Urban Chronology at a Human Scale on the Coast of East Africa in the First Millennium A.D.

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Abstract

This paper presents a new high-resolution excavation sequence of a house at the first millennium site of Unguja Ukuu, Zanzibar, with implications for a new and detailed understanding of the period between the 7th and 9th centuries CE on the East African coast. This is an important period associated with a broad and distinctive cultural tradition, often seen as a pre- or proto-urban phase. Household excavations at Unguja Ukuu revealed two occupation phases, spanning less than 40 years each. The results here thus present an unprecedented temporal resolution on the site, at the scale of human experience.

Excavation and microstratigraphic analyses of multiple floor layers reveal decadal change in occupation at this house. Positioning this house into the broader settlement sequence, we argue for episodic settlement at the site of Unguja Ukuu and draw out detail on how we can explore change at this generational scale.

Keywords

radiocarbon; Bayesian analysis; Swahili; geoarchaeology; spatial analysis

Introduction

This paper presents a high-resolution sequence from a single house at the site of Unguja Ukuu (Figure 1), as a point of insight into a fascinating time on the eastern African coast. These excavations offer contextual detail on a place and time where there was the vibrant and sudden flourishing of a widespread cultural tradition. Sites like Unguja Ukuu were settled from the 7th century onward along the East African coast, offshore islands and neighboring regions inland, linked to particular types of ceramics, the production of iron and beads and with a deep engagement with trade networks that connected them to the Persian Gulf (LaViolette and Wynne-Jones 2018). These trade connections are often used as evidence that 7th – 10th century sites were precursors to second millennium Swahili stonetowns, which have themselves often been defined through material exchanges with the Indian Ocean world and by their adoption of Islam (LaViolette 2018; Wright 1993; for critique see Fleisher and LaViolette 2013). Unguja Ukuu itself has seen multiple investigations, with the most extensive conducted as part of the investigation of 'urban origins' on the Swahili coast (Horton and Clark 1985; Juma 2004). Yet recent archaeological investigation has meant that it is increasingly possible to speak about the first millennium in its own right, with detailed study of ceramics (Fleisher and Wynne-Jones 2011), trade relationships (Priestman 2018; Boivin and Fuller 2009), and subsistence economy (Crowther et al. 2016a; Walshaw 2005, 2010; Prendergast et al. 2017; Faulkner et al. 2017) relating to sites of this period.

Yet within the late first millennium it remains challenging to describe significant spatial or chronological definition. In fact, the 300 years between the 7th and the 10th centuries are often understood only through the presence of a particular locally produced ceramic tradition. The project reported here set out to change this, adopting a method for exploring social contexts in detail through excavations in domestic settings. In particular here we report on the high-resolution dating of a domestic sequence and how that offers a new understanding of the rhythms of social life during this vibrant period. By focusing at a more human scale of change, we are more able to consider the structuring of social life and how it shifted and coalesced through the occupation of Unguja Ukuu. These excavations are part of a broader project exploring local resource landscapes associated with the development of urbanism on the eastern African coast (Wynne-Jones and Sulas 2017). Detailed dating has also exposed how the broad span chronology offered by the artifact sequence has led to a sense of greater continuity through time than may actually have existed, supporting and refining chronometric dates from across the region.

Research context

The site of Unguja Ukuu holds a special position in reconstructions of the East African coastal past. When a novel and recognizable cultural tradition emerged along the east African coast between the 7th and 10th centuries A.D., Unguja Ukuu was among the earliest places occupied. It has also consistently returned some of the highest quantities of imported goods from any site of this period (Priestman 2018). Settlements of this period contained a common suite of material culture, notably a shared ceramic tradition known as Early Tana Tradition or Triangular-Incised Ware (ETT/TIW), evidence for the production of shell beads, iron and cloth, and consistent evidence for trade with external partners, particularly in the Persian Gulf. The population of these sites were undoubtedly derived from the Early Iron Age inhabitants of the region, who had already adapted to maritime settings (Chami 2000; Crowther et al. 2016a; Sinclair et al. 1993), yet they also had a distinctive and innovative character. Attention has often been focused on the suite of imported goods that testify to the integration of these sites into Indian Ocean networks of trade. These were, however, only a small part of a material assemblage that contained rich evidence for a mixed economy of fishing and farming and the manufacture and consumption of crafts such as potting and ironworking.

Unguja Ukuu was first investigated during the survey of sites on the Zanzibar archipelago (Horton and Clark 1985) and later significantly excavated under the aegis of the “Urban Origins” project during the 1990s (Sinclair and Wandibba 1988; Juma 2004). Data from these excavations has been supplemented in recent years by detailed studies of artifacts and bioarcheological material from middens. Study of the imported ceramics and beads has suggested that the site held a prominent place in international trade networks (Juma 2004; Crowther et al. 2015; Priestman 2018; Wood 2018; Wood et al. 2016). This is complemented by botanical data for early imported rice (Crowther et al. 2016a, 2016b; see also Walshaw 2005, 2010). The site has also yielded some of the earliest chronometric dates obtained from sites of this cultural tradition, with radiocarbon dates from archaeological charcoal reaching the 5th century A.D. and -- with greater confidence -- the early 7th centuries A.D. The latter was first suggested via the ceramic record (Juma 1996) and recently elaborated via a series of radiocarbon dates taken from a dense midden deposit on the western edge of the site (Crowther et al. 2016b). It is thus one of the earliest instances of this type of settlement linked into Indian Ocean networks of trade.

Yet it is surprisingly difficult to tease out the internal chronological sequence across the several centuries of the site’s occupation. Juma’s (2004) excavations were combined with a program of coring, establishing the depth and extent of archaeological deposits. Phosphate levels in the sediments were measured as a proxy for estimating population density and intensity of occupation. In combination with the data from excavations, Juma (2004: 84–85) created an argument for a two-phase occupation of the site: an early occupation from the 6th to the 10th centuries CE, followed by a sudden break and then a reoccupation between the 15th and 16th centuries. This later occupation does not, then, follow directly from the first millennium layers; in fact, a different area of the site seems to have been occupied in the 15th century and on a much smaller scale (Fitton and Wynne-Jones 2017). During the primary occupation of the 6th – 10th centuries, Juma postulated a gradual growth of the site and the population contained within it, peaking after A.D. 800.

Bayesian modelling of 31 radiocarbon dates from a 3-meter deep midden deposit confirmed these estimates (Crowther et al. 2016b; Faulkner et al. 2017). Dates on economic taxa span the 7th – 10th centuries A.D. (Prendergast et al. 2016, 2017a: 634, 2017b). The associated midden deposits are densest, thickest and most diverse in the 8th – 9th centuries A.D., suggesting the greatest intensity of occupation at that time.

Yet these chronological sequences cannot account for change and development across those centuries, seemingly demonstrating only periods of greater and lesser intensity of occupation. This particular site was then largely abandoned in the 10th century and only partially reoccupied later. Accounting for change remains challenging in this setting, where the subsistence base, ceramic record and suite of imported goods do not undergo transformative change over these 300 years. For the current research, households were targeted as a means of incorporating *context*, with the aim of exploring transformations in lifeways and household practices over time. Detailed chronology was central to that level of understanding, allowing us to explore changing practice over time. Ultimately, it is expected that this type of household-level data can create a new insight into what the transition to urbanism and what it really meant for the ways people lived their lives.

Excavation and sampling methods

Sites of this period were built from wattle-and-daub architecture of which no trace stands above ground. Archaeology has most frequently recovered only traces of structural materials including burnt daub; consequently there are very few examples of excavated houses for the 7th – 10th century coast (Fleisher and LaViolette 2013; Horton 1996), and none from Unguja Ukuu itself. Previous studies have explored the culture history, economy and external connections of the site through midden sequences (Crowther et al. 2015, 2016a; Horton and Clark 1985; Wood et al. 2016) and area excavations (Juma 2004), which have encountered walls and floors only incidentally.

Previous work at Unguja Ukuu provided a guide for locating the excavations. The spatial layout of the site has been clarified by drawing together existing data, augmented with geophysical survey (Figure 2; Fitton and Wynne-Jones 2017). The site occupies a spit of land called Ras Makime, on the south-western edge of Zanzibar (Unguja) Island. The spit is bordered to the west by the Indian Ocean, via a protected shallow beach that probably functioned as the harbor area for local and foreign vessels. To the east, the spit is delineated by a mangrove-lined creek. The central zone of the site lies along a ridge between those areas of seawater. Previous excavations have investigated rich midden deposits that lie along the edges of the site, particularly on the seaward side (Crowther et al. 2015, 2016; Horton and Clark 1985). Yet both Juma's (2004) excavations and our own survey had pointed to the central area as the most likely location for finding domestic structures.

Our excavations, conducted during July 2017, consisted of two trenches positioned to examine domestic structures directly (Figure 2). The first (UZ001) encountered a rich but disturbed stratigraphy with material culture from the 7th – 10th centuries, while the second (UZ002) encompassed an undisturbed house indicated by the presence of successive packed-earth floors and postholes.

UZ002 was a 3 x 5 m trench positioned over a house sequence. Excavation encountered a series of packed earth floors, with domestic debris in and around. These were excavated using a single-context system, with multi-proxy sampling and analysis to access detail on the use of environmental resources. The methods were based on those developed at the second millennium site of Songo Mnara, where they had proven valuable for exploring the use of space inside and outside built structures (Sulas, Fleisher and Wynne-Jones 2017; Wynne-Jones and Fleisher 2010, 2011). In particular, floors were sampled on a grid to explore spatial variation and allow characterization of differing archaeological features (Figure 3).

Excavation

Excavation was by single context and 100% of the material removed was dry-sieved through a 2 mm-mesh. Artifacts were recorded *in situ* where possible and by context when recovered from the sieve.

All deposits were sampled for flotation to retrieve charred botanical macroremains and charcoal, a sample of which was then processed for specialist analysis. Systematic sampling across house floors (at 0.5m intervals) produced sediment samples for the further characterization of space.

Post-excavation analyses

Post-excavation analyses focused on the study of daub, ceramics, glass and metal finds, charcoal, phytoliths, and archaeological sediments.

All ceramics were counted and weighed; diagnostic sherds were analyzed as part of a developing ceramic typology for the site, following the methodology outlined by Fleisher and Wynne-Jones (2011). Numbers of diagnostic ceramics from UZ002 were low, but they can be incorporated into a series developed from other excavations at Unguja Ukuu and along the eastern African coast. Imported ceramics were identified and recorded. Glass vessel finds were weighed by context and glass beads were identified following the typology established by Wood (2011; Wood et al. 2016). Iron slag was weighed and characterized using morphometric criteria (Baužytė 2019).

Geoarchaeological analyses focused on characterizing the sediments of every context using laser diffraction, pH and Loss-on-ignition, while soil chemistry was measured using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The wide range of elements considered (n=59) magnified the potential to detect chemical signatures deriving from a variety of processes, activities, and conditions within and between contexts (Sulas, Kristiansen and Wynne-Jones 2019). Microstratigraphy was studied using soil micromorphology. Samples were processed following the procedure described in French and Rajkovaca (2013). Thin sections were studied under a polarizing microscope under different magnification views and using plane polarized light (PPL), crossed polarized light (XPL), and oblique incident light (OIL). The description and interpretation follow international standards for terminology (Bullock et al. 1985; Stoops 2003), and guidelines from reference studies (Macphail and Goldberg 2018; Nicosia and Stoops 2017; Stoops, Marcelino and Mees 2010).

Analysis of botanical remains focused on charcoal and phytolith samples. Charcoal was picked by hand from the trench and the sieve during excavation, as well as being recovered from flotation. . In the laboratory, further gentle wet-sieving on a 1-mm screen produced 29 charcoal samples that were studied for classification and radiocarbon dating. Full protocols for analysis, classification and interpretation are given elsewhere (Out 2018)

Charcoal fragments were studied using a microscope with a maximum magnification of 40X and a reflected light microscope with a maximum magnification of 500X. In total, 339 charcoal fragments were weighed and studied in transversal, tangential and radial section and classified by means of InsideWood (2004 onwards; Wheeler 2011) and the CSIRO wood atlas (Ilic 1991).

Phytoliths were extracted from bulk soil samples and analyzed as described in Sulas, Kristiansen and Wynne-Jones (2019). Summary of phytolith findings mentioned here adopt the latest International Code for Phytolith Identification 2.0 (ICPT 2019), which was published after our first study (Sulas, Kristiansen and Wynne-Jones 2019).

Dating

Samples for Accelerator Mass Spectrometry (AMS) radiocarbon dating were taken from stratified deposits and selected on the basis of stratigraphic consistency and relations (Table 1). Paired samples were taken from the same stratigraphic unit but in different, connected contexts such as, for example, a floor and an artifact concentration within it. Radiocarbon measurements were performed using the HVE 1MV tandetron accelerator AMS system at the Aarhus AMS Centre. ^{14}C dates are reported as conventional ^{14}C ages BP normalized to −25‰ according to international convention using online $^{13}C/^{12}C$ ratios (Stuiver and Polach 1977). The ^{14}C concentration for modern samples (after 1950 AD) are provided as $F^{14}C$. Charcoal samples were pretreated using the acid-base-acid (ABA) procedure to remove carbonates and humic acids. Subsequently CO_2 was produced by combustion in vacuum sealed vials containing CuO and then graphitized. Shell samples were mechanically cleaned and 10% of the surface was etched off using HCl prior to dissolution in 85% phosphoric acid for CO_2 production and graphitization. All samples were calibrated to calendar ages using OxCal 4.3 (Bronk Ramsey 2009). Modern ^{14}C age were calibrated using the Bomb13NH3 calibration curve (Hua, Barbetti and Rakowski 2013), and shell samples using the global marine calibration curve, Marine13 (Reimer et al. 2013). Non-modern charcoal samples were calibrated using a mixed calibration curve consisting of the Northern atmosphere (IntCal13, 70%) and the Southern Hemisphere (SHCal13, 30%) (Hogg et al. 2013; Reimer et al. 2013) to take into account the effects of the Intertropical Convergence Zone (Crowther et al. 2017; Wright 2017).

Results

Stratigraphy

The archaeological stratigraphy reached a variable depth of c. 50-70 cm (Figure 4). Three main macro-stratigraphic units were found over sterile, lateritic bedrock. These were comprised of a mixed and artifact-rich topsoil, covering two packed-earth floors separated by sandy fills. Each of the two packed-earth floors was defined by a clay-like texture, with daub remains suggestive of previous walls. The edges of these floors were not apparent on all sides but were delimited by sandy sediments at the eastern and northern sides. Although the floors represented separate periods of occupation, they were almost perfectly superimposed, suggesting a continuity of the basic structure and a moment of renovation (Figure 5). It also seems that the layout of the structures had some basic spatial continuities. In particular, on each floor we recorded a shallow pit with a concentration of artifacts, charcoal and ash (contexts #2009, #2012, #2017) in approximately the same position on both floors but separated by a layer of cleaner fill, in which no cut was present.

Chronology

The 15 AMS dates discussed here were obtained from charcoal and shell fragments. While we recognize the desirability of using economic taxa, such as charred seeds, for the purposes of dating, these were not available from this trench (see discussion of archeobotany, below). To mitigate the possibilities of dating older charcoal, we worked to identify what kind of tree part each fragment represented and to choose younger branches whenever possible. Fragments of shell that were subjected to AMS dating returned consistently earlier dates, reflecting a clear reservoir effect (see Table 1). Because the local reservoir age is unknown the four shell samples will not be discussed any further. Attempts to date associated bone were hampered by a lack of collagen.

The stratigraphy allowed us to construct a sequence to model the occupation history of the house using the ^{14}C samples from context #2017, #2015, #2012, #2009 and #2004. The Bayesian model (Table 1 and Figure 4) returned a relatively compact timeframe of occupation lasting between 0 and 200 years. The deepest packed-earth floor (#2018 and a pit within it #2017) produced dates ranging from 1283±27 (AAR-28404) to 1257±36 BP (AAR-28409) that, when modelled, place the start of the occupation sometime between CAL A.D. 599 – 825 (95.4% confidence). The upper deposits (#2004 and #2009) returned dates ranging between around 1240 B.P. (AAR-28407, -28408), leading to a modelled end of occupation between CAL A.D 718 – 951 (95.4% confidence). The sequence with two packed earth floors allows the Bayesian model to estimate the duration of two occupations each spanning approximately 35 years (Figure 4). This enables us to explore change *within* the 7th and 8th centuries, rather than regarding them as one phase.

Several of the dates were discounted from our analysis. Two ^{14}C samples yielded modern (post A.D. 1950) ages: AAR-28506 from (topsoil) context #2001 can be expected to yield a young age, whereas sample AAR-28403 from (packed earth floor) context #2006 is reworked. Further, three (AAR-28410, AAR-28405, AAR-29060) samples yielded ages older than 900 B.C. These are interpreted to originate from older deposits which are probably unrelated to any archaeological activity (Figure 4). The charcoal samples from context #2005, #2006 and #2003 consistently yield ages around CAL A.D 350 to 500. However, the age range from A.D. 350 to 500 conflicts with the cultural material from #2005 and #2006 which is firmly associated with the 7th and 8th centuries. It also conflicts with the dates from the hearth features on the same floors. We interpret the ceramics and hearths to reflect the activity on the site and, as a consequence, we believe that the material used for constructing the upper floor (#2005, #2006) may have been brought in from deposits elsewhere and that the older charcoal must have come with it. However, the consistency of the age range, also considering the shell ages, may point towards an earlier occupation period at the site around A.D. 350 to 500, of which we have no further evidence. The age range is also consistent with an "anomalous" 5th century date produced during Juma's excavations (2004, 84–85). Together the three dates may suggest 5th-century activity on or around this site that has left charcoal within the sediments later used for building.

Artifacts

The quantity of artifacts was low throughout, as might be expected of household excavations, which encounter spaces normally kept fairly clean by the inhabitants. Nonetheless, two aspects of the artifact assemblage deserve further mention. First, the range of artifacts encountered is diagnostic of the entire period 7th – 10th centuries A.D. From the artifact data alone, it would not be possible to tease apart the type of chronological detail that we see in the ^{14}C results. Second, it is possible to discern variation in quantity and artifact category over time and space, even within this relatively restricted assemblage.

The ceramic record is dominated by locally produced types (Table 2). The numbers were low and there were no diagnostic sherds from the lower levels. In the upper floor only 18 sherds were diagnostic; of these 9 were identifiable as coming from necked jars characteristic of the Early Tana Tradition. The range of imported ceramics contains a massive majority of Turquoise Glazed jars from the Persian Gulf (75 of 88; 85% of the diagnostic sherds). Torpedo jars made up the remainder. This assemblage is comparable with that recovered from excavations across the middens (Horton, pers. comm. 2017).

The assemblage did, however, vary over time. The upper floor contained a greater variety of artifacts, in particular those that suggest craft activity, such as bead grinders used for smoothing marine shell beads (Flexner, Fleisher and LaViolette 2008) and iron slag related to smithing (Baužyté 2019). All types of artifact were more numerous in the upper floor layer, suggesting perhaps a more intensive occupation, although this may have been affected by clearing of the earlier floor before laying fill for the second structure. The post-occupation sediments that overlay the house were noticeably richer in all types of artifact, indicating that after abandonment the area became a diffuse midden.

In addition, it is possible to discern a pattern of indoor and outdoor discard for some artifact types. Imported sherds were significantly more numerous within the house. To a lesser extent this was true of vessel glass. Local ceramics were more numerous inside the later house, but in earlier periods were found outside the walls. Crafting debris was significantly more common outside the house (Figure 6). Much higher quantities of charcoal and shell fragments were also recovered from the sandy sediments immediately outside the walls.

Archaeological sediments

Analysis of soil physical and chemical properties established a baseline for local conditions and characterization of the nature and history of the archaeological sediments (Sulas, Kristiansen and Wynne-Jones 2019). The results also illuminated aspects of resource use associated with the occupation. In UZ002, two main archaeological sediment types were found, and their properties appear to remain consistent through depth. The floors were made of compact red (2.5YR to 5YR), fine sand clayey sediments with neutral pH (>6) and organic matter. The bordering sandy deposits consisted of looser, brown-pale brown (7.5YR), fine sand silty sediments with slightly lower pH (<6) and lower organic matter content (Figure 7). These results suggest that, although different, both archaeological sediments developed over local (colluvial) lateritic soil material.

The resolution of chemical mapping was instrumental in capturing clustered associations between element concentrations. One of the main outcomes of the chemical mapping was the identification of distinctly different signatures between the floors and outdoor deposits with no significant change through depth. In addition, distinctive clusters of chemical concentrations, when considered together with other contextual data, could be linked to specific activities and conditions. In general, packed-earth floors were characterized by enhanced concentrations of elements reflecting the input of lateritic sands (e.g. Al, Cs, and Zr) and selected rare earth elements (REEs - e.g. Ce, La, Sm), which are likely to reflect intensity of occupation. Sandy deposits, instead, were marked by enriched salts (Ba, K, Na) and generally depleted for most of the other elements, including low contents of REEs (Sulas, Kristiansen and Wynne-Jones 2019).

Micromorphology

Soil micromorphology established that both packed-earth floors were made using the same materials and, in thin section, they look virtually identical (Figure 7). These floors were characterized by lateritic (colluvial) fine sand-clay fabric, massive microstructure, mixed fabrics, common organics and low porosity. The presence of moldic pores, often horizontally oriented, together with fibrous plant remains suggested the input of plant material for tempering the sandy matrix. These voids, together with the presence of illuvial clay pedofeatures and mixed fabrics were diagnostic features of manufacturing/making of the earth floor (see Friesem, Wattez and Onfray 2017). Anthropogenic inclusions consisted of small amounts of fine charcoal (and microcharcoal), rare fragments of daub and possibly also coalesced excremental (phosphatic) matter reminiscent of herbivore dung. Whilst clear dung indicators (e.g. vivianite, spherulites) were not recorded, the conditions and distribution of coalesced excremental matter might originate from dung additions to the clayey matrix during the preparation of the floor mix. The addition of dung would have enhanced binding and, upon drying, the strength of the final product.

Thin-section analysis of samples from the exterior sandy deposits revealed a far coarser texture and higher organic content, especially charcoal (Figure 7). These deposits exhibited a crumb microstructure with a higher degree of porosity, deriving from biological activity enhanced by the higher organic content. The organic fraction is here more diverse and includes excremental matter, fungal spores and abundant charcoal. The presence of silty clay coatings and crust fragments was indicative of unroofed conditions exposed to wind and rain (Banerjea et al. 2015).

Charcoal and phytolith analysis

Contextual analysis of charcoal remains and phytoliths detected patterns of different concentrations and range of plants represented (Table 3; Out 2018; Sulas, Kristiansen and Wynne-Jones 2019). The botanical signatures highlight the differences between the floors and sandy deposits. Across the excavation, charred seeds were rare; the focus here is therefore on the wood charcoal recovered during flotation and on the evidence of phytoliths.

In general, three hardwood (Angiospermae) groups were identified in the charcoal, including Fabaceae and possible Fabaceae characterized by the clear presence of typical axial parenchyma, a second group consisting of possibly six different types that may represent mangrove vegetation, and a third group consisting of a single anatomically very distinct type. Fabaceae (Leguminosae) is a large family and includes many different taxa, including those typical of *miombo* woodlands in Tanzania (e.g. *Brachystegia* sp., *Julbernardia globiflora* and *Isoberlina* sp.; see Abdallah and Monela 2007; Chikumbirike 2014). The Fabaceae family includes taxa that are used today for fuel for iron working, timber and carving (Lyaya 2015;

Malimbwi & Zahabu 2008). However, this family also includes *Hymenaea verrucosa* (Zanzibar copal), which has been found at Unguja Ukuu in midden deposits dated to the 7th–8th century A.D. (Crowther et al. 2015). Notably, Fabaceae are not part of the taxa that dominate the modern-day mangrove vegetation at Zanzibar (cf. Punwong, Marchant and Selby 2013a, b). The presence of mangrove wood is indicated by fragments (including some showing scalariform perforation plates) that potentially represent taxa like *Bruguiera gymnorhiza*, *Ceriops tagal* and *Rhizophora mucronata*, which grew in the area in the past and occur on Zanzibar now (Punwong, Marchant and Selby 2013b). Charcoal fragments of the third group (a single type), possibly also representing mangrove vegetation, were found to be filled with iron-rich clay known from the site landscape; some of these also look partly shiny and molten.

Charcoal was in general more common in the exterior deposits than those from the house floor. This complements the artifact data suggesting more craft and productive activity outside the house. Charcoal of the third type was only found in the exterior sandy deposits (Out 2018).

The phytolith signature of the floors was dominated by grass morphotypes, woody types being hardly present. Grass short cell types (trapezoid, saddle) derived from grass culms or leaves were here relatively common and might reflect the use or storing of harvested plants or derive from other sources of grasses such as dung and vegetal temper for daub (Lancelotti and Madella 2012; Piperno 2006; Portillo et al. 2017). In the later floor, grasses still dominate the assemblage but here we find a higher number of saddle morphotypes from C4 plants and fewer spheroid (rugose and echinate) morphotypes from dicot plants and palms. A number of morphotypes might be associated with food crops (echinate elongate, bilobate, bulliform) such as sorghum and rice, and gathered seeds and fruits (sedge-type and honey-comb irregular cells). The scarcity of these remains suggests that the processing and cooking of these crops were not happening indoors. Instead, the exterior sandy deposits yielded more diverse phytolith assemblages, including over twice the number of non-grass morphotypes that were detected in the floor. Spheroid (rugose and echinate) phytoliths are abundant reflecting the presence of leaves from woody and monocotyledonous plants, including palms (Piperno 2006). Rare grass inflorescence phytoliths may be linked to plant food resources (Harvey and Fuller 2005). In sum, the phytolith assemblage suggests that there was increasingly intense activity in the upper floor of the house, but that the processing of plants and cooking happened outdoors.

A house through time

The dates recovered from UZ002 fall within the range of variation described by chronometric dating and artifact sequences elsewhere at Unguja Ukuu (Figure 8) and do not require a reassessment of the site's overall timeline. Bayesian analysis positions this house at the earlier end of the site occupation, coinciding with the period during which midden deposits (Faulkner et al. 2017) and soil phosphate enrichment (Juma 2004) are suggestive of less dense occupation. Yet the ability to reach generational-scale resolution from a single house allows us to examine social life at this site at a new scale of detail. It becomes possible to consider the households that made up the settlement and thus to explore the ways that domestic and productive life was structured through the spaces of the house. The narrowing down of the timescale of activity also enables a new consideration of the overall settlement chronology as intense and short-lived rather than long and cumulative.

The use of space

The first house on this spot was built in the early 8th century A.D., using wattle and daub and with a floor of packed earth. The walls have left no physical trace beyond a single posthole (and a chemical footprint; Sulas, Kristiansen and Wynne-Jones 2019) and yet the characteristics of the structure can be discerned through the shape of the floor and the patterning of the data. The second house was constructed just a couple of generations later on the exact same footprint, and using the same building technologies and materials. A new, thicker and denser floor was laid, separated from the first by a layer of beach sand. In thin section, this later packed-earth floor is almost indistinguishable from the one recorded below. Both were built using local lateritic soils, brought in from the surrounding landscape.

As well as sharing the same spatial layout, the two iterations of this house shared similar spatial organization, and probably the same walls. Throughout the life of this house, a hearth was located in the same position, approximately in the center of the structure. It also seems that similar types of activity were concentrated indoors and outdoors. Food preparation and possibly craft working may have happened immediately outdoors; imported ceramics and glass were more likely to be kept indoors. Inside the house, matting, the processing of cereals, or even the use of animal dung meant that the floor contained higher amounts of grass culm and leaf phytoliths than outdoors. This distinction between indoor and outdoor space is echoed in the soil chemistry, which has demonstrated consistent differences between roofed and unroofed spaces (Sulas, Kristiansen and Wynne-Jones 2019).

Over the life of the house it is possible to discern an increase in the density and diversity of material culture. The house itself seems to have become busier, and in later levels the quantities of ceramics (both local and imported) and glass beads found inside the structure outnumber those found outdoors. Rather than simply having cleared out the artifacts for rebuilding, there does seem to have been more activity concentrated inside the house during the later occupation, evidenced by charcoal, which was significantly more abundant in the upper floor than in the lower floor and increased quantities of phytoliths. Together these suggest more intense or more prolonged occupation.

Over time there was also an increase in the amount of activity seen in the deposits outside the house, particularly in traces of production. Iron slag is appreciably higher than inside the house. Slag from these and previous excavations has been analyzed for morphology and microstructure; it seems to relate to small-scale smithing activity in and around the houses, rather than large-scale production or smelting (Baužyté 2019). Another key indicator of craft activity in these levels is the appearance of bead grinders in exterior contexts. These are grooved sherds, common on coastal sites of this period and thought to relate to the production of marine shell beads (Flexner, Fleisher and LaViolette 2008). At Unguja Ukuu, they are mainly made from sherds of imported ceramics, notably Torpedo jars. Their appearance at this upper level, in these spaces exterior and adjacent to the house, suggests not only that this production became more common over the first century of the site's occupation, but also hints at the location of craft activity outside and near to the houses. Charcoal and phytoliths were also more abundant and diverse in these exterior spaces.

Destruction

The upper floor was covered by a mixed deposit containing artifacts and large amounts of daub, probably deriving from structural collapse of the house. Here we find local pottery, abundant imported pottery, a few bead grinders, iron slag and iron fragments, common glass (vessel) fragments and glass beads. Glass beads are significantly numerous (n=67) and primarily of the same types recorded elsewhere across the site (Wood et al. 2016) and along the coast more generally (Wood 2018). They also include several Zhizo-type blue beads: the same types found inside the house layers. Zhizo beads are chronologically sensitive and related to the 8th century, thus the repurposing of the area as a midden apparently occurred relatively swiftly after it was abandoned, within the same century it was occupied. The artifact record is indistinguishable from the layers below in terms of chronology, differing only in density. This points again to the limitations of categorizing periods and dates on the basis of artifact repertoires, as the construction, renovation, destruction and post-abandonment use of the house would have fallen within a single ‘horizon’.

Discussion

Houses and households

The archaeology of a house at Unguja Ukuu allows us to explore two aspects of the site. The house was the setting for domestic life, a space where we can explore resource use in context. The house is also a guide to the structuring of social life around the social institution of the household. There are hints of the beginning of an investment in particular places; the house itself is an enduring form of space, with its internal organization recreated in the second iteration. We can also begin to see hints of the ways that domestic life and production were structured, with a set of activities conducted outside the walls. The debris of production in the exterior spaces can be put in the context of a site where consistent production of beads, iron and pottery has been attested by excavations in the deep midden deposits, but where significant survey, geophysics and excavation have not identified any exclusive craft-working locations. Instead, archaeology has found evidence for small-scale iron working across the site (Baužytė 2019). Bead grinders have not been reported in detail but seem also to have been retrieved from multiple domestic locations. This pattern of household production has also been intimated by excavations at the contemporary site of Tumbe on Pemba (Flexner, Fleisher and LaViolette 2008; Fleisher and LaViolette 2013). Put together we might see this as evidence for small-scale production across the site of Unguja Ukuu and this particular house gives us a sense of how those activities were organized around household exteriors, alongside cooking and possibly eating.

The chronology of settlement

The evidence for construction, rebuilding and destruction within a single century also allows a new focus on the chronology of settlement here. As described, it demonstrates the inadequacy of artifact sequences for dating settlement as they can give only an estimate of the century or centuries during which the site was occupied. In this case, studies that have depended on artifacts for dating cannot distinguish within the period 7th – 10th centuries, giving a 200-300 year window. Thinking through the lens of this house sequence, we might begin to imagine the history of the site at a generational scale, as each generation rebuilds, perhaps on the same spot or perhaps elsewhere on the site. Previous chronometric dates on the midden deposits already challenge the idea of a long, slow, urban trajectory, showing a peak of activity in the 7th and 8th century (Figure 8) followed by an assumed continuity into the 10th century and beyond. Understanding this chronology through generational-scale rebuilding helps us visualize this peak in occupation and might draw attention to its episodic nature and how that might have been produced.

Here a comparison with Tumbe on neighboring Pemba is again interesting. The dates on the Unguja Ukuu house parallel those obtained on an excavated house at Tumbe (CAL. A.D. 780–980 (95.4% confidence); CAL. A.D. 770–980 (95.4% confidence); CAL. A.D. 770–980 (95.4% confidence); Fleisher and LaViolette 2013). Tumbe as a site was abandoned in the 10th century and the excavators have argued that this was a distinctive settlement of the first millennium, better understood as a village than as an early form of a Swahili town and distinct from the reoccupation that occurred a century later at adjacent Chwaka (Fleisher and LaViolette 2013). At Unguja Ukuu, further periods of occupation have resulted in debris from the mid-2nd millennium and beyond at locations across the site and thus the first millennium has less often been considered as a distinctive iteration. Yet the archaeological data from these later centuries is slight: Juma (2004) concluded that the primary period of occupation here was in the 8th – 9th centuries. Data on the spatial patterning of remains across the site has likewise suggested only limited and sporadic occupation during later centuries (Fitton and Wynne-Jones 2017).

The dates from Unguja Ukuu and from Tumbe together suggest an intense century on the Zanzibar archipelago, when settlements were built and became locations for craft and trade activity, which waned in the 9th century. The archaeology of this structure at Unguja Ukuu begins to give an insight into human-scale activity within that intense century that can inform on the ways that sites of this period were structured and created.

Examining 'urban origins'

The high-resolution excavation and dating of this house sequence at Unguja Ukuu invite reflection on the process of settlement. The level of resolution, with occupation lenses of less than 40 years, is unique for this region and demonstrates the potential of high-resolution sampling. First, it ties the founding and life of this house to local resources such as lateritic soils, mangrove, and other local plants, which are suggestive of more local reasons for occupation based on proximity to particular materials. This is crucial in a region where the narrative of settlement has revolved around positioning for external trade and the exploitation of connections with a broader Indian Ocean network. The evidence for these long-distance connections litters the archaeology of Unguja Ukuu but cannot tell the whole story. Instead, there is now evidence for using a set of local environmental resources to build houses that were used over the course of a century or so and then abandoned.

Second, the high-resolution chronology of this house fits into a recent move towards understanding the centers of coastal trade as part of an episodic and halting trajectory of development. Here we can see that the house was occupied for only a few generations. It was then abandoned. Occupation of the site continued along similar lines (producing the sheet midden that covers the structure) across the southern area of the site and then this part of the site was largely abandoned. The northern areas of Unguja Ukuu were reoccupied much later, probably in the 14th or 15th centuries. This creates a fascinating picture of a brief but distinguished moment on the Zanzibar archipelago, when inhabitants laid down houses at the site of Unguja Ukuu and lived, created and traded so intensely that they shaped the way the site of Unguja Ukuu, or ‘Great Unguja’, was understood well into the 21st century.

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Tables

Table 1: Unguja Ukuu AMS results organized by phase. Outlying dates on shell (discussed in the text) are shaded gray. Samples marked with * were collected from sieving of deposits, others were collected at the trowel's edge.

Lab ID	Name	Context	Phase	Type	Material	^{14}C years B.P.	Calibrated age (68.2% confidence interval)	Calibrated age (95.4% confidence interval)
AAR-28406	ZNZ17-C21	2001	Mixed Topsoils	topsoil	charcoal (type C)	1 ±0	A.D. 1962 – 1963 [34.6%] A.D. 1980 – 1981 [33.6%]	A.D. 1962 – 1963 [44.6%] A.D. 1979 – 1981 [50.8%]
AAR-29061	ZNZ17-C23	2003	Mixed Topsoils	midden	charcoal, CS#2003 (frg 3, type I)	1610 ±26	A.D. 439 – 453 [10.7%] A.D. 462 - 532 [57.5%]	A.D. 420 – 549 [92.2%] A.D. 559 - 571 [3.2%]
AAR-29063	ZNZ17-S1	2005	Upper Floor (Exterior)	outdoor/open floor	shell frg *(Pleuroploca trapezium)* [best pres. high columella]	2084 ±26	A.D. 415 - 539 [68.2%]	A.D. 349 – 593 [95.4%]

AAR-29064	ZNZ17-S2	2005	Upper Floor (Exterior)	outdoor/open floor	shell frg *(Pleuroploca trapezium)*	2056 ±32	A.D. 435 – 559 [68.2%]	A.D. 379 – 625 [95.4%]
AAR-28407	ZNZ17-C25	2004	Upper Floor (Interior)	shell concentration	charcoal (type K), Rhizoporaceae-mangrove?	1233 ±26	A.D. 777 - 812 [28.8%] A.D. 841 - 887 [39.4%]	A.D. 770 - 896 [90.0%] A.D. 933 - 957 [5.4%]
AAR-29065	ZNZ17-S3	2004	Upper Floor (Interior)	shell concentration	shell frg *(Pleuroploca trapezium)*	1925 ±26	A.D. 587 - 676 [68.2%]	A.D. 515 - 722 [95.4%]
AAR-29066	ZNZ17-S4	2004	Upper Floor (Interior)	shell concentration	shell frg *(Terebralia palustris)*	1799 ±25	A.D. 687 - 781 [68.2%]	A.D. 656 - 861 [95.4%]

AAR-28403	ZNZ17-C12	2006	Upper Floor (Interior)	earth floor	charcoal (type C), Leguminoseae/Malvaceae?	1 ±0	A.D. 1979 - 1980 [68.2%]	A.D. 1978 - 1980 [95.4%]
AAR-29067	ZNZ17-C12-2	2006	Upper Floor (Interior)	earth floor	*charcoal (frg 29, type I)	1659 ±27	A.D. 391 - 400 [5.2%] A.D. 406 - 477 [60.1%] A.D. 512 - 517 [3.0%]	A.D. 380 - 526 [95.4%]
AAR-28408	ZNZ17-C26	2009	Upper Floor (Interior)	burnt feature (hearth?)	charcoal (type K), Rhizoporaceae-mangrove?	1245 ±33	A.D. 774 - 818 [32.8%] A.D. 836 - 883 [35.4%]	A.D. 690 - 704 [1.5%] A.D. 711 - 734 [2.5%] A.D. 765 - 897 [86.9%] A.D. 931 - 960 [4.5%]
AAR-29059	ZNZ17-C15	2012	Upper Floor (Interior)	charcoal-rich (hearth?)	*charcoal (frg 10, type K2)	1240 ±22		

AAR-29062	ZNZ-C28	2014	Lower Floor (Exterior)	outdoor/open floor	charcoal, CS#2006 (frg 1, type I)		A.D. 438 - 453 [12.3%] A.D. 462 - 525 [55.9%]	A.D. 419 - 543 [95.4%]
AAR-29060	ZNZ17-C18-2	2015	Lower Floor (Exterior)	bottom of earth floor?	*charcoal (frg 1, type G)	2856 ±26	1003– 920 B.C. [68.2%]	1054 – 890 B.C. [92.8%] 876 – 847 B.C. [2.6%]
AAR-28404	ZNZ17-C18	2015 (2006)	Lower Floor (Exterior)	earth floor	*charcoal (indet.)	1283 ±27	A.D. 692 - 699 [3.5%] A.D. 723 - 731 [3.9%] A.D. 766 AD – 860 [60.9%]	A.D. 685 - 740 [24.9%] A.D. 762 - 880 [70.5%]
AAR-28409	ZNZ17-C29	2017	Lower Floor (Interior)	pit	charcoal (indet.)	1257 ±36	A.D. 773 – 823 [35.4%] A.D. 830 – 878 [32.8%]	A.D. 684 – 741 [11.3%] A.D. 762 - 894 [82.5%] A.D. 938 - 952 [1.6%]
AAR-28405	ZNZ17-C20	2018	Lower Floor	earth floor	*charcoal (type B/H), Fabaceae	4362 ±35	3008– 2978 B.C. [19.6%]	3080 – 3067 B.C. [2.1%]

			(Interior)					
AAR-28410	ZNZ17-C30	2024 (2018)	Lower Floor (Interior)	earth floor	charcoal (type B/H/I), Fabaceae	4687 ±32	3500 - 3427 B.C. [56.5%]	3618 - 3611 B.C. [0.9%]

Table 2 Artifacts organized by context and context type

Phase	Context	Local Ceramics (g)	Imported Ceramics (g)	Glass Beads (#)	Vessel Glass (g)	Iron Slag (kg)	Bead Grinders (#)
Mixed Topsoils	2001	4681	0.65	27	73	9.43	3
Mixed Topsoils	2002	1522	0.03	4	12	23.29	
Mixed Topsoils	2003	7000	1.19	36	158	10.52	3
Upper Floor (Exterior)	2005	1405	0.12	1	31	0.24	4
Upper Floor (Exterior)	2008	112		4	8	0.27	
Upper Floor (Interior)	2004	250	0.03		2	0.02	
Upper Floor (Interior)	2006	2424	1.22	4	52	1.08	2
Upper Floor (Interior)	2009	19	0.1	1	2		

Upper Floor (Interior)	2012		0.05				
Lower Floor (Exterior)	2013	304	0.05	5	13	1.26	1
Lower Floor (Exterior)	2014	123	0.02			0.23	
Lower Floor (Exterior)	2015	157	0.05		3	0.04	
Lower Floor (Interior)	2017	125	0.07		7		
Lower Floor (Interior)	2018	6	0.25		3	0.02	

Table 3 Unguja Ukuu, Summary of the charcoal results per floor and context. A-K3: charcoal types. Sieve/HP= type of sample (from sieved sediment or hand-picked). N fragm. = number of classified fragments. Indet.=Unidentified. Grey color= present. Cf.= *con forma*.

Sample nr.	**Layer**	**Feature**	**Context**	**Location**	**A**	**C**	**G**	**H**	**I**	**K1**	**K2**	**K3**	**Indet.**	**Sieve/HP**	**N fr.**
21	Midden	2001	Midden, topsoil	-										HP	10
10+22+23+24	Midden	2003	Midden	-	?									Sieve + HP	60
13	Upper floor	2008	Cf. Floor	Outside										Sieve	10

11 + 27	Upper floor	2005	Artifact conc. on floor (occupation deposit)	Outside										Sieve + HP	31
15	Upper floor	2012	Artifact conc. on floor	Inside										Sieve	10
14+26	Upper floor	2009	Artifact conc. on floor (burning feature)	Inside										Sieve + HP	40
12	Upper floor	2006	Floor	Inside										Sieve	30
31	Lower floor	2016	Cf. Floor	Outside					cf.					HP	10
17+28	Lower floor	2014	Cf. Floor	Outside										Sieve + HP	31
18	Lower floor	2015	Cf. Floor	Outside							cf.			Sieve	10
16	Lower floor	2013	Cf. Floor	Outside										Sieve	10
20	Lower floor	2018	Floor	Inside				cf.						Sieve	1
29	Lower floor	2017	Pit in floor	Inside										HP	6

Figures

Figure 1 Map of Unguja Island showing location of Unguja Ukuu

Figure 2 Map of Unguja Ukuu showing trench locations and the main areas with occupation deposits, as understood from previous work by the authors and others. The midden areas along the shoreline to the west have been the focus of several previous investigations.

Figure 3 Sampling grid across lower floor level in UZ002

Figure 4 Section of UZ002 showing relatively shallow stratigraphy and interpretation of chronology

Figure 5 Plans showing archaeological contexts at different levels through UZ002. The top row (a) shows the mixed abandonment deposits. The middle row (b - d) shows different levels of excavation through the upper floor contexts. The lower plan (e) is the lower floor level. The floor contexts (#2006, #2018) are neatly superimposed; note also the continuity of the hearth feature (#2004, #2009, #2012, #2017) at different levels. Black shapes represent ironworking debris.

Figure 6 Graph showing frequencies of different artifact categories by phase and by context type, showing differences over time and between interior and exterior spaces. Categories are (from top left): a. Glass beads (number); b. Iron slag (weight in kg); c. Imported ceramics (weight in g); d. Vessel glass (weight in g); e. Local ceramics (weight in g); f. Bead grinders (number).

Figure 7 UZ002 thin sections of packed earth floors (above) and of exterior sandy sediments (below).

Figure 8 Bayesian model showing UZ002 dates against all available ^{14}C dates for the site