dwellers, it is more likely that the produce of distant farms was regularly transported by pirogue into Jenn6-jeno, which would have been an important market center for staple commodities. A growing importance of local trade in consumables probably accounts for the lack of evidence for intensification of subsistence production at Jenn-jeno. There is, of course, always another possibility, namely, that population has been dramatically overestimated for Jennd-jeno and its hinterland. If it were the case, for example, that tell inhabitants kept their herds overnight in pens adjacent to their
compounds, resulting in a more dispersed pattern of residences like that of the Tukolor of the Middle Senegal valley but quite unlike that of the present-day occupants of the IND, then even the conservative population projections earlier in this chapter would be much too large. If this were the case, however, we would expect to find significant concentrations of dung in at least some excavation units, as we did at the site of Siourd in the Middle Senegal valley in 1990. But we do not. Thus, until and unless future excavation forces revision, our assumption is that intrasite settlement patterns are similar to those in the region today, and local Phase III population totals probably stood at an alltime high. The resulting pressure on staple resources was likely relieved by effectively enlarging the size of the productive hinterland through trade.

Some changes in resources through time are detectable, but they never constitute any fundamental change in the broadly diverse fishing, farming, herding, and hunting economy that characterized the first settlers at Jenn& jeno. For example, Kob antelope are present in abundance in Phase I/II at LXN, CTR and HAMB, then precipitously decline. MacDonald attributes this to the unwillingness of the Kob to cede its territory to humans, making it an easy target for hunters. Hunting of other wild antelope, however, continues in subsequent periods. In Phase III, the earlier dwarf ovicaprids of Phase I/II are joined by nondwarf forms, indicating the introduction of new stock breeds. The cattle morphometrics tell the same tale, of a diverse herd composition in Phase III that reflects a variety of breeds. In the second half of Phase III, the domestic chicken is introduced. While the Phase III shifts in grazing stock may reflect a need to experiment with breeds that travel better, are more disease- and drought-resistant, or possess other desired characteristics, we do not at present understand enough about the various breeds present in Phase III to draw any conclusions. By Phase IV, however, stock types have stabilized. Ovicaprids are almost exclusively dwarf forms, and the cattle seem to be virtually all of the N'dama type. Thus, at some point between A.D. 1400 and A.D. 1900, a total shift from dwarf to nondwarf ovicaprids and from N'dama to Zebu cattle may have occurred in the region of Jennd. Today, specialized pastoralist economies based on Zebu are a prominent feature of the IND. Is it possible that these emerged in the IND only after 1400? Only future research committed to recovering large faunal assemblages from IND sites can answer the question.

The diversity of the Phase III fauna is intriguing, suggesting movement of stock from different sources into the Upper IND between A.D. 500 and 900. One possible factor implicated in this movement is the domestic horse, present at Akumbu in the M~ma by the seventh century A.D. (MacDonald 1992b) The horse was known to the inhabitants of Jenn6-jeno by later Phase III (as attested by a horse statuette from ALS, Level 9). I suggested earlier (in S. McIntosh and R. McIntosh 1988:124-125) that the impact of the introduction of the horse to the Sahel grasslands was probably far-reaching, expanding potential exploitative strategies and increasing both the range of subsistence resources and conflicts over them. It is possible that the diverse stock present at Jennd-jeno reflects the

Conclusion

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expanded range of trading and raiding activities facilitated by the use of mounted horses. I would expect that stock-raiding activities may have been quite extensive in the grasslands of the Sonink6 heartland northwest of the IND, which gave rise during this time period to the Empire of Ghana. Through both population movements into the Upper IND and trade with the Sonink6 heartland, a diverse range of stock could have entered the Upper IND. Horses in large numbers and mounted raiding would have been largely confined to the non-inundated areas east and west of the Inland Delta, where floods do not constrain pasture or use of horses. The perennially marginal political authority of the Jenn6 region may stem in part from the difficulties that its natural environment poses for hippiculture (Monteil 1903:63).

For other aspects of the subsistence economy, exploitation continues to focus on the deep floodplain that surrounds Jenn&jeno. Cereals are heavily dominated throughout the sequence by floodplain rice and Brachiaria, with the levee crops of millet and sorghum present but poorly represented. Wild fauna exploited are largely floodplain or marigot species, and fish is important at all times. The domestic stock are the most convincing evidence, however, that seasonal exploitation of upland areas was practiced, since herds cannot graze on the floodplain during the flood season. The apparent lack of any fundamental change in subsistence strategies throughout the 1500-year sequence at Jenn-d-jeno is astonishing. It seems necessary to conclude that the mixed and highly diverse economy practiced at the site was well adapted to the uncertainty of the IND's flood regime and rainfall pattern, providing a wide range of fallback options in case of crop failure. But we must also be aware that the available sample of paleoeconomic data constrains, by its very nature, the investigation of change. If we examine the data level by level, the samples are often too small to permit us to detect meaningful change. If, on the other hand, we lump samples together, by phase or subphase, we risk smoothing out evidence of shifts in, for example, herd composition or wild fauna exploitation that reflect responses to short-term environmental change. Beyond this, the variability in taxonomic composition of fauna from different excavation units raises important red flags about conclusions that can be drawn from the limited samples we can recover from large sites.

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PRODUCTION, TRADE, AND THE ORGANIZATION OF SOCIETY

I begin this discussion with a consideration of metals, which are the only items for which there is any evidence, however indirect, for changes in the organization of artisanal production at Jenn6-jeno. The evidence is considered in the context of spatial patterning within the rural hinterland as well as in adjacent regions. In addition to providing insights on the organization of production, metals offer indisputable evidence of trade into the IND, since no ores or native metals are indigenous to that zone. Other items that arrived at Jennd-jeno through trade or exchange include glass beads and stone. Through this evidence, it is possible to suggest the extent of the trade networks into which Jenn6-jeno was incorporated at different periods of time. In the final part of this discussion, I offer an overview
of what we can say at present about the organization of society in the Upper IND prior to A.D. 1400.

Iron Production

No data relevant to the debate surrounding the initial working of iron are forthcoming from the Jenn6-jeno sequence, which begins toward the end of the first millennium B.C. All we can say is that the initial inhabitants of the site were smelting lateritic ores to produce iron. Abundant smelting and smithing debris is present in the earliest deposits at Jenn6-jeno, but no furnace bottoms have been discovered. There is currently no reason to believe that a smelting technology other than the bloomery process was involved, despite the presence of high carbon (0.8-1.2%) steel among the iron artifacts in these earliest levels. Elsewhere (S. McIntosh and R. McIntosh 1988:106) I have suggested that the early iron technology at Jenn6-jeno, where quenching was apparently unknown, resembled that of the early (pre-Roman) Iron Age in large parts of Europe. As in Europe, heterogeneous blooms with variable carbon content were a natural consequence of the bloomery process, and smiths were quick to appreciate the hardness of higher carbon portions of the bloom, reserving them for utilitarian objects such as knives (see Killick 1988 and France-Lanord in Gr(b)nart 1985:338-339 on the subject of variable carbon blooms). In all of these aspects, the initial iron technology at Jenn6-jeno parallels that described at Taruga, Nigeria (Tylecote 1975).

Unfortunately, owing to the highly mineralized nature of most of the iron artifacts, and the lack of intact furnace bottoms in the excavated deposits at Jenn6-jeno, we have no information on how iron technology changed through time at the site.

The source of the ore used at Jennd-jeno is unknown, although we have previously pointed out (S. McIntosh and R. McIntosh 1980, 1:19) that historically the neighboring Bn-dougou region was an important source of iron for Jennd. LaViolette's (1987:173-174) questioning of Jenn6 smiths on the source of local pig iron substantiates this: virtually all the smiths identified Minyanka smelters to the south as the producers of the iron used at and traded into Jenn until early in the twentieth century. It would be

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surprising if importation of ore, rather than blooms or ingots as in historical times, remained important for any extended period at the site, but we have no direct evidence on this question. If historical experience is any guide, source areas would have shifted through time in response to changes in the regional political scene. (Caillid [1968, 1:465-466], for example, describes in detail how the movement of goods into and through the IND was disrupted by Fulani-Bambara hostilities at the time of his visit in 1828.) The signal fact that remains is the absolute dependence of the IND sites on iron sources outside the floodplain.

The suggestion made in Chapter 6 that the Jennd-jeno evidence for metallurgy offers the possibility of a fundamental reorganization of either metal production or town structure (or both) between Phase I/II and late Phase III requires consideration within a larger, extrasite context. In essence, I have suggested that the earliest occupation at JennO-jeno involved on-site smelting of imported ores.
The subsequent disappearance of smelting slag indicates that iron blooms were imported from that point, and the concentration of smithing slag and other debris in Unit LX from terminal Phase III through Phase IV suggests the long-term installation of smiths in specific locales or quartiers, probably as members of organized specialist producer groups. If this shift has indeed taken place by late Phase III, then we would expect the many sites in Jenn6-jeno's hinterland with Phase IV surface assemblages to exhibit characteristics consistent with the hypothesis, namely, spatial concentration of forges and smithing debris and general lack of smelting furnaces or slag heaps.

If we look at the data for the thirty-four (out of sixty-eight total) sites surveyed within a 4 km radius of Jennd, we find that these expectations are generally met. There are no slag heaps to suggest significant smelting activity (although the presence of ore blocks at two sites indicates some smelting may have occurred during Phase IV), and tuyeres, crucibles and furnaces interpreted as forges have a restricted distribution. Out of twenty-eight surveyed sites measuring less than 4 ha in area, only seven have smithy evidence of this kind. Among the remaining sites measuring greater than 4 ha, all have smithing debris on the surface; and where multiple forges are recorded, they tend to cluster, as though several smiths worked near to one another in one or more sectors of the site. (The interpretation of the slag as smithing slag is significant. It is almost axiomatic among West African archaeologists that fired circular features with slag are smelting furnaces. However, McDonnell [1983] provides an overview of the difficulties in distinguishing a smelting from a smithing furnace bottom. The smithing forge is characterized by a predominance of vesicular slags and a rarity of flowslag. This conforms to the surface evidence at most of the IND sites). One confusing element is the high incidence of slag: only eight of the thirty-four sites have no, or negligible evidence of slag on the surface. All the others have light-to-moderate scatters of small pieces interpretable as smithing slag produced from working iron blooms. Although one would expect smithing slag and smithies to correlate closely, they do not, to the extent that there are many sites with slag but no other smithy evidence.

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Obviously, postdepositional processes that could differentially affect the preservation of surface features and artifacts hold a key to understanding this phenomenon, and these need to be targeted for future investigation. There is also the possibility that the slag at smaller sites was produced by itinerant smiths who worked briefly at forges that were little more than shallow pits. LaViolette (1987:206-215) documents the seasonal movement from Jenn6 and other smithing centers of itinerant smiths today. The use of a fire pit for forging over the course of a single seasonal visit would oxidize the soil but leave much less in the way of durable, visible debris: for example, built-up hearth walls, ash, and slag accumulations in the bottom of the hearth. This could explain the presence of slag on so many sites lacking other forge debris.

A nonmetallurgical explanation is also possible. Dembdld (1986) has suggested for the Lakes Region that slag was used architecturally to reinforce mud matrix.
Unfortunately, among the many banco and mud brick walls we excavated in 1981, no slag was detected in the building material, even after we crushed mud bricks to examine their constituents. Some other nonmetallurgical use for slag produced elsewhere may be responsible for the presence of slag on so many sites, but we cannot at present offer ideas on what it might have been. The fact that demands explanation, both in the IND and in adjacent regions, is that slag is relatively common on sites, but metallurgical features, such as furnaces and tuyeres, are not. Whatever the source of the slag, and whatever the reasons for its presence at three-quarters of the sites surveyed, it should not be forgotten that the total surface slag falls far short of what we would expect were local smelters producing iron for the population of the greater Jenn6-jeno area. It is likely that 10,000 to 26,000 people lived within a 4 km radius of Jenn6-jeno c. 1000 A.D., creating a tremendous demand for iron. Clearly, the bulk of this iron was smelted outside the IND.

Elsewhere within the Inland Delta, additional evidence for the spatial patterning of Phase IV smithing is forthcoming from Bedaux's work at Doupwil near Mopti, where considerable amounts of large slag pieces as well as tuyeres were observed to be concentrated in certain sectors (Bedaux et al. 1978:144). Szumowski's (1954) work, while often described in too little detail to be useful, yields in the case of Fatoma site 4 (near Mopti) a clear picture of a Phase IV surface assemblage with diagnostic fine channeled ware on a tell site with a definite metalworking quarter, characterized by forges, tuyeres, and stone mortars. At the western edge of the Inland Delta, work at Dia and its hinterland revealed a remarkable absence of furnaces, tuyeres, and significant slag scatter within a 64-km² area around the town of Dia, including the surface of the two major sites, Shoma and Mara (Haskell, et al. 1988). The presence of slag in the excavations, however, indicates that smithing was occurring at the site.

Further downriver, in the Lakes Region, metallurgical activity appears to be similarly spatially restricted. Desplagnes (1907:29) reported that the inhabitants in the region of Koulikoro referred to local archaeological sites with metallurgical debris and plastic-decorated pottery as "vieux ateliers de Noumous" (smiths). He observed other sites of this kind around Sumpi and

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Gourao. Site inventory work conducted by the D-partement de Patrimoine Culturel since 1981 in the Lakes Region has documented several dozen metallurgical sites, all defined by the presence of furnaces, slag, and other metallurgical debris. These sites are more numerous around Tonka, Dir6, Sumpi, and the Douanas (see Figure 10.1), but rarely exceed 20% of the total Iron Age sites identified (cf. inventory lists in Raimbault and Sanogo 1991). Typically, the Lakes Region metallurgical sites have from ten to several dozen furnaces, ranging from 30 cm to 90 cm diameter, accompanied by small slag heaps. Mauny (1961:315) describes one such site near the Kouga tumulus. Chibze (1991) provides a plan of another near Sumpi, SMP 3, where three different furnace types are present. Probably the oldest is the single charge bowl furnace, c. 50-55 cm in diameter, with low clay walls, four tuyeres, and a central slag evacuation pit
c. 15 cm in diameter and 15 cm deep. A second type, with slightly larger diameter, and a central slag tapping pit of 50 cm or more depth, is also present. One of these produced a radiocarbon date of 1310 ± 70 B.P. (cal A.D. 645-780), indicating contemporaneity with habitation at adjacent occupation mounds. The majority of the furnaces at SMP 3, however, are much larger, measuring 1.2 m in diameter and accompanied by slag heaps about twice as large. The form and functioning of these furnaces was described to Chize by smiths in Sumpi, where they were still used within living memory (Chize 1991:451). Standing some 3 m high, these furnaces had a large slag-tapping basin adjacent to the furnace and connected to it by a channel. A charcoal sample at SMP 3 produced a date within the last three centuries, confirming the recent chronology of this furnace type. At another site, KWZ 1, yet another type of smelting furnace was observed and excavated, this one with a central, vertical tuyre buried deep in the slag, reminiscent of the draft system observed historically in the Mandara Hills (Tylecote 1976:47). Charcoal from one of the KWZ 1 furnaces produced a date of 380 ± 60 B.P. (cal A.D. 1440-1630). Clearly, the history of iron technology is complex in the Lakes Region, and we understand very little of its development at present. It is interesting to note, however, that furnaces dating to the second half of the first millennium and those of very recent date share a common distribution that is spatially restricted and adjacent to contemporaneous habitation sites. This suggests that in the Lakes Region, the segregation of smelting and domestic activity has significant time depth. Whether any distinction was made between smelting and smithing debris in the Lakes Region surveys (as distinct from the excavation mentioned above) is not directly addressed in the publications available to me. Thus, it is not possible to ascertain the spatial patterning of forging activity at these sites. It remains, however, an important topic for future study.

Further to the west, in the M-ma, we find a similar pattern of metallurgical activity reported at c.15% of the inventoried sites. Most of the these comprise a small number of furnaces clustered on the edge of habitation sites in low-lying locales (personal communication, T. Togola). Notable exceptions are several sites located on the ferruginous Boulel Ridge, including sites B, D and E near Poutchouwal, where slag heaps total 30,000 m3 in volume (Hiland 1980:42). The magnitude of the exploitation at this last site led HAland, who excavated there briefly in 1978, to suggest that production occurred on an industrial scale for a short time, serving demand from the capital of Ghana, to the north. But the industry was short-lived and intermittent, due to the massive deforestation that quickly resulted. Hfiland's data indicate that smithing was carried on within the habitation mounds, where forge slag was particularly abundant in the deepest levels, dated to 1170 ± 90 B.P. (cal A.D. 690-970). Reduction took place outside the mounds or on its outskirts, where the slag heaps are located. Excavation revealed that simple bowl furnaces were used. One interesting but unexplained aspect of this site is the presence in the lowest habitation levels of slag cylinders c. 25 cm in diameter and 45 cm in length.
Subsequent work by Togola (1992) in the Mdma revealed extensive evidence of smelting at two other sites on the Boulel Ridge. In the Inland Delta, the Lakes Region and the M~ma, where Iron Age surface material generally dates to some time after A.D. 500 (earlier material occurs in the bottom deposits of these mound sites), a common pattern of metallurgical activity has been observed: less than 20% of the known sites have smelting or smithing furnaces and tuy~res. Where these occur, they are spatially restricted to certain sectors of some habitation sites (this pattern involves forge activity in the Inland Delta around Jenn6), or to areas separate from but associated with habitation sites (known to involve smelting at Lakes Region sites such as SMP 3 and KWZ 1). In only a handful of truly exceptional cases are quantities of slag suggesting large-scale ore reduction present. My provisional conclusion from these facts is that most of the iron used from the later first millennium onward in the Inland Delta, the M~ma and the Lakes Region was imported into the area as blooms or ingots and forged by local smiths who formed an organized artisan group and whose activities were spatially restricted, rather than ubiquitous, among these societies. That smelting was carried out in on the fringes of these areas is undeniable, but much work will be required to understand the relation between ore sources and the scale and nature of smelting activities through time. For the moment, it appears that, of the known sites within these three regions, only on the Boulel Ridge in the M~ma was iron smelted in quantities that far exceeded local demand. Thus, we must expect that as archaeological prospection pushes further into the fringes of these areas, new centers of large-scale smelting activity that served these regions of the Middle Niger will be found. And we must also assume that reduced iron was, throughout much of the Iron Age up until the establishment of colonial hegemony, a resource of enormous value and consequence in these three regions.

Copper and Gold
In recent years, evidence has been accumulating that is inconsistent with earlier assumptions that copper and gold appeared in sub-Saharan Africa subsequent to the establishment of the trans-Saharan trade by Arabs and Arabo-Berbers after the eighth century A.D. Three copper-based artifacts from the Phase III deposits excavated in 1981 can be added to the four Phase III copper pieces found in 1977 (S. McIntosh and R. McIntosh 1980, I: 165). At least three of these Phase III copper pieces come from the earlier part of the phase, confirming that copper was reaching the site by the mid-first millennium A.D. Compositional analysis of SF (Small Find) 1460, the earliest copper artifact found in 1981, revealed it to be copper with significant amounts of both lead (2.6%) and arsenic (2.5%). SF 1136, a small bronze wire circle with a notably high tin content (17%), probably also dates to the first half of Phase III; but because an ash pit (Pit 10) from the Phase III/ IV transition was dug into the level from which it came (Level 72), there is a chance that this piece is a later intrusion. A bracelet definitely dating to the Phase III/IV transition (c. A.D. 850-900) is bronze with 3% lead. Also dating to this same time period are a crucible fragment with traces.
of tin bronze, plus mold fragments, indicating that metals were being worked on the site by A.D. 900. Thus, the period between A.D. 400 and 900 (Phase III, transition III/IV) at the site saw the importation and use of arsenical copper early in the phase and the use and working of bronze by the end of it. In early phase IV (c. 900-1000) brass appears and coexists briefly with bronze. Later in Phase IV, the analyzed artifacts are either brass or pure copper. We may be seeing here an in situ evolution of local technology from copper to bronze, with the later introduction of brass from the north.

The question of indigenous copper metallurgy in West Africa and its evolution has been raised by discoveries of first-millennium B.C. copper industries around Akjoujt in Mauritania (Lambert 1971, 1980), near Azelik in Niger (Gr~b~nart 1985), and by the demonstration of the indigenous nature of the brilliant lost wax castings from Igbo Ukwu, Nigeria, dating to the ninth or tenth century (cal. A.D.) (Craddock and Picton 1986). The Jenn.-jeno evidence fills in the almost millennium-long gap in evidence for copper use that separates the desert and the forest sites. But it provides few answers to any questions about the development of copper technology and trade. The conundrum of copper exploitation at Akjoujt has always been the convincing clustering of dates in the first millennium B.C., consistent with finds of Punic style, and then, nothing. There is no direct evidence for later exploitation of these copper sources, although Vanacker (1979) and Devisse (1982:161) have argued that the compositional similarity of the copper at Akjoujt to that at Tegdaoust suggests that the source of the Tegdaoust copper was either Akjoujt or another source of similar chemical composition (i.e., with high arsenic and iron). Still, much of the first millennium A.D. is missing from this scenario, since the Tegdaoust material dates largely to the tenth and eleventh centuries. Certainly, Vernet (1983:568) is correct to observe that much remains to be discovered on the subject of the origins and development of copper metallurgy in Mauritania. But for the present, we must admit that the canvas is largely blank for much of the first millennium A.D. in Mauritania.

The same is true for copper in the vicinity of Azelik, Niger. With the evidence for a third millennium B.C. copper industry (Cuivre I) in the region called into serious question by the results of new analyses (Killick et al 1988; discussed in S. McIntosh and R. McIntosh 1988: 103-105), attention has increasingly focused on the more coherent Cuivre II industry, roughly contemporaneous with Akjoujt. As in Mauritania, the metal appears to have been exploited on a relatively limited scale during the first millennium B.C., within the context of a predominantly Late Stone Age economy and technology. Again, exploitation of copper appears to end at the beginning of the first millennium A.D., and is not resumed until sometime after the eleventh century (Gr~b~nart 1988:129). From this apparent vacuum, the Igbo Ukwu bronzes appear, far to the south, brilliant and idiosyncratic, in the ninth or tenth century (Shaw 1970).

What happened to West African copper use and production for the first 800-900 years of our era? The facts we have in hand are these: We know that two earlier sources (Akjoujt and Azelik) no longer appear to be in use. We know that other
sources of copper exist-in Mali at Tessalit, Nioro-du-Sahel, and Sirakoro, in Mauritania east of the Gorgol Noir, and in Burkina Faso at Gaoua-and that many of these sources show evidence of ancient mining (Grab~nart 1988:137-140; Vanacker 1983). None of these has been subjected to serious investigation, however. We know that copper working at Marandet (Ya'qubi's Maranda?) may extend back to the sixth to eighth centuries (cal A.D.) and involved imported copper (not copper from nearby Azelik) and lead, which both appear to have been alloyed on site (Bourhis 1983:134). We know also that it is likely that the copper and lead in the Igbo Ukwu bronzes came from deposits of the Benue Rift, "right on Igbo-Ukwu's doorstep" (Chikwendu et al. 1989:35). And we can assume that the metallurgical artistry at Igbo Ukwu has a history and a time depth for which we have no evidence at present. For this first millennium gap, Jennd-jeno currently provides the bulk of the firmly dated evidence of copper use prior to 800 A.D. (GarenneMarot [in press] points out the chronological uncertainties of the brass earring from the Toloy horizon [third to second centuries B.C.] in the Bandiagara caves, and of the bronze and brass jewelry associated with burials attributed by Grdb~nart to Fer I in Niger), but we do not know what the source of that metal might be. The evidence from Jennd-jeno indicates the possibility of an evolution from copper to bronze by A.D. 850 and the replacement of bronze with brass by A.D. 1000. Much further work in the region is required to substantiate or refute this potential metallurgical sequence, and carefully controlled, stratigraphic excavation must lie at the heart of this research. Such excavations by T. Togola in the Mema produced a bronze bracelet from a burial dated to cal A.D. 780-1010 (at 1E), which is consistent with the proposed metallurgical sequence (Togola 1993). Far more needs to be done, however, and the fascinating question of exploitation at the Nioro-du-Sahel copper mines west of the M~ma should be investigated by an archaeometallurgist familiar with the stratigraphic difficulties of mine sites. The source of the tin in the Jennd-jeno bronzes is another issue of great interest, for which we have virtually no information.

Sourcing of copper-based metals is, of course, fraught with problems, since smiths re-melted and potentially mixed metals from many different sources (Craddock 1985:17-19 outlines the issues). Nevertheless, the recurring presence of certain diagnostic trace elements or other compositional aspects may eliminate certain known sources and also permit the

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identification of sites using metals so similar in composition that trade connections are likely. An example of the former is the dissimilarity of the Marandet metals (signaled by Bourhis 1983:133), in which antimony was present, and Azelik copper, in which antimony is absent (Figure 10.4), indicating that Azelik was not the source of Marandet's copper. Similarly, Vanacker (1983:100) has emphasized how dissimilar the Marandet metals are to the alloys used at Tegdaoust, partly due to the much higher percentages of arsenic and iron at the latter. By this same logic, the arsenic content of the Kumbi Saleh and Mdma alloys (Figure 10.5) would exclude Marandet as a secondary trade source. Low arsenic and iron, by contrast, characterizes the coherent set of copper and leaded
bronzes from Igbo Ukwu (Figure 10.6). Their high silver content virtually excludes a North African or Saharan origin, where this quantity of silver would have been reclaimed (Craddock 1985). Igbo Ukwu's copper looks different, compositionally, from other analyzed metals in West Africa, apparently due to the exploitation of local ores as well as the unique technological style of the smiths involved. Thus, it is possible to detect consistent compositional differences among the metals used in different areas, differences that may be due to use of different sources and/or use of different smelting/alloying techniques. As more metal objects are recovered from excavation, it may also be possible to begin to recognize regional metallurgical traditions, characterized by a broadly common technological style (Lechtman 1977) and possibly by use of metals from common sources.

One such potential regional tradition can already be defined at Tegdaoust and the Middle Senegal valley (MSV) for the period of the tenth to twelfth centuries A.D. Both areas are dominated by brass with zinc averaging 10%, and arsenic and lead variably present up to 2% each (excepting a single highly leaded brass from Tegdaoust) (Figures 10.7 and 10.8). The one difference is a significantly higher incidence of iron at Tegdaoust. The fact that virtually identical copper-based artifacts, including small cast bells (Robert-Chaleix 1989:251; Thilmans and Ravis6 1980:27, 38, 45; Chavane 1975-6:50), ingots (Polet 1985:65; cf. Chavane 1985:160), diamond head needles (Robert-Chaleix 1989:25; cf Chavane 1985:160), and iron rivets in copper plates (Robert-Chaleix 1989; Chavane 1975-1976:70) have been found at Tegdaoust and MSV sites emphasizes the connections among them. At the same time, the originality of the MSV smiths should not be overlooked. A whole range of artifacts from harness pieces, small rolled rim vessels, viroles, bitronconic beads, and double-twisted wire objects is characteristic of the MSV sites of the period, from Podor in the west to Ogo in the east. To date, these artifact categories have not been reported from Tegdaoust. It is particularly relevant that recent work along the MSV has demonstrated that copper does not appear until after c. A.D. 900, coincident with the period of intense occupation and metallurgical activity at Tegdaoust (McIntosh et al. 1992). These sites may well document the introduction of a foreign metallurgical tradition and its subsequent local elaboration. In all these speculations, however, it is well to recall that the currently available sample of analyses is probably inadequate to reflect the full range of copper alloys used or produced through time at any given site.

Conclusion
Claudette Vanacker’s research at Tegdaoust has demonstrated that copper smithing was practiced at the site, with forge residues, including copper slag, and cire perdu molds, particularly numerous in the tenth- and eleventh-century deposits (Vanacker 1983: 96) of the artisans’ quarter that she excavated. The presence of copper slag suggests that ore was smelted on site at least occasionally. The source of this ore might be from the Tajalt Oumar Kadiar sector, east of the Gorgol Noir (Vanacker 1979:139), where geologists have reported evidence of ancient copper mining. Furthermore, the presence in the metal of iron in amounts of 2–6%
argues for smelting of iron-rich copper ores, such as chalcopyrite or malachite, without subsequent refining to remove the iron, according to Vanacker (1979:138). This contrasts with the general expectations for Islamic brass or copper from North Africa, potentially typified by the brass ingots from the Ma'den Ijafen caravan cache, discovered in southern Mauritania and dated to cal A.D. 1170-1260 (note: two dates: 860 ± 108 B.P. = cal A.D. 1030-1260; 785 ± 110 B.P. = 1170-1280 at one sigma) (Monod 1969, Craddock 1985:29). The iron content in the analyzed ingots averages 0.08% (Figure 10.7), suggesting the use of low-iron copper ores (or subsequent refinement out of the iron after smelting of high-iron ores), and sphalerite (zinc sulphide) ore, the oxidation of which also removes the iron (Craddock 1985:29). If the Islamic brass traded across the Sahara generally conformed to these characteristics, then the high iron content of the Tegdaoust brasses requires explanation. (It is worth noting here, however, that there is little information available on shifts in iron content through time in North African brasses so that it is not clear a priori that high-iron brass at Tegdaoust could not have originated in North Africa). Local smelting of iron-rich copper ores is one possibility. A copper globule extracted from slag found at Tegdaoust had little iron (0.15%), while a copper ingot had much more (2.5%) and a brass ingot had exceptionally high amounts (6.5%)(Bourhis 1983:137).

Vanacker accounts for this by suggesting that brass was manufactured on site by the Tegdaoust smiths, using local Mauritanian copper and lead and associated zinc ores. Thus far, the closed cementation crucibles required for the alloying of copper and zinc have not been documented at Tegdaoust. Vanacker's (1979:139) suggestion that the hemispherical "enamelware" bowls at the site served as brass-making crucibles cannot be seriously entertained. Since zinc boils at only 9170 C and forms a vapor that promptly reoxidizes and is lost, the alloying must take place in a closed crucible that excludes oxygen (Craddock 1985:23). Until the characteristic debris of brass alloying is found at Tegdaoust, I would prefer to hold the "on-site alloying" hypothesis in a suspense account. The few facts that we do have are that some copper smelting took place at Tegdaoust; fragmentary ingots at Tegdaoust indicate that imported ingots were used; ingots of several different forms, sizes, and compositions are known, but among the analyzed objects, ingots have the most consistently high percentages of iron; ingots may also have been fabricated on site (though one "lingotire" described by Vanacker [1979:121] had a yellow-green substance that proved on analysis to be glass, not brass), numerous small (3 cm long) copper (alloy) wires with flattened ends have been found at Tegdaoust and are thought to have functioned as money

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(Vanacker 1979:116). It may be that Tegdaoust smiths reworked imported brass for shipment further south. If ingots arrived as large bars of 20% zinc brass, similar to those of the Ma'den Ijafen, local smiths may have melted them down and added locally smelted and poorly refined copper to stretch the zinc, creating the 7-12% zinc brass common along the Middle Senegal valley. Smiths receiving these ingots further down the line would have refined out much of the iron. Alternatively, some North Africa copper producers may have omitted the step of
refining out the iron in a move to reduce production costs. In which case, there would be no need to invoke extensive local smelting of copper ores near Tegdaoust, and no need to postulate anything other than a secondary use of imported metals, both copper and brass, to account for the vast bulk of the metallurgical activity at Tegdaoust. The furnaces and artisanal debris at Tegdaoust remain fascinating, but unfortunately difficult to interpret, as Vanacker (1979: 134-138) readily admits. It is interesting to note that the analyzed objects from Kumbi Saleh present no immediate compositional similarities with the sites of Tegdaoust/ MSV tradition (Figures 10.5, 10.7, and 10.8). Most are copper, and among these, ingots form a coherent series with very high lead (20-30%) and significant arsenic (2-4%). These high arsenic levels are repeated further to the south in the bronze bracelet from the Mdma (specimen 11, Figure 10.5). Stylistically, however, the common origins of the jewelry styles at Koumbi and Tegdaoust are apparent (Thomassy and Mauny 1951:455; Vanacker 1979:111) The small double-headed "fils" thought to have been used as money at Tegdaoust are also present at Koumbi (Thomassey and Mauny 1951). Unfortunately, the results of the several excavation seasons at Koumbi in the 1960s and 1970s have not been published, so the full range of copper objects found is unavailable. While we would expect Kumbi Saleh, the Mdma, and Jenn&jeno to have operated from the eighth or ninth century, at least, as part of a single interaction sphere, the analyzed metals from Jenn& jeno bear little compositional similarity to those from the other two (Figure 10.9). It is unclear how this should be interpreted. Stylistically, the importance of small pendants and hair ornaments among the Jennd-jeno copper assemblage is unmatched elsewhere. One pendant has been reported from Koumbi (Thomassey and Mauny 1951:455, n. 10). The small bronze disc pendant (SF 704) from early Phase IV may possibly be an attempt to imitate a dinar, with beaded relief representing the raised epigraphy on a struck coin. The raised "mamelon" decoration of a bronze earring (SF 1496) recalls the style of a bracelet from El Oualadji (Desplagnes 1951:1166); and the "wound" technique of SF 1541 is also present at El Oualadji (Desplagnes 1951:1168). Other than suggesting a north-south line of stylistic influence during Phase IV, which is scarcely news, these stylistic similarities provide us with relatively few insights. Much more metal must be recovered from meticulous excavations and subjected to compositional, stylistic, and technological analyses before useful conclusions can be drawn. For the time being, the compositional differences between the metals at Tegdaoust and Kumbi are interesting and perhaps unexpected. And the lack of compelling conclusions or stylistic similarities between the Kumbi Saleh and Jenn6jeno metals remains enigmatic.

Conclusion

The single piece of gold from Jenn6-jeno appears to date to the Phase III/IV transition, c. A.D. 850-900, although it should be recalled that its deposition context, sealed under the city wall in Unit NWS, is dated by ceramics only. Thus, this date can be conservatively regarded as a terminus post quem for the gold
earring. This means that by Phase IV, Jennd-jeno was receiving gold from one or more unidentified southern sources. To my knowledge, the only other site to have produced evidence for gold in first millennium contexts is Tegdaoust, where Robert-Chaleix (1989:188) reports crucibles with traces of copper and gold in Occupation I deposits (eighth century A.D.?) Elsewhere (S. McIntosh 1993), I have commented on the apparent lack of stratigraphic control in the Tegdaoust excavations, concluding that mixed deposits containing material of different periods may not have been recognized during excavation. The Occupation I gold-working crucible should thus be placed in a "suspense account" pending the recovery of evidence for gold working from a closed, well-dated context at Tegdaoust. Publications thus far have not given details on the chronology of the five gold ingots found buried beneath a kitchen floor at the site (Robert 1970; pictured in Devisse 1990:433) or the gold wire prepared for filigree (Devisse 1990:433).

Trade And Interregional Contact
As indicated above, metals provide a rough outline of Jennd-jeno's participation in trade networks that begin regionally, importing iron ore from uplands adjacent to the IND, and expand to include copper sources (probably in the Sahel) and then gold from distant forest sources, bronze (source unknown) and brass from North Africa. Other artifacts, notably stone and glass, allow us to expand this picture somewhat, but the general conclusions remain close to those put forward on the basis of the 1977 excavations (S. McIntosh and R. McIntosh 1980, 1:444-461). At that time, we suggested that Jennd-jeno had developed rapidly during the first millennium as a producer of surplus staples (grains, smoked meat and fish, fish oil, condiments) that it traded to adjacent regions for desired commodities, such as metals, stone, and salt (Figure 10.10). This trade was well established and far-reaching by the end of the first millennium, at which time Arabo-Berber traders from the Sahara tapped into these indigenous routes and rapidly expanded their commercial enterprise.

Phase I/II imports included sandstone and iron from regions adjacent to the alluvial zone, and stone beads from a variety of sources probably slightly further removed. The big surprise and enigma from this phase is the glass bead of a composition currently known only from south and southeast Asia contemporary with the Han dynasty. Assuming that the bead originated in southeast Asia, its route to West Africa is unknown. Did it move overland into the Mediterranean and thence south from North Africa or west from Egypt? Or is there a chance that it followed a maritime route from Indonesia.

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and thence overland from East Africa? The answer is impossible to determine. This tiny bead reminds us of how little we know of the movement of peoples, crops, ideas, and objects into Africa in the early Iron Age. It also serves as a useful counterbalance to the tendency to consider north-south trans-Saharan contact as the major route for these movements. The bead may have traveled across Africa partly in the course of migratory movements of populations affected by the climatic downturn during this period, and partly by hand-to-hand exchange.
of goods among different social groups. There is also the possibility that it traveled as an incidental item along trade routes largely consecrated to other, more invisible items, such as salt. The case for the importance of salt to Sahelian populations, especially those with domestic stock, has already been made (S. McIntosh and R. McIntosh 1980, II: 446; McDougall 1980:199-225). The salt trade from the Sahara may be one of the most enduring links between Sahara and Sudan, providing a conduit for Sudanic goods to travel into or across the Sahara (south to north or west to east) in exchange for an archaeologically invisible commodity. The lack of archaeological evidence for pre-Arab trans-Saharan trade has always been a problem for its advocates. The various glass beads from Phases I/II and III at Jenn6-jeno are among the first foreign items to be recovered from secure early Iron Age contexts in West Africa. It is possible that they are the sole remaining testimony to an early Berber-organized trade in salt from the Sahara. Long-distance trade contacts in Phase III (A.D. 300-850) are attested by the presence of copper, whose nearest known source, in Burkina Faso at Gaoua, is 350 km away. Farther yet are the Nioro and Sirakoro copper mines, both c. 500 km distant. Other possible sources even farther away are Tessalit (happily located on the Saharan route to Gao) and Akjoujt in Mauritania. A glass bead from Phase III deposits is typical of Roman glass made with natron and could have been manufactured in Egypt or Italy (Brill in Chapter 5, this volume). The likelihood of contacts with North Africa during this climatic optimum seem high. Brooks (1986) points out that the increasing rainfall would have expanded Sahelian and Saharan pasturage and water supplies, facilitating the use of camels, and, I would add, expanding the range of horses, which might have become an important item of trade from the Mediterranean basin during this period. Garrard's (1982) argument for the movement of Sudanese gold into North Africa from the fourth century A.D. is also relevant in this context. The presence of gold sometime after A.D. 850-900 at Jennd-jeno, while much earlier than an earlier generation of scholars would have thought possible, is still too late to support Garrard's hypothesis directly. It does, however, directly support my contention (S. McIntosh 1981) that gold was moving through the IND by the tenth century, giving rise to reports by Arab chroniclers of an "Island of Gold" located within the territory of the Wangara (Soninkel traders). It is of interest that the Tellem footed bowls, known from excavations at Niani, located upriver near the Boud gold sources, also appear at Jennd-jeno early in the Phase III deposits. Bedaux (1980), who has studied the distribution of this distinctive form, shows a Niger-oriented pattern, ranging from Niani in the southwest, to the IND and

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Bandiagara escarpment centrally, the Mama to the northwest (Togola 1993) and the Niger Bend to the northeast. Dated contexts for the bowls are available at Niani (sixth to the sixteenth centuries A.D.; Filopowiak 1979: 170, 177), Akumbu (seventh century A.D.; Togola 1993) and Sanga (eleventh and twelfth centuries A.D.; Bedaux and Lange 1983). The Jenn(-jeno footed bowls are present for almost a thousand years, from early Phase III to late Phase IV. Bedaux argues that such a distinctive form is unlikely to have been independently invented in several
different areas and attributes the presence of this form over such a wide area to population movements.
The appearance of bronze between A.D. 900 and 1000 at Jenn&jeno points toward continuing involvement in Saharan trade, where copper and tin were available, even though the actual source areas for the bronzes at Jenn-jeno are unknown. The major axis of contact with Jenn-jeno appears, from pottery distributions, to be reoriented at this time away from the Niger (DiaJenn6) and toward the Bani (Jenn6-Mopti). A marked decline in settlement density around Dia at this time may be related to the migration of Soninké trading clans to the Senegal Valley and other locales emerging as strategic points for trade with rapidly realigning southern Saharan routes. The eleventh and twelfth centuries at Jenn-jeno see the advent of the first major shifts in material culture that can be unambiguously credited to North African or Islamic influence. At this time, brass, spindle whorls, and rectilinear house plans appear at the site. It is interesting that the latter are executed in cylindrical mud brick, a building technology that first appeared at Jenn-jeno c. A.D. 850, indicating that new architectural forms were adapted to a pre-existing technology. One of the implications of this was an inability to reproduce, with cylindrical brick, several of the elements and embellishments common to Islamic architecture further north, such as the arch, vault and dome, and the geometric Berber stonework motifs so familiar from Kumbi Saleh, Tegdaoust, Walata, etc. (Prussin 1973:130, 132). While the execution of niched window facades may have been accomplished with the fired rectilinear bricks found in Phase IV, the range of architectural forms would have been constrained at Jenn-jeno by the "structural limitations imposed by laying a cylindrical brick vertically" (Prussin 1973:132). Why, we may wonder, was rectangular mud brick (known from both Malinké areas to the southwest and in Gao on the Niger Bend) not successfully introduced at Jenn-jeno? Whatever the case, rectilinear domestic architecture appears at the site within a century of the traditional date (A.D. 1180) of Koi-Konboro's conversion to Islam. At this time, as-Sa'di (1900:23-6) informs us, the Jenn6 chief razed his palace and replaced it with a mosque. The presence of 4,200 local ulimas at Koi Konboro's abjuration of paganism indicates that conversion to Islam was no longer a novelty in the late twelfth century. The appearance of rectilinear architecture at Jenn6-jeno may reflect the chronology of conversion at the site. By A.D. 1200, the site is in decline, presumably at the expense of the present-day town of Jenn, where Koi Konboro's palace and, subsequently, his mosque were located. Although imported goods continue to appear in the late Phase IV deposits at Jennd-

Conclusion
jeno, the town's commercial focus has clearly shifted to Jenn. Jenn-jeno is abandoned by A.D. 1400.

THE ORGANIZATION OF SOCIETY
Having considered Jenn-jeno within the context of trade and interaction with adjacent regions, I now turn to discuss the organization of the society that inhabited the Jenn-jeno complex of settlements and how it changed through time. This is difficult for the earliest occupation phase because the sample is so
limited. I assume that the initial colonizing group was small and undifferentiated, and there is nothing in the excavated material to contradict this. It remains, nevertheless, an assumption. But we can say that by the first century A.D., Jenne-Jeno had grown to a size of at least 12 ha. Two hundred years later, its size had doubled and neighboring Hambarketolo was also inhabited. By 800 A.D. both sites had reached their maximum areal extent of 41 ha (Figure 10.3), and it appears that a massive city wall some two kilometers in extent was constructed around Jenne-Jeno at this time or shortly thereafter. If we are correct in believing that, in the past, as today, most of this hard-earned site surface was put to residential use, and not to stock pens or some other non-residential use, then the population at Jennejeno and neighboring sites was impressive. Elsewhere, R. McIntosh and I have argued that Jenne-Jeno represents an early phase of African urbanization (R. and S. McIntosh 1980; S. and R. McIntosh 1984).

Recognizing urban centers or cities archaeologically has been problematic (discussed in S. McIntosh and R. McIntosh 1984), and it remains true that the problems begin with the definition of "urbanism". A recent attempt to avoid Eurocentric biases by defining African urbanism on the basis of settlement size alone must be roundly rejected. Not only is Sinclair et al.'s (1993:22) definition hopelessly vague, ("a town is defined in its widest sense as a collection of houses greater than a village"), but it also eliminates any theoretical content that would permit us to study urban systems as organizationally different from non-urban settlement systems. The fact that towns are not simply villages on a larger scale, but involve new ways of structuring social and economic interaction, must lie at the heart of attempts to define and understand urbanism and its origins. I still find much merit in Trigger's (1972: 577) idea that an urban center "performs specialized functions in relation to a broader hinterland". The specialized functions may be of an economic nature, such as production and export of goods and services, or they may have a more social aspect, such as the elaboration of power and new social institutions or the exchange of information. Human geographers are primarily responsible for demonstrating how countryside and town are joined into an economic and social continuum that is structured by the principle of specialization into a hierarchy. As Wrigley (1978:300) explains: Because trickles of goods sent or received by each hamlet flow to and from local market towns and in turn between them and larger centers, like the gradual conjunction of many small brooks into larger streams and ultimately great rivers, there is always an ordering of towns and cities into a hierarchy.

Conclusion
In this hierarchy, the intimate connection between specialization of function and urban growth is readily visible since the higher order urban centers contain all the specialized trades to be found in lower order centers and others in addition.

One of the best-known models generated to describe the nature and functioning of urban hierarchies is Central Place Theory, which deals with spatial relationships among settlements in a hierarchical system. Another concept, or rather an empirical observation made by human geographers, is the consistent relationship
between ranks and sizes of settlements in an urban system (Berry 1961; Berry and Garrison 1958; Haggett et al 1977). This relationship is described by the rule \( P_r = P_1 \times \frac{1}{r} \), where \( P_1 \) is the population of the city ranked 1 and \( P_r \) is the population of the settlement ranked \( r \). Thus, a town of rank 5 would be expected to have one-fifth the population of the first-ranked city in the system. The rank-size relationship can also be described graphically by plotting settlement rank against population. If arithmetic scales are used for axes, the resulting graph is a curve. If the logarithms of size and rank are plotted, a straight line is produced. The formula in this case is written \( \log P_r = \log P_1 - \log r \) (Bradford and Kent 1977:60). This relationship has been observed so frequently that it is accepted as an empirical regularity; the rank-size distribution is a recurring urban signature. Precisely why this should be so is not understood. Some geographers suggest that the underlying mechanism is cost minimization or efficiency maximization; others believe that stochastic processes inherent in the growth of systems may be responsible. Whatever the reasons, I agree with Crumley (1976:65) that "the rank-size distribution curve itself is a reflection of that system's degree of urbanization".

Application of the rank-size rule to archaeological situations is difficult for two reasons. First, there is the need for sufficient chronological control to enable the identification of contemporaneous sites that likely functioned as part of one and not two overlapping systems. Second, there is the thorny problem of the degree to which population size (the original "size" statistic used by geographers) corresponds to site area. The relationship is not straightforward. Population densities can vary from site to site, as they do in the IND today, depending on the amount of public or otherwise nonresidential space present. Thus, site size can not be reliably used as a proxy measure for site population. We have acknowledged these difficulties and discussed them at greater length elsewhere (S. McIntosh and R. McIntosh 1993). Despite the problems attendant upon this kind of analysis, the results for the thirty-four sites around Jenn6-jeno with contemporaneous early Phase IV surface deposits are gratifying (Figure 10.11). The distribution closely approximates the expected rank-size distribution, suggesting that by A.D. 1000, there was a fairly developed, well-established urban hierarchy centered on Jenn6-jeno. Moreover, this distribution shows unambiguously that a threeter settlement hierarchy had emerged by late Phase III, with two very large sites > 20 ha, several medium-size sites between 8-19 ha, and a large number of smaller sites (Figure 10.12). In considering further the questions of how

Conclusion and why society grew in scale and complexity at Jennd-jeno, several distinctive aspects of the archaeological sequence are especially relevant (summarized in Table 10.2).

Table 10.2. Summary of significant elements of the Jenn-jeno regional sequence

| 0 Aggregation trend present from early occupation |
| " rapid areal expansion of Jennd-jeno |
| * adjacent settlement of Hambarketolo founded soon after |
Jenn&jeno
0 By Phase III, smiths installed in specific locales, possibly as members of organized specialist-producers
0 By 800 A.D., a regional site hierarchy is present
" intense clustering around Jennd-jeno
" population estimates of 10,000-26,000 people within 1 km of Jenn&jeno
* within study region, large and intermediate size sites unique to Jenn6 vicinity
0 Interregional exchange for stone and iron ore present in earliest levels
* long-distance exchange for copper by A.D. 500
0 Subsistence economy does not change detectably over 1500-year occupation of Jennd-jeno
* no signs of agricultural intensification
0 Minimal evidence from houses or burials for elites
The important question of the extent to which craft specialization developed at Jennd-jeno requires further research. I believe that we are able to detect increasing specialization at Jenn&jeno in the smithing debris, but it is not possible to say whether full-time specialization or castes had appeared by the early second millennium. The evidence for artisanal specialization in other materials (pottery, glass, etc.) is non-existent at present. There is nothing to incline us one way or another. It has been argued that uniformity of pottery over a wide area, such as we find in the Upper IND, is a hallmark of organized pottery production (LaViolette 1987; R. McIntosh and S. McIntosh 1988:151). This may be so, but I would be surprised to find specialized pottery production among the earliest colonists at Jenn6-jeno, yet their pottery is the most uniform and the most carefully made of any of the ceramic phases at the site. The fact is, in the absence of kilns and piles of wasters, it can be very difficult to identify different levels [domestic, market, export] of pottery production at a site. Much larger excavations will be needed to understand the nature of economic organization at Jenn6-jeno. Thus, for now, discussions of Jennd-jeno's organizational structure cannot specify the nature of craft specialization.

Conclusion
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Based on what we currently know, two aspects of the evidence for social organization at Jenn6-jeno and neighboring settlements are of particular interest. First is the unusual pattern of settlement agglomeration that characterizes the archaeological landscape of late Phase III and early Phase IV. The agglomeration that we see at Jenn6-jeno is an isolated phenomenon within the floodplain, with several large and intermediate sized sites packed within a three-kilometer radius, and no other floodplain sites of comparable size found within a thousand square kilometers to the north and west of the site (Figure 10.12). This contrasts strikingly with the geometrically tidy settlement landscapes predicted by popular models such as Peer Polity Interaction (Renfrew 1986) and Central Place Theory,
with its lattice of multiple complementary regions (Haggett 1972:186-188). In our opinion, the clustered Jennd-jeno site hierarchy results from clumping of population around a rare conjunction in the floodplain of several highly desirable features: excellent rice-growing soils, levees for pasture in the flood season, deep basin for pasture in the dry season, and access to both major river channels and the entire inland system of secondary and tertiary marigots (Figure 10.13). The settlement pattern that emerged there, of both large agglomerated sites and smaller individual sites in their immediate vicinity likely reflects to a lesser degree some aspects of economic specialization among producers, and to a greater degree social factors, including attraction to the ritually powerful eponymous settlement in the region and reluctance to be subsumed by the center (R. McIntosh 1991:209-210).

A second intriguing feature of the Jenn6-jeno site hierarchy, lack of any evidence for chiefly elites, also needs to be considered. There are strong presumptions in the archaeological literature concerned with culture process that hierarchical forms of leadership should have emerged in societies as large in scale as that centered on Jenn6-jeno. Why do we find no overt signs of chiefly power by the end of Phase III? Several possibilities come to mind. Sample error stemming from the small size of the sample excavated and surveyed thus far could be at fault, meaning that evidence for elites is present but not yet discovered. It is also possible that evidence for elites is minimal because very few status markers were employed. In Feinman and Neitzel's (1984) study of New World intermediate-level societies, the Cherokee and Choctaw provided examples of societies with three administrative levels and only one status marker for leaders. There is, too, the possibility that elite status was expressed in behaviors or artifacts that are not easily recoverable archaeologically. Feinman and Neitzel (1984:75) point out that a wide variety of status markers normally leave no archaeological trace: feathers, tattoos, body painting, hairstyles, rare woods, skins, and special burial practices such as exposure. Another possibility is that it may take some time after the

Conclusion

emergence of elites (in Phase III) for political rank and power to be reflected by wealth differentials (Hastorf 1990).

The distressing possibility arises from all but the first of these possibilities that the theory predicting hierarchy will always be "underdetermined" (Roth 1987:6-8; 16-24) by the evidence in a number of cases, leaving no external basis on which to base the truth of the claim for hierarchy (discussed in R. McIntosh 1991:200). I suggest that the evidence as it presently stands supports equally compellingly the hypothesis that no political/administrative hierarchy existed at Jennd-jeno. Both R. McIntosh (1991) and I (1992, in preparation) have proposed the possibility that the population concentrated at and around Jenn&jeno in A.D. 800 was not hierarchically organized. Rather, it may have been horizontally integrated through numerous complex and cross-cutting associations exercising ritual or secular authority over all or part of the population. As with the ethnographically documented Yak6 of southeastern Nigeria (Forde 1964), an acephalous society organized into towns with population between 2,000-11,000, governmental
powers at Jenndjeno may have been widely distributed among a number of independent and overlapping agencies.

R. J. McIntosh (1991) has emphasized the integrative forces that brought people into close proximity in the Upper IND and the mechanisms that reduced potential conflict among the different groups in these early urban clusters. In putting forth a model for the main town center of Jennd-jeno as a primus inter pares, McIntosh eschews traditional coercive models for early urbanism, in which emerging elites facilitate the extraction of goods from the peasantry and enhance hegemony by forcing a heterogeneous population to crowd together in a central location. He re-opens the "cooperation" argument set forth by Service (1975), which is currently on the downswing compared to theories of complex society dependent on competition and conflict among elites (e.g., Earle 1991).

As a large town with no sign of highly stratified social relations or despotic authority, Jennd-jeno challenges many of our assumptions and expectations for early urbanism. It calls into question the long-standing tendency in the literature on early urbanism to conflate "urbanization", "civilization" and "state" (e.g., Connah 1987). If we have already appreciated the argument (e.g., Rowlands 1988) that much of the theorizing on the origins of urbanism, civilization and the state has taken the form of a universal monologue disseminated from the West, the importance of this data set to the process of reshaping ideas in a non-Western mold may be clear.

Jennd-jeno stands as one of the most compelling cases known for the indigenous emergence of large-scale, complex society in sub-Saharan Africa. And yet it presents certain anomalies that do not fit well with some currently popular ideas about the structure and functioning of such societies. Archaeology, as a broadly comparative discipline, cannot really claim to have explained how and why complexity arises until its explanations accommodate the Jennd-jeno's of world prehistory as smoothly and persuasively as they do the formative and pre-classic periods of the world's "great" civilizations. While feeling both proud and privileged to have made some contribution to

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this effort, I am acutely aware that the work accomplished thus far at Jennd-jeno is only a beginning. The vast scale of the Upper IND toggui (mounds) will require the concentrated efforts of large teams of researchers to extract the data necessary to comprehend how these settlement systems functioned. Because of the complex depositional histories of these sites and the deeply buried nature of the earliest (pre-Phase III) material, it is clear that surface studies will always be inadequate to address questions of settlement development and organization, such as those we have posed in our work. This is unfortunate, because excavation at deeply stratified sites is laborintensive and expensive, and we are now in a funding environment, in the United States and Europe, as well as Africa, in which resources for archaeological research are increasingly scarce. And, of course, the sites are rapidly disappearing through erosion and, much more significantly, pillage. Let us earnestly hope that the international will to explore, preserve, and
understand this extraordinary segment of world archaeological heritage can be mobilized in time.

Conclusion
MAURITANIA
Bassikounou
Kumbi Saleh Leri
Kobadi
A A Kolima
Nampala Bundu Boubou
Akumbu AA A Boulel
A
PdhO
NIEMA
MALI
I
BURKINA PASO
Figure 10.1. Map of sites and regions mentioned in Chapter 10

Conclusion
FINE CHANNELLED AND IMPRESSED WARE PHASE
TERMINAL PAINTED
PAINTED WARE PHASE
FINEWARE PHASE
Figure 10.2. Diagnostic elements of the proposed culture-stratigraphic nomenclature for the Upper Inner Niger Delta
1-1' AP

Conclusion
Fambarketol Jenne-jeno
attained by Kanian 72 A.D 800
AmbarkefoI
Figure 10.3. Expansion of jen6-jeno and distribution of ancient sites in the immediate interland

Conclusion
Azelik
2 3 4 5
SPECIMEN NO.
Figure 10.4. Chemical composition for some analyzed artifacts from Azelik (Source: Bourhis 1983)

As

Conclusion

Kumbi Saleh / Mama

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SPECIMEN NO. E Cu [l] E Zn E Sn E Pb E Fe As Specimens 1-10 are from Kumbi Saleh; specimen 11 is a bracelet from Akumbu in the Mama

Figure 10.5 Chemical composition for some analyzed artifacts from Kumbi Saleh and the Wma (Source: Bourhis 1983; Togola 1993)

Conclusion

Igbo Ukwu

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Figure 10.6. Chemical composition for some analyzed artifacts from Igbo Ukwu (Source: Craddock 1985)

**Conclusion**

Middle Senegal Valley

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Figure 10.8. Chemical composition for some analyzed artifacts from Middle Senegal valley sites (Source: Bourhis 1983)

**Conclusion**

Inland Niger Delta IBandiagara

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Specimens 1-4 are from Bandiagara. 5 Galia; 6-14 Jeime-jeno

Figure 10.9. Chemical composition for some analyzed artifacts from Bandiagara and Inland Niger Delta sites (Source: Bedaux et al. 1978)

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| millet (Nad?)    |
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| Cu              |

| fish             |
| cattle           |
| cattle           |
| Decorative       |
| Stone            |
| Crice            |
| wool             |

| O 0 0          |
| millet         |
| cattle/hides    |
| sandstone      |
| 0 0 0          |

| rice            |
| o 10           |
| fis o          |
| I e            |

| S 'ml fish      |
| mill0et        |
| ' 0            |

| Au              |
| I              |
| Jenne-jenol     |
| /               |

| Au              |
| \              |
| cotton         |
| fish           |
| 2              |

| rice            |
| game           |
| sorghum        |
| hydromel       |
| milk           |
| CU             |
| rice           |
| Fe             |
| shea butter    |
| Fe indigo      |
| Fe-* F         |
| Fe             |
| Shea bute      |
| Au             |
| Au             |

| Kola           |
| CU             |
| slaves         |
| 4000           |

| Kola           |
| 600            |
| slaves         |
| 800            |

| Au              |
| Aukola          |

Figure 10.10. Availability of resources at various distances from Jennd-jeno

Conclusion

RANK-SIZE RELATIONSHIP OF SITES WITHIN 4 KM OF JENNE-JENO

<table>
<thead>
<tr>
<th>SITE RANK</th>
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<tbody>
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<td>10</td>
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Figure 10.11. Rank-size distributions of the archaeological sites (M) within 4 km of Jenn&jeno occupied in c. 1000 A.D. and the present-day settlements (Q) of the same area

Conclusion

0 regional center
(>20 ha.)
intermediate
0 center cluster
core (8-19 ha.)
* satellite sites
0 1 2 3
A village L'1 special purpose site
* levee

Figure 10.12. The three-tier settlement hierarchy at Jennd-jeno c. 1000 A.D.

Appendix A
Stratigraphy and Features
Table A1. Description of excavated levels and features: ALS, CTR, 414 Table A2. Feature index 459
Table A3. Features and artifacts associated with structures 463

Table A1: Description of Excavated Levels and Features: ALS
UNIT ALS
(Soil description after Ahn 1970:19 - 21; * = C14 date for level)
Feature 50:
Feature 50 was a composite of house foundations, all of cylindrical bricks, exposed on the surface of the northern sector of the unit. These foundations extended only one brick in depth. This feature was labeled "House 13."
Level 1:
This was a very compact, rain-leached surface soil covering the area of the unit south of Feature 50. Level 1 contained brick from that feature and possibly artifacts deposited after abandonment of the Feature 50 houses.
Level 2:
Level 2 was a crumbly loam underlying Level 1 and part of Feature 50 and covering approximately the southern two-thirds of the unit. This level contained large quantities of terracotta clods and distinct patches of rice chaff and appeared to represent accumulation of domestic debris and wall collapse antedating the
construction of Feature 50. Artifact quantities—especially slag, bone, and pottery—increased significantly with depth.

Level 3:
Division between this level and the preceding was made by a thin ash lens. However, texture and color of the soil were very similar to Level 2 and appeared, like that level, to represent slow accumulation from mud wall collapse and domestic activity. Some mixing may have occurred between Levels 2 and 3.

Level 4:
This was an arbitrary change made from Level 3. Level 4 was part of the same deposit as Level 3, but without the mixture of artifacts from Level 2. This represented considerably earlier material.

*Level 5:
Level 5 was made up of hard wall collapse similar to the previous three levels, but with significantly greater quantities of rice chaff and charcoal. It appeared to be rather slower accumulation than preceding levels, with more sorting of mud wall collapse. Radiocarbon Sample 66 was taken from a pocket of scattered wood charcoal measuring .60-by-.50-by-.05 m in the southwest corner of the level at 1.13 m depth. Confidence that the sample was free from contamination and was reliably associated with Level 5: good. The date obtained for the sample was 1310 ± 110 B.P. (RL 1578).

Feature 54:
This is a child burial in a carinated pot buried in Level 5.

Level 6:
This was a very compact light clay very similar to Level 5, but interrupted by many ash lenses of varying depths and many small ash-filled pits. More metal and significantly more pottery were recovered than in Level 5.

Feature 52:
Feature 52 was an enigmatic circular, yellow, clay feature, 0.51 m in diameter and 2 cm thick, composed of pure clay, with no associated artifacts.

Level 7:
Level 7 was a layer of friable, easily worked soil covering almost the entire unit. This was the upper part of a large pit containing charcoal and terracotta fragments in a matrix of ash.

Table Al: Description of Excavated Levels and Features: ALS and loam. At opening there were considerably fewer artifacts than in Level 6, but by the end of the level the quantity of pottery, bone, and fired clay pieces had picked up considerably. The lower part of this ash pit was excavated as Level 9.

Level 8:
Level 8 was a distinct peninsula of very hard, gold-colored earth with very few artifacts, penetrating Levels 7 and 9 and originating from the northwest and north central wall of the unit. This almost certainly represented earlier deposits into which Levels 7 and 9 were dug.

Level 9:
This level covered most of the unit, underlying Level 7 and adjoining Level 8. It appeared to be a continuation of the ash pit represented by Level 7 and dug into
Level 8. Like Level 7, Level 9 contained large quantities of ash and charcoal but only moderate amounts of pottery and bone.

Level 10:
Level 10 was a compact clay similar in color to Level 8 but containing abundant quantities of charcoal. Soil structure was markedly different from Levels 7 and 9. This level appeared to represent moderate to slow accumulation of domestic debris and structural collapse, with a good amount of light floodplain clay beginning to appear.

*Level 11:
Level 11 was very similar to Level 10 with perhaps more pottery, charcoal, and yellow/orange terracotta inclusions. With depth this became more and more like classic Phase I/II clay. Radiocarbon Sample 72 was collected from a general scatter in the eastern half of the unit between 4.28 and 4.35 m depth. Confidence in reliability of sample to date associated level: excellent. The resulting date was 1800 ± 120 B.P. (RL 1581).

Level 12:
This was a level of heavy clay similar to Level 11, but with less pottery and greater clay content. Level 12 was very compact and gold/brown in color, with significant quantities of bone and charcoal.

Level 13:
This was a level of heavy clay containing significant quantities of pottery, slag, and bone, as well as large chunks of burnt clay with mat-and-pole impressions. The clay matrix displayed a moderately laminar structure and was notable for the many lenses and inclusions of rustlike organic material. This level clearly consisted of debris accumulation and possibly also the disturbed remains of a domestic structure just above sterile floodplain alluvium. Cultural remains diminished abruptly just above floodplain level.

Level 14:
Sterile floodplain alluvium.

Table A1: Description of excavated levels and features: CTR
UNIT CTR
(Soil descriptions after Ahn 1970:19-21; * = C14 date for level)
Level 1:
Loosely compacted loamy sand; Munsell 10 YR 3/5. This level was composed of loose, highly disturbed surface soil containing discrete lenses of sand. It appeared to represent secondary erosion of wall collapse material from Houses 8 and 9. Within the area of Feature 12, soil was somewhat more friable than in the rest of Level 1. Artifacts overall were probably more recent than those dating to the use of Features 12 and 13.

Feature 12:
This feature was a small (1.6-by-1.2-m) rectangular structure of cylindrical mud bricks exposed on the surface of Unit CTR. Feature 12 overlay Feature 13 in the southwestern corner but appeared to be only slightly more recent.

Feature 13:
Feature 13, also known as House 9, was a small irregular wall of cylindrical bricks in the shape of the Greek letter X. This feature was associated with Feature 12 and its southern part was disturbed when Feature 12 was built.

Feature 14:
Light-gray loamy sand; no Munsell reading. This feature consisted of a small pit east of Feature 12, dug into the wall collapse of Level 2 and therefore postdating Feature 12. The lower part of Feature 14 was filled with almost pure blue-gray ash and the upper part with disturbed soil very similar to that of Level 1.

Level 2:
Moderately compact loam to light clay; Munsell 10 YR 6/4 to 10 YR 5/3. This level, to the exterior of the Feature 12 walls, contained a mixture of bricks and brick fragments with a significant amount of ash. Artifacts consisted almost exclusively of large sherds. Level 2 probably represented the rapid collapse of Features 12 and 13.

Level 3:
Moderately friable loamy sand; Munsell 10 YR 6/3. This level was inside the walls of Feature 12. Soil was broadly the same as Level 2, with a slightly platier structure and a greater concentration of large sherds. This appeared to be material accumulated after the abandonment of Feature 12.

Level 4:
Compact light loam to light clay; Munsell 10 YR 6/3. Level 4 underlay Level 2 and surrounded Level 5 and the walls of Feature 12. It was composed of a compact heterogeneous soil containing fragmentary wall collapse material. This level probably represented the original exposed surface when Features 12 and 13 were erected and also probably the surface into which Level 8 was excavated. The considerable admixture of more recent material in this level particularly several sherd concentrations which resembled those from Level 5 and may pertain to the construction of Features 12 and 13—may have resulted from this activity. Level 4 contained unusually large amounts of slag.

*Level 5:
Loosely compacted loamy sand; Munsell 10 YR 6/3. This level covered the area within he walls of Feature 12. It was beneath and older than Level 3, beginning just below the level of the Feature 12 walls. Although more loosely compacted, soil from this level otherwise resembled that of Level 4, located at the same depth on the outside of Feature 12. Like Level 4, Level 5 contained older material mixed with large sherds dating to the erection of Feature 12, and some artifacts probably lost during the lifetime of that structure. Radiocarbon Sample 20 was collected from a discrete pocket of wood charcoal measuring .30-by-.30-by-.10 m at 0.43 m depth. Confidence that the sample was reliably associated with Level 5 and was not contaminated: very good. The resulting date is 1,060 ± 110 B.P. (RL 1571).

Level 6:
Hard to moderately compact loamy sand; Munsell 10 YR 5/3. Level 6 covered the entire unit except for the area of Level 5 and appeared to be debris from mud wall collapse, with some small fragments of brick visible. The soil matrix was quite homogeneous, implying a slow period of accumulation. Ash lenses at the bottom of the level marked a sharp discontinuity with Level 7.

Level 7:
Moderately friable loamy sand with ash; Munsell 10 YR 6/2. This was a very heterogeneous and badly disturbed level. The greater part of the unit was moderately friable loam and ash, with many scattered burnt patches. In the northeast corner was a concentration of cylindrical mud bricks, perhaps a disturbed wall, but more probably the fill of a small pit. The urn burial of Feature 22 was dug into this level.

Level 8:
Extremely friable loamy sand to pure ash; Munsell 10 YR 7/2. This deep pit, filled with almost pure ash containing many large sherds and clods of burnt earth, was a continuation of Level 5. The ash fill extended from a depth of 0.75 m to 2.5 m below the point of origin, contained within the area originally defined by Feature 12.

Level 9:
Very friable light loam and ash; Munsell 10 YR 6/2. Level 9 was an extremely heterogeneous mixture of ash, light sandy loam, and pottery concentrations. It was clearly composed of household ash and domestic debris and appeared to have been deposited very rapidly. Level 9 closely resembled Level 7 and may have been a continuation of that deposit, although it also appeared to have some association with Level 10.

Level 10:
Very friable light loam and ash; Munsell 10 YR 5/3. This level consisted of a rapid accumulation of very powdery ash, burnt debris, and loam, interrupted here and there by patches of burnt earth and harder loam terraces. Artifacts probably included some mixture of Level 9 material at the top. This level represents the fill for the pit dug for the Feature 23 burial urn.

Level 11:
Moderately soft sandy loam and ash; Munsell 10 YR 6/4. This was a level of highly heterogeneous ash mixed with large chunks of hard earth. With depth, the soil became a mangle of microlenses containing much sand and rice chaff. Like Level 10, with which it was probably contemporary, Level 11 appeared to be fill for a funerary interment pit.

Level 12:
Loamy sand matrix with bricks; Munsell 10 YR 7/4. This was a small pit, 1.07- by-1.48 m, dug into the northeastern corner of the unit and filled with unbroken cylindrical mud bricks. This pit was excavated into the tauf wall feature of Level 13 and had been disturbed by Level 11.

Level 13:
Compact light loam; Munsell 10 YR 6/4. Level 13, covering the northern and eastern sectors of the unit, was a level of hard, homogeneous loam which appeared to be made up of collapsed wall material. In the northeast corner were
one or possibly two parallel curvilinear lines of somewhat harder material. The width between these lines and the heavy admixture of rice

Table A1: Description of excavated levels and features: CTR chaff in the loam between them strongly suggested that they were the remains of tauf foundations.
Level 14:
Friable loamy sand; Munsell 10 YR 5/3. This level comprised the upper fill of an interment pit containing the urn burial labeled Feature 24. Pit fill was ash and sand similar to that of Levels 10 and 11. This pit had been dug into Level 13 and appeared to antedate the deposition of Level 9.
Level 15:
Very friable loamy sand; Munsell 10 YR 5/3. Level 15 was probably a continuation of Level 11, extending into the southwestern and west central part of the unit. Soil was soft and ashy and contained large amounts of grain chaff and bone. This level had been dug into Levels 13 and 16.
Level 16:
Rather compact loamy sand to loam; Munsell 10 YR 6/2. Level 16 underlay Level 13 throughout the unit. Soil was similar to that of Level 13 but was far less homogeneous and came up in distinct sheets containing many fine ash lenses and much rice chaff. This was classic wall collapse material (without, however, distinct bricks or wall chunks visible) mixed with domestic debris. Clay content increased with depth.
Level 17:
Friable light loam and ash; 10 YR 6/2. This was an ash-filled pit dug into the northeastern corner of the unit. Level 17 was originally dug into Level 16, although some intermingling of deposits in the upper part of the pit suggests that the two may have been close in age. Level 17 was subsequently disturbed by Levels 12 and 19.
Level 18:
No Ahn or Munsell readings. This level formed the top of the Level 17 ash pit. It was probably younger than Level 17 and may have contained some artifacts mixed in when Levels 12 and 19 were deposited.
Level 19:
Friable loamy sand and ash; Munsell 10 YR 6/2. Level 19 was the lower ash fill of an interment pit in the center of the unit, containing Urn Features 22 and 24 and perhaps also 23.
Feature 22:
Feature 22 was the westernmost of the three funerary urns found in the center of the unit. It consisted of a large funerary urn, 52 cm in height, which had been covered with an inverted carinated pot. Fragments of badly deteriorated bone were found in the bottom 10 cm of the urn. Fill level associated with Feature 22 is Level 19.
Feature 23:
This was the northernmost of the three central funerary urns. Feature 23 was associated with Level 10.
Feature 24:
Feature 24 was the southeasternmost of the three burials in Unit CTR, comprising an urn 44 cm in height covered with both a pot lid and an inverted carinated pot. Feature 24 was associated with fill Levels 11, 14 and 15.

Table A1: Description of excavated levels and features: CTR

Level 20:
Soft loam and ash; Munsell 10 YR 6/4. This was another small pit dug into Level 16 in the northeastern corner of the unit. Level 20 was associated with but appeared to antedate Level 17.

Level 21:
No Ahn or Munsell reading. Level 21 was a terrace of very compact earth, apparently a floor, which extended along the east central wall of the unit at the base of Level 16. It appeared to be fire-hardened and contained reddish inclusions similar to those found in floodplain soil. Material from this level appeared to be earlier than material recovered from Level 16 at the same depth.

Level 22:
Rather friable loam to loamy sand; Munsell 10 YR 6/4. This was a level of relatively soft loamy sand and domestic debris underlying Level 21. Level 22 contained many more sherds than nearby levels.

Feature 25:
No Ahn or Munsell reading. Feature 25 was a shallow ash pit, c. 0.5 m in diameter, which had been dug into Level 22.

Level 23:
Compact clay to loamy sand; Munsell 10 YR 5/4. This was a classic horizon of slow accumulation wall collapse, similar to Level 16 above it. It was very compact and contained much dispersed charcoal and rice chaff.

Level 24:
Soft light loam and ash; Munsell 10 YR 7/3. This level appeared to be the western edge of a pit located in the east central sector of the unit and extending into the eastern profile. Level 24 was dug into the wall collapse of Level 23 and was filled with ash, charcoal, rice chaff, and chunks of Level 23 material. Several human phalanges suggested that it may have been part of an inhumation pit. This level contained large amounts of pottery.

*Level 25:
Friable sandy loam and ash; Munsell 10 YR 6/2. This was the comparatively hard topmost layer of a large pit which was continued in lower levels as Levels 27, 29, 31, 33, and 35. Level 25 covered the southern part of the unit at the same depth as Level 23. Deposits consisted of a mixture of Level 23 material with ash and charcoal similar to that of Levels 27 and 29. Radiocarbon Sample 38 was collected from a dense pocket of rice husks and charcoal between 2.24 and 2.33 m depth. Confidence in the sample to reliably date Level 25 was good. The resulting date is \( \text{1,590 + 110 B.P. (RL 1573)} \).

*Level 26:
Compact light loam to loam; Munsell 10 YR 5/3 to 6/3. Level 26 underlay Level 23 throughout the unit. It was composed of clayey wall collapse material very
similar to that of Level 23, although the soil was slightly softer and was characterized by pink/red burnt patches, especially in the southeast corner. Level 26 was opened as an arbitrary level change from Level 23 and was combined with it for analysis. Radiocarbon Sample 45 was collected from a pocket of large chunks of wood charcoal at 2.8 m depth. Confidence in the quality and reliability of the sample was excellent. The resulting date is 1,860 ± 120 B.P. (RL 1574).

Level 27:
Friable light loam to loam, with ash. Munsell 10 YR 5/3. Level 27 was a continuation of the refuse pit first encountered as Level 25. Deposits consisted of ash and dispersed charcoal.

Table A1: Description of excavated levels and features: CTR

Level 28:
Very compact clay; Munsell 10 YR 5/8. This level underlay Level 26 throughout the unit. Soil was extremely compact, contained many inclusions, and in places was olive-colored and mottled red. A distinct hard burnt floor was exposed at the very bottom of the level. It seems likely that Level 28 was the original living surface associated with the structure whose collapse was represented by Levels 23 and 26. The absence of any visible wall foundations may indicate that the structure was of tauf construction.

Level 29:
Soft ash and heavy loam; Munsell 10 YR 7/4. This was a continuation of the pit feature already seen as Levels 25 and 27, and was combined with those levels for analysis. With depth this feature narrowed and ash content declined in favor of a greenish heavy loam.

Level 30:
Friable loamy sand and ash; Munsell 2.5 Y 5/4 to 5/6. This was a second pit in the northeast corner of the unit, dug into and disturbing Levels 26, 28, and possibly the lower part of Level 23. The pit was filled with ash, charcoal, and chaff/grass.

Level 31:
Friable light clay mixed with ash; Munsell 10 YR 6/4. Level 31 was located in the southeastern corner of the unit at the same depth as Level 28 and the lower part of Level 26. This level was the southeastern edge of the large pit feature previously excavated as Levels 25, 27, and 29. It was filled with powdery ash mixed with chunks of hard greenish earth which may have been tauf wall fragments.

Level 32:
Compact light clay to clay; Munsell 10 YR 6/3 and 2.5 Y 7/4. Level 32 was a level of slow collapse material and domestic debris, underlying the wall collapse/occupational surface of Levels 26 and 28 but quite distinct from them. This level was classic Phase I/II material, composed of hard olive-brown clay with much charcoal and organic material and several patches of ashy grass. From the southeast corner came many chunks of wall material with matand-pole impressions. Patches of burnt clay and limonite/indurated quartz inclusions increased noticeably below a depth of c. x3.2 m.

Level 33:
Moderately compact light loam; Munsell 10 YR 6/3. Level 33 underlay Level 29 within the large pit feature in the southern sector of the unit. Pit fill at this level consisted of a platy, moderately compact light loam with charcoal admixture. Level 33 yielded significant amounts of pottery and slag, as well as numerous clods of burnt earth which may have been daga wall fragments. Artifacts from this level included some material probably originating in the surrounding Levels 34 and 36.

Feature 45:
Ash lens separating Levels 32 and 34.
Level 34:
Compact light clay; Munsell 10 YR 7/4. Level 34 consisted of classic Phase I/II material composed of clay with ash lenses and chunks of mat-and-pole walling. Like Level 32, which it underlay, it surrounded the southern pit deposits at the depth of Levels 33 and 35. It was very similar to Level 32 (although with fewer artifacts) and identical to Level 36.

*Level 35:
Loam to light loam and ash; Munsell 2.5 Y 5/4. This level continued the southeastern pit feature below Levels 31 and 33. Fill in Level 35 consisted of soft loamy sand mixed with charcoal, ash, chunks of bricklike clay, and concentrations of fish bone. Radiocarbon Sample 49

Table A1: Description of excavated levels and features: CTR
was collected from a heavy concentration of wood charcoal at 3.41-3.51 m depth. Confidence in the quality and reliability of the sample to date the level was excellent. The resulting date is 1,310 ± 120 B.P. (RL 1575).

Level 36:
Very compact light clay; Munsell 10 YR 7/4. This level was a continuation of the clayey Phase I/II material of Level 34. Soil became slightly less compact with depth, especially in the southern part of the unit.

*Level 37:
Friable loam to light loam; Munsell 2.5 Y 5/4. This level was part of an early large pit feature, covered initially by Level 32, into which Levels 33 and 35 had later been dug. Feature 45 may represent the top level and overflow from this pit. The top of Level 37 was quite ashy, but with depth it became more compact, with increasing numbers of mat-and-pole impressed clods. The quantity of bone, ash, and burnt earth fragments increased significantly below a depth of c. x4. m.
Radiocarbon Sample 53 was collected from a central area of the level where charcoal was concentrated in an area .20-by-.30-by-.10 m at 3.7 m depth. The quality and reliability of the sample to date level 37 appeared to be excellent. The resulting date is 1,790 + 120 B.P. (RL 1576).

Level 38:
Very compact clay with yellow inclusions; Munsell 10 YR 8/2 to 5/4. This was classic sterile floodplain alluvium. It contained an insignificant number of sherds, probably transported down from overlying cultural deposits by natural agents.

Level 39:
Friable loamy sand; Munsell 10 YR 7/3. This was the bottom level of the deep pit begun as Level 37. Level 39 had been dug into sterile floodplain alluvium. Extraordinary quantities of pottery and terracotta clods (some with distinct mat-and-pole impressions) were recovered from the floor of the pit, just below floodplain level. At this depth, Level 39 contained significantly greater amounts of slag than in its upper levels, but less charcoal and fish bone.

422 Table Al: Description of excavated levels and features: HAMB
UNIT HAMB
(Description of soil texture after Ahn 1970:19-21; * - C14 date for level)
Level 1:
This was classic disturbed and badly eroded surface material composed of a somewhat friable, badly leached sandy loam. The surface was covered by a thick blanket of sherds.
Level 2:
Soil in this level was a chunky, sandy light loam with charcoal flecks dispersed throughout. At the top, Level 2 covered the entire unit, but in the south and east it quickly came down on Level 3, an ash pit which had been dug into the lower part of Level 2. With depth, Level 2 became ashier and contained many burnt sandy patches.
Level 3:
This was a pit feature dug into Levels 2 and 5 and slightly mixed with material from Levels 2 and 4. The pit was filled with hard earth clods in a greenish ashy matrix and contained many pieces of burnt earth. Except for one pottery concentration in the southeast corner, artifact content decreased with depth. Sand content was high throughout.
Level 4:
Level 4 was the continuation of the pit feature dug into Level 5. It was associated with, but probably older than, Level 3. Soil was less greenish and less ashy than that of Level 3. In the lowest part of the level it was reddish, mottled, and somewhat friable.
Level 5:
Level 5 consisted of wall collapse material which had been slowly accumulated over a long period of time. Very probably this level was exposed as the surface of the settlement for a considerable period. This level probably represented a definite horizon which we can expect to find elsewhere at Hamarketolo.
Level 6:
This was part of the same horizon first encountered as Level 5. Soil was a homogeneous, light reddish brown moderately compact loam, somewhat crumbly in texture. Sand content increased with depth.
Level 7:
This level, opened as a more or less arbitrary level change from Level 6, appeared to be a continuation of the same horizon as Levels 5 and 6. Soil was compact and homogeneous but was slightly sandier than Level 6 and contained more red and yellow inclusions.
Level 8:
This level continued the trends noted in the previous three levels and appeared to be part of the same horizon. With depth, the soil became sandier and generally more friable, and the number of inclusions declined. Level 8 was opened as an arbitrary level change from Level 7, and was combined with it for analysis.

Level 9:
Soil in Level 9 was more friable and sandier than Level 8, with a definite platy texture and a noticeable increase in sand at the bottom of the level. Quantities of sherds and bone showed a significant rise. This level was clearly related to Levels 7 and 8, perhaps as part of the same horizon, but the differences were significant enough to warrant its treatment as a separate level.

Table A1: Description of excavated levels and features: HAMB
*Level 10:
This level was very similar to Level 9, although somewhat less clayey and with some charcoal content. At the very bottom it contained much chaff, many sherds, and dispersed charcoal. Level 10 was combined with Level 9 for analysis.

Radiocarbon Sample 65 was collected from a concentrated pocket of wood charcoal at 1.55-1.60 m depth. Confidence in quality and reliability of sample at time of collection was good. The resulting date is 1,220 + 110 B.P. (RL 1577).

Level 11:
Level 11 was very friable and sandy, and contained dispersed charcoal and rice chaff. It completely covered Level 12 and formed a clear discontinuity between Levels 10 and 12. Level 11 also covered and was clearly related to the urn burials excavated as Feature 51. It appeared to be a layer of artificial fill which had been used to fill in and cover the site of those burials.

Feature 51:
This feature consisted of two urn burials which had been placed in trenches excavated into Level 12. Only the northernmost of the two burials was excavated, as the other was too firmly embedded in the south wall of the unit to be excavated. The excavated burial was in two funerary urns placed mouth-to-mouth, with the body extended inside. Fill in the trenches surrounding the burials consisted of disturbed Level 11 material. Both urns were crushed, suggesting that the trench excavation was quite shallow and that Level 11 remained the surface of the settlement for some time thereafter.

Level 12:
This was another true, slow accumulation horizon into which the trenches for Feature 51 had been dug. Soil was a very compact homogeneous dark-brown clay and showed a sharp discontinuity from the sandy fill of Level 11.

Level 13:
Level 13, opened as an arbitrary level change, was a continuation of the horizon represented by Level 12. Soil was essentially the same as Level 12, although becoming slightly sandier with depth. Level 13 was combined with Level 12 for analysis.

Level 14:
This level marked the transition from the clayey soils of Levels 12 and 13 to the ashy material of Level 15 below. Deposits in Level 14 were still rather clayey, but
pottery yield was much higher than in preceding levels and a distinct ash lens was encountered in the eastern part of the unit. Soil was generally soft, brown, and ashy, with discrete pockets of clay and rice chaff.

Level 15:
Level 15 was a true ash horizon which appeared to be the result of a short period of massive ash accumulation. This level was somewhat mixed with Level 14 material and was probably quite close chronologically to that level. Soil in Level 15 was red, powdery, and, like Level 14, mottled with patches of clay. A pocket of burnt earth was encountered in the northeast corner. At the bottom of the level the soil changed to a pure black ash containing very large sherds.

Level 16:
This level consisted of patches of pure ash, very similar to that at the bottom of Level 15, covering most of the unit.

Level 17:
Level 17 represented the bottom of the ash episode first recognized with Level 14. Soil consisted of ash and red burnt earth mixed with plain yellow clay, with the lower part of the

424 Table Al: Description of excavated levels and features: HAMB level composed of a very white homogeneous ash. Level 17 was combined with Level 16 for analysis.

Level 18:
This level represented the transition from the ash of Level 17 to the heavier soil of Level 19 below. Soil was a moderately compact mottled ash and clay, containing none of the pure ash found in Level 17. Clay content increased with depth. Level 18 contained some mixture of artifacts from surrounding levels.

Level 19:
Level 19 marked the start of a new horizon, but it still displayed some ash from Level 18 and was somewhat heterogeneous in nature. Soil consisted of a reddish dark-brown heavy loam/light clay mottled with white clay, patches of burnt earth, and occasional orange inclusions.

Level 20:
This was a small ash lens, c. 10 cm thick, in the southwest corner of the unit at the same depth as Level 19.

Level 21:
Level 21 was a true horizon of very hard clay with many inclusions and dispersed charcoal. At the top of the level this was overlain by a distinct lens of sterile clay c. 5 cm thick. This thin lens was the only indication at either Jenn6-jeno or Hambarketolo of possible temporary abandonment of occupation on any part of the site. The lens may, however, have been intentionally created.

Level 22:
Level 22 was classic Phase I/II material composed of a compact reddish light clay/heavy loam with ash intrusions. It was nearly identical to Phase I/II levels from Jenn6-jeno.

Level 23:
This level was opened as an arbitrary level change from Level 22. Soil was a chunky heavy loam/light clay with significant amounts of charcoal, many furnace parts and slag, and a sherd concentration in the southeast corner. Level 23 was combined with Level 22 for analysis.

*Level 24:
Soil in this level changed to a friable, ashy loam with great quantities of ash, slag, animal bone, and ceramics. This was classic Phase I/II material also. Wood charcoal for radiocarbon Sample 70 was collected from an area between 3.80-3.90 m depth in the northeast quadrant of the unit. Confidence in the quality and reliability of the sample to date the level was very good. The resulting date is 1,750 ± 100 B.P. (RL 1580).

Level 25:
This was the lowest level in Unit HAMB. Soil was a dark olive-brown clay, very moist and containing a significant amount of ash. Sherd yield increased dramatically at the very bottom of the cultural deposits. In the lower part of the level, cultural deposits graded into sterile floodplain alluvium. Level 25 was taken to a depth of x4.84 m (0.5 m below the lowest cultural deposits) to confirm sterility.

Table A1: Description of excavated levels and features: HK

UNIT HK
(Soil descriptions after Ahn 1970:19-21)

Level 1:
Compact loamy sand; Munsell 10 YR 7/4 to 6/4. This level consisted of badly eroded sunbaked surface material covering the entire unit. It contained many quartz and clay inclusions. In compactness and inclusion content this level more closely resembled the surface of the "cemetery" Unit JF1 of the 1977 season than it did the "residential" Units LX-N and LX-S.

Level 2:
Very compact light loam; Munsell 10 YR 7/4. Soil in this level came up in thin horizontal sheets and was far harder than Level 1. Level 2 yielded little pottery and even less with depth. It appeared to be the remains of slow melt of mud structures, perhaps an indication that the majority of structural decay in this area occurred only after abandonment.

Level 3:
Compact light loam; Munsell 10 YR 7/4. Level 3 marked a clean discontinuity with Level 2. Overall, this level was just as compact as Level 2, but the soil was far more heterogeneous, with the compact matrix interrupted by frequent patches of soft ashy soil and spots of fire oxidation. A possible wall in the east center of the unit was too indistinct to be confirmed.

Feature 5:
This was a female (?) inhumation in a slightly flexed position, resting in a shallow trench dug into Level 3. Depth of the burial was x0.33-x0.53 m, with the skull resting at north 0.71 m and east 2.22 m from the point of origin. A large quantity of fish bone was noted in the fill near the skeleton.

Level 4:
Moderately compact light loam; Munsell 10 YR 7/6 to 6/6. Soil in this level was brownish yellow and flaky in texture, rather than platy or laminar as in previous levels. It was less compact than Level 3 and contained occasional patches of burnt earth. The top of this level had the appearance of a long-exposed surface, possibly in a residential setting, since the soil resembled that of LX-N/LX-S and other residential units rather than that at the cemetery site JF1. With depth, there was an increase in slag and a significant increase in the amount of pottery recovered.

Level 5:
Moderately compact loamy sand; Munsell 10 YR 6/6. Level 5 appeared to be classic moderately slow wall collapse with a great deal of domestic trash. Soil was harder than in Level 4, and artifact quantities, especially pottery and slag, picked up considerably. There were also many terracotta chunks. A very compact feature in the southeast corner of the unit may have been a wall, but no distinct wall shape or brick could be distinguished.

Level 6:
Moderately compact loam to light clay; Munsell 10 YR 6/3 to 5/3. Texture in this level was heterogeneous, dark, and chunky with several more oxidized patches scattered throughout. One of these patches resembled a hearth in size and shape but contained no charcoal. Soil became more friable toward the base of the level, and artifact density began to decline. A distinct north-south tilt of strata noticed in the western part of the unit could not be traced across the rest of the exposure.

Level 7:
Light clay; Munsell 10 YR 7/4. This appeared to be the lowest occupational level at Unit HK. The soil came up in large chunks and in general was of extremely variable compactness, ranging from very ashy in some places to quite hard in others. It contained dense quantities of red quartz/clay inclusions and much smaller amounts of pottery than previous levels. The 450 north-south tilt of strata noted in Level 6 continued in the western part of Level 7. This may represent the original topography of this part of the site, before settlement expanded southward into the area of Unit HK.

Level 8:
Clay to light clay; Munsell 10 YR 6/6 to 5/4. This level and the next were completely sterile. Soil consisted of a very dense, chunky clay with many large red inclusions. It was less compact and sandier than the sterile floodplain alluvium found in all the other units at Jenndjeno and Kaniana and probably represented a light clay levee underlying the cultural deposits at Unit HK.

Level 9:
Clay; Munsell 10 YR 6/2. This level was a continuation of the apparent levee structure encountered in Level 8. Color was mottled red and gray, as opposed to the uniform red stain of Level 8. Texture was identical to Level 8 through most of the level but showed an increase in pure, fine, homogeneous clay at the very bottom. Like Level 8, Level 9 was completely sterile.

426 Table Al: Description of excavated levels and features: HK

Table Al: Description of excavated levels and features: KAN
UNIT KAN
Soil descriptions after Ahn 1970:19-21; * - C14 date for level)
Level 1:
Sand to sandy loam; Munsell 10 YR 7/3. This was typical surface material, composed of extremely compact silt with evidence of reworking by wind and water. The uppermost part of the level contained a high percentage of fine sand, which changed to sandy loam with depth. This material in turn showed a clean discontinuity with the softer levels below. Level 1 contained large amounts of slag and numerous furnace parts, although the furnace from which these materials derived was not found within the area of Unit KAN.
Level 2:
No Ahn reading; Munsell 10 YR 7/4. Level 2 covered the northern two-thirds of the unit at the same depth as Level 3. Soil was softer and darker than Level 1 and had a distinct laminar structure. The matrix contained charcoal, rice chaff, large pottery sherds, and many nearly whole cylindrical bricks. There were several patches of powdery dark-gray ash and fireoxidized earth. The boundary with Level 3 was a distinct curvilinear line of fire-oxidized cylindrical bricks, suggesting the possibility that Level 2 may have been the southern edge of the interior of a round house. On stratigraphic evidence, however, it seemed far more likely that this was the upper level of a pit feature which had been filled in with structural remains and domestic refuse. Subsequent parts of this pit were excavated as Level 4.
Level 3:
Heavy loam to clay; Munsell 10 YR 7/2. This level consisted of a very hard clay and heavy loam, containing many red inclusions and lacking the laminar structure of Levels 2 and 4. Level 3 covered the southern third of the unit and contained far fewer and more fragmentary bricks than Level 2. It was probably the original surface into which the pit feature of Levels 2, 4, and 5 was dug.
Level 4:
No Ahn reading; Munsell 10 YR 6/2 to 5/2. This level was the lower part of the pit feature whose upper level was excavated as Level 2. Soil was friable, laminar, somewhat ashy, and softer even than the soft matrix of Level 2. At the top, Level 4 contained many large and often loaf-shaped mud bricks, some of which were fire-oxidized. These bricks measured, on average, 23-by-16-by-10 cm, as opposed to the standard cylindrical brick diameter of c. 10-12 cm. Radiocarbon Sample 67 was collected at the interface of Levels 4 and 5 from a lens of wood charcoal at 0.87 m depth. Confidence in reliability and quality of sample was very good. The resulting date is 1,210 ± 110 B.P. (RI 1579).
Level 5:
Loam to light clay; Munsell 10 YR 6/6 to 6/4. The matrix in Level 5 was a sandy light loam in strong laminae. It contained large quantities of burnt earth, charcoal, and large sherds at the top but became more and more like classic floodplain material with depth. The artifacts at the top of the level appeared to be associated with the pit feature of Levels 2 and 4, but the bottom of this pit could not be distinguished during excavation.
Level 6:
No Ahn or Munsell reading. This was a small, straight-sided ash pit, c. 90 cm deep, which had been dug into Levels 2, 4, and 5 in the north central sector of the unit. This feature appeared to begin at the interface of Levels 1 and 2.

**Level 7:**
Clay; no Munsell reading. Level 7 was classic floodplain clay, containing rather more sherds and disturbances than this alluvium typically has at Jenn4-jeno. This was disturbed by

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**428 Table Al: Description of excavated levels and features: KAN**

The remains of hearths such as Feature 53. These disturbances suggest that the Kaniama region was used by mobile groups for their temporary camps before permanent occupation began.

**Feature 53:**
This feature was a patch of red fire-oxidized earth, ash, and charcoal, encountered approximately midway through the excavated deposits of Level 7. It probably represented a temporary camp hearth.

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**Table Al: Description of excavated levels and features: LX-N**

**UNIT LX-N**
(Soil descriptions after Ahn 1970:19-21; * = C14 date for level)

**Level 1:**
Compact loamy sand to light loam; Munsell 10 YR 7/3. The surface level of Unit LX-N consisted of a compact dusty sand in tiny grains, significantly disturbed by postabandonment intrusions and exhibiting a distinct laminar structure suggesting rework by wind or water. This level was formed by the slow to moderately slow accumulation of wall collapse from House 1 (Feature 1.) Aside from one concentration of bricks in the northeast corner, it contained few discernible bricks and none of the domestic debris usually associated with accumulation around a house during its occupation.

**Level 2:**
Very compact loamy sand to light loam; Munsell 10 YR 6/3. Level 2 covered the threequarters of the unit to the east of the north-south wall of House 1 and consisted of the relatively rapid accumulation of wall collapse above the original house floor. Soil was a very hard light loam containing many distinct cylindrical bricks (especially in the northeast corner) and many small sherds which probably were originally included in the building material. With depth, Level 2 was limited in the south by the appearance of the slightly earlier eastwest wall of House 1. It ended at c. xO.35 m in a clear discontinuity with the friable material of Level 4, the apparent floor of House 1. Two sandstone grinders found at the bottom of Level 2 may have been associated with this floor.

**Level 3:**
Moderately friable loam; Munsell 10 YR 6/4. Level 3 covered the one-fourth of Unit LX-N west of the north-south wall of House 1 and appeared to represent the slow accumulation of domestic debris to the exterior of the house during the period when it was in use. Soil was extremely heterogeneous, rather friable, and platy in structure and contained little wall collapse material. This level almost
certainly also contained some mixture of artifacts deposited after House 1 was abandoned.

*Level 4:
Moderately compact loamy sand to light loam; Munsell 10 YR 6/4. Level 4 underlay Level 2 in the area north and east of the two walls of House 1. It probably represented the floor inside that structure during occupation and at the time of abandonment. Soil was a moderately compacted fill with less evidence of wall collapse than in Level 2. Some of this material continued to a depth below the lowest bricks of the (more recent) north-south wall, while still flush with those of the east-west wall. This raised the possibility that Level 4 antedated the construction of the north-south wall and may even have originally been on the exterior of an earlier building represented by the L-shaped east-west wall. There was, however, no stratigraphic evidence of changes in deposition which might be expected to accompany such a change in function. Radiocarbon Sample 2 was collected from a small pocket of charcoal at 0.52 m depth. Confidence in the sample to reliably date Level 4 was very good. The resulting date is 550 ± 100 B.P. (RL 1616).

Level 5:
Compact light loam; Munsell 10 YR 6/3. Level 5 consisted of a level of hard fill to the south of the east-west wall of House 1, and at the same depth as Level 4. Soil was heterogeneous, with many lenses of varying compactness and more broken wall collapse and fragmented sherds than in Level 4. This level clearly represented an original surface dating to the occupation of House 1. While it is possible that Level 5 represented a floor within an earlier structure represented by the east-west wall, the nature of the deposit suggested that it was more probably composed entirely of external occupational debris. This would situate the interior of House 1, in both its earlier and later stages, to the north of the east-west wall in the area of Levels 4 and 7.

430 Table Al: Description of excavated levels and features: LX-N
Level 6:
Friable light loam; 10 YR 6/4. Level 6 underlay Level 5 in the southeast sector of the unit. It was south of the east-west wall of House 1, and below the depth of the lowest bricks of that wall. Soil was composed of a maze of thin horizontal lenses, all generally softer than Level 5 and containing great quantities of rice chaff and pottery. This level either represented the original material upon which House 1 was constructed, or the rapid deposition of domestic waste outside House 3 (Feature 3) of Unit LX-S.

Level 7:
Compact loamy sand to light loam; Munsell 10 YR 6/4. Level 7 underlay Level 4 to the northeast of the two walls of House 1. Soil was a sandy, platy loam with patches of gray ash and charcoal which increased with depth. This level was probably the original floor of House 1, contemporary with Level 5 to the exterior of that structure, although the possibility exists that it may have been an exterior surface before the construction of the later north-south wall.

Feature 1:
This feature, labeled House 1, appeared on the surface of Unit LX-N as an L-shaped foundation of irregular cylindrical bricks. Excavation showed it to be a rectilinear foundation with walls constructed of two types of cylindrical bricks. These appeared to reflect two separate building episodes, although this could not be confirmed by changes in the miscellaneous deposits inside or outside the walls. The earlier, east-west wall ran from the east central edge of the unit almost to the southwest corner, before forming a right angle and disappearing into the southern baulk. This wall was composed of small, regular bricks ending at a somewhat lower level (x0.4 m in the south and x0.53 m in the east) than those of the later, north-south wall. The north-south wall ran slightly south-southeast across the west central part of the unit and intersected the east-west wall in a well-bonded joint in the southwestern corner of the unit. This wall was constructed of highly irregular and generally larger bricks which extended to a depth of only c. x0.3 m.

Level 8: Compact loamy sand; Munsell 10 YR 5/4. Level 8 covered the eastern two-thirds of the unit, east of Level 3 and underlying Level 7. Soil was heterogeneous, rather compact but brittle in structure, and contained many sherds. This was the fill upon which House 1 was built.

Level 9: Friable loamy sand mixed with ash; Munsell 10 YR 6/3 and 2.5 YR 6/4. This level had a distinctive soft, mottled matrix, characterized by the flaky structure usually associated with water-deposited material. It contained many patches of ash and was rich in bone, pottery, bright orange terracotta clods, rice, and possibly millet. A large number of quartzite flakes may have been debris from the manufacture of beads. This level was associated with Feature 8 and may have been waste deposits outside a workshop.

Feature 8: Feature 8 (House 14) consisted of two adjacent wall stumps of cylindrical bricks penetrating Unit LX-N from the center of the south baulk. The easternmost of these extended from x0.55 m to x0.66 m in depth and the westernmost extended from x0.79 m to x0.87 m. The relationship of these stumps to each other and to the various house remains of Units LX-N and LX-S was far from certain. One or both of them may have been associated with House 5 (Feature 9) of Unit LX-N, or with House 3 (Feature 3) or House 6 (Feature 10) of Unit LX-S. The excavators' suspicion was that the lower stump was a true wall related to House 6 only, and that the upper stump was in fact wall collapse from the lower. This interpretation could not be independently confirmed.

Table A1: Description of excavated levels and features: LX-N

Level 10: Rather compact loamy sand; Munsell 10 YR 5/4. This level was classic wall collapse material, composed of moderately slow to slow accumulation from the postabandonment decay of House 5 (Feature 9). Soil was platy and heterogeneous, with many artifacts and burnt clay clods.

Level 11:
Friable loamy sand to light loam; Munsell 10 YR 6/3 to 5/3. Level 11 was a mixture of wall collapse and domestic debris located to the south and east of the two walls of House 5, in what would have originally been the interior of that structure. Soil was far less compact than normal slow or medium wall collapse, with an unusually high ash content and many large sherds. This level appeared to be a combination of wall collapse from House 5 in the upper part of the level, and occupational debris from inside the house in the lower part. Part of the original surface on which the house was constructed may also have been excavated with the lowest part of this level.

Feature 9:
This feature, labeled House 5, was a rectilinear structure composed of two narrow walls of cylindrical bricks. The bottom of the bricks was at a depth of x0.80–x0.84 m. This was an unusual feature, being only two bricks wide and including an unusual number of burnt clay clods and fired bricks.

Level 12:
Moderately compact loamy sand to light loam; Munsell 10 YR 6/4 to 5/3. Level 12 covered two-thirds of the unit to the north and west of House 5 and represented the original surface into which the foundation trenches of that structure were dug. Soil was heterogeneous and had the appearance of a long-exposed surface, with numerous interfingerinng lenses of ash and burnt earth, and plates of water-deposited clay. Level 12 contained few sherds at opening, but quantities of both ceramics and terracotta clods increased with depth. Together with Level 13, this level formed an apparent horizon separating the levels associated with House 10 (Feature 20) from the later building episodes of Levels 1-11.

Level 13:
Loamy sand becoming loam with depth; Munsell 10 YR 6/3 to 5/3. This level covered the entire unit. It was clearly related to Level 12, with which it was combined for analysis. Soil was very soft and mottled with ash and burnt sandy loam. It contained numerous termite runs and many localized patches of laminar water-borne clay, suggesting exposure on the surface. Artifacts included large quantities of rice chaff and terracotta clods and, at the top, large amounts of pottery which decreased in size and number as excavation continued. Like Level 12, Level 13 represented the slow accumulation of seasonal wall wash along with large quantities of peripheral activity and trash accumulation. These two levels combined appeared to represent the exposed surface of a settlement with buildings nearby. This horizon ended at the bottom of Level 13 in a slight but discernible transition to the House 10 wall collapse of Level 14. Radiocarbon Sample 18 was collected from a pocket of charcoal measuring .20-by-.20-by-.10 m at 1.19 m depth. Confidence in the quality and reliability of the sample to date level was excellent. The resulting date is 790 ± 100 B.P. (RL 1617).

Feature 26:
This feature consisted of a badly disturbed skeleton interred in a pit which had subsequently been filled in with brick rubble. The pit originated in the northeast corner of Level 13 at a depth of x1.25 m. It extended down into Level 24, with the skeleton resting at a depth of x2.08-x2.12 m.
Level 14:
Loosely compacted light loam to loam; Munsell 10 YR 6/3. Level 14 consisted of loosely compacted probable wall collapse, covering the entire unit outside the small area covered by Level 15 in the northeast corner. Soil was very ashy and heterogeneous, with relatively few sherds but many terracotta clods. These latter were probably fragments from the three House 10 ovens (Features 15, 17, and 19), which first appeared in this level. This level represented the relatively rapid collapse of House 10 (Feature 20), mixed with ashy debris from the three ovens. It did not appear to have been exposed as the site surface as had Level 13 above.

Level 15:
Friable loam with much ash; Munsell 10 YR 6/2 to 5/2. This level of very friable ashy loam was confined to the northeastern corner of the unit. It contained large amounts of charcoal and bone and many very large sherds and was clearly the waste from Feature 15, the easternmost of the three House 10 ovens.

Level 16:
Loam mixed with ash; Munsell 10 YR 6/3 to 5/3. Level 16 covered the entire unit and appeared to represent the slow accumulation of domestic debris on the original floor of House 10. Soil was a dark brown, soft to moderately compacted, very heterogeneous loam containing much ash but no wall collapse material. Level 16 yielded many sherds and other artifacts, as well as numerous terracotta clods like those seen in Level 14 above.

Level 17:
Loam; Munsell 10 YR 6/3. Level 17 was a continuation of Level 16 material down to the depth at which the walls of House 10 appeared. Soil was essentially identical to that of Level 16, with only a slight color change. This level was combined with Level 16 for analysis.

Level 18:
Friable light loam; Munsell 10 YR 6/3 to 7/2. This level covered approximately one fifth of the unit in the south and east. Level 18 was the upper level of fill in a pit dug just south of the easternmost oven (Feature 15), below the “tap hole” of that feature. Soil was a very heterogeneous, extremely ashy light loam, similar to that of Level 15 above. Like Level 15, this was clearly oven waste from Feature 15, although at an earlier date than Level 15 and with none of the debris from the destruction of the oven which was present in Level 15. Soil at the bottom of Level 18 was layered in microstrata, possibly the effect of water washing into the pit during use of the oven.

Feature 39:
This was the lower level of the deep pit which began with Level 18. Soil was very similar to that of Level 18. Like Level 18, it represented oven waste from the use of Feature 15.

Level 19:
Compact light loam; 10 YR 7/3. Level 19 covered a small area in the extreme southeast corner of the unit and probably represented accumulation to the exterior of House 10 (Feature 20) during its occupation. Soil was clayey and compact, with no wall collapse material and few artifacts. This level may also have
included some of the original surface into which the wall trench for House 10 was
dug.
Level 20:
Very compact loam to heavy loam; Munsell 10 YR 6/3. This level almost
certainly represented the original floor of House 10. Soil was red, sandy, and very
hard, almost completely lacking in normal artifacts but with several sandstone
grinders recovered at a uniform depth of X1.75 m.

Table AI: Description of excavated levels and features: LX-N
Level 21:
Compact light loam to loam; Munsell 10 YR 6/3. This level was located to the
north and northwest of House 10. Although texture was similar to that of Level
20, this level appeared, like Level 19, to represent accumulation to the exterior of
House 10 during its use.
Level 22:
Lightly compacted loam; Munsell 10 YR 6/2 to 7/3. Like Levels 19 and 21, Level
22 represented exterior debris accumulation during the occupation of House 10.
This level lay to the north and northeast of House 10, underlying the oven waste
of Level 15 in the northeast corner. Soil was more heterogeneous than Levels 19
and 21 but was clearly of the same class. It contained terracotta clods, ash, and
significant amounts of bone, probably destruction debris and later waste from one
of the ovens (Feature 17?) associated with House 10.

Feature 15:
This was a triangular oven adjacent to House 10 in the east central sector of the
unit. It was constructed of cylindrical bricks cemented with a (now-oxidized) mud
mortar. Waste from this oven was represented by Levels 15 and 18 and Feature
39.

Feature 17:
This was a second triangular oven, identical to Feature 15 and located north-
northwest of House 10.

Feature 19:
This was a third triangular oven of cylindrical brick, located to the southwest of
House 10. The soft ashy waste inside and immediately to the south of this feature
was included as part of Feature 19.

Feature 20:
This was the feature designation for House 10, a round house located
approximately in the center of Unit LX-N. The three ovens labeled Features 15,
17, and 19 were attached to this house, and at least three partition walls extended
from the house into the walls of the unit. The walls of House 10 were constructed
of cylindrical bricks with, in places, a yellow clay rendering still visible on the
exterior surface. Just east of the southern doorway, a male/female pair of
terracotta statuettes (SF 696 and SF 697) was found, still resting on a small
platform which had been enclosed in the southern wall of the house. Average
depth of the foundation wall was c. X1.97 m in all except the southeast corner of
the unit, where it reached a depth of X2.21 m. The significance of this anomaly
was unclear, but it may have represented wall repair necessitated by undermining of the wall by the ash pit of Level 18/Feature 39.

Level 23:
Heavy loam; Munsell 10 YR 6/3. This was a true horizon of compact, chunky wall collapse material containing significant amounts of pottery. Level 23 represented the original, hard, exposed surface deposited before House 10 was built. The wall trench for House 10 was dug into this level.

Level 24:
Ash and light loam; variegated color. Level 24 underlay Level 23 through the entire unit. Soil was very soft, dark, ashy, and full of bone and pottery. This level was a huge ash-filled depression of hearth sweepings and domestic debris, dating well before the occupation of House 10. A very fragmentary brick wall stump in Level 24 may represent an earlier structure.

Feature 27:
Feature 27 was a small ash pit dug into Level 25. It was associated with Feature 28 and probably also with Level 24.

434 Table Al: Description of excavated levels and features: LX-N

Feature 28:
This feature consisted of two ash pits in the west center of the unit. The ash pits had been dug into Level 25, probably from Level 24. This feature was associated with the Feature 27 ash pit.

*Level 25:
Ashy loamy sand; Munsell 10 YR 6/3. Level 25 began in the northwest as approximately one-third of the unit and expanded slightly to the northeast with depth. Soil was slightly more compact than the overlying Level 24 and was distinguished from that level by its platy, horizontal (possibly water-deposited) structure. At the top, Level 25 was characterized by a series of black and bright orange lenses of very powdery ash, interfingered with sand and loamy sand. The ash contained much charcoal and many artifacts. This level was related to Level 24 and may have included some destruction debris from House 11 (Feature 37). Radiocarbon Sample 36 was collected from a pocket of charcoal in the southeast quadrant at a depth of 2.37 m. Confidence in the quality and reliability of the sample to date level was excellent. The resulting date is 940 ± 110 B.P. (RL 1807).

Level 26:
Compact loam; Munsell 10 YR 6/3. Level 26 was a loam terrace covering the center of the unit, bounded by Level 25 in the northwest and by the Level 18/Feature 39 ash pit in the southeast. Soil was gray, platy, and quite homogeneous, with few sherds or brick fragments but several large chunks of terracotta. This level appeared to be composed of a very slow accumulation of wall wash with little domestic debris, perhaps from the final decay of House 11.

Level 27:
domestic debris accumulated over the entire unit, particularly within the walls of House 11. It contained large quantities of pottery and bone and very little brick.
This appeared to be domestic debris built up on the living surface during the occupation of House 11.

Feature 38:
Feature 38 was a small ash pit dug into Level 29 just to the west of House 11. It probably served as a tip for domestic waste during the occupation of House 11.

Level 28:
Compact light loam; Munsell 10 YR 5/2 to 6/3. Level 28 appeared to be the original floor of House 11. It consisted of a compact layer of mottled gray/brown homogeneous light loam, enclosed by the walls of House 11 and covering the part of Feature 40 which fell within the house walls. It contained large amounts of charcoal and terracotta clods.

Feature 30:
This was a small platform of terracotta and concentrated sherds which lay beneath the skeleton of Feature 26 in the northeast corner of the unit. Some of this material appeared to be associated with the Feature 26 burial, but most appears to belong with the levels immediately underlying Level 24.

Feature 37:
Feature 37 was the round house labeled "House 11" which appeared approximately in the south center of the unit. The foundation trench for this house was dug into Levels 29 and 31, the lower part of Level 30, and the ash pit designated Feature 40. It was intruded upon by the large ash pit of Level 18/Feature 39, which had been dug into the southeastern edge of the house long after abandonment. House 11 was constructed of irregular sun-dried bricks, ranging from cylindrical to almost loaf-shaped, with the yellow clay rendering of the external walls still visible in most places. The top part of Level 30 and the ash pit of Feature 38 were associated with the occupation of this building.

Table A1: Description of excavated levels and features: LX-N

Level 29:
Loamy sand; Munsell 10 YR 6/3. Level 29 covered the western sector of the unit at the same depth as Levels 30 and 31. It adjoined House 11 from the west and was intruded upon by Features 38 and 40. This was the original surface into which the wall trenches of House 11 were dug, with some apparent mixture of debris from the occupation of House 11 in the upper part of the level. Soil was friable and rather homogeneous, with moderate amounts of pottery and much bone. Ash content was low until the bottom of the level, when ash lenses appeared.

Feature 40:
This was a large ash pit beneath the southwestern walls of House 11. Feature 40 was dug into Level 29, but the two were probably close in age.

Level 30:
Moderately compact light loam; Munsell 10 YR 6/3. Level 30 was a narrow platform of soil immediately to the north of House 11. Soil was a moderately hard homogeneous light loam, with several microstrata of clay at the very top which may have represented water deposition. Like Level 29, this level represented the original surface on which House 11 was constructed. The microlayering at the top
of the level resembled that of the putative "bath area" encountered in Level 18, Unit M1 of the 1977 field season (S. McIntosh and R. McIntosh 1980, (1:81) and may indicate that the upper part of Level 30 could be dated to the occupation of House 11.

Level 31:
Compact light loam to light clay; Munsell 10 YR 7/4. Level 31 was a level of very hard clay with moderate amounts of ash, covering the entire area east of House 11. Like Levels 29 and 30, this was part of the original surface upon which House 11 was built. Level 31 was intruded upon in the east central sector of the unit by the lower levels of the Feature 39/Level 18 ash pit.

Level 32:
Very friable light loam and ash; Munsell 10 YR 5/3. Level 32 was a broad shallow ash terrace containing much charcoal and bone. It was located in a shallow depression underlying Feature 39 and overlying Level 31.

Level 33:
This was an unidentified architectural feature adjoining House 11 from the northeast. It was composed of very compact pure loam and may have been a terrace or partition wall.

Level 34:
Compact loam to light clay; Munsell 10 YR 5/3. This level was an artifact of excavation only. It was a small terrace of Level 31 material which extended beneath the area occupied by Level 33. Level 34 was combined with Level 31 for analysis.

Level 35:
Clay; Munsell 10 YR 6/3. At opening, this level covered the entire unit, but with depth it was reduced to a small terrace in the northwestern corner only. Soil was moderately compact, crumbly, and largely homogeneous, although it had some ash patches and yielded large sherds in moderate numbers. The discontinuity with the ash of Level 36 below was very distinct. Level 35 was probably the slow accumulation of tauf wall collapse, occasionally exposed as the site surface.

*Level 36:
Friable light loam and ash; Munsell 10 YR 5/3 to 5/2 and 7.5 YR 8/6. Level 36 underlay Level 35 throughout the unit except in the northwest, where Level 35 was significantly deeper than elsewhere, and in a small part of the southeastern sector. Soil was a soft ash mixed with...

436 Table Al: Description of excavated levels and features: LX-N light loam, deposited in multicolored lenses containing many fire-oxidized clods. This level postdated the destruction of House 12 (Feature 46) and represented a later use of the area. Radiocarbon Sample 46 was collected from a pocket of charcoal measuring .60-by-.60-by-.08 m at 3.13-3.20 m depth. Confidence in the quality and reliability of sample was excellent. The resulting date is 970 ± 110 B.P. (RL 1808).

Level 37:
Friable light loam and organic material; Munsell 2.5 Y 6/4. This was an accumulation of ashy debris in the southwest corner of the unit, containing
notable amounts of rice and chaff, moderate amounts of pottery, and very little bone or slag. Level 37 was related to the overlying Level 36 and, like that level, could be dated after the occupation of House 12.

*Level 38:
Friable light loam and ash; Munsell 10 YR 3/4 and 7.5 YR 6/4. This was a large ash pit which had been dug into the southern wall of House 12 (Feature 46) after the house was abandoned. Fill was a very soft heterogeneous ash, variegated in color and containing large amounts of pottery and bone. Radiocarbon Sample 47 was collected from a pocket of charcoal measuring .15-by-.15-by-.03 m at 3.45 m depth. Confidence in the quality and reliability of the sample to date level was excellent. The resulting date is 1300 ± 110 B.P. (RL 1618).

Feature 44:
This was another ash pit dug into House 12 and related to the ash level, Level 36. Level 39:
Light loam; Munsell 10 YR 5/4. This level was located in the northeastern corner of the unit and consisted of wall melt and wall collapse from House 12. Soil was a moderately friable, extremely homogeneous light loam containing some mixed ash and some burnt earth remains.

Level 40:
Compact light loam; Munsell 10 YR 6/2. Level 40 was a ledge of quite hard and crusty loam running diagonally northwest-southeast across the unit. It was flanked by the softer wall melt material of Level 39 to the north and by the Level 38 ash pit to the south. Like Level 39, this was an accumulation of wall melt and wall collapse from House 12. This material contained significant amounts of ash and pottery, but little slag or bone.

Level 41:
Compact loam; Munsell 10 YR 7/3. This level, covering approximately the northern two thirds of the unit, consisted of immediate collapse material from House 12. Soil was somewhat compact and platy, with localized ash patches. At the bottom it came down on a sharp discontinuity in soil which was marked by sandstone grinders and chunks of fallen tauf and appeared to be the original floor of House 12.

*Level 42:
Loam to light loam; Munsell 10 YR 6/4. This was a heterogeneous and badly mixed level containing a melange of material dating from various periods before the construction of House 12. This level appears to have been partly an excavation of the original surface on which House 12 was built, and partly a spillover of excavation into the far earlier lower strata of the ash pits of Levels of 44 and 45. Radiocarbon Sample 54 was collected from a pocket of scattered charcoal at 3.99 m in the west central part of the unit. Confidence at the time of collection in the reliability of the sample to date Level 42 was excellent. Only after drawing the sections was it clear that Level 42 deposits were mixed. The resulting date is 2,050 ± 120 B.P. (RL 1619).

Table A1: Description of excavated levels and features: LX-N

Level 43:
Compact loam; Munsell 10 YR 7/3. Level 43 was a terrace of homogeneous hard white loam covering the northwestern third of the unit. Like Level 41, this was immediate tauf collapse and melt from House 12.

Feature 46:
Feature 46 consisted of the fragmentary remains of the circular tauf wall which was labeled "House 12." Enclosed within the wall of this structure was an enigmatic round clay feature, similar to that of Unit ALS, Feature 52. This feature measured c. 0.85 m in diameter and was composed of the same hard clay as the house wall.

Level 44:
Friable light loam and ash; Munsell 10 YR 7/2 and 4/3. This was a deep pit in the western part of the unit, filled with highly variegated ash and ashy soil. Level 44 had been dug into Level 46 and was intruded upon by Level 38. Part of Level 44 was excavated with the badly mixed Level 42.

Level 45:
Ashy light loam; Munsell 10 YR 5/2 to 4/2. This was another rubbish pit dug into Levels 46 and 48 in the east central sector of the unit. This level may have been associated with the burnt clay floor of Feature 48. Fill was a dark ashy soil containing large quantities of charcoal, large sherds, and terracotta chunks. Like Level 44, Level 45 was partially excavated as Level 42.

Level 46:
Compact light clay; Munsell 10 YR 6/4 and 8/6. Level 46 covered the entire unit outside the ash pits of Levels 44, 45, and 38. It appeared to be the original surface upon which House 12 (Feature 46) was built. The level as a whole represented slow accumulation of mud wall decay, with the upper part of the level composed of classic tauf wall collapse material, probably from the structure whose floor was excavated as Feature 48. In the lower part, Level 46 began to come down on classic gold/olive-brown Phase I/II material. Soil in this level was a hard heavy loam to clay, with little pottery at the top but increasing numbers of artifacts with depth.

Level 47:
Clay; Munsell 10 YR 8/4 and 5/4. Level 47 was a shallow depression to the west of Feature 48, at the same depth as Level 48. Soil was classic Phase I/II material, composed of compact, rather moist or oily clay containing dispersed ash lenses and many bits of fired terracotta. This level also yielded much rice chaff and an unusually large number of bovid bones.

Feature 48:
This was a compacted burnt clay floor which emerged from the baulk in the south central part of Unit LX-N and continued through to the northern sector of Unit LX-S.

*Level 48:
Moderately compact clay; Munsell 10 YR 5/4. Level 48 covered the northern and eastern three-quarters of the unit. It was composed of classic slow-accumulation Phase I/II material consisting of moderately compact clay with tiny dispersed ash lenses, much bone and charcoal, many red quartz/clay inclusions, and an unusual yield of fish bone and bovid teeth. Radiocarbon Sample 60 was collected from a
scatter of charcoal at 4.62 m depth. Confidence in the quality and reliability of the sample to date level was excellent. The resulting date is 2,060 ± 110 B.P. (RL 1620).

*Level 49:
Compact clay; Munsell 10 YR 6/6 to 6/4. This level was very similar to Level 48 and was combined with it for analysis. The upper part of Level 49 was at approximately the same depth as Level 48 and was clearly deposited contemporaneously with or even later than that...
Level 2: Compact loamy sand; Munsell 10 YR 6/3. Level 2 was classic mud wall collapse consisting of loamy sand with brick clods and moderately large sherds. At the top, Level 2 covered the entire unit, but after c. 10 cm it covered only the area northeast of House 3 (Feature 3).

Feature 2: Feature 2 (House 2) was a rectilinear structure made of cylindrical sun-dried bricks, visible on the surface in the northwestern corner of Unit LX-S. The walls of this house were three courses deep, terminating at a depth of xO.42-xO.44 m. Feature 2 was located above Levels 7 and 12. It enclosed Level 5, which appeared to be composed primarily of wall collapse accumulated inside the house walls. House 2 was located just west of House 3 (Feature 3) and north of House 4 (Feature 7). It was clearly a separate structure from House 3, although its relation to House 4 was uncertain.

Feature 3: Feature 3 (House 3) was a second rectilinear structure built of cylindrical bricks. It was located in the northeast corner of the unit, just east of House 2, with its northern wall entering the northern baulk at a very acute angle. The walls of House 3 were visible on the surface and terminated at a depth of xO.36 m in the west and xO.40 m in the southwest corner. These measurements suggest that much of House 3 was built after House 2. It may have partially incorporated an earlier wall, possibly the same wall visible as a spur off the southeastern corner of House 2.

Level 3: Friable loamy sand; Munsell 10 YR 5/3. This was a very thin layer-in places, just a lens-of very friable sandy loam and ash to the exterior of House 2. Level 3 was underlain throughout the level by substantial wall collapse. It may represent a very short period of surface exposure, following the original collapse of Houses 2 and 3 but preceding the slow erosion of the remaining walls which was deposited as Levels 1 and 2.

Level 4: Compact sandy loam; Munsell 10 YR 5/4. Level 4 was a level of hard-packed sandy loam located to the outside of House 2 and containing significant amounts of rice chaff, ash, "gravel," and quite small sherds. It was clearly related to Level 3 and was combined with it for analysis. These two levels may have represented the remains of burnt thatch.

Level 5: Light loam; Munsell 10 YR 6/3. Level 5 was located to the interior of House 2 and extended approximately to the bottom of the brick walls of that structure. Soil was composed of a very fine-grained light loam containing a moderate number of brick fragments and appeared to represent an accumulation of slow to moderately slow wall melt. Sandstone grinders found at a depth of c. xO.18 m may have marked the surface of the floor of House 2, which appeared to be built up c. 10 cm above the lowest depth of the bricks.

Table A1: Description of excavated levels and features: LX-S
Level 6: Friable loam; Munsell 10 YR 5/2. Level 6 was a soft, ashy loam located on the interior of House 3. A sandstone grinder found at a depth of x0.28 m may have marked the house floor. Like Level 5 in House 2, Level 6 appeared to represent wall collapse inside the walls of House 3 and probably also the accumulated floor of that structure.

Level 7:
Friable loam; 10 YR 5/3. Level 7 was a soft, heterogeneous loam located inside House 2 beneath the hard soil of Level 5. When excavating, we were not sure we had reached the floor of House 2. However, the deposit of Level 7 was continued in Level 12 and now appears to represent material deposited before the construction of House 2.

Level 8:
Rather friable light loam; Munsell 10 YR 5/3. This level, in error, was excavated only to the interior of House 3. It is now clear that we had reached the house floor in Level 6 and that Level 8 was material antedating the construction of House 3. Soil was a moderately friable light loam with pockets of soft ashy material. It was probably contemporaneous with Level 7 to the northwest.

Level 9 (Pit 1):
Level 9 began as a level of soft light loam, with much root disturbance, covering the entire area south of Houses 2 and 3. It rapidly narrowed to a regular, man-made trench leading south from House 2 to the top of the deep shaft pit known as Pit 1. This pit, the most recent of the eleven large shaft pits bisecting the strata of Unit LX-S, was located in the southeastern sector of the unit. It was identified by the workers as a latrine. Approximately the upper 20 cm of Pit 1, from c. x0.32 m to x0.50 m, were excavated as part of Level 9.

Feature 4 (Pit 1):
This was the first level excavated entirely within Pit 1. Feature 4 consisted of a soft greenish earth containing many large sherds and a cylindrical drain pipe. This greenish soil extended from a depth of x0.50 m to x1.10 m. Pit 1 continued to a depth of x4.49 m and was excavated in its lower levels as Levels 22, 23, 25, 26, 40, 45, 60, and 62. Diameter of the pit was 0.71-by-0.64 m at x0.50 m; 0.97-by-0.96 m at x1.01 m; 1.34-by-1.32 m at x2.13 m; 1.58-by-1.48 m at x2.75 m; 1.57-by-1.52 m at x3.48 m; and 1.22-by-1.10 m at x4.06 m.

Level 10:
Loamy sand; Munsell 10 YR 5/3 to 5/4. Level 10 was a mixture of ash and loamy sand confined to the extreme north center of the space between the east wall of House 2 and the west wall of House 3. Tumbled bricks were present immediately adjacent to the walls and at the top, but nowhere else in the level. In the center, at a depth of x0.41 m, was a deposit of strongly laminar, green-stained, water-deposited soil which formed a northwest-southeast trough leading toward the opening of Pit 1 in Level 9/Feature 4. This greenish soil was built up to a thickness of over 20 cm. It was identified by the workmen as the remains of a bath area and/or latrine. Level 10 was, however, excavated to a depth well below the walls of Houses 2 and 3. This must therefore be considered a badly mixed level, containing both material from the "bath area" dating to the use of Houses 2 and 3, along with material antedating the construction of both houses.
Level 11:
Compact light loam; Munsell 10 YR 5/3. Level 11 covered the half of Unit LX-S south of Houses 2 and 3 and Level 10. Soil was a compact light loam, more homogeneous and finegrained than classic wall collapse, and interspersed with patches of laminated olive-green soil similar to that of Level 10 and Feature 4. This material partially covered, but was mostly contemporaneous with, the top of Pit 1. Like Level 10, it appeared to represent a bathing or latrine area outside the two houses, more probably associated with the earlier House 2.

Table A1: Description of excavated levels and features: LX-S
Level 12:
Compact light loam; Munsell 10 YR 5/3. Level 12 was located in the interior of House 2, beneath Levels 5 and 7 and extending well below the level of the brick walls of House 2. This level was opened in an attempt to find a distinct floor for House 2, which we then realized we had overlooked in Level 5. Level 12 was similar to Level 7 and was combined with it for analysis.

Level 13:
Compact light loam; Munsell 10 YR 6/3. Level 13 underlay Level 11 south of Houses 2 and 3 but was almost certainly laid down before the use of those structures. Soil was a compact finetextured light loam containing little pottery or bone and no slag. It appeared to be a combination of slow wall collapse with some horizontally structured, possibly water-deposited, material. In the southwest corner, Level 13 covered the brick rubble of Feature 6. This level probably represented slow to moderately slow wall collapse from House 4 (Feature 7), accumulated after the initial rapid collapse of that house which was reflected in Feature 6.

Level 14:
Compact loam; Munsell 10 YR 5/3. Level 14 underlay Levels 7 and 12 within the area of House 2 but below the depth of the House 2 walls. Soil consisted of a lightly compacted loam which overlay the rapid wall collapse of House 4. This level was at the same depth as Level 13, with which it was combined for analysis.

Level 15:
Moderately compact light loam; Munsell 10 YR 6/2 and 5 Y 6/2 to 6/6. Level 15 covered the northeastern one-third of the unit beneath the area of House 3. This was a level of moderately slow wall collapse, composed of a chunky light loam containing many soft patches of sand and termite intrusions and mottled with lenses of greenish soil of the type associated with Levels 10 and 11 and Pit 1. The greenish soil appeared immediately beneath the walls of House 3. In the southwest corner of Level 15, it had been excavated into by the wall trench of House 3. This confirmed earlier suspicions that House 3 was constructed later than House 2, and that the excavation and initial use of Pit 1 was associated with House 2.

Level 16:
Loamy sand; Munsell 10 YR 6/4. This level covered the two-thirds of the unit to the east of House 4 (Feature 7) and appeared to represent the buildup of debris outside that structure during its occupation. Soil was generally a very loose loamy
sand containing moderate amounts of ash and numerous artifacts, but it also included several extensive, shallow terraces of harder-packed material. The presence of burnt earth patches and sandstone grinders suggested that the original exterior living surface lay at about x0.68 m.

Level 17:
Loam; Munsell 10 YR 6/4. This was a terrace within the area of House 6 (Feature 10) in the northwest to north central sector of the unit. It was very similar to Level 15 and was combined with it for analysis. The matrix was a heterogeneous hard-packed loam, combined with some brick and ashy material. Like Level 15, Level 17 represented wall collapse of House 4 which had been exposed and later reworked on the surface.

Feature 6:
This was the initial rapid wall collapse of House 4 (Feature 7), accumulated to the interior of that structure. It was located in the southwestern part of Unit LX-S, between the parallel southeast-northwest brick walls of House 4. Feature 6 was composed of very distinct individual cylindrical bricks loosely set in the soft matrix of Level 18. This brick rubble extended northward from the southern profile of the unit to the point at which the western wall of House 4 entered the western profile, c. 1.77 m north of the southwest corner of the unit. All loose bricks found north

Table A1: Description of excavated levels and features: LX-S
of that point were included as part of Level 18. The brick rubble of Feature 6 extended from a depth of x0.58 m to x0.71 m, with scattered individual bricks occurring within Level 18 as low as x0.9 m.

Feature 7:
Feature 7 (House 4) was a rectilinear structure of cylindrical bricks running southeastnorthwest from the south central profile to the northwestern corner of Unit LX-S. This "house" consisted of two parallel wall stumps of cylindrical bricks, each three courses deep and c. 2 m apart. The wall stumps ranged in depth from x0.56 m at the top to x0.94 m beneath the third course of bricks. The eastern wall of House 4 lay directly beneath the eastern wall of House 2, and the brick rubble of Feature 6 terminated just at the outer edge of the southern wall of House 2. This suggests that House 2 may have been built on the remains of House 4 and that the two were therefore fairly close in age.

Feature 10:
This feature, labeled House 6, was the southwest corner of a rectilinear structure of cylindrical bricks. This structure began approximately in the north center of Unit LX-S and continued north into the baulk separating Units LX-S and LX-N. It was probably associated with the wall stump excavated as Feature 8 in Unit LX-N. With a brick depth of x0.74 m at the top and x0.83 m at the bottom, House 6 appeared to be slightly more recent than House 4. Nevertheless, it was clearly related to that structure, since its southern wall was at a right angle to and apparently originally bonded to the eastern wall of House 4.

Level 18:
Friable loam; Munsell 10 YR 6/3. This was a level of powdery loose loam, located inside the parallel walls of House 4 and containing occasional loose bricks. The bricks were identical to those from Feature 6, which covered Level 18 in the southern part. Level 18 was probably made up of debris from the final use and destruction of House 4, mixed with the first evidence of rapid wall collapse.

Level 19:
Very compact light loam; Munsell 7.5 YR 6/4. Level 19 was located in the extreme northeastern corner of the unit, immediately east of House 6. Soil consisted of a hard-packed light loam with a heavy concentration of pottery and several extensive patches of burnt floor. The largest of these burnt patches occurred at a depth of x0.77 m. Level 19 was almost certainly associated with House 6, perhaps as the original outside courtyard showing traces of exterior cooking fires.

Level 20:
Somewhat friable loamy sand; Munsell 7.5 YR 5/2. This was a level of loamy sand with patches of ashy soil, located to the interior of House 6 in the north central sector of the unit. It probably represented the original floor of House 6.

Level 21:
Compact heterogeneous loam; Munsell 10 YR 6/3. Level 21, covering all of Unit LX-S east of House 4, was the original surface into which the wall trenches for Houses 4 and 6 were dug. Soil was a fairly hard-packed loam containing several burnt earth patches, isolated patches of green earth, and localized soft areas. Pottery yield was extremely high. At the bottom of the level, the upper bricks of House 7 (Feature 11) were visible. This material was the slow to moderately slow wall collapse of House 7, exposed at various times for brief periods as the site surface. Level 21 was arbitrarily closed at a depth of x1 m in order to draw unit profiles.

Table A1: Description of excavated levels and features: LX-S

Level 22 (Pit 1): This was a level of friable and ashy loamy sand which underlay Feature 4 within the large shaft pit known as Pit 1. Level 22 extended from a depth of X1.05 m to X1.93 m. It contained burnt brick fragments, clods of greenish earth, furnace and tuyere parts, and many artifacts and bones.

Level 23 (Pit 1): Level 23 underlay Level 22 within Pit 1, at a depth of x1.93-x2.13 m. This level consisted of a compact greenish soil, similar to that encountered in Feature 4 above. Level 23 contained fewer ceramics than Level 22, but moderate amounts of bone and fragmentary brick.

Feature 11: This feature, labeled House 7, was a rectilinear structure of cylindrical bricks, located in the southeastern corner of the unit. Most of this foundation was only one brick deep, with the walls uniformly three bricks wide. Near the southern end of the unit, House 7 was divided by a brick partition wall into two compartments or "rooms." The shaft of Pit 8, which began at or just above the level of House 7, was located within the area south of the partition wall, raising the possibility that
this "room" may have been a bath/latrine area enclosed off from the rest of the house. Along its western wall, House 7 had been disturbed by Feature 4, the deep upper level of Pit 1.

Level 24:
Loamy sand; Munsell 10 YR 6/3. Level 24 covered the entire unit west and north of House 7. It was similar to and probably contemporaneous with Level 13 of Unit LX-N. Soil was a homogeneous, moderately compact sandy loam containing moderate amounts of slag and pottery, but little bone. This level probably represented the living surface to the exterior of House 7. The top of Pit 2/5 (Feature 18) was found directly beneath Level 24 in the center of the unit.

Feature 18 (Pit 2):
Feature 18 was the top level of the second of the large shaft pits found in Unit LX-S. It was encountered approximately in the center of the unit at the bottom of Level 24 and may have been associated with House 7 (Feature 11) at approximately the same depth. Feature 18 was encountered at a depth of x1.21 m and consisted of a scoop-shaped drainage trough filled with soft greenish earth, containing many ceramics and partially covered by hard brick debris. In a relationship identical to that of Level 9 and Feature 4 in Pit 1, Feature 18 led directly into the shaft of Pit 2, surrounding the hard central core of pit fill excavated as Level 32. Feature 18 and Level 32 ended at a depth of x1.51 m. Subsequent deposits in Pit 2, excavated as Levels 34 and 35, extended to a depth of x2.71 m. At a depth of x2 m, Pit 2 intersected the upper levels of another shaft pit, Pit 5 (excavated as Levels 37, 48, and 51). This appeared to be an earlier shaft pit which had been intruded upon by Pit 2. The diameter of Pit 2 was 0.75-by-0.75 m at x1.21 m; 0.95-by-0.90 m at x1.51 m; 1.09-by-1.04 m at x2.13 m; and 1.12-by-1.21 m at x2.71 m.

Level 25 (Pit 1):
Level 25 was a continuation of Pit 1, the large shaft pit previously excavated as Level 9, Feature 4, and Levels 22 and 23. Soil in this level was a moderately compact greenish loam, similar to that found in the overlying Level 23. Artifact content was somewhat reduced from that of Level 23. Depth of Level 25 was x2.13-x2.75 m.

Level 26 (Pit 1):
Level 26 underlay Level 25 within Pit 1, at a depth of x2.35-x2.75 m. This was a rather homogeneous fine-grained loam to loamy sand, with a strong laminar structure indicating water deposition. It had few, but large, artifacts and relatively little evidence of the greenish soil which had characterized Levels 23 and 25. A series of regular, shallow depressions which may have been toe holds were visible along the east and west walls of the shaft. Level 26 terminated in a layer of distinct lenses of sand and loamy sand.

Table A1: Description of excavated levels and features: LX-S

Level 27:
Moderately compact light loam; Munsell 10 YR 6/4. Like Level 24, this level covered the entire unit outside the walls of House 7. At the top, Level 27 was
composed of wall collapse containing barely discernible dispersed bricks. It was particularly rich in sandstone grinders, suggesting exposed living or working areas. A large cache of black spindle whorls (Feature 16) was found in the upper part of this level. With depth the matrix became increasingly heterogeneous, yielding large amounts of pottery but little slag or bone. This material was identical to Level 30, located to the inside of House 7. The wall trenches of House 7 were dug into Level 27, as was Pit 2/5 in the central part of the unit.

Feature 16:
This was a cache of fifty spindle whorls and spindle whorl fragments in a small shallow pit which had been dug into the north central part of Level 27. Depth of the pit was x1.22-Xi.35 m. In the upper part of this feature, spindle whorls were found dispersed outside the area of the original pit, as though the top of the cache had been disturbed. Associated with the spindle whorls were burnt clay clods, large sherds, and a fragmentary clay bracelet.

Level 28:
Compact loam; Munsell 10 YR 6/3 and 2.5 Y 6/4. This level was located inside House 7, in the northern compartment formed by the east-west partition wall of that structure. Soil consisted of a very compact loam with a greenish tinge in parts, underlain by a "gravelly" burnt layer. Level 28 was probably the floor of House 7.

Level 29:
Moderately compact loam; Munsell 10 YR 5/2. Level 29 was located in the "room" to the south of the east-west partition wall of House 7. This level included material from the upper part of Pit 8 (Feature 33), which was not recognized during excavation until Level 36 nearly 1 m below. The presence of a shaft pit in this area may indicate that the southern compartment of House 7 was a bath/latrine area, kept separate from the northern living quarters. In any case, Levels 28 and 29 were clearly contemporaneous and were combined for analysis.

Level 30:
Light loam; Munsell 10 YR 6/4. Level 30 was located inside House 7, beneath Levels 28 and 29 and below the level of the House 7 walls. This level was part of the original surface upon which House 7 was built. Soil had a microlayered platy structure indicative of water deposition, suggesting that it had been exposed at some point as the site surface. Texture and artifact content were identical to those of Level 27 in the rest of the unit.

Level 31:
Moderately compact loamy sand to light loam; Munsell 10 YR 6/3. Level 31 was a classic horizon which covered the entire unit and separated the maze of rectilinear houses above from the round houses of lower levels. Soil was a heterogeneous mixture of wall collapse and domestic debris and appeared to be the buildup of material outside House 10 (Feature 20) in Unit LX-N. Deposits were interrupted by several exposed activity surfaces. Pottery yield in this level was moderate near the top but diminished with depth. Slag, rare in the upper part of the level, was found in enormous quantities just above closing. Level 31 was interrupted in the northwest by Pit 6 and in the north center by the apparently slightly earlier Pit 3 (Level 33), both of which appeared to begin in this level. A
cache of sandstone (Feature 21) was encountered in the northwest corner of Level 31.

Feature 21:
Feature 21 was a large cache containing ninety-three pieces of worked and unworked sandstone and several nearly whole ceramic vessels, some decorated with appliquéd serpents. This feature showed much evidence of fire exposure, in the form of ash lenses and hard-baked

Table A 1: Description of excavated levels and features: LX-S

patches of earth. Feature 21 appeared in the northwest corner of Level 31, at a depth of X1.52 m. It was underlain in Level 36 by the ashy material of Level 43.

Level 32 (Pit 2):
This was a hard plug of packed brick debris which formed the center of the top level of Pit 2. It was surrounded by the drainage trough of Feature 18. Like Feature 18, Level 32 material was stained green by long exposure to water. The plug of Level 32 rose 17.5 cm above the shaft opening of Pit 2 to a height of x1.04 m. It ended at the same depth as Feature 18 at X1.51 m. Level 32 was underlain within Pit 2 by Levels 34 and 35.

Level 33 (Pit 3):
Pit 3 was actually a series of four related shallow shaft pits in the north central sector of the unit. All four were excavated, in entirety, as Level 33. Fill in these pits was a loamy sand with very powdery ash, containing some wall collapse fragments and many large sherds. The pits began in Level 31 at a depth of c. x1.46 m. They ranged in diameter from 0.55 m to 1.09 m and ended at depths of (from west to east) X1.64 m, x1.85 m, X1.92 m, and X1.76 m.

Level 34 (Pit 2):
This was a level of moderately soft to soft earth underlying Level 32 and Feature 18 within Pit 2. Soil consisted of a laminated, clearly water-deposited, loamy sand which contained large amounts of pottery but few other artifacts. Depth of this level was x1.51-x2.68 m. Beginning at a depth of x2 m, Level 34 was surrounded on the east by Level 37 of Pit 5, an apparently earlier shaft pit into which the lower levels of Pit 2 had intruded.

Level 35 (Pit 2):
This was the lowest level of Shaft Pit 2, extending from a depth of x2.68 m to x2.71 m. Soil consisted of loam and fine sand with diminishing amounts of pottery. Level 37 of Pit 5 continued to the east of and beneath this level.

Level 36:
Rather compact loam to heavy loam; Munsell 10 YR 6/3 to 5/3. This was a very thick heterogeneous level covering the entire unit. Soil in the upper part of the level was similar to Level 31 above: a moderately compact to compact loam with localized burnt areas, soft ash patches, moderate amounts of pottery, and very little bone or slag. With depth, soil became slightly harder and deposits took on a somewhat laminar, horizontal structure. Toward the bottom, Level 36 was interspersed with soft ash pockets, notably Level 43 in the northwest corner and Level 46 in the southeast. Shaft Pits 4 (Level 38) and 5 (Level 37) made their first
appearance at the top of this level, as did the two westernmost of the Level 33 ash pits.

Level 37 (Pit 5):
This was the topmost level of Pit 5, the offset continuation of the Pit 2 shaft. Like Pit 2, Pit 5 was located just east of the center of the unit. It first appeared in Level 36, where it intersected the eastern wall of Pit 2 at a depth of x2 m (0.68 m above the bottom of that pit). It appeared to represent an older shaft into which Pit 2 had been dug. Level 37 of Pit 5 began at x2 m and continued below the terminus of Pit 2 to a depth of x2.8 m. Soil was a moderately compact loam which contained large quantities of bone and sherds at the top of the level. Beneath Level 37, Pit 5 continued as Levels 48 and 51, and terminated at a depth of x4.62 m. Diameter of Pit 5 was 0.63 m at x2 m; 1.02-by-0.89 m at x3.38 m; and 0.76-by-0.76 m at x4.62 m.

Level 38 (Pit 4):
This was the upper level of another large shaft pit which began in the northeastern sector of the unit at the top of Level 36. Level 38 extended from a depth of x1.99-x2.56 m. Soil was a lightly to moderately compacted light loam with several sandstone grinders and a heavy concentration of pottery at the top. At a depth of x2.11 m a curved row of nine bricks appeared to delineate the northern wall of the shaft. Pit 4 extended from its opening measurement of x1.99 m

Table A1: Description of excavated levels and features: LX-S
to a depth of x3.53 m. In its lower levels it was excavated as Levels 39 and 50. Diameter of the pit was 1.12-by-1.4 m at x1.99 m; 0.88-by-0.95 m at x2.56 m; and 1.12-by-1.21 m at x3.53 m.

Level 39 (Pit 4):
Level 39 underlay Level 38 and overlay Level 50 within Pit 4. This was a level of moderately compacted light loam, slightly harder than Level 38. A mass of bricks was encountered at a depth of x2.78 m. Depth of Level 39 was from x2.56 m to x2.83 m.

Level 40 (Pit 1):
Level 40 underlay Level 26 within Pit 1. Soil consisted of a clearly water-deposited heavy loam mixed with ash and charcoal in fine horizontal strata. Depth of Level 40 was x2.75-x3.3 m. Pit I continued beneath this level as Levels 45, 60, and 62.

Level 41 (Pit 6):
Level 41 was the first excavated level in Pit 6. This deep shaft pit, located in the northwest corner of the unit, was recognizable in section as high as X1.2 m, some 26 cm above the top of Pit 3 in Level 31. It remained undetected during excavation until the top of Level 41, encountered at the bottom of Level 36 at a depth of x2.07 m. Level 41 extended to a depth of x2.6 m. Soil consisted of a soft but chunky ash and loam, with a low pottery yield but occasional large sherds and miscellaneous artifacts. Pit sides were very distinct at the close of this level. Beneath Level 41, Pit 6 continued as Levels 42 and 57 and terminated at a depth of x4.79 m. Diameter of Pit 6 was 0.62-by-0.75 m at x2.6 m and 0.76-by-0.73 m at x4.79 m.
Level 42 (Pit 6):
Level 42, the second excavated level within Pit 6, extended from a depth of x2.6 m to x3.1 m. It was overlain within Pit 6 by Level 41 and underlain by Level 57. Soil in Level 42 was a very soft ash and heavy loam. The upper part of the level contained many sherds, moderate amounts of bone, and little slag. By closing, sherd output was negligible.

Level 43:
Friable ash and heavy loam; Munsell 10 YR 5/3. Level 43 was a layer of ash and loam containing distinct chunks of wall collapse and a large fire-damaged twine-decorated bowl. This level underlay the sandstone and pottery cache of Feature 21 in the extreme northwest corner of Unit LX-S, approximately midway through the wall collapse deposits of Level 36.

Level 44 (Pit 7):
Pit 7 began in the northeast corner of Level 21 at a depth of x0.9 m but was undetected in excavation until x2.23 m, in the lower part of Level 36. This pit appears to have been dug into the wall collapse of House 7 (Feature 11), either during or after deposition, and therefore is assumed to postdate that structure. The upper 2 m of Pit 7 were filled with brick rubble, the top 1.33 m of which was removed with surrounding levels. At the top of Level 44, the first excavated level of the pit, the shaft was ringed by a single circle of bricks (Feature 29). Level 44 extended from x2.23 m to x2.92 m and was filled with brick rubble to the exclusion of all other artifacts. Beneath Level 44, the lower part of Pit 7 was excavated as Level 56, terminating at a depth of x4.22 m. This pit appears to have had a funerary function, at least at its inception, as a funerary urn with inverted pot cover (Feature 47) was found resting on the bottom of Level 56. The diameter of Pit 7 was 1.02-by-0.53 m at the opening depth of x2.23 m, and 1.17-by-0.92 m at closing.

Feature 29 (Pit 7):
This was a retaining wall of a single row of circular bricks which lined the outer edge of Pit 7 at the top of Level 44. Bricks extended from a depth of x2.22-x2.36 m.

Feature 33 (Pit 8):
Pit 8 was located in the far southeastern corner of the unit and was bisected by the eastern and southern unit walls. Like Pit 7, this shaft pit originated in Level 21, at a depth of c. x0.8 m.

Table A1: Description of excavated levels and features: LX-S
but was undetected in excavation until Level 36. Feature 33, the first excavated level of Pit 8, extended from x2.25 m to x2.73 m. Pit 8 appeared to have been dug into the wall collapse of House 7 (Feature 11), but its position in the center of the southeastern "room" of that house suggested the possibility that it might have functioned as part of an enclosed latrine/bath area, either during the occupancy of House 7 or shortly thereafter. Soil in Feature 33 was a mixture of gray ash, sand, and the same greenish loam which had characterized the upper levels of Pits 1 and 2. As in those pits, the soil had a noticeable chemical odor, resembling that of the pesticide DDT. Artifacts in Feature 33 included some burnt brick and
considerable quantities of fish bone and large sherds. Pit 8 reached a depth of x3.96 m and was excavated in its lower levels as Levels 52, 61, and 74. Diameter was not taken in this corner pit.

Level 45 (Pit 1):
This level underlay Level 40 within Pit 1. The upper part of Level 45 consisted of a loosely compacted ashy soil containing extremely large amounts of pottery. This was underlain in the lower part of the level by a moderately compact, very fine-textured loam containing occasional lenses of ash with burnt brick and occasional large sherds. Level 45 extended from a depth of x3.3 m to x3.48 m. Beneath Level 45, Pit 1 continued as Levels 60 and 62.

Level 46:
Friable ash and loam; Munsell 10 YR 5/4 to 5/3. This was a deep ash layer found at the bottom of Level 36 in the southeast and south center of the unit. Soil was highly friable and was layered in multiple lenses of gray, brown, and red. It contained large amounts of pottery and bone and occasional pieces of burnt brick.

Level 47:
Friable heavy loam and ash; Munsell 10 YR 6/4. Level 47 continued the ashy deposits of Level 46. Together, these two levels formed a broad, deep ash pit covering the southeastern and south central part of the unit. Artifact quantities were moderate in the upper part of Level 47, but at the bottom it yielded large amounts of pottery and moderate-to-large amounts of bone. Slag was sparse throughout. The feature excavated as Pit 9 (Level 54) was entirely contained within Level 47. In the northern part of the unit, Pit 11 (Level 55) was encountered at the same depth.

Level 48 (Pit 5):
Level 48, the lowest level of fill in Pit 5, underlay Level 37 within that feature. Level 48 opened at x2.8 m as a moderately compact loam containing few artifacts. At a depth of x3.38 m, the pit shaft expanded laterally to a diameter of 1.02-by-0.89 m, while soil changed to a friable ash very rich in artifacts. This deep ash level continued until Pit 5 terminated at a depth of x4.62 m. It was interrupted, from x3.38 m to x3.59 m, by a layer of more reddish ash excavated as Level 51.

Level 49:
Compact heavy loam; Munsell 10 YR 5/3. Level 49 underlay Level 36 in the western half of the unit and adjoined the ash pit of Levels 46 and 47. This level was a continuation of the heterogeneous wall collapse of Level 36 and differed very little in either texture or artifact content from that level. It showed a sharp discontinuity with the ashy soil of Level 58 below.

Level 50 (Pit 4):
This was the bottom level of Pit 4, underlying Level 39 of that feature at a depth of x2.83 m to x3.53 m. Soil was a moderately compact loam layered in water-deposited microstrata. On the east, Level 50 was surrounded and underlain by Level 55 (Pit 11), an apparent funerary pit into which the bottom of Pit 4 had been dug.

Level 51 (Pit 5):
This was a lens of reddish ash, separately excavated within Level 48 of Pit 5. Depth of Level 51 was x3.38-x3.59 m.

Table A1: Description of excavated levels and features: LX-S
Level 52 (Pit 8):
Level 52 underlay Feature 33 within Pit 8, extending from x2.73 m to x3 m. Soil was a moderately compact homogeneous sand which formed a sharp discontinuity with the highly organic greenish earth of Feature 33. Level 52 contained several sandstone grinders and a large number of sherds. A cache of nearly whole vessels was found at a depth of x2.95 m. Beneath Level 52, Pit 8 continued as Levels 61 and 74.

Level 53:
Moderately compact heavy loam; Munsell 10 YR 6/3. Level 53 underlay Level 36 in the northeastern sector of the unit. Soil was a compact heavy loam containing ash, rust-colored inclusions, moderate amounts of pottery, and little bone or slag. The soil had a strong horizontal structure indicative of water deposition, suggesting that this level was associated with the pit deposits of Levels 58 and 59 below.

Level 54 (Pit 9):
Pit 9 consisted of a single layer of soft ash and loam which adjoined the northwestern edge of Level 40 of Pit 1. This feature was excavated in its entirety as Level 54. Level 54 was entirely contained within the trash pit of Level 47 and may have simply been a fortuitous ash pocket within that pit. Level 54 measured 0.54 m north-south by 0.98 m east-west. Depth was x2.69-x2.8 m.

Level 55 (Pit 11):
Level 55 extended from x2.56 m to x4.36 m and was the only excavated level in Pit 11. This pit was an apparent funerary pit which appeared to have been disturbed by the lower levels of Pit 4. Level 55 appeared just below Level 36 in the north central sector of the unit and was intruded upon in the west by Level 50, the lowest level of Pit 4. Soil consisted of a soft to moderately compact water-deposited loam similar to that of the adjacent Level 50. It contained large amounts of ash and had a pronounced chemical odor like that of Feature 33 in Pit 8. Like the other shaft pits, Pit 11 yielded large amounts of pottery. Resting on the bottom of this pit was a large upright burial urn (Feature 42) containing an adult male skeleton. The diameter of Pit 11 was 1.26-by-1.44 m at opening and 1.36-by-1.31 m at closing.

Feature 42 (Pit 11):
Feature 42 was the designation of the burial found in the bottom of Pit 11. This burial consisted of a large upright funerary urn, 0.86 m in height, covered with an inverted carinated pot and containing what appeared to be a tightly flexed adult male skeleton. This appeared to be strong evidence of the original funerary function of Pit 11, although in texture, composition, and artifact content the deposits of Pit 11 were otherwise identical to the water-deposited soil of the other large shaft pits.

Level 56 (Pit 7):
Level 56 was the lowest level of Pit 7, underlying Level 44 of that feature at a depth of x2.92x4.22 m. Level 56 contained two superimposed funerary urns (Feature 47), encountered at a depth of x3.01 m and extending to the bottom of the level. Soil was a soft to moderately compact ashy loam which formed a sharp contrast to the brick rubble that made up the fill of upper levels of this pit. Level 56 contained little pottery except at the very bottom of the pit.

Feature 47 (Pit 7):
This feature consisted of an urn burial found at the bottom of Level 56 of Pit 7. A large urn rested in an upright position on the bottom of the pit covered by an inverted pot. A broken pot lid, apparently an urn cover, was found adhering to the eastern side of the smaller vessel. The urns contained the remains of two tightly flexed adult burials.

Table A1: Description of excavated levels and features: LX-S
Level 57 (Pit 6):
Level 57, the lowest level in Pit 6, underlay Level 42 of that feature. It was differentiated from Level 42 by a lateral expansion of the pit wall at a depth of x3.1 m, to a width of 0.75-by-1.04 m. Soil in the upper part of Level 57 was a moderately compact loam and light ash with low pottery yield, similar to Level 42. Below a depth of x3.49 m, Level 57 consisted of successive layers of almost pure red and dark-gray ash which continued to the bottom of the pit at x4.79 m.

Level 58:
Friable ash and light loam; Munsell 10 YR 4/3. This level underlay the wall collapse of Level 49 in the western half of the unit. Soil was a very friable almost pure ash in various shades of gray, brown, and red. It contained large amounts of pottery. Level 58 was ended artificially at x3 m.

Level 59:
Friable loam and ash; Munsell 10 YR 5/3. Level 59 underlay Level 53 in the northeastern quadrant of the unit. Soil was a yellowish moderately compact loam with ash patches, significantly more friable than Level 53 and with fewer rust-colored inclusions. Level 59 contained occasional sand lenses and isolated brick fragments. This level appeared to be a horizontal extension of Level 58.

Level 60 (Pit 1):
This level underlay Level 45 and overlay Level 62 within Pit 1. Soil was a soft ash mixed with light loam, containing large quantities of pottery and moderate amounts of bone and slag. At this level the sides of Pit I were indistinct, possibly due to water erosion. The depth of Level 60 was x3.48-x4.06 m.

Level 61 (Pit 8):
Level 61 underlay Level 52 within Pit 8. Soil in this level was a moderately compact homogeneous pale-brown loam and clay which was sterile in the top few centimeters but then yielded almost complete bowls and a few large sherds. The homogeneity of these deposits suggested that they may have been deposited as fill following initial use of the pit. Level 61 extended from x3 m to x3.42 m. It was underlain within Pit 8 by Level 74.

Level 62 (Pit 1):
This was the lowest level of Pit 1, underlying Level 60 of that feature at a depth of 4.06-4.49 m. Soil was a moderately compact yellowish heavy loam, containing isolated ash pockets and very few ceramics. At the bottom of the pit the shaft sides were very indistinct.

Level 63:
Moderately compact heavy loam; Munsell 10 YR 5/3. Level 63 was a roughly semicircular terrace of hard loam extending inward from the northwestern, northeastern, and southeastern edges of the unit. It underlay Levels 58 and 59 and appeared to mark the top of a second broad ash-filled depression, which continued as Levels 64 through 69. Like subsequent Levels 65, 67, 70, and 73, Level 63 probably represented a temporarily exposed surface within these deep ash deposits. Soil in Level 63 appeared to have been hardened into a crust by the intermingling of the underlying ash with wind and, possibly, water-borne sediments from nearby surface deposits. This level yielded large amounts of pottery and slag, probably a mixed accumulation of artifacts from the underlying ash and nearby deposits.

Level 64:
Very friable ash and light loam; Munsell 10 YR 4/3. Level 64 began in the southwest and center of the unit at the same depth as Level 63. Beneath Level 63, it expanded to cover the entire unit. This was a level of soft ash, deposited in a variety of colors ranging from greenish gray to red and mottled with patches of moderately compact loam. Level 64 was underlain by identical ash deposits in Level 66.

Table AI: Description of excavated levels and features: LX-S
Level 65:
Moderately compact light loam; Munsell 10 YR 5/3. This level consisted of several patches of indurated ash and loam haphazardly arranged over the northern sector of the unit. Like Level 63, this material formed a crust over the soft ash of Levels 64 and 66 and was probably formed during a period of surface exposure. Artifact yield was moderate and, as in Level 63, probably represented a mixture of artifacts from surrounding levels.

Level 66:
Ash and loamy sand; Munsell 10 YR 4/3. Level 66, continuation of Level 64, was combined with it for analysis. At this level, the mottled ashy deposits of Level 64 could be seen to be a series of small ash-filled depressions terminating in the slightly harder material of Level 67. Soil was a powdery ash containing large amounts of pottery, bone, slag, and sandstone, several copper items, and fragments of brick.

Level 67:
Moderately compact heavy loam; Munsell 10 YR 6/3. Like Levels 63 and 65, this level was a terrace of harder material forming a crust within the ash of Levels 64, 66, and 68. Level 67 covered the southern and western third of the unit, southwest of the similar material of Level 65. Soil was a moderately compact loam containing significant quantities of pottery, bone, and slag.

Level 68:
Friable loamy sand and ash; Munsell 10 YR 5/4. Level 68 continued the ashy deposits of Levels 64 and 66 over the entire unit. Soil was mottled ash and sand, containing much pottery, many sandstone grinders, and miscellaneous other artifacts.

Level 69:
Very friable loamy sand and ash; Munsell 10 YR 4/3 and 5 Y 5/3. Level 69 was another ash level covering the entire unit. This level was a continuation of Level 68, although it was slightly more friable than Level 68 and exhibited minor variations in ash color and texture. In the north, east, and south, it terminated in another loamy terrace (Level 70), which separated this and previous ash levels from the large ash-filled basin of Levels 71, 75, and 77. Level 69 was combined with Level 68 for analysis.

Level 70:
Lightly compacted light loam; Munsell 10 YR 6/3. Level 70 was a crust of soft to moderately compact loam which covered the ash deposits of Level 71 in small patches in the north, east, and southwest. Like Levels 63, 65, and 67, this level appeared to have been formed by the deposition of wind- and water-borne material during a period of surface exposure of the underlying soft ash. Level 71 contained a large number of sherds, burnt earth clods, and brick fragments.

Level 71:
Very friable ash and loamy sand; Munsell 5 Y 5/3. This level marked the top of a massive ash basin which had been dug into the surrounding occupational deposits of Levels 72, 76, and 78. Fill was a friable ash characterized by rapid color changes and showing no discernible differences from preceding ash levels. As in Levels 63, 65, 67, and 70, many dispersed, small, loamy terraces or "crusts" suggested that the basin was not filled immediately but was interrupted by periods of exposure on the surface and/or deposition of sediment by water. Level 71 was closed arbitrarily at a depth of x 4.2 m. Beneath this level, deposits within the ash basin continued as Levels 75 and 77.

Level 72:
Moderately compact to compact heavy loam; Munsell 10 YR 5/3. Level 72 represented the surface of the original slowly accumulated cultural deposits into which the ash pit of Levels 71, 75, and 77 had been dug. This level formed a continuous platform to the northeast, east, and

Table Al: Description of excavated levels and features: LX-S
south of Level 71. Soil was a heavy loam with some ash inclusions, quite different from that of the loamy terraces interspersed with the ash deposits. Level 72 included some mixture of material from Pit 10, a separate small ash pit dug through the eastern part of Level 72 but not separately excavated at this level.

Level 73:
Moderately compact to compact heavy loam; Munsell 10 YR 5/3. This was a small patch of loamy material overlying Level 72 in the southeast corner of the unit. It was probably related to the ash and loam "crust" of Level 70 at the same depth.

Level 74 (Pit 8):
This was the lowest level of Pit 8, underlying Level 61 within that feature. Level 74 began at x3.42 m as a fine-grained sandy clay laid down in multiple water-deposited microstrata. In the lower part of the level, this graded into a fine wind- or water-deposited sand. Level 74 contained sparse pottery and no bone or slag and probably represented deposits made during the original use of Pit 8 as a latrine or drainage area. The shaft of Pit 8 narrowed considerably in this level (to 0.31-by-0.54 m) and had a well-defined terminus in the loam of Level 72 at a depth of x3.96 m.

Level 75:
Very friable ash with some loamy sand; Munsell 10 YR 5/2. This was the last level of soft ash fill in the large basin dug into Levels 72, 76, and 78. Level 75 produced an enormous number of sherds. It was underlain within the basin by the more compact, but still ashy, material of Level 77.

Level 76:
Moderately compact heavy loam; Munsell 10 YR 5/3. Level 76 was a continuation of the moderately compact heavy loam of Level 72 above. Like that level, it represented the original material into which the basin of Levels 71, 75, and 77 was dug. A thin ash lens separated Level 76 from the underlying Phase I/II deposits of Level 78.

Level 77:
Light loam and ash; Munsell 5 Y 5/4. Level 77 was the bottom fill level within the large ash basin dug into Levels 72, 76, and 78. Soil was a slightly greenish light loam with high ash content, but it was more compact than the overlying pure ash of Levels 71 and 75. Like Level 75, this level had an extremely high sherd content, with some possible mixing from the Phase I/II deposits beneath it. Level 77 terminated in the hard clay matrix of Level 78.

Level 78:
Very compact clay; Munsell 10 YR 5/4. Level 78 formed the lowest level of cultural deposits in Unit LX-S. Soil was a very compact clay characterized by small ash lenses and many yellow and orange inclusions, with relatively little pottery, bone, or sandstone. This appeared to be classic Phase I/II material, similar to that found in the lower levels of other units. Level 78 formed the base of the large ash basin excavated as Levels 71, 75, and 77 and underlay the surrounding occupational deposits of Levels 72 and 76. It was separated from Level 76 by a thin layer of ash, and by the southern extension of the burnt clay floor excavated in Unit LX-N as Feature 48. Along the eastern, northern, and southern faces of the unit, Level 78 was excavated down to sterile floodplain alluvium.

Level 79 (Pit 10):
This was a separate, comparatively small ash pit dug into the occupational deposits east of the large ash basin of Levels 71, 75, and 77. Pit 10 began in Level 72, just below the ash of Levels 68 and 69. In its upper levels, Pit 10 merged with, and was excavated as part of, the large ash basin, although there was also some mixing with Level 72 material. It was not until midway through Level 78 that Pit 10 was recognized as a separate (though probably associated) feature and given a separate level designation. Level 79, beginning in Level 78 at a depth of x4.69 m and
Table Al: Description of excavated levels and features: LX-S

terminating in sterile floodplain alluvium at x5.15 m, was the only excavated level in Pit 10. Fill in this level was a soft ash and light clay containing abundant structural remains and loaf-shaped bricks, significant amounts of pottery, moderate amounts of bone, and no slag. The diameter of Pit 10 was 1.9 m at the top of Level 79 and 1.47 m at closing.

Level 80:
Moderately compact clay; Munsell 10 YR 5/3. Level 80 was an irregular patch of moderately compact clay which overlay Level 78 approximately at the the northern and western borders of the Levels 71, 75, and 77 ash deposit. The clay of this level was similar to that of Level 78, although somewhat less compact, lighter in color, and with a higher ash content. It contained much larger amounts of pottery than Level 78 and probably included material from the overlying ash pit. This level was separately excavated c. 0.25 m down to floodplain alluvium, by which point it was indistinguishable from Level 78.

Level 81:
Moderately compact clay; Munsell 10 YR 5/3. This was a thin layer of grayish clay located in the west center of the unit, just southeast of Level 80. Like Level 80, it was located at the top of Level 78, within the area of the Level 77 ash deposit. Soil color and ash content of this level were analogous to Level 80, but it lacked the high pottery yield of that level.

Feature 49:
This was a poorly preserved, contracted adult burial encountered beneath Level 78 in the southeastern corner of the unit. Burial was in a shallow irregular pit dug into sterile floodplain alluvium to a depth of x5.11 m.

Table Al: Description of excavated levels and features: NWS
UNIT NWS
(Soil descriptions after Ahn 1970:19-21)

Level 1 (North Test):
Loam to heavy loam; Munsell 10 YR 6/4 to6 /3. This was the surface level of the 1.-by-4.5m North Test Unit opened perpendicular to the northern face of the city wall. Level 1 of the North Test was excavated in two parts. The upper c. 40 cm were made up of slow wall melt which corresponded to Level 2 in the South Test Unit on the other side of the wall. This material was composed of a moderately compact, rather disturbed mud matrix with many brick fragments and significant amounts of pottery, but negligible bone and slag. The wall melt extended down and out from the existing surface of the city wall foundation and had clearly been deposited after the wall had deteriorated. Beneath this, approximately the lower 20 cm of Level 1 were composed of classic rapid wall collapse in which individual bricks were distinguishable and brick comprised c. 80% of excavated material. This material, which continued into the underlying Level 3, was debris from the initial rapid collapse of the city wall.

Level 2 (South Test):
Light loam to light clay; Munsell 10 YR 5/4 to 5/3. This was the topmost level of the South Test Unit, the 2.-by-1.5-m unit located directly opposite the North Test Unit on the south side of the city wall. Like Level 1 of the North Test Unit, Level 2 consisted of slow melt from the city wall after its initial deterioration. Level 2 was more compact and more clayey than Level 1, containing only moderate amounts of pottery and few discernible brick fragments. This was almost pure wall melt with little or no inclusion of wall collapse or later artifacts.

Level 3 (North Test):
Clay; Munsell 10 YR 6/4. Level 3 underlay Level 1 in the North Test Unit and continued the rapid wall collapse first encountered in the lower part of that level. As in Level 1, the wall collapse consisted almost entirely of closely packed whole and partial bricks, with very few artifacts. This level corresponded in depth to Level 4 of the South Test Unit but contained many more bricks and fewer artifacts than Level 4. The difference between these two units made it almost certain that the initial rapid collapse of the city wall was primarily toward the northern, external side of the wall.

Level 4 (North Test):
Clay; Munsell 10 YR 6/3. Level 4 underlay Level 2 in the South Test Unit, at the same depth as Level 3 of the North Test Unit. This was a level of slow to moderately slow wall collapse and melt, accumulated on the original site surface to the interior of the city wall. Soil was a very hard and homogeneous clay with more artifacts than the wall melt of Level 2 above, and with one or more periods of surface exposure indicated by the presence of sandstone grinders. In contrast to Level 3 on the northern side of the wall, this level contained relatively few distinguishable large bricks.

Level 5 (North Test):
Loam; Munsell 10 YR 6/4. Level 5 was the lowest level excavated in the North Test Unit. It underlay the rapid wall collapse of Level 3 and occurred at the same depth as the analogous Level 6 of the South Test Unit. Level 5 consists of the last vestiges of the grayish brick rubble attributable to the collapse and initial melt of the wall. Beneath was a level of very compact clay with patches of burnt earth and very thin ash lenses, apparently ground that had been deliberately prepared for the wall construction.

Level 6 (South Test):
Loam; Munsell 10 YR 6/2. Level 6 underlay Level 4 in the South Test Unit and was at the same depth as Level 5 of the North Test Unit. This level was nearly identical to Level 5: a layer fallen brick represents the initial deterioration of the wall. Deliberately placed within

454 Table A1: Description of excavated levels and features: NWS
this level was a small vessel or urn, c. 40 cm high, covered by a ceramic plate. The bottom of this vessel was at the discontinuity between Levels 6 and 7.
[Feature 56]. The vessel contained the remains of an infant aged twelve-to-eighteen months.

Level 7 (South Test):
Almost pure ash; no Munsell reading. This was a small ash pit which had been dug into Level 8 before Level 6 was deposited. Soil was ash with several charcoal lenses and many artifacts.

Level 8 (South Test):
Light to heavy clay; no Munsell reading. This was the original site surface upon which the city wall was constructed. Soil was a compact clay containing discernible bricks from earlier structures.

Wall Trench Section:
The Wall Trench Section was a 6-by-1.1-m section through the city wall and adjacent deposits, located 0.5 m east of the North and South Test units. No individual level records were kept for this unit. Stratigraphy of the Wall Trench Section can be summarized as follows: The main wall foundation measured 3.3 m north-south at the surface and was flanked on either side by wall melt and wall collapse deposits analogous to those of the North and South Test units. The wall itself was a solid mass of large cylindrical gray bricks, with a very compact coating of mud melt, possibly a deliberate rendering, found on the lower external surface of the north and south faces. The foundation measured 3.7 m across at its base, and extended to a depth of X1.35 m in the east and X1.58 m in the western part of the unit. As in the North and South Test units, the lowest two courses of the wall were made up of distinctive yellow bricks which flared out to the north and south to form a flat "skirt" along the inner and outer wall faces. Beneath these bricks was a platform of hard clay, burnt earth, and ash lenses. The builders' trench, if it existed, was very indistinct. Excavators collected ceramics from the area directly beneath the wall foundation, beginning at a depth of X1.42 m and ending with the closing of the unit at x2 m. The gold earring (SF 1433) was found below the northern edge of the wall at a depth of X1.52 m, in pre-wall deposits corresponding to those of Level 8 of the South Test Unit.

Table A1: Description of excavated levels and features: WFL

<table>
<thead>
<tr>
<th>UNIT</th>
<th>Soil descriptions after Ahn 1970:19-21; * = C14 date for level</th>
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<tbody>
<tr>
<td>Level 1:</td>
<td>Friable light loam to loam; Munsell 10 YR 6/4. Level I of Unit WFL consisted of mixed and quite disturbed surface deposits which contained many potsherds and other artifacts. This level was soft, crumbly, and easily excavated. It showed a sharp discontinuity with Level 2 beneath, probably marking the lower limit of postdeposition disturbance.</td>
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<tr>
<td>Level 2:</td>
<td>Compact loam to light loam; Munsell 10 YR 7/3 to 6/3. Level 2 was a level of classic undifferentiated rapid to moderately slow wall collapse, composed of a hard, platy, and very homogeneous loam. Three terracotta statuettes (SF 468, SF 468A, and SF 468B) and an infant burial in a small jar (Feature 55) were recovered from this level. A large funerary urn (Feature 31) had been interred just below the bottom of the level. The soil in Level 2 contained some amorphous terracotta clods but was otherwise unusually lacking in artifacts. This level may</td>
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</tbody>
</table>
have been deliberately deposited, perhaps in association with the Feature 31 burial.

Feature 55:
This was an child burial in a small slipped urn, buried in Level 2.

Feature 31:
This was a funerary urn (not excavated) encountered in the north wall of Unit WFL at a depth of x0.24 m. The urn was actually interred in Level 3, but the top of the vessel continued up into the lower part of Level 2. Whether this burial is associated with the statuettes and infant burial (Feature 55) of Level 2, and with the earlier burials found in Level 4 (Features 34, 35, and 36), is unclear.

Feature 32:
Feature 32 was a single layer of hard red-fired terracotta clods located in the extreme northwestern corner of the unit at a depth of x0.32 m. This feature abutted on and was clearly related to the urn burial of Feature 31, but its function was uncertain.

Level 3:
Loosely compacted heavy loam; Munsell 10 YR 6/4. Level 3 was another level of wall collapse with no discernible bricks or brick fragments. It contained even fewer artifacts than Level 2. Level 3 was similar to Level 2, but it was more easily worked and was separated from Level 2 by a clear discontinuity. This may have been the surface of Unit WFL before Feature 31 was put in place.

Level 4:
Compact light clay; Munsell 10 YR 7/4. Level 4 resembled Level 3 in color and composition but was more clayey, more compact, and contained more domestic debris. At the bottom of the level were found the urn burials of Features 35 and 36, as well as Feature 34, a shallow trench burial containing a slightly flexed adult skeleton. Two smaller globular ceramic vessels were apparently associated with these burials. Level 4 appeared to be surface material which accumulated following these interments.

Feature 34:
This feature was a semiflexed adult skeleton, interred in a shallow, irregular trench at the juncture of Levels 4 and 5. Feature 34 was located at the west central edge of the unit and extended into the western wall. It was found just north of the urn burials Features 35 and 36 at the same depth. The depth of Feature 34 was c. x0.65-x0.69 m.

Table A1: Description of excavated levels and features: WFL

Feature 35:
Feature 35 was one of two adjacent urn burials found in the southwest corner of the unit at the base of Level 4. This burial consisted of a large upright funerary urn, 89 cm in height and covered with an inverted carinated pot. A large ceramic plate rested to one side of the top of the urn. Inside the urn were the poorly preserved, partially burnt remains of two individuals, at least one of whom was an adult male.

Feature 36:
This urn burial was located just southeast of Feature 35 in the southwest corner of the unit. It was at the same depth as and had been interred in a common pit with the urn of Feature 35. Like Feature 35, Feature 36 was a large, well-made, covered funerary urn which had been buried in an upright position. This urn was lodged in the eastern wall of the unit and was not opened.

Level 5:
Compact light clay; Munsell 10 YR 7/4. Level 5 was the surface into which Features 34, 35, and 36 had been dug. It closely resembled and was clearly related to Level 4, with a compact platy soil somewhat redder in color than Level 4. Like Level 4, Level 5 was formed by the slow accumulation of wall collapse and domestic debris, with various episodes of exposure as the site surface.

Level 6:
Compact clay; Munsell 10 YR 7/6. Level 6 had a somewhat higher clay content than Level 5 but was otherwise very similar. It contained large sherds, but few obvious bricks or brick fragments. This level continued the slow and homogeneous accumulation of wall collapse that had characterized previous levels of Unit WFL. Like those levels, it was notable for the absence of the great quantities of domestic debris found in similar wall collapse deposits in the central "residential" precinct of Jenn6-jeno.

Level 7:
No Ahn or Munsell reading. This level was opened as an arbitrary level change within the homogeneous wall collapse of Level 6. Soil was very similar to that of Level 6 but represented an earlier period within that lengthy deposition episode.

Level 8:
Friable clay; 10 YR 7/6. Level 8 was a layer of friable clay, related generally to Levels 4-7 above, but softer, flakier, and with more artifacts. This level originated in the southwestern three-quarters of the unit, surrounding Level 9 in the northeast corner. Beneath Level 9, it spread to cover the entire unit. This level of soft earth directly overlay the potsherd pavement of Feature 41. Some of the potsherds and calcite nodules of Feature 41 were inadvertently removed as part of Level 8 before the pavement was recognized.

Level 9:
Very compact clay; Munsell 10 YR 7/3. This was a platform of brick-hard clay confined to the northeastern corner of the unit. Level 9 was surrounded by and underlain by the soft clay of Level 8. It did not appear to be related to the potsherd pavement of Feature 41 found beneath the southern part of Level 8 at a slightly lower depth.

Feature 41:
Feature 41 was an irregularly shaped pavement of potsherds and calcite nodules, covering most of the southern half of the unit beneath Level 8. This pavement had been laid on top of Level 10, just north of the lowest part of the urn burials Feature 35 and 36. Depth of Feature 41 ranged from X1.29 m at the eastern end of the unit to X1.41 m in the lowest, central part of the feature.

Table A1: Description of excavated levels and features: WFL
Level 10:
Moderately compact clay; Munsell 10 YR 7/6. This was the level upon which the pavement of Feature 41 had been constructed. Soil was a very homogeneous clay containing few artifacts.

Level 11:
Light clay; Munsell 10 YR 8/6. This was an arbitrary level change from Level 10. Soil was essentially the same as in Level 10, but flaked up in large plates and containing much rice chaff. It also had some pockets of softer material, especially in the northwest corner. Level 11 contained much more domestic debris overall (possibly hearth sweepings?) than Level 10.

Level 12:
Moderately compact clay; Munsell 10 YR 6/4. Level 12 was a transition from the wall collapse of Levels 10 and 11 to the more complex stratigraphy below. Soil was a chunky clay with dispersed charcoal and almost no pottery. By the end of the level, distinct differences were visible between the northern and southern parts of the unit.

Level 13:
Light clay; Munsell 10 YR 7/3. Level 13 began as a moderately compact wall collapse containing few artifacts. At a depth of c. x2.5 m there was a substantial increase in artifacts, accompanied by the appearance of mottled brown patches within the clay matrix. Beneath this, soil was a white and homogeneous clay with more quartz/clay inclusions and negligible artifact content. By the end of the level, Level 13 was present only in the southern part of the unit. This may represent the earliest true occupation in the area of Unit WFL, overlying a layer of essentially sterile floodplain clay which had been built up deliberately at the site periphery.

Level 14:
Compact clay; Munsell 10 YR 8/2. Level 14 began in the northern third of the unit but expanded with depth to include all but a tiny patch in the southeast. This was a level of very compact, rapidly walling (probably taut) collapsed with many small sherds, covering Level 15 and part of Level 13. A possible wall in the northwest corner was too fragmentary to isolate reliably.

*Level 15:
Friable light clay and ash; Munsell 10 YR 5/4. This was a very ashy level containing much domestic debris. Level 15 first appeared in the central part of the unit, south of Level 14, but then spread to encompass the entire northern third of the unit. This material appeared to be the fill of a refuse pit over which the Level 14 wall collapse had been accumulated. Radiocarbon Sample 51 was collected from a pocket of scattered charcoal at 2.73 m depth. Confidence in quality and reliability of sample to date level was good. The resulting date is 1,310 ± 110 B.P. (RL 1809).

Level 16:
Moderately compact light clay; Munsell 10 YR 6/6. Level 16 began in the center west of the unit and extended downward to cover the northern two-thirds of the unit. It underlay Levels 13, 14, and 15 and continued the whitish clay found at the bottom of Level 13. Soil was moderately compact and chunky, with many terracotta clods but few artifacts. This material appeared to be a mixture of
floodplain clay with some slow accumulation of deposits from occupation elsewhere on the mound. Level 16 probably represented the deliberate raising of the ground level preparatory to occupation of the western periphery of the site.

Table A1: Description of excavated levels and features: WFL

Level 17:
Compact clay; Munsell 10 YR 6/6. Level 17 underlay and closely resembled Level 16. Like Level 16, it probably represented the purposeful raising of the ground level at the site periphery. Soil was a compact clay which was nearly sterile but did not appear to be typical floodplain alluvium.

Table A2: Feature Index

<table>
<thead>
<tr>
<th>Feature</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LX-N</td>
</tr>
<tr>
<td>2</td>
<td>LX-S</td>
</tr>
<tr>
<td>3</td>
<td>DX-S</td>
</tr>
<tr>
<td>4</td>
<td>LX-S</td>
</tr>
<tr>
<td>5</td>
<td>HK</td>
</tr>
<tr>
<td>6</td>
<td>LX-S</td>
</tr>
<tr>
<td>7</td>
<td>LX-S</td>
</tr>
<tr>
<td>8</td>
<td>LX-N</td>
</tr>
<tr>
<td>9</td>
<td>LX-N</td>
</tr>
<tr>
<td>10</td>
<td>DX-S</td>
</tr>
<tr>
<td>11</td>
<td>LX-S</td>
</tr>
<tr>
<td>12</td>
<td>CTR</td>
</tr>
<tr>
<td>13</td>
<td>CTR</td>
</tr>
<tr>
<td>CTR LX-N</td>
<td></td>
</tr>
<tr>
<td>LX-S</td>
<td></td>
</tr>
</tbody>
</table>

Description
House 1: Rectilinear structure of cylindrical bricks at top of Level 8; visible on surface of unit
House 2: Rectilinear structure of cylindrical bricks at top of Levels 7 and 12; visible on surface of unit
House 3: Rectilinear structure of cylindrical bricks, visible on surface; foundation dug into Levels 8 and 15; associated with House 2
Upper level of Pit 1: Possible bath/latrine drainage for House 2; dug into Level 11
Skeleton 1: Slightly flexed adult inhumation in shallow trench dug into Level 4
Level of heavy brick rubble overlying Level 18 on interior of Feature 7
House 4: Rectilinear structure of cylindrical bricks at top of Level 21
House 14: Wall stump extending into Unit LX-N from Unit LX-S; probable northern extent of Feature 10; dug into Level 11
House 5: Rectilinear structure of cylindrical bricks in Level 12
House 6: Rectilinear structure of cylindrical bricks at top of Level 21; associated with Feature 7
House 7: Rectilinear structure of cylindrical bricks on Levels 27 and 30
House 8: Small rectilinear structure of cylindrical bricks, built on Level 4; possible funerary structure; visible on surface of unit
House 9: Irregular linear structure of cylindrical bricks associated with Feature 12; built on Level 4; visible on surface
Small ash pit dug into wall collapse of Feature 12 (Level 2)
Triangular oven of cylindrical bricks, attached to east wall Feature 20
Cache of black clay spindle whorls in Level 27

Table A2: Feature Index

<table>
<thead>
<tr>
<th>Feature</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>LX-N</td>
<td>Triangular oven of cylindrical bricks, attached to north wall Feature 20</td>
</tr>
<tr>
<td>18</td>
<td>LX-S</td>
<td>Drainage trough leading into top level of Pit 2; Possible bath/latrine drainage area, encountered at top of Level 27; probably associated with Feature 11</td>
</tr>
<tr>
<td>19</td>
<td>LX-N</td>
<td>Triangular oven attached to southwest wall of Feature 20</td>
</tr>
<tr>
<td>20</td>
<td>LX-N</td>
<td>House 10: Round house made of cylindrical bricks, associated with Features 15, 17, and 19; house foundation dug into Level 23</td>
</tr>
<tr>
<td>21</td>
<td>LX-S</td>
<td>Cache of sandstone grinders and appliqué-decorated vessels in Level 31</td>
</tr>
<tr>
<td>22</td>
<td>CTR</td>
<td>Funerary urn containing small amount of deteriorated bone; associated with Levels 14, 19, and perhaps 15</td>
</tr>
<tr>
<td>23</td>
<td>CTR</td>
<td>Urn burial with bone fragments from two or more individuals; associated with Level 10 and perhaps Level 19</td>
</tr>
<tr>
<td>24</td>
<td>CTR</td>
<td>Urn burial with cremated bone; associated Levels 14, 19, perhaps 15</td>
</tr>
<tr>
<td>25</td>
<td>CTR</td>
<td>Shallow ash pit in Level 22</td>
</tr>
<tr>
<td>26</td>
<td>LX-N</td>
<td>Skeleton 2: Disturbed skeletal remains at bottom of deep shaft pit dug into Level 13</td>
</tr>
<tr>
<td>27</td>
<td>LX-N</td>
<td>Small ash pit in Level 25</td>
</tr>
<tr>
<td>28</td>
<td>LX-N</td>
<td>Two small ash pits, at same depth as and associated with Feature 27</td>
</tr>
<tr>
<td>29</td>
<td>LX-S</td>
<td>Brick retaining wall around edge of Pit 7, at top of Level 44</td>
</tr>
<tr>
<td>30</td>
<td>LX-N</td>
<td>Sherd concentration underlying Feature 26 at bottom of Level 24</td>
</tr>
<tr>
<td>31</td>
<td>WFL</td>
<td>Funerary urn in north wall of Unit WFL, Level 3</td>
</tr>
<tr>
<td>32</td>
<td>WFL</td>
<td>Concentration of terracotta nodules associated with Feature 31</td>
</tr>
<tr>
<td>33</td>
<td>LX-S</td>
<td>Upper level of Pit 8: Probable latrine/bath drainage function; first encountered at depth of Level 36</td>
</tr>
</tbody>
</table>

Table A2: Feature Index

<table>
<thead>
<tr>
<th>Feature</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>WFL</td>
<td>Skeleton 3: Semiflexed adult burial in shallow irregular trench in Level 5</td>
</tr>
</tbody>
</table>
35 WFL Funerary urn in Level 5 with bone fragments from two individuals
36 WFL Funerary urn and cover in east wall of Level 5; unexcavated
37 LX-N House 11: Round house of cylindrical bricks; foundation dug into Levels 29, 30, and 31
38 LX-N Small ash pit associated with Feature 37, dug into Level 29
39 LX-N Lower level of deep ash pit containing oven waste from Feature 15; upper level of pit was excavated as Level 18
40 LX-N Large ash pit dug into Level 29 beneath Feature 37
41 WFL Potsherd pavement at top of Level 10
42 LX-S Funerary urn containing tightly flexed adult skeleton, at bottom of Level 55 of Pit 11
43 VOID
44 LX-N Ash pit dug into remains of Feature 46
45 CTR Ash lens at top of Level 34
46 LX-N House 12: Round tauf house at top of Level 46
47 LX-S Two superimposed funerary urns containing tightly flexed adult skeletons; found at bottom of Level 56 within Pit 7
48 LX-N Burnt clay floor at top of Level 48 of Unit LX-N; extended into Unit LX-S at top of Level 78
49 LX-S Skeleton 4: Contracted adult burial dug into sterile floodplain beneath Level 78
50ALS House 13: Composite brick foundations on surface of Unit ALS
51 HAMB Two urn burials in shallow trenches dug into Level 12; excavated burial consisted of two urns laid end to end enclosing extended skeleton

Table A2: Feature Index

<table>
<thead>
<tr>
<th>Feature</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>52 ALS</td>
<td></td>
<td>Unidentified round clay feature found in Level 6</td>
</tr>
<tr>
<td>53 KAN</td>
<td></td>
<td>Burnt earth hearth found midway through disturbed floodplain deposits of Level 7</td>
</tr>
<tr>
<td>54 ALS</td>
<td></td>
<td>Child burial in carinated pot in Level 5</td>
</tr>
<tr>
<td>55 WFL</td>
<td></td>
<td>Child burial in urn in Level 2</td>
</tr>
<tr>
<td>56 NWS</td>
<td></td>
<td>Infant burial in pot in Level 6</td>
</tr>
<tr>
<td>57 KAN</td>
<td></td>
<td>Soil section from Main Marigot Trench</td>
</tr>
<tr>
<td>58 KAN</td>
<td></td>
<td>Soil section from Thalweg Trench</td>
</tr>
</tbody>
</table>

Table A3: Features and artifacts associated with structures

<table>
<thead>
<tr>
<th>Associated Level/Feature</th>
<th>Artifacts</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hs. 13 (Feat. 50)</td>
<td>Unit ALS</td>
<td></td>
</tr>
<tr>
<td>L. 1 (wall collapse)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feat. 50 (Hs. 13)</td>
<td>4 slag</td>
<td>94 g</td>
</tr>
</tbody>
</table>
Hs. 8-9 (Feat. 12-13)
Unit CTR
L. 2  (wall collapse)  1 fired brick
L. 3  (wall collapse)  1 fired brick
I glass bead
39 slag (L. 2 and 3 combined)  900 g
Feat. 12 (Hs. 8)  Feat. 13 (Hs. 9)
Hs. 1 (Feat. 1)
Unit LX-N
L. 1  (wall collapse)  1 spindle whorl (2 frags.)
L. 2  (wall collapse)  1 anim. figurine/Sao face frag.
L. 3  (ext. surface)  2 glass beads 108 slag
L. 4  (floor)  I unid. copper
L. 5  (ext. surface)  1 copper wire ring I clay bead frag.
L. 7  (floor)  1 bead/spindle whorl  I anim. figurine frag.
1 sandstone 98 slag
2 iron wire/nail
1 poss. iron knife blade I copper wire ornament 24 slag
I unid. iron I teardrop weight I clay net weight frag. I figurine frag, poss. Sao face
76 slag
I unid. iron 15 slag
1 sandstone 40 slag
3 iron wire/nail
Feat. 1 (Hs. 1)
478 g  0.4 g  Ig
985 g
5g  425 g  5g
500 g  Ig  100 g
500 g

Table A3: Features and artifacts associated with structures
Hs. 14 (Feat. 8)
Unit LX-N
L. 8  (wall collapse)  1 quartz bead 41 slag
L. 9  (occ. debris)  I spindle whorl/bead
Feat. 8 (Hs. 14)
1 quartz bead 41 slag
I spindle whorl/bead
1 sandstone 98 slag
1 frag. anim. figurine I unid. fired day cylinder 70 slag
2 iron wire/nail
1 copper pendant
Hs. 5 (Feat. 9)
L. 10 (wall collapse) L. 11 (wall collapse/occ. debris) Feat. 9 (Hs. 5)
1 poss. figurine frag. 1 frag. carnelian bead 50 slag
1 iron wire
1 iron nail frag. 1 unid. copper
2 spindle whorls I frag. ceramic arm band
6 fired brick frags.
1 poss. stone bracelet frag.
6 sandstone 62 slag
1 iron wire
1 unid. copper
5 slag
Hs. 10 (Feat. 20)
L. 14 (rapid collapse) L. 16 (occ. debris)
L. 17 (occ. debris) L. 15 (ash frag./Feat. 15 oven) L. 18 (ash frag./Feat. 15 oven)
1 terracotta statuette head
4 sandstone 62 slag
1 iron knife blade
5 unid. iron
1 teardrop weight
2 pinchpots/pseudocrucibles
1 fired brick frag.
5 sandstone 304 slag (L. 16 and 17 combined)
1 iron arrowhead
1 iron wire/nail
1 unid. iron 1 unid. iron 1 sandstone
1 poss. furnace parts
1 unid. fired day 1 sandstone
1 iron spike/ spear tip
2 iron wire
410 g 975 g
4g
Unit LX-N
285 g 3g
1,330 g
0.1 g 65 g
Unit LX-N
460 g log
1,525 g 6g 7g
464

Table A3: Features and artifacts associated with structures
Feat. 39 (ash fr/Feat. 15 oven)
L. 21  (ext. surface)  L. 19  (ext. surface)  L. 22  (ext. surface)  L. 20  (floor)
Feat. 15 (oven)  Feat. 17 (oven)  Feat. 19 (oven)  Feat. 20 (Hs. 10)
L. 31, LX-S (cont. L. 16/17)
Feat. 21, LX-S (sandstone cache)
L. 43, LX-S (assoc. F 21)  L. 33, LX-S (Pit 3)
1 day pot smoother
2 pinchpots/pseudocrucibles
1 sandstone 15 slag I iron wire/nail
1 iron ball
2 iron spike frags. 16 slag
1 iron knife blade I unid. drilled quartz pebble
1 sandstone
6 slag
1 iron wire/nail
6 slag
1 iron spike 3 sandstone 16 slag
1 poss. iron nail
3 unid. iron 2 sandstone 2 iron blades
2 slag
1 unid. iron
4 slag
1 iron hook frag.
1 poss. teardrop weight
2 terracotta statuettes
1 sandstone
7 slag
2 iron wire/nail I unid. copper I teardrop weight
2 ear plugs/labrets
1 poss. fired brick frag.
1 hematite nodule
5 sandstone 988 slag
7 iron wire I iron pendant 1 iron triangle
4 unid. iron
1 poss. copper bracelet frag.
1 day pot smoother
1 terracotta statuette frag.
1 unid. ceramic sphere
1 granite hand axe 93 sandstone
4 unid. iron 1 day bead 2 sandstone
1 slag
1 iron wire/nail
1 pinchpot/pseudocrucible I glass bead I sandstone
825 g  55 g  134 g  33 g  183 g  37g  9g  1 g
35g
25 g  2.2 g
7,448 g  12.5 g  4.5 g
Table A3: Features and artifacts associated with structures

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>Artifacts</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. 25</td>
<td>(wall collapse)</td>
<td>5 slag, 1 fired brick frag.</td>
<td>75 g, 2 unid. iron, 1 sandstone, 11 slag</td>
</tr>
<tr>
<td>L. 26</td>
<td>(wall collapse)</td>
<td>2 sandstone</td>
<td>1 iron wire/nail, 1 copper globule, 1 fired brick frag.</td>
</tr>
<tr>
<td>L. 27</td>
<td>(occ. debris)</td>
<td>22 slag</td>
<td>1 iron wire/nail, 1 copper frag., 1 sandstone, 1 quartz bead</td>
</tr>
<tr>
<td>L. 28</td>
<td>(floor)</td>
<td>3 slag</td>
<td>4 sandstone, 12 slag (L. 29 and 30 combined), 1 sandstone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>Artifacts</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. 39</td>
<td>(wall collapse)</td>
<td>6 sandstone</td>
<td>1 furnace parts w/ slag</td>
</tr>
<tr>
<td>L. 40</td>
<td>(wall collapse)</td>
<td>14 slag</td>
<td>2 iron wire/nail, 1 iron ring, 1 slag</td>
</tr>
<tr>
<td>L. 41</td>
<td>(collapse and floor)</td>
<td>14 slag</td>
<td>2 coiled iron wire, 1 unid. iron, 1 copper ornament</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>Artifacts</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit LX-N</td>
<td></td>
<td></td>
<td>135 g, 7.5 g, 509 g, 0.5 g, 300 g, 0.1 g, 300 g, 228 g</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>Artifacts</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. 43</td>
<td>(collapse and house wall)</td>
<td>3 slag</td>
<td>175 g, 12 g, 3 g, 325 g</td>
</tr>
</tbody>
</table>

Table A3: Features and artifacts associated with structures
Hs. 3 (Feat. 3)
L. 2  (wall collapse)
L. 3  (wall collapse)
L. 4  (wall collapse)
L. 6  (collapse and floor)
L. 6 LX-N (occ. debris) Feat. 3 (Hs. 3)
I spindle whorl 73 slag I poss. iron knife blade I unid. iron
1 clay bead or weight 27 slag (L. 3 and 4 combined) I iron plate 3 unid. iron
9 slag
4 unid. iron
1 unid. drilled sandstone
4 slag

Hs. 2 (Feat. 2)
L. 4  (wall collapse)
L. 5  (wall melt and floor)
L. 10 (top = "bath area")
L. 11 (ext. surface)
L. 9  (Pit I and trough)
Feat. 4 (Pit 1) L. 22  (Pit 1)
L. 23  (Pit 1) L. 25  (Pit 1) L. 26  (Pit 1) L. 40  (Pit 1) L. 45  (Pit 1)
L. 60  (Pit 1)
27 slag (L. 3 and 4 combined) 23 slag
1 unid. iron
1 spindle whorl
1 vessel glass frag. 17 slag
1 spindle whorl 18 slag
1 iron knife blade
2 unid. iron 1 sandstone
3 slag
1 sandstone
2 slag
1 sandstone 15 tuyere frags. (MNI = 2)
1 slag
1 iron wire/nail 1 iron fish hook
4 iron wire 1 unid. iron
1 spindle whorl
1 slag
2 slag
1 pinch pot/pseudocrucible
1 sandstone
3 slag
2 sandstone
1 sandstone
4 slag

Unit LX-S
325 g 3g 210 g 20 g 125g 5g 44g
<table>
<thead>
<tr>
<th>Unit</th>
<th>L. 62 (Pit 1) Feat. 2 (Hs. 2)</th>
<th>L. 8 LX-N (wall collapse)</th>
<th>L. 9 LX-N (occ. debris)</th>
<th>Feat. 8 LX-N (Hs. 14)</th>
<th>L. 19 (ext. surface)</th>
<th>L. 20 (floor) Feat. 10 (Hs. 6)</th>
<th>Hs. 6 (Feat. 10)</th>
<th>L. 15 (reworked collapse)</th>
<th>L. 17 (reworked collapse)</th>
<th>L. 13 (slow collapse)</th>
<th>L. 14 (slow collapse)</th>
<th>Feat. 6 (brick rubble)</th>
<th>L. 18 (destruction debris/ final occ. debris)</th>
<th>L. 16 (ext. surface)</th>
<th>Feat. 7 (Hs. 4)</th>
<th>L. 44? (Pit 7) Feat. 29? (Pit 7)</th>
<th>L. 56? (Pit 7)</th>
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<tbody>
<tr>
<td></td>
<td>4 slag</td>
<td>1 quartz bead</td>
<td>1 sandstone</td>
<td>6 slag</td>
<td>1 quartz bead</td>
<td>41 slag</td>
<td>1 sandstone</td>
<td>64 slag</td>
<td>2 iron wire/nail</td>
<td>1 copper pendant</td>
<td>1 glass button or vessel frag.</td>
<td>1 sandstone</td>
<td>1 slag</td>
<td>1 sandstone</td>
<td>1 copper ring frag.</td>
<td>6 slag (L. 13 and 14 combined)</td>
<td>I copper ring frag.</td>
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<tr>
<td></td>
<td>1 sandstone</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td>17 slag</td>
</tr>
<tr>
<td></td>
<td>6 slag</td>
<td></td>
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Table A3: Features and artifacts associated with structures

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1 ceramic bracelet frag.
1 chipped quartz: poss. unfinished bead
1 sandstone 39 slag 330 g
1 iron wire/nail I ceramic pendant
1 fired brick frag. 21 slag 400 g
17 slag 125 g
1 frag. anim. figurine
1 unid. clay oval
5 sandstone
273 g 550 g
Unit LX-S

Table A3: Features and artifacts associated with structures
Feat. 47? (Pit 7)
Feat. 33? (Pit 8) L. 52? (Pit 8) L. 61? (Pit 8) L. 74? (Pit 8)
10 slag
1 iron ring frag. 1 iron wire/nail
1 iron point
1 iron "spoon"
1 iron ring frag.
1 copper ornament
2 sandstone
1 slag
Hs. 7 (Feat. 11)
L. 21 (wall collapse) L. 24 (ext. surface)
L. 12 LX-N? (ext. surface)
L. 13 LX-N (ext. surface)
Feat. 18 (Pit 2) L. 32 (Pit 2) L. 34 (Pit 2) L. 35 (Pit 2) L. 41 LX-S (Pit 6)
1 frag. anim. figurine
5 sandstone 95 slag
1 unid. iron
1 day bead
1 clay pot smoother
2 sandstone I poss. furnace parts 92 slag
1 poss. iron arrowhead
4 unid. iron
2 fired brick frag.
9 sandstone
1 flanged iron circle
1 iron wire/nail I iron nail/arrowhead shaft
1 conical copper, poss. weight
1 unid. copper I clay net weight I anim. figurine
2 fired brick frag.
5 sandstone 196 slag(L. 12 and 13 combined)
2 iron wire
1 iron wire/nail I spindle whorl I fired brick frag.
2 slag
3 slag
1 sandstone
2 slag
1 sandstone
6 slag
1 frag. anim. figurine I terracotta statuette frag.
1 ceramic cone I sandstone I slag
183 g 5g
Unit LX-S
1,345 g
0.5 g
975 g 24 g
3.5 g lg
2,530 g
18 g 51 g 68 g 60 g

Table A3: Features and artifacts associated with structures
L. 42 LX-S (Pit 6) L. 57 LX-S (Pit 6)
L. 28 (floor) L. 29 (floor) Feat. 11 (Hs. 7)
5 unid. iron
1 day pot smoother
1 slag
1 frag. anim. figurine
2 sandstone
9 slag
1 iron spike 27 slag (L. 28 and 29 combined)
1 unid. iron
1 iron nail
500 g 161 g
2g

Appendix B
Pottery
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Appendix B: Pottery
Table B1. Pot bases and handles, by excavation unit

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Appendix B: Pottery
Table B4. Twine-decorated body sherds by twine type

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Appendix B: Pottery
Table B4-continued. Twine-decorated body sherds by twine type

LEVEL	Twine
1+2+3+10	Twine	Twine	Twine	4+5	6+7	12
1	6
2	3/4/6
5	7/12
8
10/11
PIT 1	13/14	15/17
16	18
19/20
21
PIT 7	PIT 8
24
PIT 2
27	28/29	30
PIT 6	31
Feat21/L43
33
PIT 4	PIT 5	36
49	46
47	55
53	58/59	64/66	65/67	68/69	70/73
(79)
PIT 10	71	75	77	80	72	76	78
8-9-11	Twine	Twine	TOTAL
Appendix B: Pottery
Table B4-continued. Twine-decorated body sherds by twine type

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26 28 29 32 33 34 35 36 37 39
- 13
- 45
- 27
- 116
- 81
- 134
- 73
- 81
- 50
2 - 2 66
2 115
-- 17
1 - 3 85
2
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1-1-0
1-0-0
4-0-0
2-3-0
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0-4-0
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Table B4-continued. Twine-decorated body sherds by twine type

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Appendix B: Pottery

LEVEL

493
Figure Ba. Relative frequency graph of twine-decorated body sherds: LX-S
Percent of Classes of Sherds
Legend: Twine Classes
* Braided twines 1, 2, 3, 10  
0 Plaited Strip twines 4, 5  
0 Twisted twines 6,7 M  
All other twines Figure Blb. Relative frequency graph of twine-decorated body sherds: ALS

Appendix B: Pottery 495
LEVEL
25
71 m
8 9 10 11 13 16 17
22 23
24 25 26 28 29 32 33
34 35 36
37 M/7
39
0 20 40 60 80 100
Percent of Classes of Sherds
Legend: Twine Classes
M Braided twines 1, 2, 3, 10  
[I Plaited Strip twines 4, 5
Ea Twisted twines 6,7
* All other twines
Figure Bic. Relative frequency graph of twine-decorated body sherds: CTR

1
23
4 5 6
7/8
9 10 12/13
14 15 16 17 18 19
21 22 23
25 25
Percent of Classes of Sherds
Legend: Twine Classes
Braided twines 1, 2, 3, 10  
Plaited Strip twines 4, 5  
Twisted twines 6,7  
All other twines
Figure Bld. Relative frequency graph of twine-decorated body sherds: HAMB
Appendix B: Pottery
LEVEL
1
02/// 6 80 10
020 40 60 80 100

Appendix B: Pottery 497
2
3/4
Appendix B: Pottery

LEVEL
1
2 4 5 6
7/8
Trench
20 40 60

Appendix C Sandstone Table C1. Sandstone from excavation

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Appendix D
Metals
Table D1. Unidentifiable iron 534
Table D2. Slag counts and weights 536
Figure D1. Slag totals from unit LX by level and phase

a. LX-N late Phase IV: slag by level, 540
b. LX-N Phase I/II, III, and early IV: slag by level, 541
c. LX-S late Phase IV: slag by level, 542
d. LX-S Phase I/II, III, and early IV: slag by level, 543

Appendix D: Metals

Table D1. Unidentifiable iron

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### Appendix D: Metals

Table DI-continued. Unidentifiable iron

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Appendix D: Metals
Table D2. Slag counts and weights
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24 16
21 &22
25 27 & 29
33 31 &35 37 & 39
23 26 28 32
34 36
2 9&10
11 16 & 17
18 22 & 23
24
1
2 3
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IV IV III II II I/I
IV IV IV IV IV III sup. III sup. III sup. III sup. III sup.
I/H1
I/II I/V
I/II I/II
IV III sup. III sup. III inf. III nf I/I I/II
IV IV III
III
94.0 100.0
45.0 250.0 152.0 175.0 816.0
275.0 7.6 900.0 150.0 100.0 850.0 50.0
149.8 200.0 34.5 225.0 267.5
44.3 250.0 18.0 275.2
237.4 97.8 2,050.0 215.1 130.6 20.8 29.9 100.0 25.0 6,703.5
3.8
47.3 20.0 58.5 58.0
450.0 297.9 935.5
150.0 560.0 16.0 160.0

Appendix D: Metals
Table D2-continued. Slag counts and weights

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29 & 30 Trans. IV/III 31 & 34 Trans. IV/I
35 III sup.
36 & 37 III sup.
153.4 165.0
2.4 1,206.8
66.9 101.5 175.0 1.6
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## Appendix D: Metals

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<td>2</td>
<td>3&amp;4</td>
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<td>10</td>
<td>11</td>
<td></td>
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<td>7&amp;12</td>
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</tr>
<tr>
<td>15 &amp; 17</td>
<td>13 &amp; 14</td>
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<td>LEVEL</td>
<td>PHASE</td>
<td>NO. OF PIECES</td>
<td>WEIGHT (g)</td>
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Appendix D: Metals
Table D2-continued. Slag counts and weights

UNIT | LEVEL | PHASE | NO. OF PIECES | WEIGHT (g) |
<table>
<thead>
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<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NWS NWS NWS NWS NWS NWS
NWS TOTAL
WFL WFL WFL WFL WFL WFL WFL WFL WFL WFL
WFL TOTAL
SITE TOTAL
Pit 4
Pit 5
36
49 46 47 54 Pit 11
53 58 & 59
63 64 & 66 65 & 67 68 & 69 Pit 10
75 77 80
72 76 78
2 1 3 5 6
7
1
2 3
4 5 6 7 8 10 11
12
IV IV IV IV IV IV IV
Trans. IV/III Trans. IV/III Trans. IV/III Trans. IV/III Trans. IV/III
Trans. IV/III Trans. IV/III Trans. IV/III Trans. IV/III
III inf.
III inf.
I/II
IV IV IV IV IV IV
IV sup.
IV sup.
IV inf.
IV inf.
IV inf.
III sup.
III sup.
III inf.
III inf.
III inf.
38 29 105
7 10 50
6
9 27 92 58
21 32 57 70 37
4
5 30
7
14 2,610
Appendix D: Metals

1. 2. 3. 4. 5.

7. 8. 9.

10. 11.

Feat. 9 12 & 13

14.

16 & 17 Feat. 39

21. 19.

22.

Feat. 19 >20

Feat. 20 Feat. 17
Appendix D: Metals

Figure Dla. Slag totals from LX-N late Phase IV, by level

Figure Dib. Slag totals from LX-N Phase I/II, III, and early IV, by level
Appendix D: Metals

Appendix E

Fauna

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Figure E1. Weight of animal bone from ALS and CTR

Figure E2. Weight of animal bone from HK, NWS, and WFL

Figure E3. Weight of animal bone from LX-N

Figure E4. Weight of animal bone from LX-S

Figure E5. Weight of animal bone from KAN and HAMB

Figure E6. Average weight of animal bone per unit in g/m³

Appendix E: Fauna

Table E1. Measurements of selected elements attributable to Bos sp.

<table>
<thead>
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<th>Element and Measurements</th>
<th>Measurements (mm)</th>
<th>Provenience</th>
<th>Phase</th>
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<td>36.0 / 14.0</td>
<td>MI 30</td>
<td>I/II</td>
</tr>
<tr>
<td>(L/B)</td>
<td>37.0 / 13.3</td>
<td>LX-N 47</td>
<td>I/II</td>
</tr>
<tr>
<td>34.5 / 13.6</td>
<td>LX-N 42</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>37.2 / 13.2</td>
<td>LX-S 79</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td>34.0 / 13.0</td>
<td>LX-N 27</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>30.0 / 11.0</td>
<td>LX-S F21</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>1st Phalanx</td>
<td>56.0 / 29.8</td>
<td>CTR 37</td>
<td>I/W</td>
</tr>
<tr>
<td>(GLpe/Bp/Bd)</td>
<td>50.0 / 21.6</td>
<td>MI 20</td>
<td>III</td>
</tr>
<tr>
<td>49.5 / 23.5 / 23.0</td>
<td>MI 20</td>
<td>III</td>
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</tr>
<tr>
<td>56.8 / 26.8 / 25.4</td>
<td>LX-S 75</td>
<td>III 61.9 / 29.5 / 28.2 LX-S 69</td>
<td>III 53.3 / 27.7 / 27.0</td>
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<tr>
<td>ALS 7</td>
<td>III</td>
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<td></td>
</tr>
<tr>
<td>51.7 / 22.1 / 22.9</td>
<td>MI 5</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>52.1 / 24.0 / 23.6</td>
<td>LX-N F19</td>
<td>IV 52.3 / 25.3 / 24.0 LX-S 9</td>
<td>IV</td>
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<tr>
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<td>LX-S 9</td>
<td>IV</td>
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<td>LX-S 9</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>52.2 / 26.4 / 24.6</td>
<td>LX-S 3</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>53.1 / 23.8 / 23.3</td>
<td>LX-S 3</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>2nd Phalanx</td>
<td>38.5 / 29.4 / 23.8</td>
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</tr>
<tr>
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<td>36.4 / 24.5 / 20.5</td>
<td>MI 20</td>
<td>111</td>
</tr>
<tr>
<td>38.2 / 28.9</td>
<td>MI 15</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>38.6 / 29.8 / 25.2</td>
<td>LX-N 38</td>
<td>II 34.0 / 25.4 / 22.1 LX-N 38</td>
<td>III 36.0 / 23.8 / 20.6</td>
</tr>
<tr>
<td>LX-N 31</td>
<td>111 40.0 / 34.1 / 28.6 LX-S 77</td>
<td>111</td>
<td></td>
</tr>
<tr>
<td>39.7 / 30.9 / 29.0</td>
<td>LX-S 75</td>
<td>III 39.3 / 32.2 / 29.2 LX-S 75</td>
<td>III 40.6 / 27.2 / 23.2</td>
</tr>
<tr>
<td>LX-S 71</td>
<td>III 39.0 / 32.2 / 27.0 LX-S 69</td>
<td>III 31.8 / 22.6 / 18.7 ALS 7</td>
<td>II</td>
</tr>
<tr>
<td>33.8 / 24.0 / 20.6</td>
<td>MI 8</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>31.9 / 21.8 / 18.5</td>
<td>MI 8</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>/25.9</td>
<td>MI 5</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>34.7 / 26.2 / 21.7</td>
<td>LX-S 36</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>34.6 / 24.0 / 20.6</td>
<td>LX-S 4</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Calcaneus (GL)</td>
<td>115.7</td>
<td>LX-N 52</td>
<td>I/I</td>
</tr>
<tr>
<td>Tibia (Bd)</td>
<td>59.1</td>
<td>LX-N 38</td>
<td>III</td>
</tr>
<tr>
<td>Scapula</td>
<td>51.4 / 42.5</td>
<td>LX-N 47</td>
<td>I/II</td>
</tr>
<tr>
<td>(LG/BG)</td>
<td>61.9 / 52.6</td>
<td>LX-S 77</td>
<td>III</td>
</tr>
<tr>
<td>48.9 / 42.2</td>
<td>KAN 2</td>
<td>IV</td>
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Note: all measurements as per von den Dreisch (1976).

Appendix E: Fauna

Table E2. Measurements of selected elements attributable to dwarf ovicaprids

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<th>Element and Measurements Measurements (mm)</th>
<th>Provenience Phase</th>
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<tbody>
<tr>
<td>Maxillary M3 15.5 / 12.0 LX-N 52</td>
<td>I/I1</td>
</tr>
<tr>
<td>(L/B) 165 / 11.0 LX-N 18</td>
<td>IV</td>
</tr>
<tr>
<td>Maxillary dP4 (L/B) 13.7 / 9.0 LX-N 32</td>
<td>IV</td>
</tr>
<tr>
<td>Mandibular M3 20.2 / 7.1 LX-S 63</td>
<td>III</td>
</tr>
<tr>
<td>(L/B) 20.3 / 7.0 LX-S 58</td>
<td>II</td>
</tr>
<tr>
<td>19.3 / LX-N 27</td>
<td>TV</td>
</tr>
<tr>
<td>18.0 / LX-N 24</td>
<td>IV</td>
</tr>
<tr>
<td>Mandibular dP4 (L/B) 15.9 / 5.6 ALS 10</td>
<td>III</td>
</tr>
<tr>
<td>Mandibular Tooth-row 49.7 LX-S 63</td>
<td>III</td>
</tr>
<tr>
<td>M1 (CL) + M2 (CL) + M3 (GL) 44.1 LX-S 58</td>
<td>1/11</td>
</tr>
<tr>
<td>45.6 LX-N 24</td>
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</tr>
<tr>
<td>Atlas Vertebra 61.4 / 50.9 / 39.5 LX-N 49</td>
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</tr>
<tr>
<td>(GB/GL/BFcd)</td>
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</tr>
<tr>
<td>Axis Vertebra 33.3 / 24.9 LX-S 58</td>
<td>111</td>
</tr>
<tr>
<td>(BFcr/BPaccd) 39.1 / LX-N 27</td>
<td>IV</td>
</tr>
<tr>
<td>Femur (DO) 19.1 HAM 24</td>
<td>I/I1</td>
</tr>
<tr>
<td>Tibia (Bd) 20.5 LX-S 58</td>
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</tr>
<tr>
<td>Metacarpal 24.7 LX-N 52</td>
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<td>(Bd) 24.8 LX-N 51</td>
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<tr>
<td>Metatarsal (GL/Bd) 90.4 / 20.2 LX-S 46</td>
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<td>Calcaneus (GB) 15.3 LX-N 24</td>
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Note: All measurements as per von den Dreisch (1976).

Table E3. Body part distribution by provenience for Kobus Kob (the Kob)

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<tr>
<th>Element</th>
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<th>LXS</th>
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<tr>
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<td>77 76 70 66 3</td>
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<td>1</td>
<td>1</td>
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<tr>
<td>Mandible</td>
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</tr>
<tr>
<td>Mandibular dentition</td>
<td>2</td>
<td>1(1) [31]</td>
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<tr>
<td>Atlas Axis</td>
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<td></td>
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<tr>
<td>Cervical vertebrae Thoracic vertebrae Lumbar vertebrae</td>
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<td></td>
</tr>
<tr>
<td>Sacrum Scapula</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humerus-proximal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humerus-distal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radius-proximal</td>
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<tr>
<td>Radius-distal</td>
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Appendix E: Fauna
Table E3-continued. Body part distribution by provenience for Kobus Kob (the Kob)

<table>
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<th>ALS</th>
<th>CTR</th>
<th>HAM</th>
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</tr>
<tr>
<td>Mandible</td>
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<td></td>
<td></td>
</tr>
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<td>6</td>
<td>7</td>
</tr>
<tr>
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<tr>
<td>Axis</td>
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<td></td>
</tr>
<tr>
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<td></td>
<td></td>
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<tr>
<td>Thoracic vertebrae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumbar vertebrae</td>
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</tr>
<tr>
<td>Sacrum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scapula</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humerus-proximal</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>Radius-distal</td>
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<td>Ulna</td>
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<td></td>
</tr>
<tr>
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TOTAL NISP: 3 2 3 4 1 2 1 1 1 1 1 2 1
MNI: 1 1 2 1 1 1 1 1 1 1 1 1

Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcranial elements.
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<tr>
<td>Mandibular dentition</td>
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<tr>
<td>Atlas</td>
<td>1</td>
</tr>
<tr>
<td>Axis</td>
<td>1</td>
</tr>
<tr>
<td>Cervical vertebrae</td>
<td>1</td>
</tr>
<tr>
<td>Thoracic vertebrae</td>
<td>1</td>
</tr>
<tr>
<td>Lumbar vertebrae</td>
<td>1</td>
</tr>
<tr>
<td>Sacrum</td>
<td>1</td>
</tr>
<tr>
<td>Scapula</td>
<td>1</td>
</tr>
<tr>
<td>Humerus-proximal</td>
<td>1</td>
</tr>
<tr>
<td>Humerus-distal</td>
<td>1</td>
</tr>
<tr>
<td>Radius-proximal</td>
<td>1</td>
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<td>Radius-distal</td>
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</tr>
<tr>
<td>Ulna</td>
<td>1</td>
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</tr>
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<tr>
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<td>Femur-distal Patella</td>
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<td>Tibia-distal</td>
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<tr>
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<td>Indet. metapodials</td>
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</tbody>
</table>

**TOTAL NISP**

1 1 1 5 1 1 4 7 8 5 1

**MNI**

2 1 2 1 1 1 2 1 2 1

Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcraniar elements.

Appendix E: Fauna

Table E4-continued. Body part distribution by provenience for Ovis/Capra (sheep/ goat) dwarf variety

<table>
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<tr>
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<td>Maxillary dentition</td>
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<tr>
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<td>Atlas</td>
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</tr>
<tr>
<td>Axis</td>
<td>1</td>
</tr>
<tr>
<td>Cervical vertebrae</td>
<td>1</td>
</tr>
<tr>
<td>Thoracic vertebrae</td>
<td>1</td>
</tr>
<tr>
<td>Lumbar vertebrae</td>
<td>1</td>
</tr>
<tr>
<td>Sacrum</td>
<td>1</td>
</tr>
<tr>
<td>Scapula</td>
<td>1</td>
</tr>
<tr>
<td>Humerus-proximal</td>
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</tr>
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<tr>
<td>Naviculo-cuboid</td>
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<td>Metatarsal-proximal</td>
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<tr>
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</tr>
<tr>
<td>1st phalanges</td>
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<tr>
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<td>Indet. metapodials</td>
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**TOTAL NISP**

8 1 5 1 1 4 7 8 5 1

**MNI**

2 1 2 1 1 1 2 1 2 1

Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcraniar elements.
### Appendix E: Fauna

**Table E5. Body part distribution by provenience for Bos sp. (cattle)**

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<th>31</th>
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<th>27</th>
<th>25</th>
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<tbody>
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<td>Cranial Maxillary dentition</td>
<td>Mandible</td>
<td>Mandibular dentition</td>
<td>Atlas</td>
<td></td>
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<tr>
<td>Tibia-proximal</td>
<td>Tibia-distal</td>
<td>Astragalus</td>
<td>Calcaneus</td>
<td>Naviculo-cuboid</td>
<td>Other tarsals</td>
<td>Metatarsal-proximal</td>
<td>Metatarsal-distal</td>
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<td>2nd phalanges</td>
<td>3rd phalanges</td>
<td>Indet. metapodials</td>
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Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcranial elements.

**Table E5-continued. Body part distribution by provenience for Bos sp. (cattle)**

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<td>Mandibular dentition</td>
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<tr>
<td>MNI</td>
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</tbody>
</table>
Tibia-proximal Tibia-distal Astragalus Calcaneus Naviculo-Cuboid Other tarsals
Metatarsal-proximal Metatarsal-distal 1st phalanges 2nd phalanges 3rd phalanges
Indet. metapodials
1 4 1 1
1 1 1
1
2
1 1 2 [1] 1 1
2 1 [1] 1 1
TOTAL NISP 2 1 6 1 2 1 1 1 3 2 2 1 2 1 8
MNI 2 1 2 1 1 1 1 1 1 2 2 1 2 1 1

Appendix E: Fauna
Table E5-continued. Body part distribution by provenience for Bos sp. (cattle)
Element
LXS
69 68 67 66 64 57 55 48 46 37 36 29 22 13 11 9 4 3
Cranial
1
Maxillary dentition
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Mandible
1
Mandibular dentition
2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Atlas
1
Axis
1
Cervical vertebrae Thoracic vertebrae Lumbar vertebrae Sacrum
Scapula
1
Humerus-proximal Humerus-distal Radius-proximal Radius-distal Ulna
Carpals
1
Metacarpal-proximal Metacarpal-distal Innominate Femur-proximal Femur-distal
Patella
1
Tibia-proximal Tibia-distal Astragalus Calcaneus Naviculo-cuboid
1
Other tarsals Metatarsal-proximal
1
Metatarsal-distal 1st phalanges
1 1 1 1 3 2
2nd phalanges
1 1 1
3rd phalanges Indet. metapodials
TOTAL NISP 4 2 1 1 1 1 1 1 1 5 1 2 1 1 1 1 3 1 2
MNI 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1

Appendix E: Fauna
Table E5-continued. Body part distribution by provenience for Bos sp. (cattle)
Element
ALS CTR WFL IHAM IKAN
13 12 10 9 7 6 39 37 35 27 12 15 2 23 2
Cranial Maxillary dentition Mandible Mandibular dentition Atlas
Axis
1
Cervical vertebrae Thoracic vertebrae Lumbar vertebrae Sacrum Scapula
1
Humerus-proximal Humerus-distal Radius-proximal Radius-distal Ulna
Carpals Metacarpal-proximal Metacarpal-distal Innominate Femur-proximal
Femur-distal Patella
1
Tibia-proximal Tibia-distal Astragalus Calcaneus Naviculo-cuboid Other tarsals 
Metatarsal-proximal Metatarsal-distal 1st phalanges 2nd phalanges 3rd phalanges 
Indet. metapodials

11 11
1
1 1
1
1 1
1
1
2 1
TOTALNISP 2 1 1 2 1 1 2 1 1 2 1 1 1
MNI i 1 1 1 1 1 1 1 1 1 1 1 1 1

Appendix E: Fauna
Table E6. Body part distribution by provenience for miscellaneous mammals
TAXA
I UNFI/LEVEL I MNI I NISI I
ELELMENIT
Phacochoerus aethiopicus
( warthog)
Hippopotamus amphibius
( hippopotamus)
Redunca redunca
( Bohor reedbuck)
Tragelaphus scriptus
( bushbuck)
Alcelaphinae gen. et. sp. indet.
( hartebeest)
Ovis/Capra: nondwarf
( nondwarf sheep and goat)
Equus cf. caballus
( Equid, probably domestic horse)
Orycteropus afer
( Aardvark)
Cricetidae gen. et. sp. indet.
( indet. Cricetine rodent)
Lepus sp.
( Hare)
LX-N 52 1 1
LX-N 51 1 1
LX-N 49 1 1
LX-N 48 1 1
ALS 9 1 1
KAN2 1 1
LX-S 71 1 1
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<thead>
<tr>
<th>Specimen</th>
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</tr>
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<td>LX-S 69</td>
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<tr>
<td>CTR 22</td>
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<td>2</td>
</tr>
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<td>LX-N 46</td>
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<tr>
<td>LX-S 68</td>
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<tr>
<td>LX-N 52</td>
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<td>3</td>
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<td>LX-S 72</td>
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<td>LX-S 66</td>
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<td>WFL 15</td>
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indet. premolar ulna atlas
indet. molar lateral metapodial lateral metapodial
indet. molar
1st phalanx ?
2nd phalanx  ?
metacarpal  ?
mandibular dentition  right
metacarpal astragalus
mandibular dentition (2)  left
1st phalanx ?
2nd phalanx  ?
3rd phalanx  ?
humerus  left
calcaneus  right
astragalus  left
scapula  left
metacarpal  left
astragalus  left
humerus  left
mandibular dentition  left atlas
calcaneus  left
maxillary dentition  right
innominate
femur tibia
left right
Appendix E: Fauna
Table E6-continued. Body part distribution by provenience for miscellaneous mammals

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<th>MM1 NISP</th>
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<td>LX-S 69</td>
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<td>ALS 7</td>
<td>HAM 10</td>
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<td>Felis lybica/catus</td>
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<td>(wild or domestic cat)</td>
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<td>LX-N 25</td>
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<td>radius sacrum</td>
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Appendix E: Fauna

Table E7. Body part distribution by provenience for small bovids

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<td>2nd phalanges 3rd phalanges</td>
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### Appendix E: Fauna

Table E8. Body part distribution by provenience for small-medium bovids

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Appendix E: Fauna

Table E8-continued. Body part distribution by provenience for small-medium bovids

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Thoracic vertebrae 1 1
Lumbar vertebrae 1 4 1
Sacrum
Caudal vertebrae
Scapula 1
Humerus-proximal 1
Humerus-distal 1
Radius-proximal
Radius-distal 11
Ulna 2
Carpals 1
Metacarpal-distal 1
Innominate 1
Femur-proximal 1 2
Femur-distal
Patella
Tibia-proximal
Tibia-distal
Astragalus
Calcaneus 1
Naviculo-cuboid
Other tarsals
Metatarsal-proximal
Metatarsal-distal
1st phalanges
2nd phalanges
3rd phalanges 1
Indet. metapodials 1
TOTALNISP 1 2 2 1 10 9 3 1 1 1 4 1 1 2
Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcranial elements.

Appendix E: Fauna
Table E9. Body part distribution by provenience for large-medium bovids
Element 52 51 49 32 28 27 25 22 18 13 7 4 2 F38 Cranial
Maxillary dentition [1]
Mandible
Mandibular dentition
Atlas Axis
Cervical vertebrae
Thoracic vertebrae 1 1
Lumbar vertebrae


Sacrum
Caudal vertebrae
Scapula
Humerus-proximal
Humerus-distal Radius-proximal
Radius-distal
Ulna
Carpals
1 1
Metacarpal-proximal
Metacarpal-distal
Innominate
Femur-proximal
Femur-distal
Patella
Tibia-proximal
Tibia-distal
Astragalus
1
Calcaneus
Naviculo-cuboid
Other tarsals
Metatarsal-proximal
Metatarsal-distal
1st phalanges
2nd phalanges 3rd phalanges
Indet. metapodials
1 1 1 1
TOTALNISP
2 2 3 1 1 2 2 1 2 1 1 1 2 1
Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcranial elements.

Appendix E: Fauna
Table E9-continued. medium bovids
Body part distribution by provenience for large-
Element
LXS
79 76 75 74 72 71 69 66 58 55 49 48 46 9 2
Cranial Maxillary dentition Mandible Mandibular dentition Atlas
Axis
Cervical vertebrae Thoracic vertebrae Lumbar vertebrae Sacrum Caudal vertebrae
Scapula Humerus-proximal Humerus-distal Radius-proximal Radius-distal Ulna
Carpals Metacarpal-proximal Metacarpal-distal Innominate Femur-proximal
Femur-distal Patella
Tibia-proximal Tibia-distal Astragalus Calcaneus Naviculo-cuboid Other tarsals
Metatarsal-proximal Metatarsal-distal 1st phalanges 2nd phalanges 3rd phalanges
Indet. metapodials
21 21
1 1
1 1 II
Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcranial elements.

### Appendix E: Fauna

#### Table E9-continued. Body part distribution by provenience for large/medium bovids

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### Appendix E: Fauna

#### Table E10. Body part distribution by provenience for large bovids

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Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcranial elements.

Appendix E: Fauna
Table E10-continued. Body part distribution by provenience for large bovids

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<td></td>
</tr>
</tbody>
</table>

566 Appendix E: Fauna
Table E10-continued. Body part distribution by provenience for large bovids
Cervical vertebrae 1
Thoracic vertebrae 1
Lumbar vertebrae 1
Sacrum
Caudal vertebrae 1
Scapula
Humerus-proximal
Humerus-distal
Radius-proximal
Radius-distal
Ulna 1
Carpals
Metacarpal-proximal 1
Metacarpal-distal
Innominate
Femur-proximal
Femur-distal
Patella
Tibia-proximal
Tibia-distal 1
Astragalus
Calcaneus 11
Naviculo-cuboid
Other tarsals
Metatarsal-proximal
Metatarsal-distal
1st phalanges 2nd phalanges 3rd phalanges
Indet. metapodials 1
TOTALNISP 1 11 2 1 2 1 1 1 1 4 2 2
Note: Specimens listed in brackets are deciduous and uncut dentition or unfused postcranial elements.

Appendix E: Fauna
Table El. Body part distribution by provenience for birds

<table>
<thead>
<tr>
<th>TAXA</th>
<th>UNIT/LEVEL</th>
<th>MNI</th>
<th>NISP</th>
<th>ELEMENT</th>
<th>SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phalacrocorax afficanus (long-tailed shag)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anhinga melanogaster rufa (African darter)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LX-N 7</td>
<td></td>
<td>1</td>
<td>1</td>
<td>tibiotarsus</td>
<td>left</td>
</tr>
<tr>
<td>LX-N 38</td>
<td>1</td>
<td>2</td>
<td>coracoid</td>
<td>right</td>
<td></td>
</tr>
<tr>
<td>femur</td>
<td>right</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LX-S 25</td>
<td>1</td>
<td>1</td>
<td>femur</td>
<td>left</td>
<td></td>
</tr>
<tr>
<td>LX-S 58</td>
<td>1</td>
<td>1</td>
<td>femur</td>
<td>left</td>
<td></td>
</tr>
<tr>
<td>LX-S 69</td>
<td>2</td>
<td>1</td>
<td>tibiotarsus</td>
<td>left</td>
<td></td>
</tr>
<tr>
<td>[humerus]</td>
<td>left</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>femur</td>
<td>right</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LX-S 72 1 2 ulna right
tibiotarsus left
LX-S 77 1 1 tibiotarsus right
LX-S 79 1 1 ulna left
LX-S 66 1 3 humerus right
tarsometatarsus right femur left
LX-S 75 2 5 coracoid right
coracoid left
tibiotarsus left
tibiotarsus left
tarsometatarsus left
M1 15 1 1 ulna right
Egretta alba
(white egret)
Ciconia episcopus
(white-necked stork)
Plectopterus gambensis
(spur-winged goose)
Sarkidornis melanotos
(knob-billed goose)
Callus gallus
(chicken)
ALS7 1 1
LX-S 69 1 1
humerus left
coracoid right
LX-N 45 1 1 tibiotarsus right
ALS 9 LXN 4 LXN 8 LX-S 71
1 1 tibiotarsus left
1 1 1st phalanx (wing) left
1 1 carpometacarpus left
1 1 humerus left
LX-S 70 1 1 coracoid right
WFL 13 1 1 tarsometatarsus right
LX-N 18 1 1 scapula right
LX-N 32 1 1 radius left
LX-N 38 2 2 tarsometatarsus left
tarsometatarsus right
LX-S 11 1 1 coracoid left
LX-S 22 1 3 scapula right
coracoid right
radius left
LX-S 71 1 1 tarsometatarsus
M2 1 1 carpometacarpus right
Note: Specimens indicated in brackets are immature.
Appendix E: Fauna
Table Ell-continued. Body part distribution by provenience for birds

<table>
<thead>
<tr>
<th>TAXA</th>
<th>UNIT/LEVEL</th>
<th>MNI</th>
<th>NISP</th>
<th>ELEMENT</th>
<th>SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gallus/Numidinae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(chicken or guineafowl)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Francolinus/Galus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Francolin or chicken)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coturnix sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(quail)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milvus migrans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(black kite)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accipiter sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(indet. hawk)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corvus albus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(pied crow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indet. Passeriforme</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(perching bird)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indeterminate bird</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HK 2 LX-N 4 LX-N 18 LX-N F38 LX-S 72 LX-S 75 M1 14 M1 30

1 tarsometatarsus right
1 humerus left
2 humerus right
tarsometatarsus right
1 cranium
1 humerus left
LX-S 46 1 sternum
CTR 39 2 coracoid right
1st phalanx (wing) right CTR 27 1 coracoid right
ALS 7 1 humerus left
LX-S 69 1 humerus left
LX-S 72 1 tibiotarsus right
M1 22 1 carpometacarpus left
LX-N 18 1 carpometacarpus right
LX-N 1 LX-N 4 LX-N 18 LX-N 24 LX-N 29 LX-S 22 LX-S 40 LX-S 69 LX-S 72 LX-S 75 CTR 37 M1 3 M1 14 M1 15
1 humerus
1 humerus
1 tarsometatarsus
1 radius
1 humerus
1 femur
1 femur
Appendix E: Fauna
Table E12. Body part distribution by provenience for reptiles

<table>
<thead>
<tr>
<th>TAXA</th>
<th>UNITLEVELINI</th>
<th>NISP</th>
<th>ELEMENT</th>
<th>I</th>
<th>SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varanus sp.</td>
<td>indet.</td>
<td>monitor lizard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sauria indet.</td>
<td>(indeterminate lizards)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinixys belliana</td>
<td>(Bell's hinged tortoise)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyclanorbis senegalensis</td>
<td>(Senegal softshell turtle)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LX-N 18</td>
<td>LX-N 49</td>
<td>LX-N 51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>lumbar vertebra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td>cervical vertebrae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
<td>cervical vertebrae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LX-N 32</td>
<td>LX-N 47</td>
<td>LX-N 51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>2</td>
<td>costal plates right</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>hypoplastron frags.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALS 9</td>
<td>CTR 35</td>
<td>CTR 39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>entoplastron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td>epiplastron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td>hypoplastron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LX-N 12</td>
<td>LX-N 47</td>
<td>LX-N 51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>costal plate right</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>costal plates right</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LX-N 49</td>
<td>LX-N 51</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>xiphiplastron left</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>2</td>
<td>costal plates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LX-S 16</td>
<td>LX-S 57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>costal plate right</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>costal plates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LX-S 58 1 1 humerus left
LX-S 68 1 1 1 costal plate ?
LX-S 70 1 1 radius ?
LX-S 71 1 1 1 costal plate (2 pc ) ?
LX-S 72 1 3 1 hypoplatron left
2 costal plates 1 left / 1 right M1 24 1 1 femur left
M1 30 1 3 3 costal plates ?
cf. Trionyx triunguis
(probably Nile soft-shelled turtle)
Pelomedusa subrufa
(marsh terrapin)
WFL 15 1 1
LX-S 71 1 1
LX-N 8 LX-S 69 LX-S 71
Pelusios adansonii
(Adanson's terrapin)
Pelusios castaneus
(black terrapin)
1 1
1 1
1 1
humerus costal plate
costal plate xiphiplastron costal plate
right
left
right left right
CTR 25 1 9 2 neurals
7 costal fragments 1 left / 6 right LX-N 13 1 2 2 costal plates 21
LX-S 2 1 1 1 costal plate right
Appendix E: Fauna
Table E12-continued. Body part distribution by provenience for reptiles
TAXA I UNIT/LEVEL IN I NISP- ELEMENT SIDE
Indet. Peomedusidae
(indet. freshwater terrapin)
Crocodylus sp.
(Nile or long-nosed crocodile)
CTR 34 1 3 3 costal plates
CTR 35 1 3 2 marginals
humerus
CTR 37 2 5 1 costal plate
1 marginal
humerus
ilium
ilium
CTR 39 1 2 1 costal plate
1 plastron fragment
HAM 24 1 1 1 costal plate
LX-N 3 1 1 1 plastron fragment
LX-N 4 1 1 1 marginal
LX-N 8 1 1 1 costal plate
LX-N 13 1 2 1 marginal
1 costal plate
LX-N 38 1 2 1 hyoplastron
1 plastron fragment
LX-N 45 1 1 1 ilium
LX-S 2 1 1 1 costal plate
LX-S 22 1 1 1 plastron fragment
LX-S 75 1 2 2 costal plates
MI 24 1 1 1 marginal
LX-N 51 LX-N 38 LX-S 60 LX-S 70 LX-S 75 LX-S 77
1 2 2 clavicles
1 1 caudal vertebra
1 1 caudal vertebra
1 1 indet. cranial fragment
1 1 I dorsal scute
1 7 4 thoracic vertebrae
1 cervical vertebra 1 indet. vertebra 1 frontal fragment
left
right left right left
left
?
right
I left / 1 right

Appendix E: Fauna
ALS 2
3 5
6 7
8
9 10 11 13 L CTR 7
L
E 9
V 10
E 15
L
25 27 29 31 33 35 23 26 32
Feat. 45
37
39
10 100 1,000 10,000
WEIGHT IN GRAMS
Figure E1. ALS and CTR weight of animal bone (> 10 g) per level

Appendix E: Fauna
HK 1
2
Feat. 5
3 6
L NWS 1
E
V 4
E L 5
6
WFL 1
2 3 11
15
10 100 1,000

WEIGHT IN GRAMS

Figure E2. HK, NWS, and WFL weight of animal bone (> 10 g) per level

Appendix E: Fauna
100 1,000
WEIGHT IN GRAMS

Figure E3. LX-N weight of excavated animal bone (> 10 g) per level

1
2 3
4 5
7
Feat. 1
9 10 11
12 L 13
E 14
V 16
E 17
L Feat. 15
15 18 19
21 22
Feat. 19
20 23
24 25 26
Us
p
I
I
I
10,000
Appendix E: Fauna

1,000

**WEIGHT IN GRAMS**

Figure E3-cont. LX-N weight of excavated animal bone (> 10 g) per level

<table>
<thead>
<tr>
<th>I</th>
<th>U</th>
<th>I</th>
<th>I</th>
<th>27</th>
<th>Feat. 38</th>
<th>28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feat. 37</td>
<td>Feat. 40</td>
<td>32 29 30 31 35 36</td>
<td>L</td>
<td>37</td>
<td>E</td>
<td>Feat. 44 V</td>
</tr>
<tr>
<td>E</td>
<td>39</td>
<td>L</td>
<td>40</td>
<td>41 44 45 46 42 47 48 49 51 52 50</td>
<td>10,000</td>
<td></td>
</tr>
</tbody>
</table>

Appendix E: Fauna

2 3 4 5 10 11 PIT 1 16 18 PIT 7 PIT 8 L PIT 6 E 21 24 E L PIT 2 28 Feat. 11 27 31 Feat. 21 43 PIT 3 PIT 4 PIT 5 36 49 U U U UR 100 1,000

**WEIGHT IN GRAMS**

Figure E4. LX-S weight of excavated animal bone (> 10 g) per level

10,000
Appendix E: Fauna

WEIGHT IN GRAMS

Figure E4-continued. LX-S weight of excavated animal bone (> 10 g ) per level

46 47 PIT 11
53 58 59 63
64 65 66 67 68 69 70 73 71 75
77 79
72 76 80
I
10,000

Appendix E: Fauna

HAMB 1
2 3 6
L E 9
V E 10
L
12 21 23
24
KAN 2
10 100 1,000 10,000

WEIGHT IN GRAMS Figure E5. HAMB and KAN weight of animal bone (> 10 g ) per level

0 2 2

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Bibliography

Bibliography


Bibliography


Bibliography


Bibliography

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Bibliography


Plates

1. The town of Jenn6 as floodwaters begin to fall in January 1981
2. The steo Jenn-£n viwe from the no-rrth, January 1981
3. The Large Exposure (LX) at Jenn6-jeno at 5 m depth
4. The pit containing the burial urn of Feature 47 is clearly visible in section.
5. The pottery and sandstone concentration excavated as Feature 21
6. The fourteen major types of twine impression identified at Jennd-jeno From left to right: Top: Twines 1-4; Middle: Twines 5-9; Bottom: Twines 10-14
7. Examples of single braided twine impression: Upper left and centerTwine 1;
   Upper right and lower left-Twine 2; Lower right-Twine 10
8. Examples of double-braided twine roulette impression ITwine 3) 9. Relcto oTw4usin-g a. pleated roulette, picture at right
10. Examples of pleated twine roulette impression. All are Twine 4, except top center, which is Twine 5
11. Examples of twisted cord roulette: Top-Twine 6; Bottom-Twine 7
12. Examples of Twine 13, showing clear evidence of twine impression
13. Examples of cord-wrapped stick impression (rare)

14. Plastic non-twine decoration, including incision, comb impression, channeling, and circular stamping
15. Plastic non-twine decoration, including cuneiform stabbing and circular and pattern stamping

4Q
16. Plastic decoration, predominantly fine channeling and incision

17. Early geometric polychrome (black and white) painted design

18. Rare plastic motifs: Rocker stamping
19. Examples of sherds with painted decoration

j20. Examples of diagnostic type IA: simple open twine-impressed bowls with slipped or cross-hatch painted rim
21. Examples of diagnostic type IB (simple closed twine-impressed pots with twine-impressed globular pot with rolled rim [otm ide ih])

22. Double twine motifs on Types IB (left) and IC (right)
23. Early geometric polychrome (black and white) painted design

Early examples of white monochrome painted pottery from late Phase 5c. Painting pls channeling on Phase III rim sherds. RimsintoprowareTypeHI

26. Examples of geometric white on red painted pottery from late Phase III
27. Phase IV fine channeled rim of Type IVB 28. with incised design of a bird
Phase IV carinated beaded rim of Type IVC, with fingernail impression along the carination
F-W -W

29. errcota statuette (SF 468A) -front view
30. Teractt satutt (S 48A-back view

31. Statuette head (SF 468B) found in association with SF 468A
32. Burnt clay (daga) with mat and pole impressions

T,ý

33. Spindle whorls from Feature 16
~ itililililyllilriii iiiiiii ý lil;ilT llýlit!lllllllllllj:
I
34. Spindle whorls

35. Selected artifacts from the Phase I/I assemblage at Jennd-jeno. Top (from left): pot smoother/ potlid; labrets/ earplugs; Middle: fragments of animal figurines; stone beads; spherical clay bead; Bottom: iron blade fragment and bracelets.

36. Selected artifacts from the Phase III assemblage at Jenn6-jeno. Top (from left): pot smoother/ potlid; gold earring; small copper bead; iron blades, fishhook, ring. Middle: bone pendant (?); cylindrical clay beads; horse and cow figurines. Bottom: Tellem tripod pot base; animal figurines.

37. Seecedartfatsfrm te hae V asemglge at Jeinn6-jeno. Top (fro left): cpperornaent terdrop weight; iron fishhooks, hoe, hematite; ~ spnleworsBto: pot smother/ potid; ceramic Botom SFe 2, 217 SF291.

39. Jugal with flat orbital rim possibly indicative of Bos indicus (from LX-S Level 48, Phase IV)

40. Hypoplastron of a Senegal soft shell turtle (Cyclanorbis senegalensis) with two drilled holes (LX-S Level 72)