

Pushing the Boat Out:

A study of spatial organisation and
harbour spaces in the early Swahili ports
of the Zanzibar Archipelago,
550-1100CE

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Abstract

The aim of this thesis is to identify maritime activity and patterns of spatial organisation through archaeological survey at first millennium coastal settlements in the Zanzibar Archipelago, in order to explore the nature of proto-Swahili harbours and evaluate the role of maritime activity as a component of proto-Swahili settlement in the region. Despite frequent scholarly reference to the maritime cultural identity of the Swahili there has been little consideration of the maritime archaeology of first millennium East African coastal settlements. Although intertidal zones associated with later sites have been surveyed, no investigation has ever been conducted into the nature of proto-Swahili harbours. The work presents an inductive investigation of proto-Swahili harbours between the sixth and eleventh centuries in the Zanzibar Archipelago, based on observations of industrial and maritime activity in open areas along the shorelines of Swahili ports.

This thesis focuses on the geophysical survey, GIS analysis, and evaluation of the maritime areas of three contemporary sites; Unguja Ukuu (c. 600-1100 CE) and Fukuchani (c. 550-800 CE) on Zanzibar, and Tumbe (c. 600-950 CE) on Pemba.

The analysis demonstrates the existence of communal harbourfront activity areas hosting iron-working, crafting, and trade, and a previously unknown shoreline mosque. The comparison of the three sites indicates a pattern of maritime activity and settlement organisation in the Zanzibar Archipelago based on knowledgeable exploitation of the maritime cultural landscape. It is argued that the proto-Swahili coastal settlements of the Zanzibar Archipelago were deliberately located on beaches with shallow, sheltered harbours and convenient land-sea access in order to exploit the near-shore coastscape. Maritime activity therefore appears to have been an important component of proto-Swahili settlement from the earliest phases of permanent occupation, whilst the construction of shoreline mosques in the ninth century reflects the development of a syncretic maritime-Islamic coastal Swahili identity.

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Authors Declaration

I declare that this thesis is a presentation of original work and that I am the sole author. This work is the result of my own research, except where explicitly stated otherwise in text. No part of this thesis has previously been presented for an award at this, or any other University. All sources are acknowledged as References.

Chapter One

Introduction

“The traveller encounters here the land of the Zanj at the edge of the Encompassing Sea. Whoever wants to go there is thrown back by the waves, but whoever seeks the land of the Zanj, the sea waves come from behind [and assist him]”

The Book of Curiosities (2007: fol. 29b-30a, 2: Ch.7)

1.1 Introduction

This thesis presents an inductive investigation of the nature and role of harbour spaces and maritime activity as a component of Swahili settlement between the sixth and eleventh centuries in the Zanzibar Archipelago. The coast of East Africa is famous for the maritime mercantile culture of the Swahili, and for the wealthy stonetown ports of trade such as Lamu, Kilwa Kisiwani, and Zanzibar Stone Town, which controlled the flow of goods in the western Indian Ocean between the eleventh and fifteenth centuries (Allen 1981; Horton 1986; Middleton 1992). These sites were bound materially, though not politically, by a shared cultural identity across 3000km of the East African coast between Mogadishu in Somalia and Chibueni in Mozambique (Fleisher and Wynne-Jones 2011). Given the frequently referenced importance of maritime elements and connections to the cultural and economic identity of the Swahili however, until recently there has been little consideration of the maritime archaeology of first millennium proto-Swahili settlements beyond anachronistic extrapolation from eighteenth - nineteenth century ethnographies, and assumed continuity of practice with the later ‘classic’ Swahili stonetowns and culture of the second millennium (Fleisher *et al* 2015).

A traditional focus on the archaeology of the urban centres of stonetowns means that only a small number of surveys have been made of either the intertidal and submarine areas around Swahili ports (Breen and Lane 2003; Pollard 2008a, 2013; Breen *et al* 2016). Even in these surveys, there has been little or no discussion of the relationship between these potential harbour spaces and the urban area of the settlements, or of the practical requirements of vessels frequenting those harbours. Similarly, although questions regarding long-distance trade connections have always been a key focus of research, very little is known about the types of ships involved in the western Indian Ocean, their capabilities, requirements, or the evolution of these technologies in the first millennium CE (Vernet 2015; Whitewright 2015). Whilst these gaps can be ascribed to the inherent difficulties of locating ship remains or ephemeral harbours in the absence of permanent architecture, the relative lack of discussion perpetuates an implicit impression that maritime activity is a relatively minor

concern to the interpretation of Swahili ports or wider society. Given the evidence of regional and long-distance maritime networks this is clearly inaccurate, but previous attempts to explore the socio-cultural maritimity of the Swahili may have been hampered by a lack of detailed spatial information about the nature of Swahili harbours (Christie 2011). The questions posed here then are whether the Swahili coastal sites of the first millennium featured defined harbour areas as a component of settlement, what these harbours entailed, and what role did maritime activity play in proto-Swahili settlements in the first millennium?

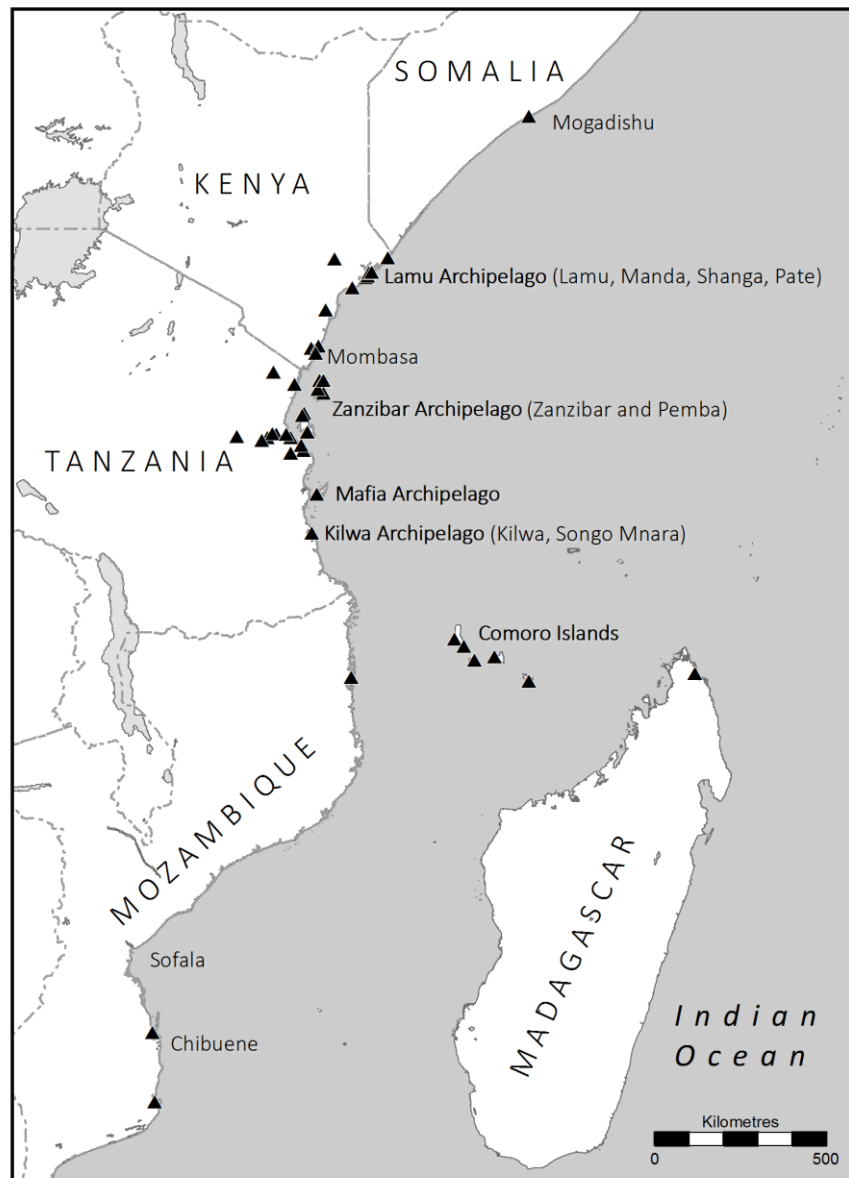


Figure 1.1 Swahili Coast of East Africa, with 'Tana Tradition' Swahili stonetowns and island archipelagos of Lamu, Zanzibar, Mafia, and Kilwa, with clusters of Swahili and proto-Swahili sites

The aim of this thesis is therefore to identify maritime activity and patterns of spatial organisation through archaeological survey at first millennium coastal settlements in the Zanzibar Archipelago, in order to explore the nature of proto-Swahili harbours and evaluate the role of maritime activity as a component of proto-Swahili settlement in the region. The inductive methodology and rationale of this thesis is based on observations of industrial and maritime activity in open areas along the shorelines of multiple Swahili and Indian Ocean settlements. It is hoped that the thesis will open up new avenues of discussion regarding the roles and relationships between proto-Swahili coastal settlements within the regional maritime cultural landscape of East Africa.

Three contemporary and previously surveyed sites were selected for study across the two islands of the Zanzibar Archipelago; Unguja Ukuu (c. 600-1100 CE) and Fukuchani (c. 550-800 CE) on Zanzibar, and Tumbe (c. 600-950 CE) on Pemba. These sites were chosen as examples of well-sequenced and previously investigated contemporary sites dating to the relevant period of study, with relatively well-defined physical boundaries, and readily-available published sources of archaeological data to use as comparative data for new archaeological surveys. The investigation of these settlements as part of this thesis consisted of primary geophysical survey and excavation, and a GIS analysis of fieldwork results set against a background of previously published archaeological, topographic and hydrographic datasets. Evidence of sailing and ship technology in the western Indian Ocean has then been used to evaluate whether the form and development of Swahili harbours may have been related to the evolution of maritime technologies in the first millennium.

This research contributes to the wider study of the East African coast in several ways. First, the traditional research focus on urban centres has meant that no dedicated investigation has previously been made of the interface between the shoreline and settlements of the coast in either the first or second millennia. The survey of these areas and potential identification of differential zones of activity will therefore provide a significant contribution to the interpretation of spatial organisation in first millennium settlements. Second, the investigation of potential patterns of spatial organisation and maritime activity between Swahili ports will provide a pathway towards the necessary recontextualisation of Swahili ports in their broader maritime cultural landscape. Third, the combination of this data with an evaluation of maritime activity and ship technology will provide contextual social background to the formalisation of maritime trade and processes of urbanisation seen in the rise of the second millennium stonetowns. Finally, it is hoped that this work demonstrates the need for further investigation into the origins of proto-Swahili society and the permanent settlement of the East African coast in the sixth century, and the development of regional and long-distance maritime networks.



Figure 1.2 Map of Zanzibar Archipelago showing proto-Swahili and Swahili sites mentioned in text

1.2 The Swahili

The initial settlement of the eastern African coast remains only patchily understood. The anonymous Greco-Roman *Periplus of the Erythraean Sea* (c. 40 CE) describes trade with several East African sites in the early years of the first millennium (Huntingford 1980; Casson 1989). This pilot's guide refers to trade with local populations at a place known as Rhapta, and an offshore island known as Menouthias. Archaeological evidence for this trade is scarce however. The disruption of wider Indian Ocean networks meant that by the fourth century CE the Red Sea port of Myos Hormos had fallen out of use, and Berenike and Adulis followed suit in the early sixth and seventh centuries respectively (Peacock and Blue 2006, 2007; Sidebotham 2008). The location of Rhapta, a regional port of trade at the limits of the network, rather than the relatively well-recorded colony sites of the

Red Sea, remains a topic of intense and controversial debate. In association with the identification of Menouthias as Pemba Island (Schoff 1912; Huntingford 1980; Kirwan 1986) Rhapta is most frequently associated today with the Rufiji Delta (Dattoo 1970b; Huntingford 1980; Chittick 1982; Kirwan 1986; Chami 1994a, 1999). No settlement has yet been found however, and whilst the existence of settled populations in the coastal hinterlands has been demonstrated archaeologically in the spread of farming sites (called locally the Early Iron Age), permanent settlement is not apparent on the coast (Phillipson 1977; Horton 1987, 1996; Sutton 1990; Allen 1993; Chami 1994; Kusimba 1999). Seasonal occupation has been identified by implication in the *Periplus of the Erythraean Sea* though, and demonstrated archaeologically in northern Kenya, Mozambique, and on the offshore island archipelagos in the third and fourth century CE (Huntingford 1980; Sinclair 1992; Horton 1990, 1996; Crowther *et al* 2016). The *Periplus* describes sewn-plank vessels and dugout canoes being used to catch fish and tortoise in the river and near-shore waters of Menouthias, indicating some degree of maritime ability, though not necessarily evidence of permanent settlements (Huntingford 1980; Casson 1989; Horton 1990). Repeat occupations of a single site have also been identified in the Mafia Archipelago, although a distinct discontinuity between EIA occupations of the fourth century and proto-Swahili settlements of the sixth century indicates that the earlier phases represent seasonal occupations related to marine subsistence exploitation rather than permanent settlement (Crowther *et al* 2016).

A new wave of occupation starting around the sixth century CE saw the establishment of permanent settlements on the coast and island archipelagos of East Africa, predominantly by iron-working Bantu agriculturalists (Phillipson 1977; Horton 1986; Sutton 1990; Allen 1993; Abungu 1994). Several of the earliest settlements of this phase have been found on the coasts of Zanzibar and Pemba, and include the sites of Unguja Ukuu, Fukuchani, and Tumbe covered by this thesis (Horton and Clark 1985; Juma 2004; Fleisher and LaViolette 2009, 2013; Crowther *et al* 2016). These permanent settlements of timber and daub houses appear to have been larger than the earlier seasonal sites of the Mafia Archipelago (Horton 1984, 1996; Crowther *et al* 2016). The inhabitants subsisted on a diet of fish and shell-fish, hunting, limited domestication of livestock, and cultivation of millet and sorghum (Juma 2004; Walshaw 2015; Quintana-Morales and Horton 2014; Fleisher *et al* 2015). The cultural affiliation of these early sites in the 'Swahili Corridor' is indicated by the predominance and ubiquity of ceramics belonging to the early Tana Tradition, and the earliest sites in this phase sometimes feature occasional finds of Kwale wares associated with the Early Iron Age of the coastal hinterlands (Horton 1987; Abungu 1994; Chami 1999; Fleisher and Wynne-Jones 2011). This cultural connectivity was presumably supported by regional maritime connections (Horton 1987; Horton and Middleton 2001; Juma 2004; Fleisher and Wynne-Jones 2011; Fleisher *et al* 2015). Common finds of imported Sasanian-Islamic glazed wares from the Persian Gulf, and of red wares and glass beads from western India also indicate that even in their early phases these settlements were connected to the long-distance trade networks of the western Indian Ocean (Chittick 1980; Horton 1987, 1996;

Horton and Middleton 2000; Juma 2004; Boivin *et al* 2013; Priestmann 2013; Fleisher *et al* 2015; Wood *et al* 2016).

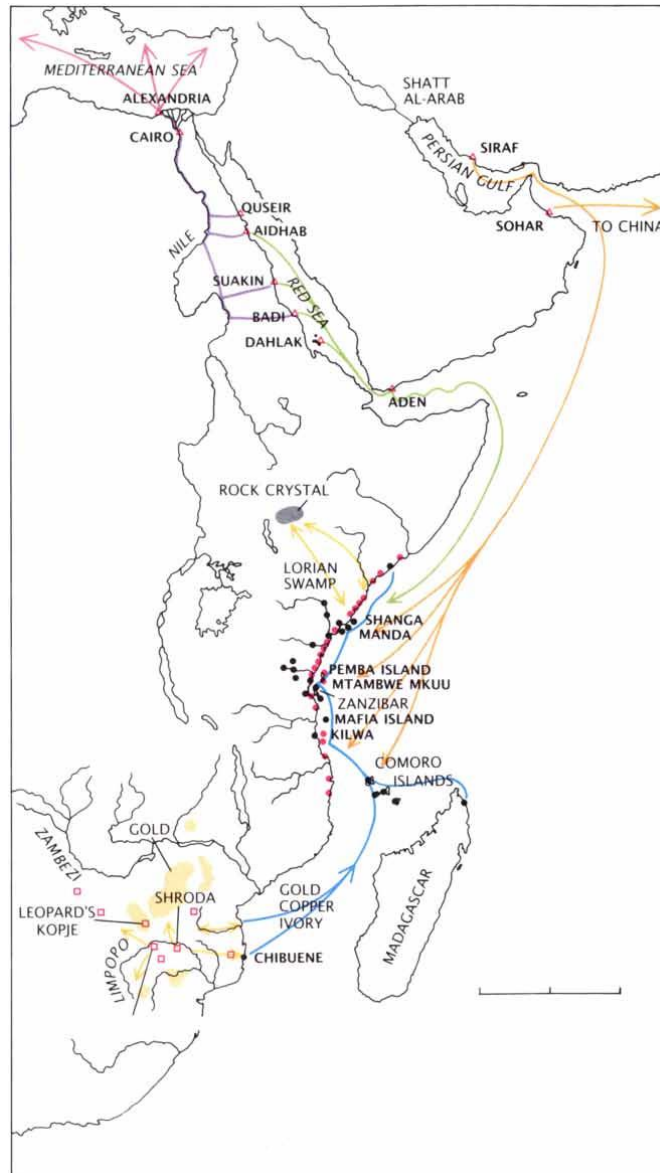


Figure 1.3: Map of East African and Indian Ocean trading connections, from Horton (1987: 89)

With the Abbasid expansion of maritime trade from the eighth century onwards, the Lamu, Zanzibar, and Kilwa archipelagos of the Swahili Coast became regional hubs in the monsoon-driven sailing networks of the western Indian Ocean rim (Chittick 1965; Whitehouse 1980; Horton and Middleton 2000). The ports reportedly dealt in luxury items including ivory, tortoiseshell, copal, myrrh, and gold, as well as resource goods such as mangrove timbers and rock crystal from Madagascar for onward trade, and brought in ceramics, glass, and cloth (Chittick 1974; Huntingford 1980; Horton 1987; Crowther *et al* 2015a; Horton *et al* 2017). The construction of the earliest East African

mosques in port towns such as Shanga in Kenya around the eighth century indicates an increasingly settled Islamic population, and suggests that the coast was home to a diverse group of inhabitants from across the Indian Ocean world (Horton 1996). The mosques were the first structures to be built of cut coral chips bound with red earth clays or mortar, and a steady Islamisation of coastal culture occurred in the centuries thereafter (Horton 1991, 1996; Insoll 2003). As with the first permanent settlements, some of the earliest known mosques of the coast have been found in settlements on Zanzibar and Pemba, and appear to have been deliberately sited close to the shorelines. These include the ruins of ninth/tenth century mosques at Ras Mkumbuu (Horton forthcoming) and buried remains at Unguja Ukuu (Juma 2004), as well as the oldest continuously occupied mosque in East Africa at Kizimkazi Dimbani, dated by an inscription to the twelfth century, but which may have earlier foundations (Horton and Clark 1985: 9).



Figure 1.4 Excavated remains of a mosque on the shoreline of Songo Mnara, Tanzania. Four of the six mosques at Songo Mnara stand on the western shoreline of the town. Photo by author.

The growth of these port towns through the eighth and ninth centuries appears to have been disturbed around the mid-tenth century, perhaps by the disruption of Abbasid trade and rise of new ports in the Red Sea which affected the flow and connections of wider Indian Ocean networks (Horton 1987; Whitehouse 1980). Many of the sites in the Zanzibar Archipelago appear to have suffered a rapid decline or were abandoned altogether, as in the cases of Unguja Ukuu (Juma 2004: 84) and Fukuchani (Horton and Clark 1985; Horton forthcoming) on Zanzibar, and Tumbe on Pemba (Fleisher 2003; Fleisher and LaViolette 2013). This appears to have been followed through the tenth and eleventh centuries by the foundation of a number of new coastal towns, such as Tumbatu and

Kizimkazi Dimbani on Zanzibar (Horton forthcoming), and Chwaka, Mtambwe Mkuu and Ras Mkuumbu on Pemba (LaViolette 2000; LaViolette and Fleisher 2004; Fleisher and LaViolette 2013; Horton and Clark 1985; Horton forthcoming). The development of the new coastal settlements was often marked by the increasing use of coral architecture, especially in mosques, which defined the so-called 'stonetowns' of the second millennium (Horton 1996). The new stonetowns were sometimes demarcated by what appear to have been largely symbolic town walls, and although streets were rare, the towns were divided internally into quarters. Different areas are distinguishable archaeologically by their architecture, and zones of daub and timber structures are now recognised to have filled what were previously thought to have been open spaces within the town walls (Fleisher *et al* 2012). These stone towns featured, for the first time, dedicated merchants houses with guest quarters for the accommodation of visiting traders and their cargoes. Wynne-Jones has argued that Swahili stonetowns did not have distinct market areas but that "instead, external trade seems to have been channelled through the houses, and the patronage system described for Mogadishu might give some suggestion as to how this could have worked" (Wynne-Jones 2012). This system, described by Ibn Battuta in the fourteenth century, involves the formal invitation or claiming of visiting traders by local merchants, and the hosting of the visitors (and their goods) in the locals home. The local merchant then acted as a representative agent for the trader in business dealings (Freeman-Grenville 1962).



Figure 1.5 Standing and conserved remains of fourteenth century merchants houses at Songo Mnara, Tanzania. Photo by author.

Wright (1993: 671) has suggested that the plans of stone towns both represent and reinforce spatially the nature of local power structures, including formalised trade systems, so that towns with few monumental or elite houses surrounded by daub structures might represent communities with a small-scale hierarchical power-system, whereas towns with large areas of both stone and daub structures might indicate a more horizontal, but perhaps more competitive social structure. The recovery of similarly valuable material assemblages from daub houses during excavations at Songo Mnara have shown however that architectural distinctions are not entirely related to material wealth, and indicate alternative means of attaining or wielding social power (Wynne-Jones 2012). Wynne-Jones (2012) has therefore argued that rather than representing a difference in function, the use of stone as an architectural material represents an expression of permanence. In either case, the large stone houses are generally agreed to represent an expression of status by an elite class, and usually one tied by ethnographic parallels to mercantile practices (LaViolette and Fleisher 2004: 340).

Following the early use of coral rag architecture in domestic structures around the tenth century, by the thirteenth century it had become the material of choice for elite residences, and these large houses and the increasing numbers of mosques within the towns were decorated with dressed and beautifully carved porites coral cut from intertidal reefs (Horton 1991; Wynne-Jones and Fleisher 2014). It is notable however that the use of coral appears to have been less common in the Zanzibar Archipelago than on the mainland coast and islands. The trend towards coastal urbanisation also led, on Pemba at least, to a notable depopulation of the countryside (Fleisher 2003). These stonetowns played a key role as wealthy and powerful ports of trade, peaking variously between the fourteenth-sixteenth centuries, so that whilst sites such as Kilwa rose to control the gold trade from Sofala into the Indian Ocean rim, the Sultan of Malindi was visited by the Chinese navigator Admiral Zheng He as part of an ambassadorial mission from the Emperor Yongle of the Ming Dynasty (Chittick 1974; Horton 1987; Zhao 2015).



Figure 1.6 Architectural remains of Husuni Kubwa, a fourteenth-century palace complex with incorporated trading site at the periphery of the stonetown of Kilwa Kisiwani, Tanzania

Following the arrival of the Portuguese navigator Vasco da Gama into the Indian Ocean in 1498, much of the subsequent history and archaeology of the Swahili Coast may be related to the efforts of various European and Arabic colonial powers to influence and control the towns and regions of agricultural or resource production by both military and economic means (Gray 1962; Freeman-Grenville 1962; Chittick 1974; Fleisher 2010; Wynne-Jones and Fleisher 2015; Horton forthcoming). This history is beyond the scope of this thesis, but is referred to here in part as a mark of the continuation of settlement between the fifteenth century and the present day, and partly because the histories, geographies, and ethnographies of this period, influenced by the colonial attitudes of the day, so heavily influenced the archaeology and interpretation of the coast in the twentieth century.

1.3 Archaeology and Research Context

Up until the late 1970s many archaeological excavations in East Africa, such as those at Kilwa Kisiwani in Tanzania, and Manda in Kenya, were aimed at identifying Roman or Persian foundations below the standing remains of the Swahili stonetowns (Huntingford 1940/1941; Kirkman 1964; Chittick 1965, 1974a; Garlake 1966). This aim was influenced by the assumed veracity of historic

texts such as the *Kilwa Chronicles* which described Shirazi origins for the sultans of Kilwa (Freeman-Grenville 1962; Sutton 1993), and by geographical sources such as the *Periplus of the Erythraean Sea* which alluded to Mediterranean connections (Huntingford 1980). This emphasis on investigating foreign trade connections led to a concentration on the excavation of stone structures in the second millennium stonetowns in order to search for Roman or Persian foundations (Chittick 1974a; Garlake 1966). These goals were also embedded in colonial policies and nationalist attitudes however, which were frequently dismissive of indigenous African society (Allen 1993: 11). This attitude meant that at Kilwa, for example, archaeological sequences were dated according to finds of imported ceramics and locally minted coins with names matching textual references, resulting in a warping of archaeological chronologies to fit the histories (Sutton 1993; Fleisher 2004; Fleisher and Wynne-Jones 2010: 500, 2011). During Chittick's excavations, it also resulted in 'local' ceramics being discarded as undatable materials, and pre-Islamic phases being dismissed as temporary and ephemeral settlement related to a theorised Persian colony site (Chittick 1974a).

Through the 1980s dissenting post-colonial voices questioned the narrative of Persian or Arabic origins, and highlighted indigenous African origins for both the sites of Roman trade, and the late first millennium ports of trade (Allen 1981, 1993; Chami 1992, 1994; Horton 1986, 1990; Nurse and Spear 1985; Sinclair 1991; Wright *et al* 1993). Horton's excellent excavation of Shanga provided firm evidence of a trading town with pre-Islamic indigenous origins, continuously occupied between the eighth and fifteenth centuries, demonstrating gradual conversion to Islam after the ninth century (Horton 1986b: 312). A key part of the supporting evidence for this work was the classification of 'local' ceramics into several phases of a broader regional type alongside wares from other sites, such as Phillipson's 'Wenje' wares (Phillipson 1979) and the 'kitchen' wares recorded by Chittick at Kilwa (Chittick 1974a, 1974b). This widely-recognised ceramic tradition, now generally referred to as 'Tana Tradition' after the Tana river valley which empties into the Lamu Archipelago, and within which Phillipson had identified a number of other sites with similar assemblages, has since become synonymous with and the primary indicator of Swahili culture (Phillipson 1979; Horton 1996; Fleisher and Wynne-Jones 2011). Horton's excavation trenches at Shanga were concentrated in and around the central area of the Friday Mosque, with smaller trenches and test pits opened elsewhere in the standing remains of the stonetown (Horton 1996: 8). His subsequent model of development for the site envisioned an early coastal site with several kinship-based clusters of houses and cattle enclosures, surrounding a central, open area with a well (Figure 1.7, from Horton 1996: 420).

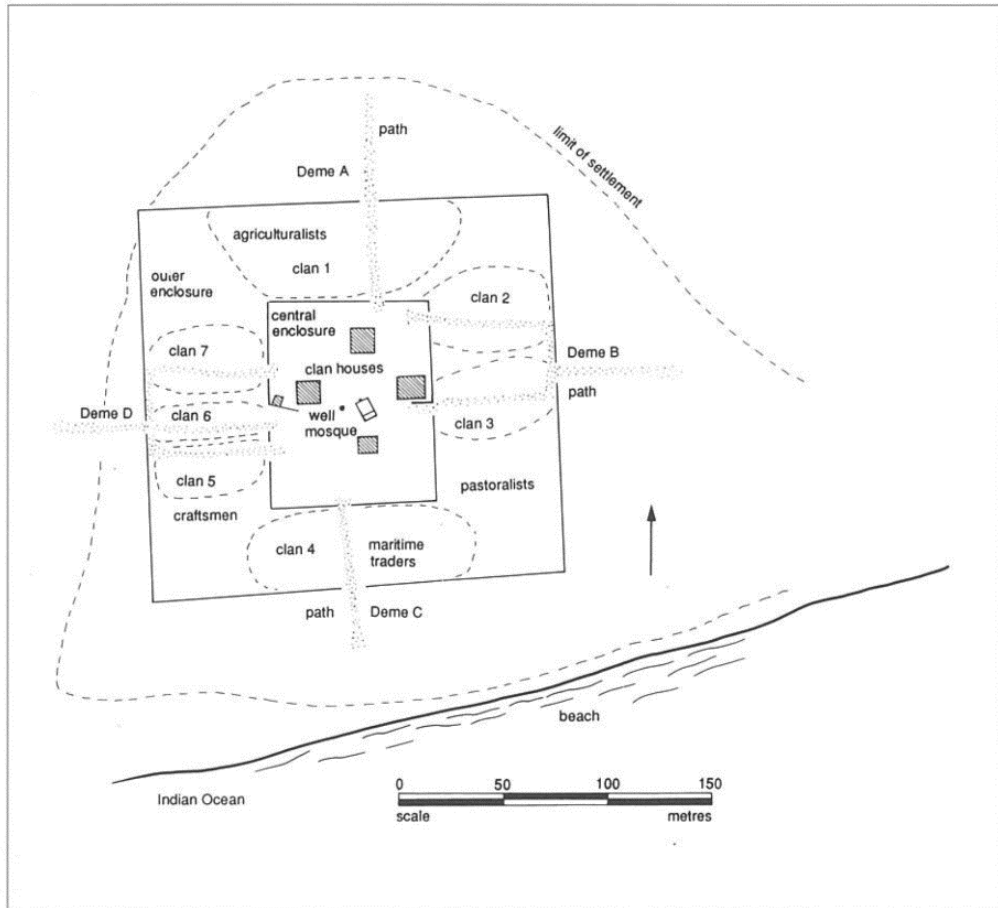


Figure 1.7: Schematic model of early Shanga, showing suggested kinship divisions and preservation of central social and ritual space (Horton 1996: 420)

Based on architectural forms and use of space, Horton suggested that the site indicated a merging of settlers from separate hinterland origins, perhaps initially on a seasonal nomadic basis (Horton 1996: 85). Ritualisation of the central space was also proposed based on the preservation of this area and a tree in its centre through several phases of site use and development, and on indications of iron-working, an activity frequently linked ethnographically to ritual magic (Horton 1996: 394). The primacy of this space was indicated by the preservation of the original plan and the cardinal 'gateways' leading into the open area through subsequent phases of expansion, and in the street plan of the later stonetown (Horton 1996: 85). Although this model was described by Horton as being specific to Shanga, and not necessarily representative of other contemporary settlements, the relatively few open area excavations conducted over the past 30 years at first millennium sites means that this has become something of a standard model of Swahili settlement development (LaViolette and Fleisher 2004; Wynne-Jones and Fleisher 2015).

Whilst Horton's study of Shanga does explore the role of Swahili settlements as ports of trade, and the theoretical place of maritime trade and traders in the settlement plan of Shanga (Horton 1996: 413), the work provides little account of the archaeology of the shoreline. In a series of otherwise

beautifully detailed plans of the site in *Shanga*, the area between the stonetown and the high tide mark is simply annotated with 'midden', 'beach', and 'reclaimed land' (Figure 1.8), in keeping with the excavation focus on the central area of the stonetown (Horton 1996: 33). It is suggested here though that Horton's own theories of *Shanga*, as well as his re-examination of Chittick's (1984) earlier excavations at Manda, in which Horton pointed out evidence of shoreline activity beneath the reclaimed waterfront (Horton 1986: 202), supports the idea that some key settlement and maritime activities are likely to have taken place on the beach. The importance of these shoreline areas and the activities which might have occurred there will be explored in Chapter Two with reference to additional Swahili settlements.

Horton's model of *in situ* urban evolution between the seventh – fifteenth centuries gained acceptance relatively quickly, and subsequent investigations in southern Tanzania, Mozambique and the offshore islands of the Comoros Archipelago showed significant regional diversity in material assemblages. Alternative sub-divisions of coastal culture were proposed by Chami (1994, 1998), Horton and Middleton (Horton 1994; Horton and Middleton 2001), and Sinclair (1995). Chami's (1994) model predicts the continuous occupation of at least southern coastal sites in Tanzania (Figure 1.1) between the first and eighth centuries CE, on the basis of a hypothesised transition between Early Iron Working (EIW) sites with Kwale wares, and Triangular Incised Wares (TIW), a decorative motif which Horton (1990) and Abungu (1989) subsume into the Tana Tradition. Horton and Middleton's (2001) model, by comparison, emphasises an ebb and flow of settlement dynamics centred on coastal and offshore archipelagos as regional hubs of maritime network connections.

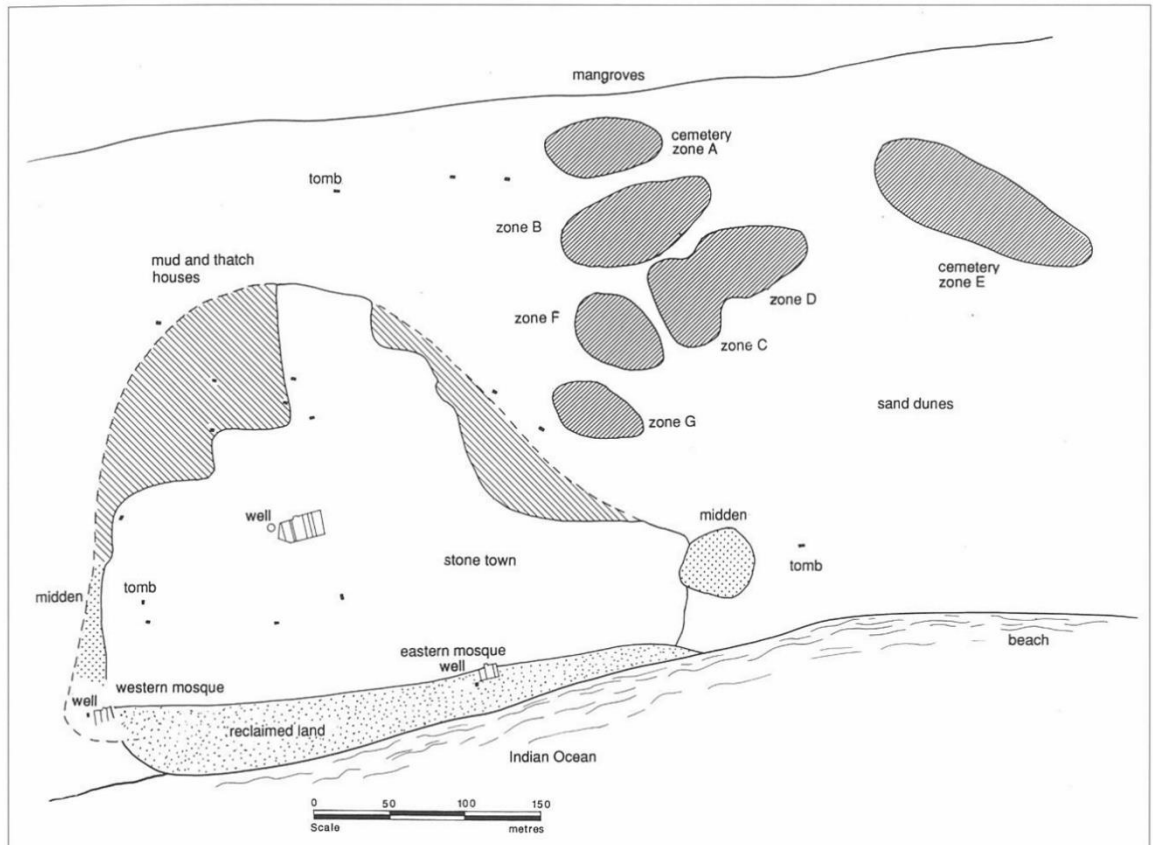


Figure 1.8: Schematic plan of land use at Shanga, showing relative lack of detail with regard to shoreline and harbour compared to stonetown and cemetery as the main foci of investigation (Figure 10 in Horton 1996: 33)

Over the past two decades archaeological efforts have expanded on the theme of diversity by looking beyond the centres of the stonetowns and encompassing different scales of spatial and temporal analysis. Research has increasingly focused on Swahili social practices at a household scale (Flexner *et al* 2008; Wynne-Jones 2013) and the ‘hidden majority’ of impermanent structures and rural settlement in both first and second millennium contexts (Fleisher 2003; Fleisher and LaViolette 1999; Kusimba 1996; LaViolette and Fleisher 1995; Fleisher *et al* 2015; Wynne-Jones and Fleisher 2014), and the processes of urbanisation between the late-first and second millennia (Kusimba 1999; Fleisher and LaViolette 2013; Wynne-Jones 2005, 2012; Wynne-Jones and Fleisher 2014). A growing recognition of the relative lack of maritime archaeology that has been carried out in these coastal settlements (Breen and Lane 2003; Wynne-Jones 2007: v; Christie 2011, 2013; Duarte 2012; Lane 2012; Fleisher *et al* 2015; Ichumbaki 2015; Vernet 2015) has influenced underwater surveys in the harbours of Mombasa (McConkey and McErlean 2007), Malindi (Bitá 2011), Zanzibar Stonetown (Breen *et al* 2016) and the Lamu and Mafia Archipelagos (Bitá 2014; Bitá and Tripathi 2015), and broad area surveys of the foreshore at Kua on Mafia (Christie 2011) and in the Kilwa Archipelago

(Pollard 2008a, 2008b, Pollard *et al* 2012; Pollard and Ichumbaki 2016). The majority of investigated maritime contexts have been associated with second millennium sites. Whilst no ship remains predating the fourteenth century have yet been identified, Pollard's surveys of Kilwa have found evidence of intertidal causeways for local and regional maritime networks in the early second millennium (Pollard 2008a, 2009, 2013). Studies of the subsistence strategies of the coast, including both daily food patterns and feasting in first and second millennium settlements have also provided evidence of trends in the exploitation of maritime resources at a number of sites (Horton and Mudida 1993; Kleppe 2007; Walshaw 2005, 2010; Christie 2011; Quintana Morales and Horton 2014; Quintana Morales 2016; Crowther *et al* 2016).

On the basis of the accumulated evidence, a recent multi-authored paper by a number of these investigators (Fleisher *et al* 2015) debated the common assumption that the maritime cultural identity of the Swahili was equally applicable to both the first and second millennium, based in part on Westerdahl's (1992: 5) criteria for cultural maritimity. Westerdahl argued that a maritime culture was defined by a combination of maritime factors, rather than demonstration of only one or two, including utilisation of maritime spaces by boat; a tradition of using the sea and its resources; terrestrial infrastructure to support seaborne practices; attention to the sea in sailing routes and ritual and oral traditions; and the naming of topography in relation to the sea and maritime features (Westerdahl 1992: 5). Fleisher *et al* (2015) argued that a notable increase of maritime and Indian Ocean elements in the foodways, architecture, and material culture of the coastal settlements around the eleventh-twelfth centuries CE marks the birth of the 'classic' maritime Swahili culture (Fleisher *et al* 2015: 110). This statement was not intended to imply any disconnect between the earlier or later inhabitants of the coast, nor to resurrect the ghosts of colonial origin theories so frequently dismissed by all authors of the paper (Ichumbaki 2017), but to note that the cultural 'maritimity' of the coastal settlements was markedly, and deliberately, more visible in the second millennium than the first. Such maritime elements include increases in the percentages of deep-water rather than shallow-water species of fish in second millennium Swahili contexts (Horton and Mudida 1993; Horton 1996; Quintana Morales 2012), the use of white beach sands as house foundations and intertidal porites coral as a prestige building material (Horton 1996; Horton and Middleton 2001; Fleisher *et al* 2015), the foundation of mosques in shoreline contexts and anchor stones used as pillar footings at Tumbatu (Horton forthcoming), as well in a recently excavated context at Songo Mnara (as yet unpublished). As well as these signs of maritime elements being incorporated into the fabric of settlements and lifeways, the authors suggest that earlier strong cultural connections between the coast and hinterland interior of East Africa began to break down around the eleventh century, reflecting the creation and growth of a distinct coastal and Islamic identity (Fleisher *et al* 2015: 110). These themes will be discussed in more detail in Chapter Two, and in the conclusion of this thesis in Chapter Nine.

Whilst concurring with Fleisher *et al*'s principle argument regarding a trend from maritime-exploiting coastal settlements towards a maritime-facing identity and the establishment of the 'classic' regional Swahili culture in the early second millennium, it is worth noting again the relative under-investigation not only of shoreline contexts, but of first millennium compared to second millennium maritime contexts. This thesis therefore expands upon the argument by investigating the maritime contexts of first millennium proto-Swahili settlements in order to establish what a proto-Swahili harbour may have looked like, and how closely it was tied into the organisation of the settlement as a whole. In doing so, it is hoped that the material may provide an earlier corollary to the successful maritime surveys carried out by Pollard in the Kilwa Archipelago (2007; 2008a), and throw new light on the origins and development of the maritime traditions which help define the Swahili.

1.4 Aims and Objectives

The aim of this thesis is to identify maritime activity and patterns of spatial organisation through archaeological survey at first millennium coastal settlements in the Zanzibar Archipelago, in order to explore the nature of proto-Swahili harbours and evaluate the role of maritime activity as a component of proto-Swahili settlement in the region.

Whilst the investigation of shoreline contexts and coastal settlements through survey and excavation is a well-established tenet of maritime archaeology, the application of maritime archaeological theories or methodologies remains rare on the East African coast, as noted above. Following Westerdahl's (1992) theory that truly 'maritime' societies are defined by more than proximal and superficial relationships to the sea, this thesis concurs with the conclusions of Fleisher *et al* (2015) in asserting that the classic form of the maritime culture known today as Swahili arose as a regional culture on the East African coast around the eleventh century CE. This culture is defined as a largely Islamic society with distinct maritime elements, and is recognisable by its ubiquitous Tana Tradition ceramics and common material assemblages, as well as by its more famous urban stonetowns. The culture appears to have been deliberately constructed as a common coastal identity between the many settlements and towns of the East African coast which were already bound socially, but not politically, by an extensive maritime network, with far-ranging connections to Indian Ocean trade. Fleisher *et al*'s (2015) theory therefore asserts that one of the principle distinctions between Swahili culture and earlier 'proto-Swahili' settlements is the embedding of both Islam and maritimity into a projected coastal cultural identity around this estimated eleventh century boundary. At present however, we know relatively little of the maritime cultural landscape of the East African coast before this period except from urban contexts and the evidence of regional and long-distance trade connections.

The success of any port depends in part upon the provision of its harbours to the requirements of its users and their vessels, whether local inhabitants, sailors, and fishermen, or visiting merchants. Both the necessary investment of labour and technology involved in equipping a ship for coastal fishing, and the immense distances and travel times involved in traversing the Indian Ocean necessitated an effective maritime network, with ports capable of hosting such visitors for extended periods, maintaining and resupplying ships and equipment, and enabling profitable trade voyages. The spatial organisation of coastal settlements is therefore likely to have incorporated infrastructure for the use of sailors, fishermen, and maritime traders in shoreline and harbour-related areas. Following methodological examples of previous studies of maritime settlements both in north-west Europe (see for example McGrail 1984; Westerdahl 1992; Margariti 2002; Byock *et al* 2015), the Red Sea (Peacock and Blue 2006, 2011; Thomas 2009) and recently in East Africa (Breen and Lane 2003; Pollard 2009; Christie 2011), it is suggested that the role and importance of maritime activity to both proto-Swahili and Swahili archaeological settlements may be inferred from the relationship between the harbour, shoreline areas, and spatial organisation of a given site, and contemporary maritime activities and technologies relevant to that site. The identification of maritime activity areas and patterns of regional harbour features will also contribute what Pearson has labelled 'ozone' into the archaeological discussion of proto-Swahili coastal settlements (Pearson, 2007). That is, that it may provide a fresh perspective on the activities and roles of the proto-Swahili coastal settlements of East Africa between the sixth – eleventh centuries, and contextual background to discussion of the processes of urbanisation in the second millennium Swahili stonetowns.

Three case study sites were therefore selected as representative of the proto-Swahili occupation of the Zanzibar Archipelago, noted previously as one of the key nodes of permanent settlement on the East African Coast in the first millennium. The three sites chosen were the ports of Unguja Ukuu (c. 600-1100 CE) and Fukuchani (c. 550-800 CE) on Zanzibar, and Tumbe (c. 600-950 CE) on Pemba. Apart from the aforementioned references in the *Periplus of the Erythraean Sea* to the probable seasonal occupation of Pemba in the mid-first century CE (Casson 1989; Horton 1987), Unguja Ukuu and Fukuchani currently represent the earliest known permanent proto-Swahili settlements of the East African coast, and Unguja Ukuu and Tumbe represent two of the largest and wealthiest first millennium settlements in the Swahili Corridor (Gray 1962; Juma 2004; Crowther *et al* 2013b; Fleisher 2003; Fleisher and LaViolette 2013; Horton forthcoming). The archipelago – and these sites in particular – therefore present a unique opportunity to study and identify patterns of maritime activity and settlement organisation in the early proto-Swahili period in a naturally delimited survey universe. As well as this, they are also the three most extensively investigated first millennium sites in the Zanzibar Archipelago. All three sites have been previously surveyed, excavated, and published, but their harbour areas have never been investigated, and although their occupation sequences and spatial extents are fairly well established, their internal layout is unknown (Horton and Clark 1985; Juma 2004; Crowther *et al* 2013a, 2013b; Fleisher and LaViolette 2013; Horton forthcoming). They

therefore offer the greatest array of published archaeological data to complement the new surveys of this thesis in exploring the physical and social contexts of maritime activity in the period.

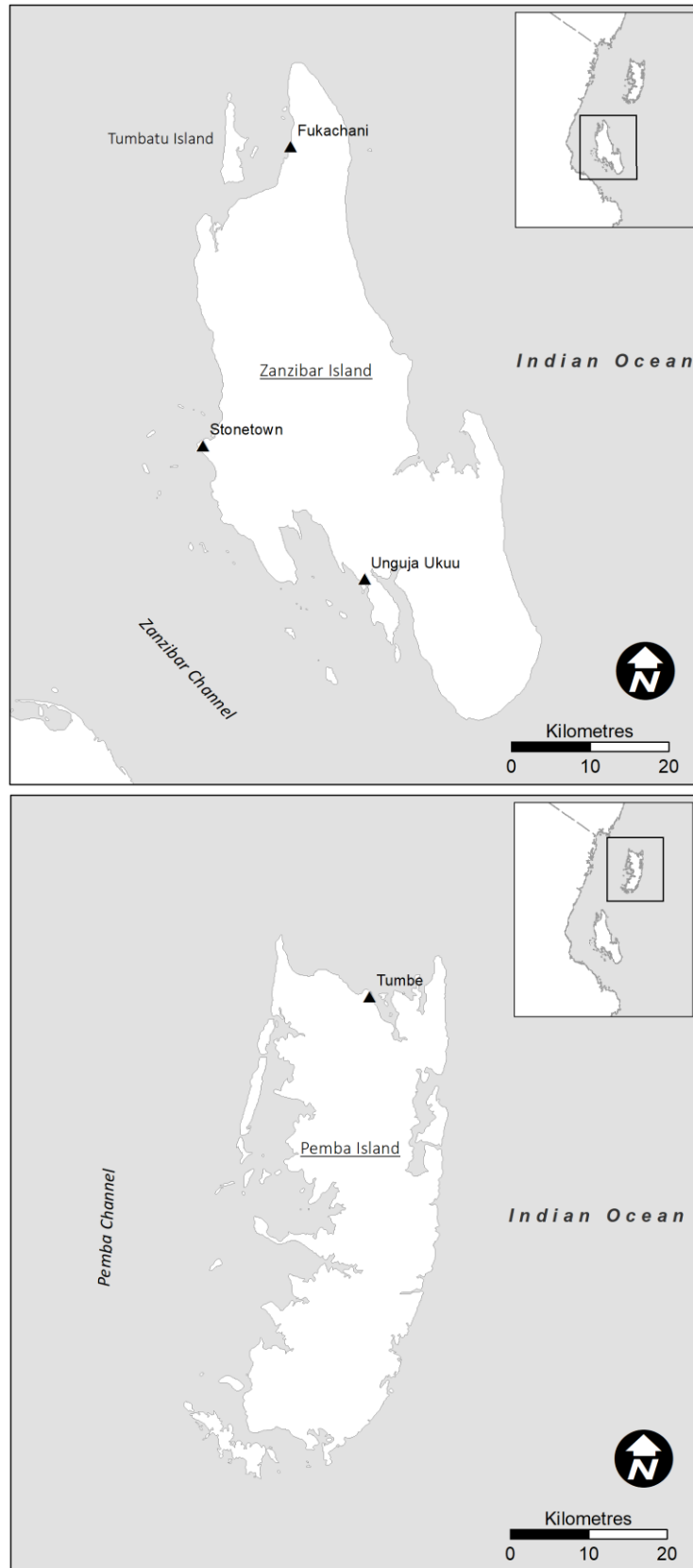


Figure 1.9 Maps of (top) Zanzibar and (bottom) Pemba Islands showing thesis case study sites of Unguja Ukuu and Fukuchani on Zanzibar, and Tumbe on Pemba

With these case studies in mind, the objectives of the project, discussed in detail in Chapter 3, are as follow;

Objective One. To analyse the archaeological use and predicted evolution of ship technology in the western Indian Ocean as evidence of potential co-dependent development of maritime activity and harbour spaces in the Zanzibar Archipelago.

Objective Two. To conduct geophysical surveys and ground-truthing excavations at three case study proto-Swahili sites in the Zanzibar Archipelago, in order to identify archaeological features related to maritime activity and settlement plans

Objective Three. To identify harbour spaces, related activity areas, and evidence of spatial organisation at each site based on a GIS analysis of collated geophysical survey and archaeological excavation results, and topographic and hydrographic datasets.

Objective Four. To identify patterns and variations in maritime activity, harbour spaces, and settlement organisation across the archipelago.

Objective Five. To evaluate and characterise the role and importance of harbour spaces and maritime activity to proto-Swahili settlements of the Zanzibar Archipelago between the sixth and eleventh centuries CE

1.5 Thesis Structure

Chapter One has introduced the main themes of the thesis, a background to the archaeology of the coast, and the history of archaeological research. This detail provides the context for the aims and objectives outlined above. The themes and sites described in this chapter, and the methods by which the research was conducted will be returned to in greater detail according to the following breakdown. Having summarised the major themes of the archaeology of the Swahili Coast in section 1.2 and 1.3, Chapter Two presents a review of archaeological literature related or relevant to the maritime archaeology of the Swahili Coast. This includes a review of evidence from some of the excavated ports of the mainland coast, Kilwa, Shanga, and Manda; summaries of the main sites of this thesis, Unguja Ukuu, Fukuchani, and Tumbe; and known examples of maritime architecture identified by previous foreshore surveys. The purpose of these summaries and reviews is to identify the types of features, activity, and archaeological remains which might be expected in surveying the ports and harbour spaces of the Zanzibar Archipelago, in order to inform the survey methodology and interpretation of results in later chapters.

Chapter Three presents the thesis methodology. This includes a review of maritime archaeological methods and survey techniques used at other port and harbour sites in the Indian Ocean and the East African Coast, and a plan of inductive research based on this review, with reference to the aims and objectives laid out in Chapter One. It also includes a discussion of the broad chronological terms and periods referred to in this thesis, and an explanation of the dating strategies employed in survey and excavation.

Chapter Four presents a review of the evidence of maritime and ship technology in the Indian Ocean particularly between the first and thirteenth centuries CE, and an evaluation of the possible evolution of such technology in the context of the East African coast in fulfilment of Objective One. No evidence of ship remains predating the thirteenth century have yet been identified on the Swahili Coast, but it is argued here that the development of this technology may have brought advantages and repercussions for proto-Swahili settlements and maritime networks.

Chapters Five, Six, and Seven present the detailed analyses of the three case study sites, Chapter Five covering Unguja Ukuu, Chapter Six covering Fukuchani, and Chapter Seven covering Tumbe. Each chapter is laid out following the same schema, in order to allow for an open comparison of the archaeological data and evidence, in fulfilment of Objectives Two and Three. Each chapter therefore presents, in order, a chronological review of previous surveys and excavations at the site; an overview of the landscape setting of the site; a description of the survey and excavation of the site, divided into discrete survey areas in the course of the project research; a discussion of the interpretation of survey and excavation results, according to the integration of datasets and a model of site organisation; and a summary of the evidence from that particular site.

Following the analysis of individual case study sites, Chapter Eight presents a comparative analysis of the harbour areas and maritime approaches of all three case study settlements, in fulfilment of Objective Four. This analysis includes a more detailed review of some of the evidence of maritime activity found at each of the sites during previous investigations, and integration with the analysis of ship technology presented in Chapter Four. This chapter examines the marine environments and maritime contexts of the three sites, and highlights possible patterns in the use and settings of the settlements.

Finally, Chapter Nine presents a discussion of the evidence of maritime activity, harbour and settlement archaeology represented in this study, and of the working hypotheses offered in Chapter Three, in fulfilment of Objective Five. The thesis ends with an evaluation of the nature and role of maritime activity in the proto-Swahili settlements of the Zanzibar Archipelago, and thoughts on the contribution of this study to the ongoing consideration, interpretation, and understanding of both proto-Swahili and classic Swahili settlements.

Chapter Two

Literature Review

“A consideration of the potential of maritime archaeology to provide new insights into oceanic communities reminds us of the limitations of restricting ourselves to land-based studies”

(Wynne-Jones 2007: v)

2.1 Introduction

Having briefly reviewed the themes of occupation and cultures of the Swahili Coast in Chapter One, the current chapter reviews relevant themes of maritime and archaeological theory in relation to the study of the East African coast as a maritime cultural landscape, the evidence of maritime activity in some of the key ports and harbours of the Swahili coast, and introduces the main case study sites of this thesis.

The following section will review the perception of Swahili and proto-Swahili societies as ‘maritime’ and demonstrate why such usage is problematic, given the current limitations of the maritime archaeological dataset related to the settlements of the coast.

2.1.1 The People of the Coast

Despite the widely acknowledged and historically documented importance of the Swahili coast as a resource area, the settlements and ports of East Africa remain largely peripheral in wider discussions of the Indian Ocean world (Ray and Alpers 2007; Prestholdt 2015). This is not unique to the Swahili Coast however, but symptomatic of the treatment of the entire African continent, which is almost entirely absent from discussion of maritime archaeology and technology outside the Mediterranean until the fifteenth century, and subsequent discussion appears limited mostly to Eurocentric sailing technologies, especially related to the slave trade or its blockade by the British Royal Navy’s West Africa Squadron in the nineteenth century (McGrail 2004; Ray and Alpers 2007; Duarte 2012). There has been little discussion of the mechanisms by which imported ceramics and artefacts arrived or were valued on the East African coast, and almost none of the possibility that African merchants might venture beyond their own ports, or have moved within their own regional networks (Duarte 2012: 86; Vernet 2015: 169). As a result, the settlements and ports of East Africa appear to have been relegated to the role of termini in maritime networks, rather than active and outgoing participants, and whilst the presence of foreign sailors and merchants is frequently highlighted in the

history and archaeology of East Africa, the same cannot be said for an African presence around the fringes of the rest of the Indian Ocean. Ray and Alpers (2007: 7) have noted the difficulty of identifying Africans, or presumably an identifiable African material culture in these maritime littorals, but highlight the recorded presence of African sailors and military slaves in post-thirteenth century Indian Ocean contexts. The problem of identification should not therefore be taken as a basis for the exclusion of Africans from the archaeological debate on the nature and mechanisms of the Indian Ocean world, but the potentially unintended bias against Swahili and proto-Swahili maritime agency persists.

The marginalisation of indigenous African groups in discussion of the Roman ports of the early first millennium is neatly, though unintentionally, encapsulated in the introduction to Thomas (2009) PhD thesis, in which he describes how, following the annexation of Egypt and Nabatea by the Roman Empire “the peoples of Egypt and Nabatea could only await the implications for their lives in being subject to empire and the economic opportunities available through providing for its elite” (Thomas 2009: 1). The unfortunate, and potentially unintended, assumption in this statement is that the indigenous Africans had no agency in either the trade networks or their own pre-existing communities and settlements. Thomas in fact goes on to argue that the ethnic groups ascribed by Greek and Roman authors are contentious, since the observers were of privileged colonial origins. However, the loss of African agency can also be felt in his identification of ethnic ‘ghettos’ in the settlement at Myos Hormos in relation to elite (Roman) or low status (Ichthyophagi and Troglodyte) assemblages (Thomas 2010), variations which might also be explained with reference to non-ethnically determined vocations and activities, such as trade or fishing activity.

With regard to the evidence and perception of the Swahili Coast as a maritime cultural landscape, the first use of the term ‘Swahili’ (from the Arabic *sawahil*, ‘People of the Coast’) appears to date to the eighteenth century, and was used to describe the cultural and language group occupying the East African Coast at the time (Middleton 1992). Ethnographies and geographies from this period, as well as subsequent works, describe these ‘people of the coast’ as a cosmopolitan ‘maritime mercantile culture’ comprised of multiple ethnic origins, bound by an adherence to Islam (Burton 1872; Dale 1920; Horton and Middleton 2000; Middleton 1992; Pearce 1920; Prins 1965). Vernet (2015) has highlighted however the fact that Swahili sailors are rarely described or discussed in terms of voyaging beyond the East African coast. Debates continue too on the retroactive application of the label ‘Swahili’, and at what point it might be applicable to the coastal culture which continues to the present day (Allen 1993; Chami 1994-5, 1999a; Fleisher *et al* 2015; Horton 1986; Kusimba 1999; LaViolette 2000; Middleton 1992). The extension of the use of the term back in time as a label for earlier forms of this Bantu-speaking, Tana Tradition-using culture is both convenient, highlighting the spatial unity of the culture, and promoting indigenous histories and traditions; and problematic, since it may unintentionally disguise temporal variations (Horton 1987; Middleton 1992; Wynne-Jones 2005). Fleisher and LaViolette (2013), discussing the first millennium

settlement at Tumbwe on Pemba, reasoned that the study of Swahili coastal settlements had become evolutionary in its approach, and that seventh – tenth century settlements such as Tumbwe, Unguja Ukuu, Manda, Chibuene, Dembeni and Shanga (Figure 1.1) were regarded as ‘stepping stones’ on an organic absolutist path towards the pinnacle of the ‘classical’ Swahili stone towns of the thirteenth-fifteenth centuries. This, they argue, denies not only the complexity and variety of the seventh – tenth century settlements, but also the poorly understood discontinuities of occupation observed at so many sites in the tenth – eleventh century. On this basis, Fleisher *et al* (2015) have recently argued for a cultural *terminus a quo* for the use of the term linked to the growing expression of Indian Ocean maritimism by various means around the eleventh century, and thereby to the initial urbanisation and growth of the stonetowns. The authors argue that the first millennium settlers of the coast became increasingly connected to their maritime environment over centuries, not as soon as they reached the shoreline, and presumably as a gradual process (Fleisher *et al* 2015). Some changes in perspective and culture may have been influenced by increasing contact with maritime traders in the eighth and ninth centuries, but the roots of this coastal society are evidently African, and the changing styles within a coastal continuum of settlement architecture and ceramics reflect active agency within African settlements rather than a passive reception or colonisation. By the eleventh century however, the inhabitants of the coast had reimagined their world as connected to the ocean, rather than the mainland, and reshaped their culture to express their coastal identity (*ibid*). This argument is compelling, directly linking the original intention of the Arabic phrase to a material expression and tradition; truly a people of the coast. It does however raise the question of how to define and ultimately label the earlier phases of the societies and settlements of the coast before this conceptual shift.

Whilst the incremental redevelopment of first millennium coastal society into the second millennium Swahili culture is generally accepted, a growing trend in East African archaeology departments seems to be to refer to the first-sixth centuries as ‘Azanian’, following the description of the coast in the *Periplus of the Erythraean Sea*, and the eighth-thirteenth centuries as ‘Zanjan’ (Huntingford 1940/41; Chami 1998; Mjema 2014). The use of these terms is intended as a decolonisation of the language of East African archaeology, and is appropriately rooted in historical terminologies (Chami 1998). With respect to this effort though, the terms have not been used in this thesis, on the grounds that there has been little discussion of the arbitrary chronological separation and boundaries for their use, and the fact that both terms are associated with unfounded concepts of political unity and regional authorities on the coast. The terms chosen for use in this thesis are, as described in the foreword, ‘Early Iron Age (EIA)’ for the first-sixth centuries (Horton 1987; Kusimba 1999; Fleisher and Wynne Jones 2011; Crowther *et al* 2013), ‘proto-Swahili’ for the sixth-tenth centuries and ‘Swahili’ for the period from the eleventh to fifteenth centuries (Fleisher *et al* 2015). The intention in this choice is to highlight the currently unknown origins and relationships of seasonal settlements in the first-sixth centuries, followed by the start of permanent settlement on

the coast and cultural evolution of proto-Swahili and Swahili cultures between the sixth-tenth and eleventh-fifteenth centuries.

2.1.2 A 'Maritime Mercantile' Society

It is now generally accepted that proto-Swahili coastal culture was derived from and related to indigenous Bantu-language iron-working agriculturalist groups who settled the coast around the sixth century CE (Chami 1998; Horton 1986; Middleton 1992). Horton (1996) and Abungu (1994) have argued for common origins for Mijikenda and Swahili groups in Kenya, based on linguistic evidence, architectural and spatial similarities between the early phases of Shanga and contemporary settlements in the Kenyan hinterlands, and evidence of trade in regional ceramics, craft goods such as shell beads, and some imports of glass beads (Abungu 1994; Horton 1996; Allen 1993). Chami (1994, 1998) meanwhile has argued for a direct development of the Tana Tradition (called by him Triangular-Incised Ware) from Kwale ware in Tanzania, pointing to a Bantu agriculturalist origin community. This theory has been questioned in part on the basis of limited evidence of a sufficiently united ceramic tradition (Abungu 1994; Chami 1998; Horton 1996) and a lack of direct observable continuity (Fleisher and Wynne-Jones 2011). As well as connections to hinterland groups, overseas trade connections to the Persian Gulf and western India are also clearly evidenced by imports of Sasanian-Islamic glazed ceramics and glass beads in varying quantities at most coastal sites in the first millennium (Chittick 1974, 1980; Horton 1987; Kirkman 1964).

What is less clear however is where and when these early coastal settlers learned to sail and to exploit the marine environment. The origins of the maritime network that connected this coast to the Indian Ocean in the seventh century, or of the maritime technology that supported such connections have not been identified. Faunal evidence demonstrates that sixth century coastal settlements were capable of exploiting of the marine environment for subsistence (Horton and Mudida 1993; Quintana Morales and Horton 2014). Various scholars have suggested that the early phases of proto-Swahili settlements may represent seasonal settlements based on the subsistence exploitation of the marine environment (Horton and Mudida 1993; Horton 1996; Sinclair 1992; Chami 1999). Until now however there has been little investigation of whether coastal sites were selected specifically for the opportunities offered by this mixed environment, whether maritime activity was a by-product development of living on the coast, or whether some merging of previously distinct cultural groups may have occurred. Horton's excavations at Shanga raised the possibility of a mixed origin settlement in the eighth century, but no evidence of Kwale ware or other links to a known and identifiable maritime society have been noted (Horton 1996). Further south, the discovery of Early Iron Age, Kwale-using settlements in the Mafia Archipelago indicates occupation by a sailing and fishing society with ties to the mainland in the fourth-sixth centuries, but there is

discontinuity of occupation between these settlements and the later Tana Tradition sites on the islands (Chami 1999b; Crowther *et al* 2014). As yet therefore, no unambiguous evidence of cultural or settlement continuity has been found between EIA and proto-Swahili sites, and the origins of the maritime technology indicated in the coastal settlements of the sixth century remain uncertain.

By the eighth century, the evidence of maritime activity in the proto-Swahili sites is unambiguous, but study of the nature and role of this activity as an integrated function of settlements has been sidelined by the thematic concerns of archaeological research outlined in Chapter One. Rising quantities and proportions of imported ceramics as a result of maritime trade were noted at Kilwa (Chittick 1974), Manda (Chittick 1984) and Shanga (Horton 1996) on the mainland coast, as well as at Unguja Ukuu (Horton and Clark 1985; Juma 2004), Fukuchani (Horton and Clark 1985; Crowther *et al* 2013a; Horton forthcoming) and Tumbe (Fleisher and LaViolette 2013; Flexner *et al* 2008). Dominant proportions of shell-fish and fish were also noted in faunal assemblages as evidence of a reliance on marine subsistence resources at Shanga and Unguja Ukuu (Horton and Mudida 1993; Quintana Morales and Horton 2014). In spite of this, the shoreline and beach areas of settlements have never been a focus of deliberate or systematic investigation, and the rare consideration of harbours has been restricted to anachronistic comparisons to recent or modern maritime activity. Allen, for example, notes simply that “a good number [of Swahili settlements] have very poor harbours” (Allen 1993: 11). With regard to Shanga, Horton predicted a need in the past for an intertidal landing place or area suitable for drawing up boats onto the shore, rather than access to a deep-water harbour, but nevertheless described the maritime approaches to the shallow beach in terms of the difficulty of access to ships, referring to the density of mangroves and hazards of silting in the channels (Horton 1996: 18). Prins (1965: 43), on the other hand, noted the wealth of words used to describe the different types and characters of shallow tidal waters around the Lamu Archipelago as a sign of the maritime ability of the local sailors, and emphasised the range of environments exploited for different purposes). The thrust of his argument was that the range of environments is a direct advantage to a sufficiently maritime society, and his descriptions of the methods by which sailors and locals exploit the mangroves, beaches, sandbanks, and intertidal reefs for different purposes indicate that many so-called ‘maritime hazards’ may in fact be regarded, again with sufficient awareness of the environment, as landmarks to different resource areas.

Breen and Lane (2003: 474) have described a similar varying use of different regions of the maritime cultural landscape, and provided a useful schematic diagram of seascape types and activity zones to illustrate some of the basic and expected requirements of different forms of maritime society in East Africa (Figure 2.2). This diagram notes, for example, the existence of offshore, near-shore and foreshore maritime zones, and outlines the types of activity and craft which might be expected within each zone. As well as movement overseas, they note the movement of craft along a coastline; the exploitation of deep- and shallow-water environments for subsistence and resource harvesting; and finally the need for anchorage and a waterfront or foreshore area for boat building and

maintenance, as well as for trade, exchange and settlement. They also note however that whilst such activities may be key to the daily life of a maritime society, many such activities are likely to leave only passing ephemeral traces, if any, in the archaeological record. As such, “most recent attempts to define the particular characteristics of early East African coastal towns, or the ethnic, linguistic and cultural progenitors of Swahili identity, have tended to overlook the changing significance of the sea to local populations in favour of other variables” (Breen and Lane 2003: 473). Their proposed solution to rectify this situation is an examination of the results of such as activity through changing proportions of imported trade artefacts over time, proportions of marine elements in faunal assemblages indicative of the exploitation of different marine zones, and the study of watercraft through linguistic, textual, and iconographic sources, as well as underwater surveys along the coast to identify shipwreck remains and maritime architecture (Breen and Lane 2003).

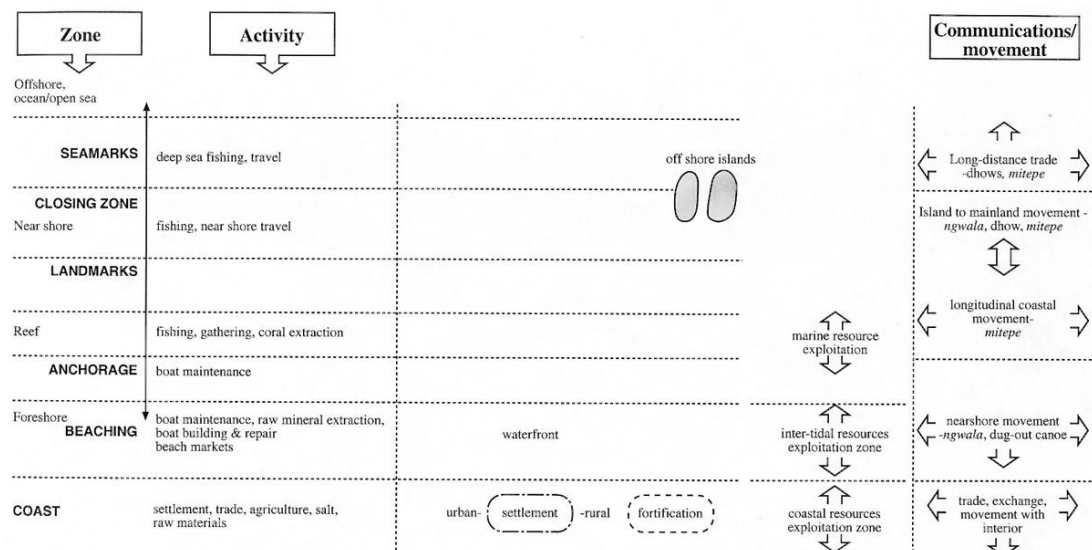


Figure 2.1: Schematic of East African maritime activity zones from Breen and Lane (2003: 474)

Given the evidence of a long history of trade on this coast provided by the *Periplus* and the importance of international trade to the proto Swahili settlements of the seventh century onwards, Lane (2012) has also noted surprise at the lack of systematic surveys aimed at identifying wrecks or any other kind of underwater sites related to either the proto-Swahili or Swahili periods on the East African coast. Ninth and tenth century shipwreck remains have been found in Indonesian waters, and will be discussed in detail in Chapter Nine, but the warm and shallow waters around the coastline of eastern Africa mean that organic preservation is rare, and it is only recently that underwater surveys have begun to gain a foothold as a useful technique. As a result of Chinese interest in investigating the rumoured shipwreck of one of Zheng He’s treasure ships in the Lamu

Archipelago, a great number of post-fifteenth century and undated shipwrecks have recently been identified in the region (Bitá 2014). Surveys in Mombasa, Malindi and Zanzibar Stonetown have similarly revealed a number of remains post-dating the seventeenth century (Bitá 2014; Breen 2016). Those wrecks that have been identified in the course of underwater survey have generally been discovered in the course of surveys aimed at identifying or salvaging colonial and modern ships. Only one systematic survey has yet been carried out with the explicit aim of targeting a Swahili-period second millennium site, but that survey, of the deep-water channel at Kilwa Kisiwani, has so far led to the discovery of two wreck sites, and resulted in several targets for future investigation (Pollard *et al* 2016). Of the two known sites, one is an artefact scatter in deep water and appears to indicate the remains of a thirteenth-sixteenth century wreck site, whilst the other appears to date to the eighth-tenth century (Pollard *et al* 2016). This earlier site was not found in deep water, but as a scatter of ballast remains embedded in the coral of the Jiwe la Jahazi reef on the eastern, ocean-facing shore of the island. It was hypothesised that the ship ran aground whilst crossing the intertidal reef, resulting in either the dispersal of ballast to lighten and save the ship or, as indicated by a local legend of a ship turning to stone on the reef, the wrecking of the vessel and subsequent scattering of cargo (Pollard *et al* 2016; Pollard and Ichumbaki 2016). The success of these surveys demonstrates their potential value to the study of East African settlements, but apart from this, no attempt has yet been made to target underwater areas in the region of the earlier proto-Swahili sites.

As well as the marine zone, Breen and Lane's seascape diagram includes a terrestrial coastal zone, represented by activities such as settlement and communication or trade with an interior hinterland. Although the remains of such trade is covered as an area of potential archaeological interest in their paper, what is not covered is the remains of maritime infrastructure which might be found in shoreline and settlement contexts. Survey and excavations of shoreline and terrestrial contexts in the Red Sea, as in the excavations of Adulis and Myos Hormos/Quesir al-Qadim, have demonstrated significant and useful archaeological remains indicating the use of the shoreline areas, social divisions between different areas of the site, and the nature and role of maritime activity in the life and biography of the site (Blue 2007; Peacock and Blue 2006, 2007, 2011). Maintenance areas, for example, are rarely given any published consideration, but the importance of activities such as antifouling by the scraping of barnacles, and the repair of fittings and rigging have been emphasised by Blue, Whitewright and Thomas (2011). The weakening of the hull structure and vast reduction of speed and manoeuvrability of boats over time if these activities are neglected necessitates regular maintenance, and therefore areas in which such activities may be carried out, whether this takes place on the beach or in the intertidal zone. Traces of these activities are likely to be ephemeral, but a suitable survey might reveal activity areas related to such tasks. As well as the evidence of an eighth-tenth century shipwreck, surveys of the intertidal zone in the Kilwa Archipelago by Pollard and Ichumbaki have identified causeways and the remains of fishtraps, dated in these cases by

associated ceramics to the second millennium (Pollard 2008; Pollard and Ichumbaki 2016; Pollard *et al* 2016).

This first part of the review has described the limits of the ways in which maritime archaeology has been applied to the settlements of the East African coast, and regarding the maritimity of proto-Swahili and Swahili settlements, as shaped by the traditional research themes laid out in Chapter One. The following section will outline the wider theoretical boundaries of maritime archaeology, and introduce relevant concepts and terminology which will be employed in this thesis.

2.2 The Maritime Cultural Landscape

Since this thesis deals with the integrated archaeological investigation of terrestrial and marine zones around a settlement, it is necessary to address the issue of how coastal landscapes are perceived, used, and how the relevant inhabitants reactions to or modification of that landscape might be interpreted. Coastal settlements are sometimes discussed as special, isolated places, liminal bridging points between land and sea, as if the water's edge represented a hard boundary between two entirely separate realms (Pearson 2006). Pearson (2007) has argued however that proximity to the sea alone does not determine whether a community should be considered more or less 'maritime' in outlook and culture than any other, and that any individual aboard ship may be defined by their landward social norms regardless of their current surroundings. Rainbird (2004) notes that for the inhabitants of a coastal settlement, embedded in this supposedly liminal zone, movement and interactions across both marine and terrestrial spaces may occur on a continuous (albeit wetter or dryer) littoral topographic space, rather than a binary choice of land or sea (Rainbird 2004). Pearson has therefore argued for an 'amphibious' perspective capable of recognising a fluid continuum of land and seascapes. Christer Westerdahl (1992: 5) has attempted to achieve this in a meaningful methodology by defining the totality of the potential landscapes, artefacts, and cognitive spaces affected by human maritime action as the 'maritime cultural landscape'. He encloses in this definition maritime spaces such as harbours, maritime architecture, and maritime settlements as a whole; maritime activities such as sailing, fishing and 'attendant subcultures' related to these activities, such as the construction and maintenance of fishing nets; artefacts at every scale between a ship and fish hook, including those at a distant relation from maritime activity, such as the axe used in hafting timbers for the ship; and conceptual spaces, allowing for the inclusion of maritime spaces and activities at a physical distance from the original subject (Westerdahl 1992: 5). This holistic conceptual space also ties in therefore with his continuum of maritimity discussed in Chapter One (Westerdahl 1998). The maritime cultural landscape is therefore a useful development of McGrail's (1997: 11) argument that maritime archaeology should include not just the study of water transport, but "the study of landing places, boatbuilding sites and

all the other maritime structures found in the coastal zone and in the vicinity of rivers and lakes” (Figure 2.1). To some extent the concept also allows for Ingold’s (1993) cognitive and socially embedded ‘taskscape’. The perception and relationship of coastal dwellers to the maritime cultural landscape has become a topic of increasing debate in the consideration of the Swahili coast, and the socially embedded practices that define Swahili culture (Fleisher *et al* 2015).

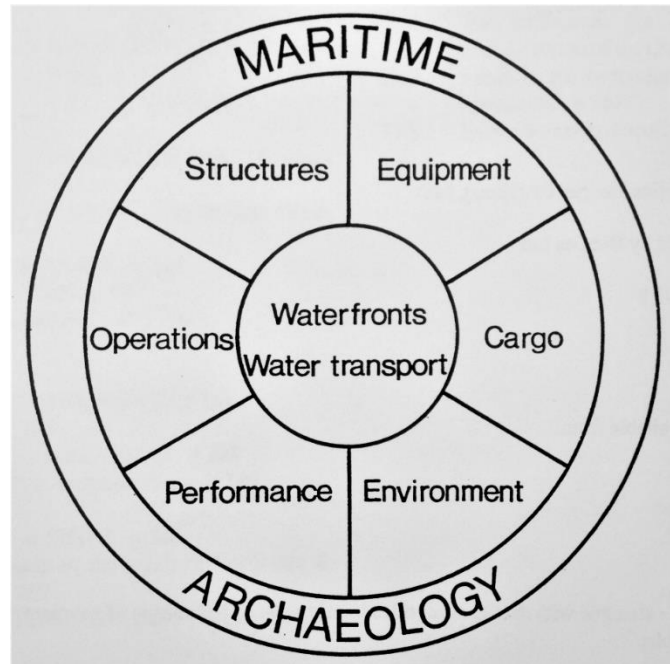


Figure 2.2: Schematic remit of maritime archaeology, from McGrail (1997: 25)

Westerdahl (1992: 7) deals with this issue by implying that a truly maritime culture is one comprising a combination of factors, including utilisation of maritime spaces by boat; a tradition of using the sea and its resources; terrestrial infrastructure to support seaborne practices; attention to the sea in sailing routes and ritual and oral traditions; and the naming of topography in relation to maritime features. As noted in Chapter One, it has recently been argued that these requirements effectively create a cultural delimitation between the ‘Swahili’ maritime Islamic culture of the second millennium, and the earlier proto-Swahili settlements which, whilst clearly engaged in maritime activity, do not appear to fulfil the multiple criteria of cultural ‘maritimity’ (Fleisher *et al* 2015). As was also noted in Chapter One though, the relative under-investigation of first millennium proto-Swahili sites and maritime elements in comparison to second millennium settlements leaves some room for uncertainty in this distinction. It is hoped therefore that the survey and analysis of first millennium harbours and maritime activity in this thesis may bring to light relevant material for the evaluation and development of this theory.

2.2.1 Maritime Sites

It is necessary at this point to define the use of the terms 'port' and 'harbour' in this thesis, and to define 'anchorage' as a third option. An anchorage is a place where boats may safely moor at anchor, but which may or may not have access links to the shore. A harbour is an area of water with access to the shore in which boats may beach or moor in order to take shelter, load, and carry out maintenance. A port is defined here as a town or settlement which includes a harbour area, and whose business is generally related to the use of the harbour (Blue 2007; Tartaron 2013). Under these terms a port requires a harbour in order to be considered a port, but a harbour or anchorage can exist independently of a port. This means that harbours and anchorages may be found either within the settlement boundary of a port, or apparently separate at some distance from the port settlement. Whilst all are intended as a shelter for vessels, the distinctions are important for the purposes of this research, since the different terms imply quite different environments and uses, and may not necessarily describe a relationship to a settlement. In comparison to this usage, the term 'port of trade' should also be defined. A port of trade was described by Polanyi (1963) as a deliberately neutral place of trade, open to the sea, at which business transactions might be carried out through the mediation of local agents neutral to both parties. Whilst various aspects of Polanyi's classification scheme and model for the development of such ports of trade are now distinctly outdated, the concept of the political neutrality of such places either within or outside a political sphere remains relevant to the study of the maritime sites within the Swahili Corridor.

In considering the setting of ports within the maritime landscape, Karmon (1985: 2) states that "a port cannot be regarded as an isolated phenomenon, but as part of the political, social and economic life of a region". It is a hub within a network of economic and social interactions, and can therefore to some extent be regarded as an indicator of the health and success of these interactions (Schörle 2011: 93). The location of such 'gateway communities', and ports in particular, may be determined not by a political authority, but by the communal actions and needs of sailors and traders, and by related environmental requirements (McGrail 1997: 68; Schörle 2011: 93). McGrail (1997) suggests that sailors are likely to prefer harbours offering shelter from wind and swell, and may opt for or create navigational aids such as readily identifiable landmarks. They will also require a suitable landing site for loading and maintenance, preferably one which is usable or approachable regardless of wind and sea conditions, and access to drinking water. Traders and merchants may also require a landing place to have access to a trading place, whilst political authorities in an associated settlement may require the site to be in a location where seamen and traders can both be segregated as an external, and potentially disruptive influence upon the local community, or so that tolls and dues can be extracted. For these reasons he suggests that sailors may therefore prefer natural harbours such as estuaries, whilst political authorities may prefer promontories, peninsulas and rivers (McGrail 1997: 68). At this point it is worth adding 'transit points' to this landscape of overlapping concerns; sites at which cargoes are broken or transferred, and the means of transport

is changed (Westerdahl 1992). These transit points usually represent liminal spaces in the maritime cultural landscape, and may be the result of economic conditions, such as a border zone, or physical environmental conditions. The continued transport of goods from the sea up an estuary or river system, for example, may well require a change of transport from a sea-going vessel to one with a shallower draught, or from a sailing vessel to one propelled by oars (Westerdahl 1992; McGrail 1997; Schörle 2011). As well as representing physical liminal zones within the maritime cultural landscape, transit points may therefore also mark the need for variants within one or more of Westerdahl's (1992) 'attendant subcultures'. The lack of maritime investigation in East Africa noted above and in previous studies (Breen and Lane 2003; Pollard 2007, 2008, 2016; Christie 2011) means though that at present there is too little comparative data to enable substantive discussion of the roles of individual anchorages, harbours, and ports in the maritime networks of the Swahili Coast. What is needed first therefore is a investigation of what proto-Swahili and Swahili harbours actually looked like, which types of activities and factors were common or rare within them, and whether these criteria were related to the rise of the stonetown ports in the second millennium.

2.2.2 Maritime Networks

The idea of transit points and gateway communities raises the broader issue of the role of Swahili settlements in various social and economic networks, maritime or otherwise. It was noted in Chapter One that the sites of the Swahili Coast are now generally accepted to have been a coastal aggregation of politically independent settlements bound by maritime social and economic networks, and a common material culture (Horton and Middleton 2001; Fleisher and Wynne-Jones 2011). On the basis of their extensive analysis of Early Tana Tradition (ETT) ceramics, synonymous with seventh – tenth century proto-Swahili sites, Fleisher and Wynne-Jones (2011) have suggested that the continuum of decorative motifs seen along the entire coast indicate "a vast interaction sphere in which communities were most in contact with those nearest to them, whilst cognizant of a larger sphere that included them all" (Fleisher and Wynne-Jones 2011: 274). Variations in form, meanwhile, may be linked to distinctions in diet and lifeways related to geographic situation and greater or lesser connections to Indian Ocean trade (Fleisher and Wynne-Jones 2011: 274). Horton and Middleton's interpretation of trade on the Swahili Coast posits a network of barter and exchange between entrepôts in the 'Swahili Corridor', with the Swahili as brokers and middle-men handling the exchange of goods between intermediaries from the coastal interior and Indian Ocean merchants (Horton 1987: 89; Middleton 1992: 17; Horton and Middleton 2001). Middleton points out that this is likely to have left individual ports, as well as the system as a whole, vulnerable to fluctuations and disruptions in the wider Indian Ocean network (Middleton 1992: 20). According to contemporary reports, by the second millennium the trading relations in this system were based on personal relationships, rather than being purely market-oriented (Middleton 1992: 22). Ibn Battuta,

for example, records ritualised welcoming ceremonies and the accommodation of Asian merchants and their cargoes at Mogadishu in specific Swahili houses according to previously established kinship ties between local and visiting merchants (Freeman-Grenville 1962; Middleton 1992: 22). It is possible that this system might have represented an attempt to ensure the continuing return of trade to specific ports and mitigating against the geographic flux of market centres.

Horton and Middleton argue that this system led to the formation of a series of urban nuclei, especially located around the archipelagos of Lamu, Zanzibar, Kilwa, and the Comoros, which were sustained by this trade (Horton and Middleton 2001) (Figure 1.1). Horton (1994) further argues that each archipelago within this system contained its own regional economies, networks, and cultural distinctions which may be visible in the expression of art, architecture, diet, and settlement plans. This archipelago model, and especially the subsequent movement of Swahili between these clusters, may also explain the complicated carriage and spread of Shungwaya and Shirazi 'homeland' origin legends common in coastal traditions (Horton and Middleton 2001).

At this point it is necessary to discuss the overlapping of functional networks at different scales of analysis. Accepting the holistic totality of Westerdahl's maritime cultural landscape, we must consider the ways in which specific types of network activity may overlap, interact, and impact upon each other and related social contexts. As discussed in Chapter One, the ports of the Swahili Coast are known to have been engaged in long-distance trade across the Indian Ocean from at least the seventh century CE, and with increasing intensity through to the tenth century CE (Horton 1987, 1996; Horton and Clark 1985; LaViolette and Fleisher 1995; Chami 1999; Fleisher 2003; Juma 2004; Wynne-Jones 2005; Kleppe 2007; Wood 2011). As well as dealing ivory and gems in exchange for cloth, ceramics, and glass beads, these towns were known for their trade in high-quality iron, and for ballast goods such as mangroves (Freeman-Grenville 1962; Chittick 1965; Horton 1987; Middleton 1992; Kusimba 1996). Many of these goods, including iron ore, are hypothesised to have been brought to the coast as raw materials from the hinterland interior before being processed in coastal settlements (Chami 1994; Horton 1996; Kusimba 1999). At present however, we have no unequivocal archaeological evidence to determine precisely where this trade connected too in the African interior, how these links operated, or what was being exchanged with the inland communities in return (Wood 2011; Wynne Jones and Fleisher 2015). It is also unclear where iron-ore was smelted for this trade, since although evidence of small-scale iron-working has been found in household and beach contexts at coastal sites, no evidence of smelting has been found on the coast except in a disputed second millennium context at Nguruni, near Kilwa Kisiwani (Chittick 1974; Horton 1996; Kusimba 1996; Chami 2006: 139; Fleisher and LaViolette 2013; Fleisher and Wynne-Jones 2011). Mangroves appear to have formed a ballast cargo for trade with the Persian Gulf, but it is not clear whether this was by demand, or simply for convenience as a break-bulk cargo. Similarly, although the spread of ETT ceramics provide clear evidence of an extensive maritime network along the East African coast, we have little firm evidence to determine whether the network was

composed only of short-range overlapping networks, or whether proto-Swahili sailors engaged in long distance voyaging along the coast and across the Indian Ocean (Pollard 2008; Christie 2011; Vernet 2015; Fleisher *et al* 2015). Apart from the evidence of ETT and Indian Ocean trade goods found in Swahili coastal settlements then, our conception of Horton’s ‘Swahili Corridor’ has remained a somewhat nebulous and hypothetical zone of coastal interaction, with little evidence of how local and regional connections were maintained.

In attempting to explore the origins and developments of these networks, it is necessary to speculate, and to begin to draw a model of possible network links and functions. Cyprian Broodbank’s (2000) now classic analysis of the development of exchange networks in the Cyclades of the Mediterranean offers one method, founded on the principal of Proximal Point Analysis (PPA). This technique of network analysis assumes the formation of links between nearby points, and transport between spatially distant points via a chain connecting the shortest distances between points. Those points with the highest numbers of connecting points are nodal points in the network, representing, in whatever terms may be relevant to the subject under discussion, the most central, and presumably successful points of the network (Irwin 1983). Broodbank’s model of a hypothetical Cycladic network was based on connecting each point of a map of sites to its nearest three neighbours, and determining potentially ‘central’ nodes based on the number of connections generated to and from each site.

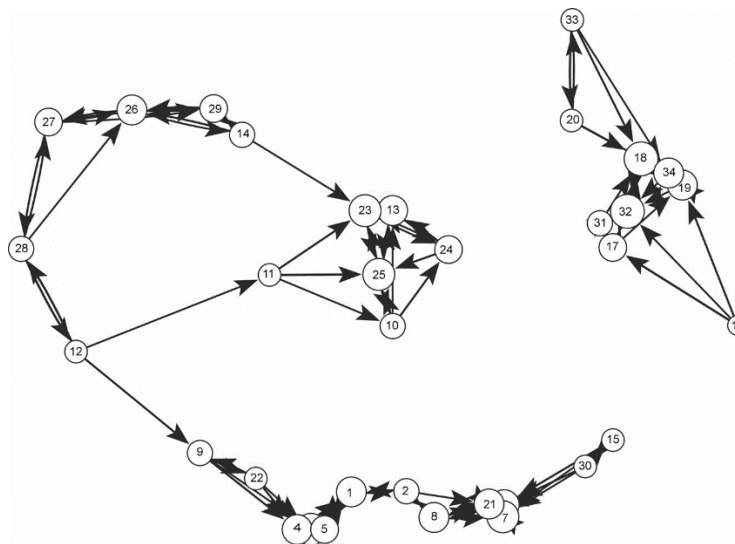


Figure 2.3 PPA network of Cycladic islands based on assignment of three shortest proximal link from each site. Proportional circles represent numbers of incoming links to each point. From Knappett *et al* (2008: 1019)

By comparing these results to archaeological data on trade and estimated settlement wealth, Broodbank noted that three of the 'central' nodes of his PPA aligned with archaeologically attested major Early Cycladic towns (Broodbank 2000). As Knappett, Evans and Rivers (2008: 1010) have noted however, this system is based on an assumed equal status between sites, and explicitly preferences short-distance 'local' connections regardless of potential social or economic considerations which might bias such connections. In spite of allowing for limited variability based on specific changes in the number of predicted connections or maximum link distances, the model does not allow for the impact of organic growth from humanising elements of social agency over time. It is therefore unsuitable as a means of modelling the totality of interactions contained by the maritime cultural landscape (Tuddenham 2010: 9).

Tuddenham (2010: 9) has discussed the necessary recognition of interactions in Westerdahl's maritime landscapes in terms of Actor Network Theory. Actor Network Theory (ANT) posits that humans, artefacts, and even physical landscapes may be considered participants, or actants, in a web of biographical connections, so that any action or interaction will impact upon every connected participant through this web. Tuddenham notes the value of ANT in conceptualising the maritime cultural landscape, and as a means of exploring the phenomena of networks from origin, through maintenance, to collapse or deconstruction (*ibid*). In order to move from concept to practice however, we must understand and be able to quantify these biographies in some way, and distinguish between different scales and network functions.

Knappett *et al* (2008: 1011) offer an alternative model which incorporates a system of preferentially 'weighting' specific points based on 'value' attributes such as settlement size and population, resource availability, and the number of onward connections, in order to allow for actor agency based on the purpose of a given network. The incorporation of a cost/benefit calculation to each point also enables the algorithmic alteration of the network over time through the accruing or loss of social, political, and economic capital. The authors found that this 'gravity model' was particularly suitable for modelling the development of homophily dynamics in which large sites preferentially connected with similarly large partners, effectively penalising small sites and exacerbating status inequality throughout the network (Knappett *et al* 2008: 1018). Whilst these methods of analysis are theoretically exciting, in terms of Swahili archaeology the gravity model is unlikely at present to yield reliable results because of the current lack in the vast majority of Swahili sites of quantifiable data which might be used as a commonly applicable proxy for site size or 'value'. An unweighted Proximal Point Analysis might be possible, and could potentially shed light on the existence or interactions between coastal networks and interior or overseas connections. However, this method is also hindered by the questions noted in Chapter One relating to the unknown capabilities of watercraft in the first millennium, such as their average of maximum voyaging distances.

Thomas Tartaron’s (2013) recent work on the Mycenaean however, offers a particularly useful, practical model of nested network interactions, built upon the broad frame of Westerdahl’s maritime cultural landscape, which is suitably applicable to discussion of the Swahili Coast. Tartaron advocates for a reorientation of perspectives away from direct international-scale trade and towards a ‘bottom-up’ view of coastscapes and small-world interactions (Tartaron 2013: 11). His reasoning for this is based in part on the more frequent evidence of mixed cargoes found in wrecks such as the Gelidonya and Point Iria ships, compared to the rare and exotic cargo of the Uluburun shipwreck; this, he suggests, indicates that multipurpose voyaging is likely to have been more common than direct voyages with a singular purpose, such as gift exchange (Tartaron 2013: 26). Recognition of this necessitates a means of describing the multiple purposes represented by a given ship, since different elements of the cargo, crew, and even parts of the vessel may be taken on, carried, and passed on through different functional networks, and the purpose of a ‘single’ voyage may be broken down or aggregated in various ways, depending on the subject perspective.

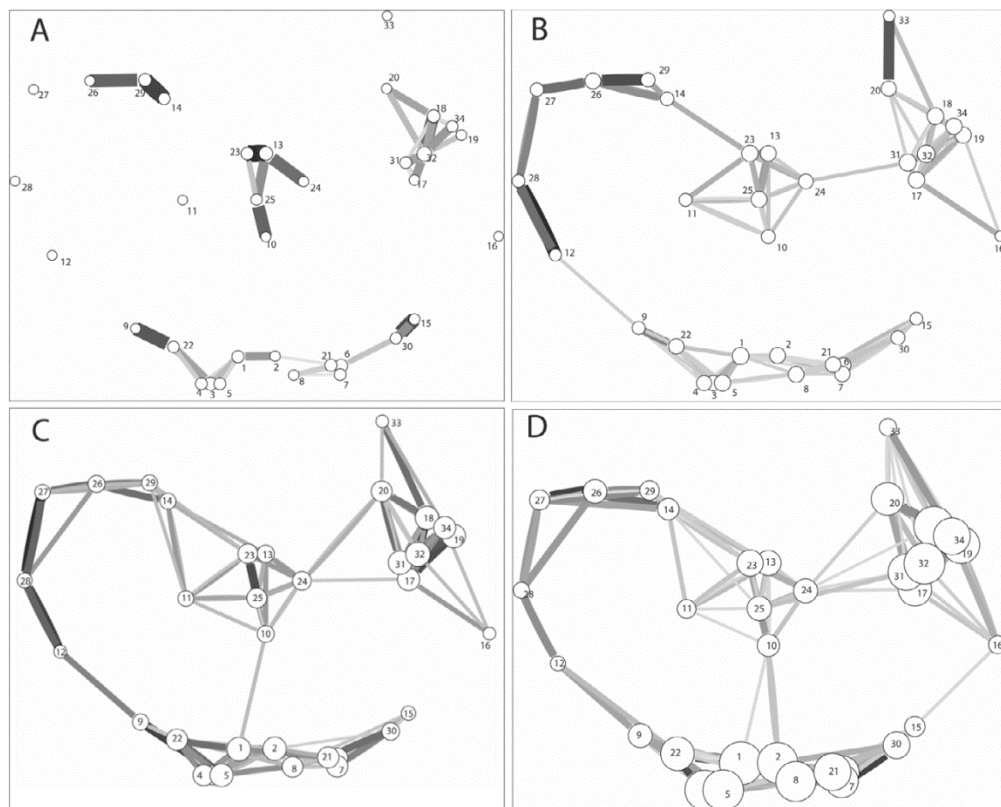


Figure 2.4 Weighted ‘gravity model’ of Cycladic Islands from Knappett *et al* (2008: 1016) showing growth of the network over time based on site/value attributions

Tartaron’s model, shown below in Figure 2.5 adapted for hypothetical reference to the Swahili Coast, proposes four overlapping scales of geographic analysis: the coastscape; the maritime small world; the regional/intracultural maritime sphere; and the interregional/intercultural maritime

sphere. The coastscape covers the shoreline, lowland, and coastal waters local to a given settlement, including inshore waters, passages inland, and the visual seascape as a continuation of territory from the perspective of the settlement. This therefore encompasses the zone of daily activities and tasks from the perspective of the inhabitants, including coastal and inshore fishing, and may also be evidenced therefore by the remains of Westerdahl's 'attendant subcultures' (Tartaron 2013: 188). The maritime small world encompasses multiple, aggregated coastscapes within a sphere of interaction or close proximity, and can also therefore be considered a local world in as much as the coastscapes and inhabitants are familiar through habitual personal interaction. The small world shares not only cultural traditions, but is likely to feature kinship ties formed through local geographic movement of individuals, and regular face-to-face social or economic networks. The boundaries of this maritime small world may therefore be difficult to distinguish archaeologically, but may be estimated based on the local environment, settlement patterns, and potentially some interdependence between settlements. (Tartaron 2013: 190). The regional/intracultural maritime sphere encompasses the cultural sphere of interaction, which may extend beyond face-to-face familiarity, but which is bound by a shared material culture, with common customs and traditions. Tartaron also emphasises the fluidity of the boundaries of this 'cultural area' at any given moment, and particularly over time (Tartaron 2013: 199). Finally, the interregional/intercultural maritime sphere describes network interactions which cross the boundaries of regional/intracultural spheres (Tartaron 2013: 202).

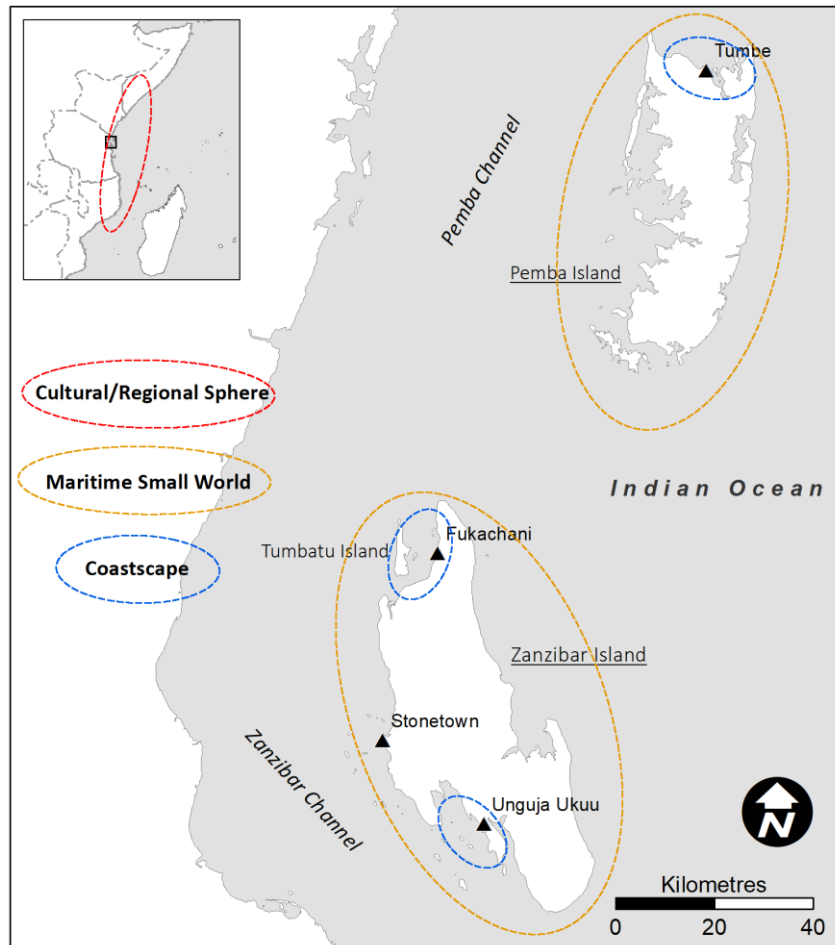


Figure 2.5 Diagram of the Zanzibar Archipelago and (inset) Swahili Coast in terms of Tartaron's (2013) overlapping spheres of maritime interaction and cultural worlds

With reference to the Swahili Coast therefore, and particularly in terms of this thesis, it could be argued that the shoreline and lowlands around Unguja Ukuu, as well as the visual seascape of Menai Bay comprise the settlement's coastscape; whilst the island of Zanzibar, or perhaps the entire Archipelago comprise the maritime small world. The Swahili Coast as a cultural sphere is then represented by the regional/intracultural maritime sphere, and the Indian Ocean networks by the interregional/intercultural sphere of interaction. This model is especially apt, since using Tartaron's own descriptions it might arguably be adapted to recognise terrestrial interactions. Thus the regional/intracultural sphere could be said to extend a short way inland, at least as far as the common recognition of ETT and Tana Tradition ceramics, which on average is around 20km, and trade with the interior therefore lies in the realm of the interregional/intercultural sphere (Figure 2.5).

The issues discussed here represent only a small part of the field of maritime archaeological theory, but they serve as an indication of how and why maritime archaeological approaches might contribute to a greater understanding of the use and perception of space by the proto-Swahili

societies of the East African Coast. The study of maritime technologies, as well as maritime spaces, is crucial to the understanding of the maritime cultural landscape, as is an openness to the varying nature of maritime settlements.

The origins of both networks and settlement clusters on the East African coast remain uncertain. The low numbers of early proto-Swahili sites excavated, together with uncertain occupation sequences at many smaller sites, and the vast areas still to be surveyed, means that at present we lack sufficient quantifiable settlement data to accurately model the network interactions of the Swahili Coast, and especially not to account for inland or overseas connections beyond the maritime Swahili Corridor. Whilst this may become possible through the efforts of ongoing digitisation projects in the near future, Tartaron's model of nested maritime spheres does at least provide a means of discussing those hypothetical and evidenced networks interactions we already know of. The review has also presented an opportunity to clarify the use of maritime landscape terminology in this thesis. Whilst the specifics of some of the terms described here may be debated, within the scope of this thesis their meanings have been clearly defined, and will not be used interchangeably.

2.3 Ports of the Swahili Coast

Chapter One has already provided a brief history of the Swahili Coast, and introduced some of the key sites of prior archaeological investigation. The current section provides a more detailed review of three of the largest and best-known sites of the mainland coast, in order to demonstrate the range of maritime-related archaeological remains which have previously been identified, but which have rarely, if ever, been the intended focus of research (Pollard 2007, 2008a; Christie 2011). As noted in Chapter One, investigations of Swahili and proto-Swahili settlements in East Africa have tended to focus either on the urban centres of settlements, or on placing the settlements in a wider terrestrial landscape by looking inland (Wynne-Jones and Fleisher 2015). As discussed previously, maritime archaeological surveys in the region have by comparison been focused either underwater, or on rare occasions, as at Kilwa, on the intertidal zone (Breen and Lane 2003; Pollard 2008a; Christie 2011). It can be argued therefore that there remains something of a blind spot of archaeological investigation between the settlements and the shoreline, which may well have meant the disregard of maritime activity areas used by local sailors and fishermen, and by visiting merchants and traders.

Of the relatively few port settlements with an occupation sequence bridging the first and second millennia, there are several which have become central to the study of East Africa. These include Manda (Chittick 1984) and Shanga (Horton 1996), in Kenya; Kilwa Kisiwani in Tanzania (Chittick 1974); Unguja Ukuu on Unguja Island, Zanzibar (Horton and Clark 1985; Juma 2004) and more

recently Tumbe on Pemba (Fleisher and LaViolette 2013). Collectively, these sites represent some of the largest and wealthiest settlements of the period (Juma 2004; Fleisher and LaViolette 2013; Horton forthcoming). It must be noted however that Kilwa, Manda, and Shanga all have occupation sequences which extend into the Swahili period, and were excavated primarily because of their stonetown phases rather than the proto-Swahili phases. The relatively limited dataset of proto-Swahili sites means that estimations of relative size and wealth must be interpreted with a degree of caution, and the discovery of Tumbe, for example, during a wider landscape survey of Pemba in 1993 demonstrated that extremely large and wealthy sites, as well as intensive settlement patterns across the countryside, may yet lie undiscovered due to a lack of suitable surveys (Fleisher 2003; LaViolette and Fleisher 1995; Fleisher and LaViolette 1999a, 2013).

The current section will therefore present a brief review of the evidence of the mainland sites in the order in which they were excavated, and Section 2.5 will introduce in greater detail the port sites of the Zanzibar Archipelago. Particular aspects of these sites will be dealt with in greater detail as they become relevant in later chapters.

2.3.1 Kilwa Kisiwani

The stone town of Kilwa Kisiwani stands on the north-western edge of the island of Kilwa in the Kilwa archipelago in Tanzania. The site is famous today both for the standing remains of the stone town, and for the Kilwa Chronicles, a genealogy of the sultans of Kilwa first committed to text in the sixteenth century (Freeman-Grenville 1964). In its heyday between the twelfth and fourteenth centuries Kilwa was one of the most powerful and influential ports of trade on the East African coast (Kirkman 1964; Chittick 1974; Horton 1986). The area of archaeological occupation is extensive, and the standing remains include the tenth - fourteenth century Great Mosque and Palace, as well as a sixteenth century Portuguese fort, all of which are surrounded by the modern occupation of Kilwa Kisiwani village (Chittick 1974; Horton 1986; Fleisher *et al* 2012). Further sites and monuments extend along the northern shore of the island at least as far as the palace/trading complex of Husuni Kubwa and Husuni Ndogo, 1 kilometre to the east (Garlake 1966; Chittick 1974; Chami 1998; Fleisher *et al* 2012).

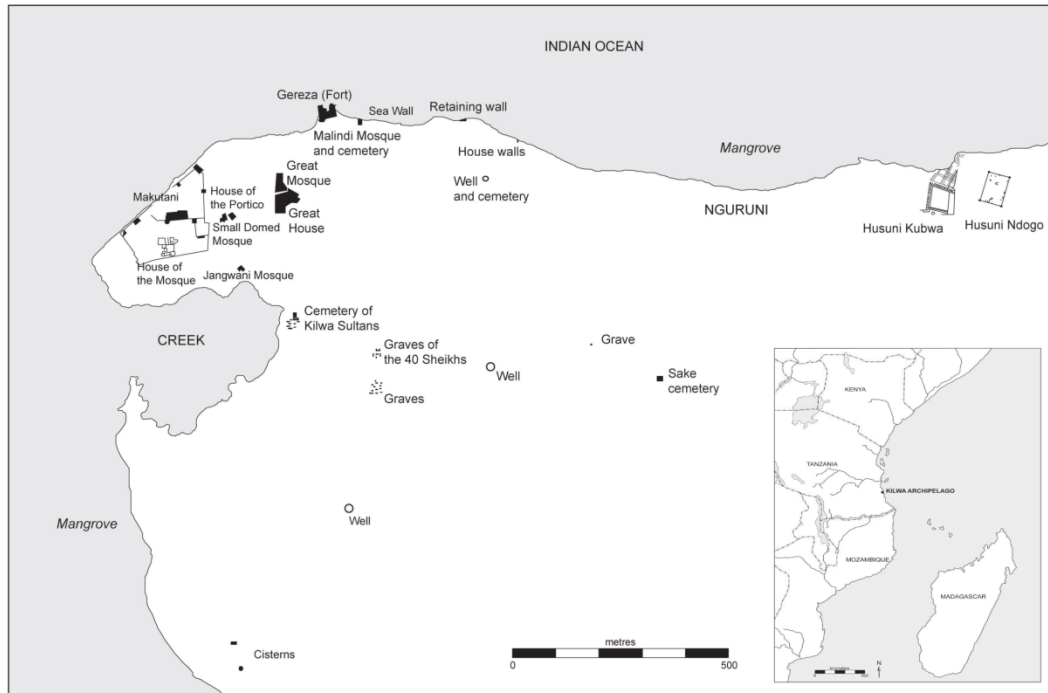


Figure 2.6: Standing remains at Kilwa Kisiwani, after Chittick (1974) and Fleisher *et al* (2012: 209)

Kilwa Kisiwani was one of the first Swahili coastal sites to be archaeologically investigated in the mid-twentieth century. Excavation began with a single trench by Mortimer Wheeler, James Kirkman and Gervase Mathew in 1955, and continued as a training project under Neville Chittick from 1958 – 1965 (Chittick 1974). One of Chittick’s aims throughout excavation was to tie archaeological evidence to the history expressed through the *Kilwa Chronicle*, which presents a mythologised origin for the Sultans of Kilwa, declaring descent from a prince of Shiraz, in Persia (Freeman-Greville 1964). This history was widely used as evidence of the colonial origins of the Swahili until around the mid-1980s (Chami 1998; Chittick 1973; Horton 1986). Chittick’s excavations were accompanied by a thorough survey of the standing remains carried out and published by Peter Garlake (1966), which, allowing for a certain straightening of the walls in plan, is still relied upon today.

Chittick’s excavations were extensive, and according to his interpretation the earliest phase of occupation at the site (Phase 1a) dated to the ninth century CE, and consisted of rectangular timber, and shortly afterwards daub houses, with evidence of iron-working in the form of tuyeres and slag, as well as copper wire and a possibly imported kohl stick (Chittick 1965, 1974). Fleisher and Wynne-Jones (2011) have argued for a re-evaluation of the date of this occupation, based on more recent studies of Persian and Arabian ceramic sequences, and on their own analysis of the ETT wares which were largely ignored by Chittick. They note that reinterpretation of the ceramics lends support to the re-calibrated OxCal C14 dates obtained and dismissed by Chittick as being too early, and suggest

that occupation may date as early as the seventh century CE (Fleisher and Wynne-Jones 2011). It should also be noted in relation to this re-evaluation that Chami has argued for an earlier settlement of Kilwa Island, and that Chittick believed the early daub remains were part of a temporary encampment close to a more permanent settlement (Chittick 1965, 1974; Chami 1994). It is possible that evidence of an earlier phase of occupation may have been missed or dismissed by Chittick, whose excavation strategy limited his trench to just 2x2m in the vicinity of these earliest reported phases (Chittick 1965).



Figure 2.7 Ruins of the Great Mosque at Kilwa Kisiwani, facing east. Photo by author

Chittick noted a lack of imported ceramics in this first known phase and declared it pre-Islamic, and although his report is dismissive of its importance, the evidence indicates establishment of a permanent coastal settlement in the vicinity of what is now the Great Mosque by the seventh century (Chittick 1965, 1974). There is no discussion in Chittick's work of where the original harbour area is likely to have been, beyond an assumption that the channel between the island and Kilwa Masoko village on the mainland would have made a reliable deep water harbour (Chittick 1974: 1). However, this view does not account for the types of vessels likely to have been utilising the channel prior to the thirteenth century, or their particular harbour requirements. Graffiti found in the complex at Husuni Kubwa and reported in Garlake's architectural review for example hints at the possible use of both pegged hulls with settee sails and sewn-plank vessels with square rigging, indicating a range of vessels, and therefore the potential for differing harbour or landing requirements (Garlake 1966). This issue will be returned to and discussed in detail in Chapter Four.

Regarding the harbour at Kilwa meanwhile, Pollard has suggested based on his own survey and Chittick's earlier test-pits, that the shoreline may have prograded to the west of the town since the tenth century (Pollard 2007). This would suggest that the original site stood on a slight promontory which has since developed into a long spit of land dividing the deep water channel to the north from Jangwani Creek to the south (marked 'CREEK' in Figure 2.6), and which later became the site of the eighteenth century Makutani Palace.

Imported Chinese and Persian glazed ceramics indicate a growing involvement in maritime trade at Kilwa in the early second millennium, and the construction of monumental stone architecture such as the Great Mosque, the palace complex and the tombs of the sultans between the twelfth and fifteenth centuries demonstrates the wealth and success this trade brought to the town (Chittick, 1974; Sutton, 2002). Various authors, including Chittick (1974), Kirkman (1962) and Elkiss (1973) have discussed the Swahili coastal towns in terms of independent city-states, and although Elkiss cautions that we have only the barest evidence of political and social organisation at this time, Kilwa has been used by many as the prime example of this phenomenon.

By the eleventh century the town was controlled by the Sultans of Kilwa, and became an extremely influential settlement controlling trade between the maritime networks of the Indian Ocean and the hinterlands, and involved in the gold trade with Sofala (Sutton 2002). The geographer Ibn Battuta visited Kilwa in 1331, declaring it a beautiful city built of wood and roofed in reed, and noted its wealthy and generous sultan (Freeman-Grenville 1962; Collins 2001). The construction of a palace and trade complex and unidentified monumental structure at Husuni Kubwa and Husuni Ndogo in the thirteenth and fourteenth centuries demonstrates the wealth of the ruling elite at this time. Pollard (2013) has identified a number of natural sandbars artificially enhanced with dumps of pottery and debris to form causeways at various points along the shoreline, which he suggests may belong to this period. Other wealthy stone town sites are also known from the Kilwa Archipelago in the classical Swahili period, including Songo Mnara, Sanje ya Kati and Sanje ya Majoma, indicating the existence of a complicated social and trade network even within this limited space (Fleisher and Wynne Jones 2012). By the end of the fifteenth century though, Kilwa was apparently in decline, and in 1505 the Portuguese took control of the island and constructed the Gereza, a fort, on the beach facing the deepwater channel (Fleisher *et al*, 2012).



Figure 2.8: Facing west along beach towards Portuguese Gereza on shoreline of Kilwa Kisiwani.

Photo by author (2013)

Kilwa appears therefore to have been occupied continuously from around the seventh century, growing from a timber and daub settlement of at least ninth century, if not older origins into a prosperous stone town noted for its wealth and influence, and its trade in gold and ivory in the second millennium. The early phases of the town indicate a community exploiting marine resources for subsistence, with detailed knowledge of iron working. The presence of a kohl stick and bead-grinders may also indicate some form of maritime trade (Chittick 1974; Horton 1996). These early phases are poorly understood, and nothing is known of the harbour area, except that it is likely to have been altered considerably by the prograding development of the shoreline between the tenth and fourteenth centuries, by which time larger vessels may have been able to utilise the deep water anchorage (Pollard 2007).

More recent surveys of the site have included Stephanie Wynne-Jones' evaluation of urbanisation and comparisons to hinterland ceramic culture formation (Wynne-Jones 2005, 2016), and Pollard's foreshore and underwater surveys of the channel between Kilwa Island and the mainland, 1-2km distant, discussed previously in the introduction to this chapter (Pollard 2007, 2008a, 2008b, 2009, 2013, Pollard *et al* 2016; Pollard and Ichumbaki 2016). A geophysical survey of the ruins of the town as part of the Songo Mnara Project also demonstrated that the apparently 'open' spaces between the coral architecture of the town were in fact occupied by structures of both coral and

impermanent materials (Fleisher *et al* 2012). The discovery of impermanent structural remains indicates that, as has also been shown on the neighbouring island at Songo Mnara, and at Chwaka on Pemba, significant portions of coastal towns, even stonetowns, may have been built of timber and daub architecture which has previously gone undetected or ignored by excavators (Fleisher and LaViolette 1999a; Welham *et al* 2014; Wynne-Jones and Fleisher 2014). As further excavations at Songo Mnara have shown, the survey and investigation of the ‘open spaces’ of settlements may result in a radical re-evaluation of settlement organisation, communal spaces, and the interpretation of social authority (Wynne-Jones 2013; Sulas *et al* 2015;).



Figure 2.9: Fish traps on the coast of Kilwa, looking east from Husuni Kubwa. Photo by author (2013)

2.3.2 Manda

The town of Manda was a wealthy port of trade in the Lamu Archipelago in northern Kenya (Chittick 1984). The site stands on the north-eastern promontory of Manda Island, a low-lying island, close to the contemporary sites of Shanga and Pate on Pate Island, the neighbouring island. The site was identified and excavated extensively by Chittick, by then Director of the BIEA, between 1965 and 1978, and the site is famous for a series of ‘sea-walls’ built along the shoreline, apparently for the purpose of land reclamation (Chittick 1984; Horton 1986). Although Chittick’s interpretations have been subject to a number of revisions by both Horton (1986) and a recent, as yet unpublished excavation by Kusimba, the investigation has provided a wealth of data.

The remains of the town lie on the western side of the promontory, just south of a shallow mangrove creek and sandbar on the northern point. Chittick (1984) theorised that the promontory may represent a recent aggradation of sand, based on the absence of either surface or buried archaeological remains on this shoreline, and on the erosion and northward movement of the eastern flank of the promontory. The early site on this promontory demonstrated both marine exploitation and maritime connections, with evidence of fish and shell subsistence, and imported goods including Chinese porcelain, Indian ceramics and Egyptian glass (Chittick 1984; Horton 1986; Priestman 2013). Chittick estimated that the site was first occupied around the mid-ninth century, based on his understanding of the imported pottery found at the site. Horton reviewed this interpretation and suggested an alternative date of late eighth or early ninth century, and Fleisher and Wynne-Jones have argued, based on their aforementioned revision of ETT ceramics, that this may be pushed back as far as the mid-sixth or early seventh century CE (Horton 1986; Fleisher and Wynne-Jones 2011).

According to Chittick, the earliest phases of the site consisted of brick, similar to that found at Siraf in the Persian Gulf, and may have been brought as ballast by colonising merchants from that region (1984). This interpretation again demonstrates Chittick's unyielding support for the colonial origins of the Swahili stone towns, but Horton's review of the evidence indicates an alternative theory. Horton demonstrated a series of flaws in both excavation and dating strategies, and argued that not only was Chittick's technique unlikely to uncover the earliest phases of the site, but that mixed beach deposits had been wrongly treated as primary contexts, and underlying evidence of timber and daub houses appeared to have been ignored (Horton 1986: 205). He suggested therefore that the site is likely to have been settled first with timber-framed, and then by daub houses, well before the introduction of brick or coral structures. Furthermore, the bricks attributed by Chittick to a port of origin in the Persian Gulf were apparently of local manufacture, and the coral rag structures attributed to Persian builders were in fact of porites coral, using a material and underwater quarrying technique entirely unknown in the Persian Gulf at the time (Horton 1986: 206). Porites corals are a genus of stony corals which can be found in the reefs of the East African coast, which may be cut and shaped when wet, but which harden upon drying into an extremely tough and weather resistant material which was used extensively as an elite building material on the Swahili Coast in the second millennium (Horton 1996; LaViolette and Fleisher 2004). The accumulated reinterpreted evidence suggests therefore a distinctly African origin for Manda, at a far earlier date than that put forward by Chittick.

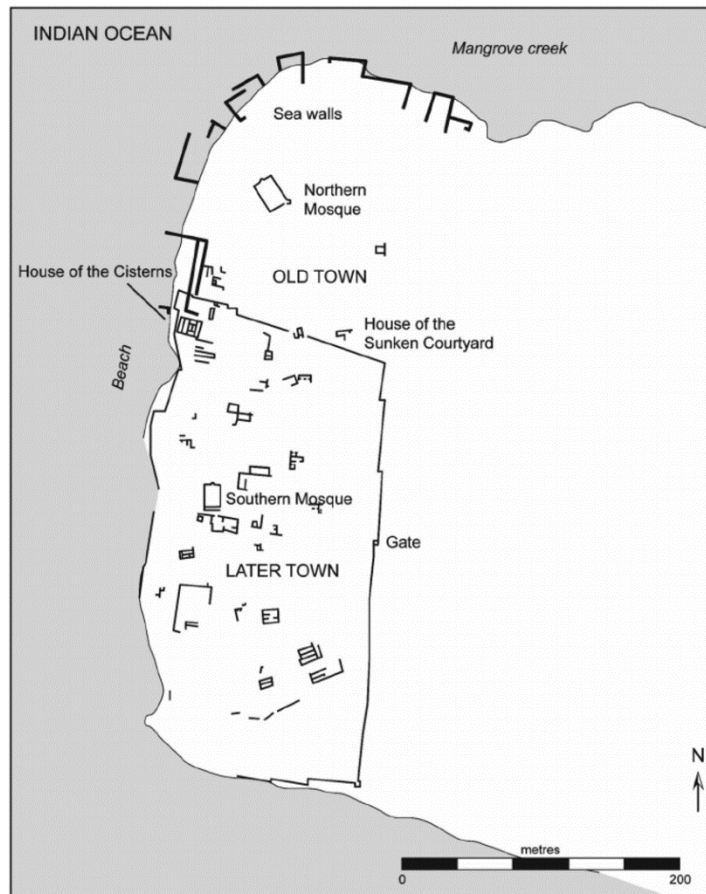


Figure 2.10 Archaeological remains at Manda, after Chittick (1967), from Wynne-Jones and Fleisher (2015: 525)

The later centuries of the site were characterised by the reclamation of the foreshore using a complicated layout of ‘maxi’ sea walls, and repeated rebuilding and restructuring of the stone town on top of this reclaimed land (Chittick 1984; Horton 1986). Chittick ascribed the earliest of these walls to the ninth century, but Horton has argued for a more likely eleventh century construction (Chittick 1984; Horton 1986). Chittick also reported a series of iron-working furnaces within 5 - 20m of the sea shore underlying the foundations of these walls, which he dated to the mid-tenth century, but which Horton’s re-interpretation pushes back to the mid-ninth century (Chittick 1984: 211; Fleisher and Wynne-Jones 2011). It is not clear what effect the restructuring and reclamation of the shoreline for occupation may have had on the earlier beachfront industrial activity and iron-working, and whether the construction of the walls which buried this activity forced these activities to move elsewhere in the settlement, or offsite.

It would seem that more work is needed at Manda, and it is to be hoped that Kusimba’s ongoing survey may shed more light on the confused sequence of construction events, and perhaps on the structure and layout of the early settlement which we may hypothesise lies undisturbed beneath the

later stone town. The presence of iron-working noted both on and buried under the sea-walls may indicate though that the beachfront of the town was utilised for loading, and for industry and resource processing.

2.3.3 Shanga

Shanga, also in the Lamu Archipelago, was visited by Kirkman in 1957, surveyed by Chittick in 1967, test-pitted by Wilding in 1973 and excavated by Horton between 1980 and 1985 (Horton, 1996). Horton's excavations revealed a complex sequence of urban development extending from the eighth to the fifteenth centuries CE, and as noted in Chapter One, his analysis of the site and ceramic data provided the basis of his idealised model of Swahili settlement development.

In contrast to earlier attempts to link Swahili towns to colonial origins, Horton drew explicit comparisons between the spatial layout of Shanga, derived from excavation and test-pitting, with the plan of the agricultural *kaya* settlements of the Mijikenda in Kenya's coastal hinterlands, providing evidence for the indigenous origins of the early Swahili. This comparison was centred on the arrangement of clan and ritual spaces within the early layout of Shanga, which Horton hypothesised was based on the arraying of domestic areas specific to clan groups around a shared, ritual central space. In this model, Horton suggests that access to the site was controlled via a series of gates in an enclosure fence, and was therefore granted only by negotiation or association with the clan who controlled a particular gate (Horton 1994).

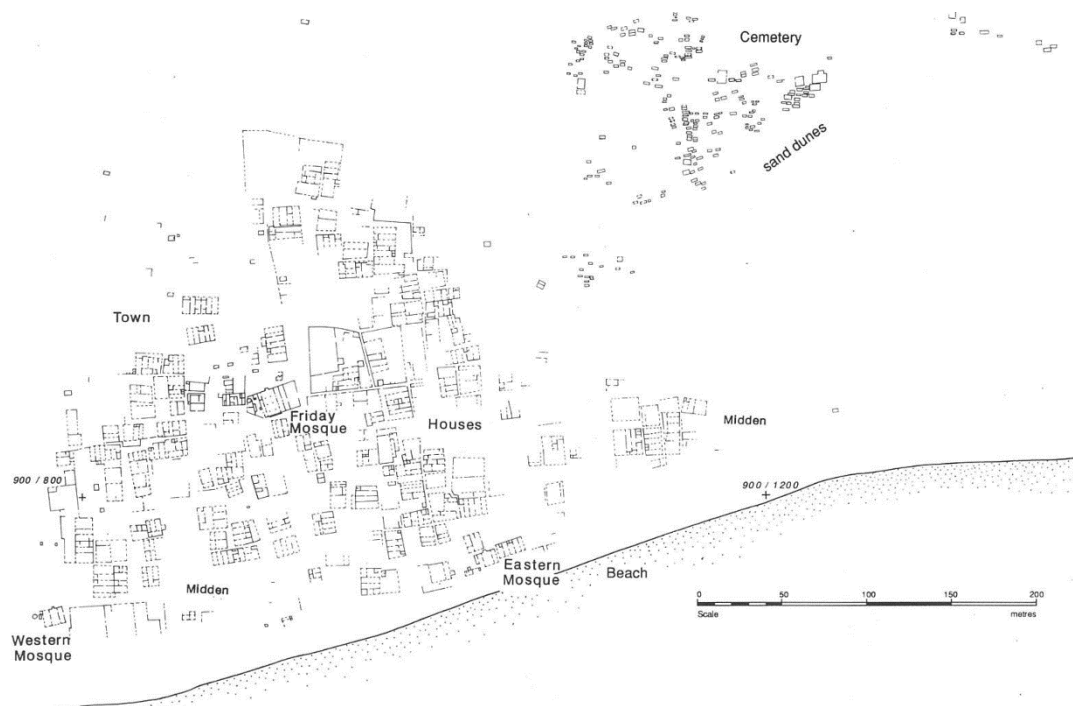


Figure 2.11: Archaeological remains of Shanga, from Horton (1996: 9)

The earliest phase of the site consists of a central space containing trees, a well, and evidence of iron working, which Horton suggests may all have non-Islamic ritual associations, surrounded by ephemeral post holes of no discernible plan, small fences, and a bounding enclosure fence. Small numbers of imported ceramics were found from this period, along with shell and fish middens and the remains of turtle shells, indicating some connection to maritime networks of trade and an active, though perhaps minor exploitation of marine resources. As the site developed, daub-walled domestic architecture appeared within the enclosure fence, and was then moved in late first millennium phases to beyond the fence, so that the ritual space appears to have dominated within the enclosure. This is indicated at Shanga by construction of a timber mosque and monumental square hall, of unknown origin, around the late eighth century. Both the mosque and the hall were rebuilt and redeveloped on a number of occasions over the following centuries, demonstrating replacement of the early timber frames with porites-and-daub, and then by coral rag, porites and lime walls, albeit in a style which mimicked the early timber designs, suggesting continuation of a strong social identity even as the site was redeveloped. By the mid-ninth century the enclosure also contained a series of small ephemeral wooden structures which Horton hypothesised may have been temporary kiosks for craft production and trade. Amongst a number of forms of craft activity, iron working appears to have peaked in the early tenth century. By the late tenth or early eleventh century the monumental spaces of the site were falling into disrepair, and although occupation and trading activity appears to have continued across the site, it was at a greatly reduced intensity. In the early twelfth century the monumental structures were either demolished and rebuilt or otherwise repaired, and new buildings constructed in domestic spaces. Much of the redevelopment took place on the same plan as in earlier phases however, indicative of a continuation of use and identity throughout this period of decline. Shanga is unusual compared to most known Swahili sites in that occupation continues straight through the tenth century, but the later phases of this site are not relevant to discussion at this point, suffice to note that a second peak of trade and craft production should be noted in the late twelfth or early thirteenth century, and that occupation continued through to the fifteenth century (Horton 1996).

As noted in Chapter One and above in Section 2.3, Horton was able to demonstrate a relationship between the spatial organisation of Shanga with similar patterns in Mijikenda sites in the coastal hinterlands (Horton 1996). His model of the development of the settlement, although intended only for Shanga, has subsequently become a standard hypothetical model for the development of proto-Swahili coastal settlements elsewhere on the coast (Fleisher 2010). The assumption in the application of this model is, of course, that other Swahili sites developed under similar cultural and

economic circumstances, but as was outlined in Chapter One, the level of regional diversity seen in the material culture of the Swahili Corridor suggests that this may not be the case.

As noted above, the model of the initial proto-Swahili settlement also assumes, but does not analyse in detail, a level of maritime activity in order to explain the marine diet found at the site (Horton and Mudida 1993). The faunal remains of the site demonstrate a reliance on shell-fish and shallow-water coastal species, and the absence of any deep-water species of fish until after the tenth century (Horton and Mudida 1993). The origin of the technology and maritime expertise required to exploit successfully the marine hinterlands of the site in the early phases of the site, as well as for the maritime trade network noted, remains unexplained and under-explored.

Similarly, the model accounts only briefly for the site's location, by making reference to the favourable location of the Lamu Archipelago on the trade route from the Persian Gulf towards East Africa, and the sheltering of the bay from the Indian Ocean swell by a protective offshore reef. Horton's test-pitting of the site indicated that the original settlement developed around 150m from the beachfront at Shanga in a low bowl between two sand dune ridges, and appears to have grown towards the beach to form a large semi-circle facing the open water (Horton 1996). By the thirteenth century the settlement was demarcated on the beach by an Eastern and a Western mosque, but between these end markers is an open area which was not investigated either by test-pit or excavation. This area would seem to have been reserved for the harbour, but as yet no investigation of this space has taken place. Horton's model postulates that market trade may have developed within the Swahili settlements from seasonal fairs, and that the central space of the town may have provided a safe trading area, accessible only by sponsorship from a settlement clan (Horton 1996). As foreign ritual spaces such as the mosque developed within this area, so access became open, and market areas grew. Horton references Freeman-Grenville (1981) in suggesting that sanctions, and even magical penalties may have been imposed on merchants who attempted to circumvent this market model and trade openly on the beach rather than negotiating access to the ritual space (Horton 1996: 413). However, Horton himself notes that such sanctions may have been no more than a threat, and without further investigation of the beachfront it is hard to say whether this theory was true of the early settlements, or is an idea imposed upon the period in later interpretations by anachronistic application of oral traditions and myths.

2.5 The Zanzibar Archipelago

Having reviewed the evidence of three of the best-known ports of the mainland coast in Section 2.4, the current section briefly introduces the Zanzibar Archipelago and the three proto-Swahili settlements which form the main case studies of this thesis, Unguja Ukuu and Fukuchani on

Zanzibar, and Tumbe on Pemba (Figures 2.16 and 2.17). The Zanzibar Archipelago lies around 50km from the northern coast of Tanzania, separated from the mainland by the Zanzibar and Pemba Channels respectively. The island of Zanzibar, once a terrestrial extension of the coast, became separated from the mainland by rising sea levels around 12,000 - 11,000 BP (Shipton *et al* 2016; Prendergast *et al* 2016). Pemba, on the other hand, has been isolated from the mainland since the early Pliocene, around 6,000,000 BP (Rowson *et al* 2010). As noted in Chapter One and above, the seasonal occupation of Pemba is recorded in the *Periplus of the Erythraean Sea* in the first century CE (Casson 1989), but as yet, apart from the contested evidence of two cave sites, no EIA sites have been positively identified in the archipelago (Sinclair *et al.* 2006; Sinclair 2007; Chami 2009: 41-79; Prendergast *et al.* 2016; Shipton *et al.* 2016). Fukuchani and Unguja Ukuu represent two of the earliest known settlements of the proto-Swahili occupation of the island, and Tumbe and Unguja Ukuu represent two of the largest and wealthiest ports of the entire Swahili Coast in this period (Horton and Clark 1985; Juma 2004; Fleisher and LaViolette 2013). By the eighth – ninth centuries, the maritime trade passing through these settlements had made the archipelago one of the regional hubs of the Swahili Corridor, and of the western Indian Ocean (Horton 2004; Fitton 2017). A pattern of settlement discontinuity and social reorganisation is visible in the archaeological record of the tenth – eleventh centuries, perhaps prompted by the disruption of Indian Ocean networks, which caused the decline of Unguja Ukuu and Tumbe. This decline coincided with the depopulation of the Pemban countryside, and was followed by the establishment, redevelopment, and growth of a coastal settlements as stonetowns, including Ras Mkumbuu, Mtambwe Mkuu, and Chwaka on Pemba; and Shangani (Zanzibar Stonetown), Kizimkazi Dimbani, and Tumbatu¹ on Zanzibar. After several centuries of great prosperity, by the fourteenth century these stonetowns had begun to slip into a decline, and it would appear that the archipelago may no longer have been the major trade hub it was in the eighth – tenth or twelfth – thirteenth centuries, but an agricultural resource for growing mainland sites such as Mombasa (Chittick 1974; Walshaw 2010; Horton forthcoming).

The settlements of the archipelago have come under increasing archaeological scrutiny in the past 30 years. Up until the 1980s investigation was limited to the few known major sites of occupation, and was conducted with the aim of identifying sites mentioned in historical texts and geographies. These included Pearce's excavations at the fifteenth - sixteenth century site of Pujini on Pemba (1920); Kirkman's excavations at Ras Mkumbuu on Pemba (1959), intended to locate the site of Qanbalu recorded by Ibn Battuta in the fourteenth century, and Chittick's investigations at Kizimkazi on Zanzibar (1962). During the 1980s Horton and Clark (1985) were employed to survey the archaeological sites of Zanzibar, and returned a gazetteer of around 50 sites known and newly identified across the archipelago. This effort was followed in the 1990s by Abdurahman Juma's excavations at Unguja Ukuu as part of the University of Uppsala's 'Urban Origins in Eastern Africa'

¹ Tumbatu, also known as Jongowe and Jongowe Makutani, is not technically on Zanzibar Island, but named after the island of Tumbatu which lies just off the north-western shoulder of Zanzibar

Project (Juma 2004), and by Adria LaViolette and Jeffrey Fleisher's surveys on Pemba, which revealed dense settlement patterns across the island in the late first millennium, and widespread evidence of the depopulation of the countryside in the early second millennium (LaViolette and Fleisher 1995, 2004, 2009; Fleisher 2003). The details of previous surveys and excavations of the three case study sites of this thesis will be dealt with in the relevant case studies of Chapter Five, Six, and Seven, but key points relevant to the current summary are outlined below.

2.5.1 The Coastal Environment

The coastline of Tanzania is composed of "biologically diverse areas characterised by deltas, estuaries, mangroves, beaches, and fringed by coral reefs" (Punwong 2013:11). According to Stigand;

"when one has seen the intricate winds and creeks running inland from Mombasa harbour, and the numerous lagoons, harbours, inlets and archipelagos which abound on this coral coast, it is easy to understand what difficulty was experienced in running to earth numberless small craft with little draught, and a perfect knowledge of all the recesses of the coast, waiting to run their precious cargo across to Zanzibar or up the coast to Arabia." (Stigand 1913:138)

Zanzibar, an island created by rising sea levels c. 12,000 – 9000 years ago (Prendergast *et al* 2016), is broadly similar in its environment to the mainland coast, but lacking the major river systems and estuaries (McClanahan 1988; Punwong 2013). The geomorphology of Zanzibar is characterised as a Pleistocene inshore coral system (McClanahan 1988; Khamis *et al* 2017: 120). The eastern side of the island tends towards loose, fertile soils covering coral limestone, whilst the western side is covered by sandy soils overlying ancient, eroded river deltas (Khamis *et al* 2017: 120). A low coral cliff surrounds much of the island, broken by beaches and mangrove-lined creeks. The western coast is generally rockier, with numerous enclosed bays and small inlets, whilst the eastern shoreline features one large bay, and extensive, shallow, white-sand beaches stretching more than 40km in total, which are sheltered from the heavy incoming swell of the Indian Ocean by a line of lagoons and submerged reefs (Rosser and Imray 1867) (Figure 2.12). The whole island is surrounded by flat shelves of coral reefs, of varying widths, which dry on average to around 0.5m MLWS, and the waters around Zanzibar are relatively shallow, with various sand banks and reef patches noted on hydrographic charts especially to the west (Admiralty 1875, 1881, 1897, 1900, 1910, 1916, 1919, 1951, 1964, 1967; Mahongo *et al* 2017). In sheltered bays and estuaries, the intertidal coral shelves are usually covered by sands and muds, and often support mangrove growth (Richmond 2011; Mahongo *et al* 2017). The single large island of Tumbatu lies just off the north-western shoulder of Zanzibar, whilst two chains of small islands and coral atolls extend from the south-western coast to around 13km. The Zanzibar Channel, between Zanzibar and the East African mainland, is between

35-40km wide and relatively shallow, averaging 35 - 65m in depth, whereas on the east coast of the island the water drops away quickly beyond the shelter of the coral reefs and continental shelf into the Indian Ocean, and depths of around 1000m (Mahongo *et al* 2017).

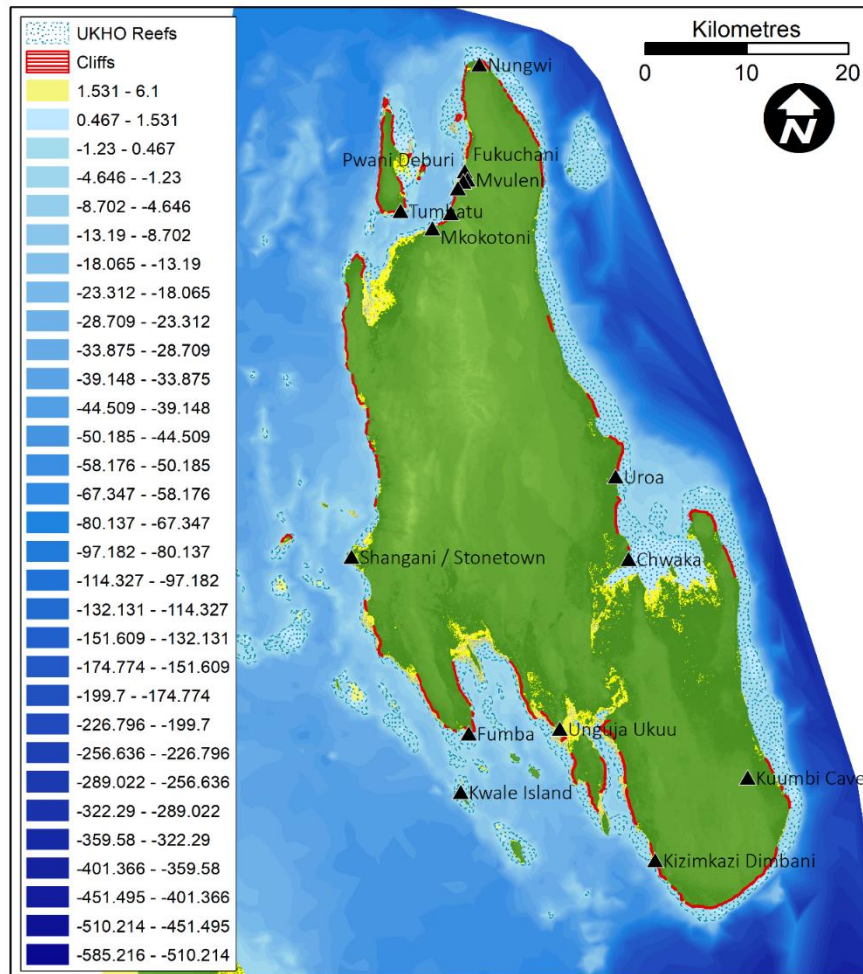


Figure 2.12: Digitised Admiralty hydrographic charts showing coastline around Zanzibar

By comparison Pemba has fewer cliffs, and the coast is broken up by a far greater number of small peninsulas, inlets in drowned valleys, and river mouths, all fringed with mangroves (Rosser and Imray 1867; NGIA 2015). The island was tectonically detached from the mainland continental shelf around 10 million years ago, and like Zanzibar the topsoils of the island overlie limestone to the east, and sandy soils cover drowned river valleys to the west (Mahongo *et al* 2017: 120). The peninsulas of the western coast form a series of wide bays, which are further enclosed by a chain of long coral islands and reefs, broken by deep, narrow channels. The water of these bays is deep, and the sides shelve steeply down (Admiralty 1878, 1880, 1958) (Figure 2.13). The south-eastern coast of the island has coral cliffs split by narrow, deep inlets, whilst the north-eastern coastline is sheltered by islands and coral peninsulas running parallel to the main island (Rosser and Imray 1867). Once again,

the whole island is surrounded by underwater coral shelves, covered by dense muds and frequent bands of mangrove growth (Rosser and Imray 1867; Admiralty 1878, 1880, 1958; Richmond 2011; Mahongo *et al* 2017). The shallows of Said Point to the south extend some 6km from the island without deep anchorage, and have significant sand and mud banks, whilst along the eastern coast the reefs apparently extends to an average of around 2km, but are fairly uniform in height, and without outlying maritime hazards (Rosser and Imray 1867). Between the two northern ‘horns’ of the island, the peninsulas of Ras Kigomasha and Ras Kiuyu, is a very broad, shallow bay, around 20km across and extending about the same distance north of the island. The whole bay is scattered with reefs known to shipping as the Pemba Knolls, of varying sizes, and many of which do not quite break the surface at low tide, rendering the bay dangerous to visitors or the unwary (Rosser and Imray 1867). Unlike Zanzibar though, Pemba’s location on the edge of the continental shelf means that its surrounding reefs drop steeply away into the depths of the Pemba Channel and the Indian Ocean (NGIA 2015; Khamis *et al* 2017). The Pemba Channel, between the island and continental East Africa, is 50km wide and runs between 400 – 800m in depth, whilst off the east coast the seabed drops beyond the reef to around 1000m (Mahongo *et al* 2017).

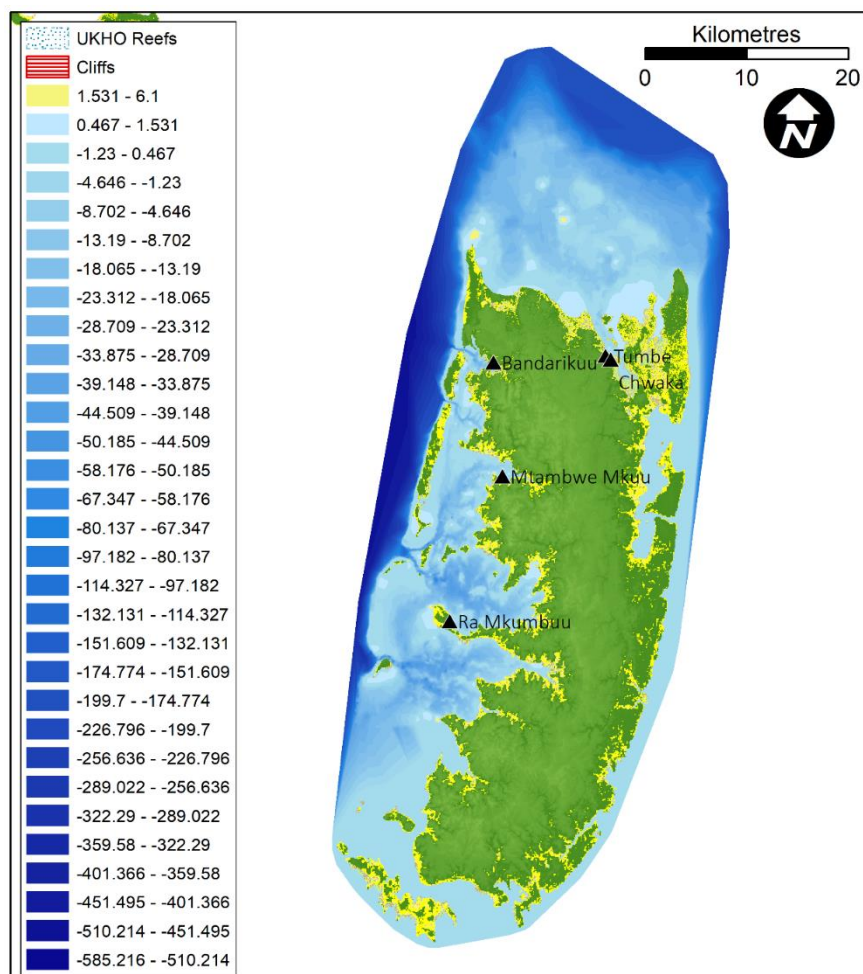


Figure 2.13: Digitised Admiralty hydrographic charts showing coastline around Pemba

The seasonal climate of the region is largely determined by the cycle of north-eastern (November to March) and south-eastern (April to October) monsoons (McClanahan 1988; Mahnongo *et al* 2011; Khamis *et al* 2017) (Figure 2.14). The north-east *kaskazi* monsoon tends to bring hot, dry, calm weather and light winds, whilst the south-eastern *kusi* monsoon heralds lower temperatures, overcast skies and increases in wind and rainfall (McClanahan 1988: 192; Mahongo *et al* 2011: 108). Stigand (1913: 139), incidentally, noted that the period of change between the south-eastern and north-eastern Monsoon is known as *tanga mbili*, ‘the two sails’, due to the unsettled variability of the winds.

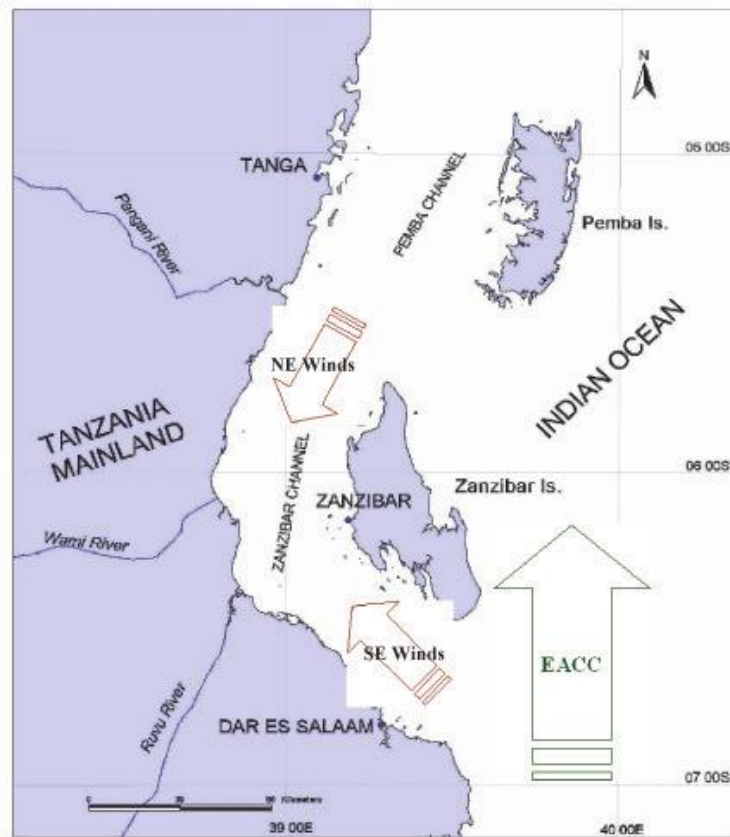


Figure 2.14 Map of Zanzibar Archipelago showing directions of north-east *kaskazi* and south east *kusi* monsoons, and northerly flow of the East African Coastal Current, after Mahongo and Francis (2010: 3)

The change in wind direction also affects regional currents. The South Equatorial current from the Eastern Pacific runs north of Madagascar and the Comoros and washes up against the coastline of Cape Delgado in northern Mozambique, splitting as it does so into two currents; the Mozambique Current, which flows as expected to the south, and the East African Coastal Current (EACC), which

flows north towards Kenya (Richmond 2011: 13) (Figure 2.15). During the south-eastern monsoon the EACC joins the Somali Current near Malindi to flow towards the Horn of Africa and the Arabian Sea. During the north-eastern monsoon however the Somali current turns to flow south-west, meeting the EACC between Lamu and Malindi and twisting to flow east into the mid Indian Ocean as the Equatorial Counter Current. Other than the EACC the main drivers of water circulation in the Zanzibar Channel are the complex interactions between monsoon winds and tides (Harvey 1977; Mahongo and Francis 2010). The orientation of the Zanzibar Channel means that the tidal flood streams enter and exit the channel at both the north and south entrances, and the length, and shallow depth of the channel means that a following wind can drive an incoming tide into an upwelling against the shorelines of either Tanzania or Zanzibar (Harvey 1977; Mayorga-Ademe 2007: 4). Coastal wave heights are apparently greatest during the south-eastern monsoon, due in part to a lag between waves and wind energy (McClanahan 1988:193). According to computer simulations by Mayorga-Ademe (2007: 5), during the north-east *kaskazi* the variation in sea-surface elevation as a result of winds is around 1.5 cm, since water accumulates at the southern entrance, whereas during the south-east *kuzi* the variation is around 5 cm, with upwelling against the western coasts of Zanzibar. Currents are also affected by these winds, as the south-east *kuzi* drives strong surface and bottom currents, especially around the coast of Tumbatu on the north-west shoulder of Zanzibar, whilst the north-east *kaskazi* creates southward surface currents and weakens the northerly flow of the EACC (Mayorga-Ademe 2007: 7; Zavala-Garay *et al* 2015). These currents and their interaction create a number of gyres, especially around Zanzibar Stone Town, and turbulence in the waters between Zanzibar and Pemba which can disturb shipping and may have contributed to capsizes (Mahongo and Shaghude 2014: 6).

At present the East African coast has a relatively high tidal range for a tropical coast; Zanzibar has a mean spring tidal range of around 3.9m, with the highest known tidal range on Zanzibar measuring 4.65m (McClanahan 1988), whilst the mean spring tidal range on Pemba is 3.4m, with local maximums topping 4.1m on the north coast of the island (Admiralty 1958; Mahongo 1999: 11; Tide-Forecast 2017). It is worth emphasising however that although these ranges have been fairly consistently reported in Admiralty charts, tide tables, and environmental reports over the past 300 years, these may not have been the case throughout the period under discussion in this thesis. As well as the Pliocene flooding of the Zanzibar Channel, it seems that eustatic change has affected relative sea-levels along the East African coast several times in the past 2000 years. Mörner (2000: 19) has suggested, based in part on observations of coral reef erosion and raised beaches in Zanzibar and Dar es Salaam, that high sea-levels on the East African coast can be dated to around 100 BCE and 950 CE, and a low stand to around 1100-1200 CE (see also Juma 2004: 46). These stands are apparently related to the cyclical redistribution of oceanic water masses around the globe, which affects relative sea-levels, so that observations of falling sea-levels in the western Indian Ocean correspond to subsequent sea-level rise in Peru. These cyclical redistributions may also have

affected the direction of the Somali current in the early second millennium (Mörner 2000: 17). Punwong *et al* (2013) have also highlighted cyclical sea-level changes in their studies of mangrove dynamics on the East African coast, and their core samples from Unguja Ukuu apparently indicate rising sea-levels to a peak around the 16th century. Kleppe (2007), among others, has noted the potential relevance of these changes to site-level studies in the archipelago, and some potential implications of eustatic sea-level change will be discussed further in relation to each of the case study sites in later chapters.

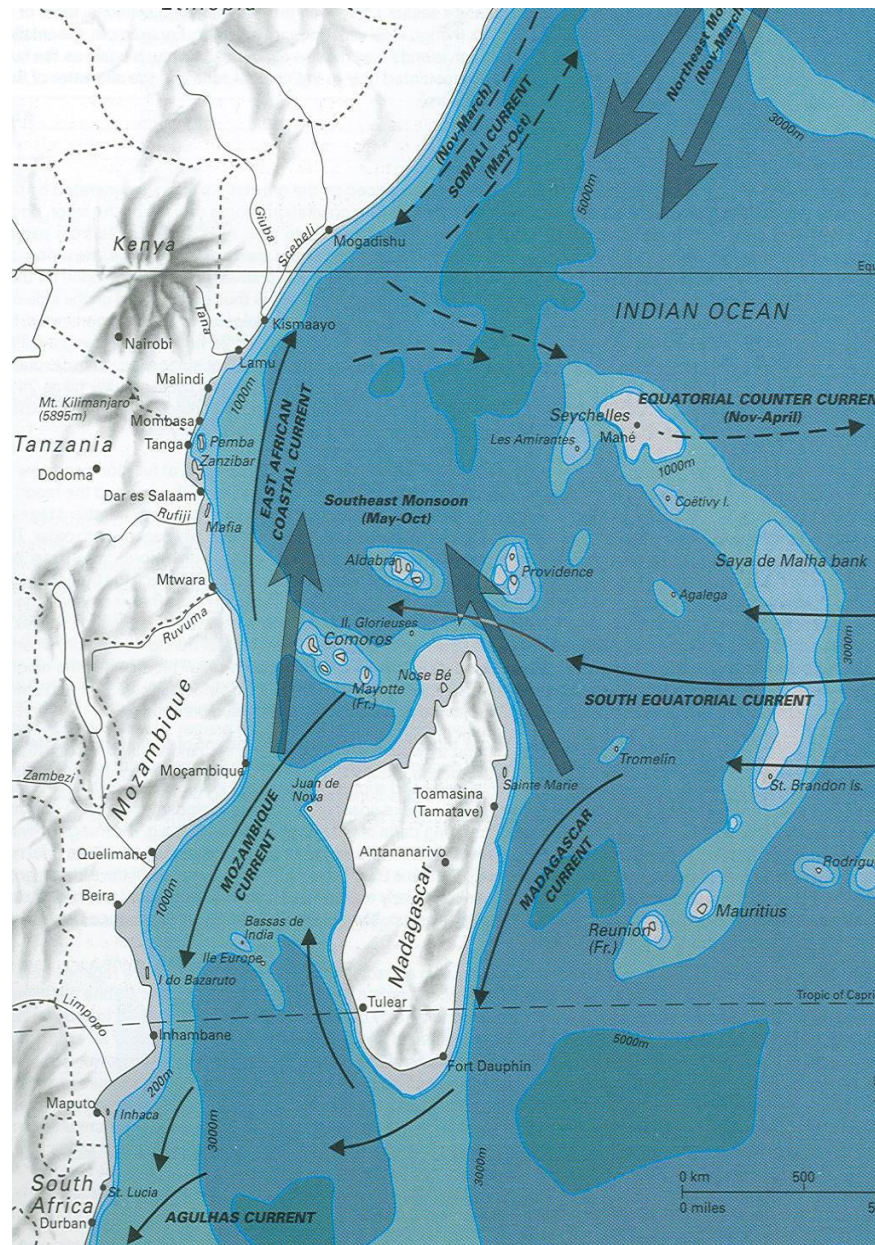


Figure 2.15: Monsoon seasons and currents in the western Indian Ocean, from Richmond (2011:13)

2.5.2 Unguja Ukuu (c. 600-1100 CE)

The site of Unguja Ukuu, translated literally as 'The Great/Old Town of Unguja', is believed to have been the principal town of Zanzibar Island and a key port of trade in the mercantile networks of the western Indian Ocean during the proto-Swahili period. The site is located towards the south of the island, at the base of a peninsula between the open beach of Menai Bay and the mangrove creek running between the mainland of Unguja and Uzi Island. Previous investigations of the site include a reconnaissance by Major Pearce (1920), fieldwalking and test-pits by Clark and Horton (1985), geophysical survey and excavation by Juma (2004), and further test-pitting for botanical remains by the Sealinks Project in 2012 (Crowther *et al* 2013a, 2013b).

The site was involved in long distance maritime trade from its earliest occupation, evidenced by finds of imported ceramics, incense, and glass beads (Crowther *et al* 2015; Wood *et al* 2016). The site grew to prominence in the late first millennium, and is likely to have been a nodal point in the trade between East Africa and western India. Whilst the numerous test-pit excavations of this site have provided a well-dated occupation sequence, a focus on middens and stone remains means that the spatial organisation of this site is still unclear, and questions have been raised as to whether the harbour of the site lay in the open beach to the west or sheltered mangrove creek to the east (Horton and Clark 1984; Juma 2004). The well-dated archaeological sequence and relatively limited spread of modern development at the site makes this an excellent case study for investigation.

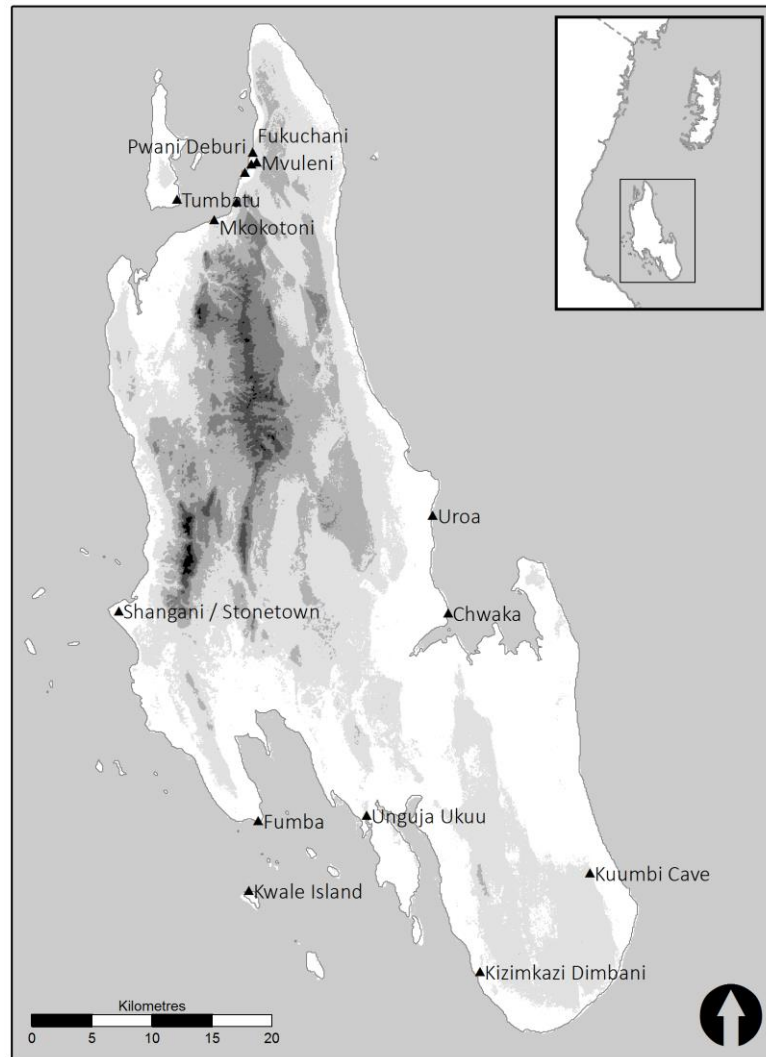


Figure 2.16: Proto-Swahili and Swahili coastal settlements of Zanzibar mentioned in text

2.5.3 Fukuchani (c. 550-800 CE)

The proto-Swahili site of Fukuchani was identified during Clark and Horton's 1984 gazette of Zanzibar sites, and has been surveyed since by Horton and Juma, and as part of the Sealinks Project (Horton and Clark 1985; Juma 2004; Crowther *et al* 2013a, 2013b, Horton forthcoming). Surface survey indicates a sixth - ninth century occupation next to the shallow beachfront, followed by a later sixteenth century, unrelated house structure to the south (Horton and Clark 1985). The early date and small scale of the site makes this an intriguing case study settlement, and the iron-working remains already reported from the site suggest iron-working close to the beach (Horton and Clark 1985). Previous excavations at this site mean that the occupation sequence is now well-established, but the construction and expansion of a modern village and school on the same site means that the excavation strategy has largely been dictated by non-archaeological concerns (Horton forthcoming). The spatial organisation of the site is therefore almost entirely unknown.

2.5.4 Tumbe (c. 600-950 CE)

The site of Tumbe, at the base of a high peninsula in north-eastern Pemba, was first identified by Fleisher and LaViolette during extensive systematic survey of the island in 1993, and subsequently recognised as one of the largest daub settlements known from the proto-Swahili period (LaViolette and Fleisher 1995; Fleisher and LaViolette 2013). Occupied between the seventh and tenth centuries, it also represents the richest settlement on Pemba from the proto-Swahili period (Fleisher and LaViolette 2013). Excavations have revealed the burnt remains of daub structures, mofa ovens, and some evidence of household iron-smithing and lead-casting, which may be related to the crafting of fishing nets, as well as large quantities of ceramic bead-grinders indicating resource processing found along the shoreline (Flexner *et al* 2008, Fleisher and LaViolette 2013). Wide area surveys carried out in the surrounding countryside have also shown that the site is surrounded by a network of smaller settlements, which may or may not have been directly related to the larger Tumbe (LaViolette and Fleisher 1995; Fleisher 2003; Fleisher and LaViolette). The abandonment of the settlement in the tenth century was followed by the establishment of the new stonetown of Chwaka, just 200m distant and on the same peninsula, in the eleventh century (Fleisher and LaViolette 2013). The site therefore offers an intriguing opportunity to explore a daub settlement with no modern occupation, evidence of shoreline activity, and with a well-defined pattern of settlement in the surrounding region.

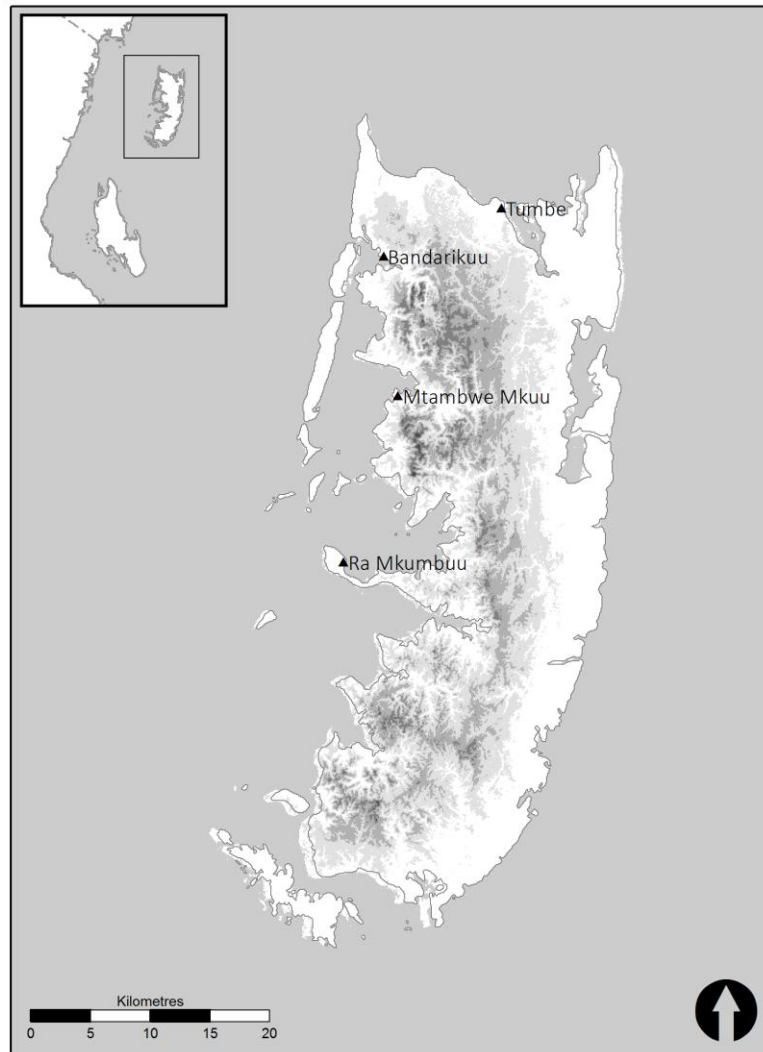


Figure 2.17: Proto-Swahili and Swahili coastal settlements of Pemba mentioned in text

2.6 Discussion

Having reviewed both the archaeological investigation of some of the major ports of the mainland Swahili Coast and relevant maritime archaeological theory, it is worth summarising the evidence of maritime activity and infrastructure contained within these examples; individual examples of maritime furniture found elsewhere on the coast; and relevant themes to be drawn from this review.

In contrast to the long history of artificially enhanced harbours in the Mediterranean or northern Europe, the Indian Ocean contains few examples of artificial facilities south of the Roman or Ptolemaic harbours of the Red Sea, or before the arrival of the Portuguese and the advent of European and Omani colonial influence from the sixteenth century (Horton 1996; Peacock and Blue 2006, 2007; Sherif 2010; Morhange *et al* 2014). As well as the traditional focus on urban centres

outlined in Chapter One and Section 2.3 above, it may be this lack of artificial facilities that has influenced a casual, and perhaps unintentional, disregard for maritime and harbour spaces in the investigation of Swahili and proto-Swahili settlements (Breen and Lane 2003; Pollard 2008a; Christie 2011; Mjema 2014). The sites of Kilwa and Manda described above represent two of the only East African sites where artificial harbour facilities have been theorised or explored. Manda's sea walls include openings which Chittick described as possible causeways, and may well have had a secondary function as wharves or to enclose sheltered berths (Chittick 1984; Kusimba pers. comm.). Pollard's survey of the intertidal zone and harbour of Kilwa meanwhile, has demonstrated a number of artificially enhanced causeways, and the partial survival of a shipwreck site dating to the eighth – ninth century (Pollard 2008a, 2013; Pollard *et al* 2016). Apart from these examples of intertidal maritime architecture though, the review has noted evidence of iron-working activity in beach contexts at Manda, Unguja Ukuu, and Fukuchani, as well as iron-working or smithing in household contexts at Tumbe (Chittick 1965, 1974; Horton 1986a, 1996; Horton and Clark 1985; Flexner *et al* 2008). Crafting activity and resource processing taking place on or close to the beach is also indicated in midden remains found at Fukuchani, Unguja Ukuu, Tumbe, Manda, and Shanga (Chittick 1974; Horton 1986a, 1996; Horton and Clark 1985; Horton and Mudida 1993; Flexner *et al* 2008).

As well as this aggregated evidence of possible harbour facilities and intertidal or beachfront activity, a number of examples of smaller maritime infrastructure have been identified elsewhere on the coast. Fish-trap fences have been identified during archaeological and ethnographic surveys at Mombasa in Kenya (Quinn *et al* 2007), Mto Kiswere in Tanzania (Pollard 2013), and at Vanga in Kenya (Quintana Morales 2014), although dating of such structures has not always been possible. Linear wooden fence traps such as the *uzio* are constructed in the intertidal zone on mud flats, and channel the fish with the falling tide, providing an efficient subsistence exploitation of the marine environment (Quintana Morales 2012). Other fishing structures less visible in the archaeological record are also hypothesised, including the trap-baskets used on Pemba described in the *Periplus*, which were lowered from boats apparently to exploit rocky areas, thereby offering a pragmatic alternative to nets, which are likely to snag and tear (Quintana Morales and Horton, 2014). The use of harpoons was recorded on the Swahili Coast by al-Masudi in the tenth century, and net and lines are also represented by lead and ceramic weights in various assemblages, and a recent comparative assessment of the faunal assemblages from a number of Swahili sites demonstrates the successful exploitation of a range of fishing grounds using a variety of techniques by individual settlements (Horton and Mudida 1993; Quintana Morales and Horton 2014; Crowther *et al* 2016). It is also worth noting that this is not dissimilar to the predicted use of fishing pots, creels, and basket traps in the Red Sea based on excavated faunal assemblages from Myos Hormos (Thomas 2009). Thomas (2012) notes that although these small, portable constructions are the least represented in the archaeological record, nets made of flax, copper and iron fish hooks, floats, and gorges made of

tamarisk or mangrove have all been identified under favourable taphonomic conditions in this region.

It is clear from this review then that both the ports and harbours of the Swahili Coast may be identified by an array of maritime activities, faunal and resource remains, and structures in the intertidal zone and on the foreshore. The traditional focus on urban centres or urbanisation processes has meant however that these areas and examples have rarely been subjected to further excavation or analysis, and as such consideration of these sites in terms of the maritime cultural landscape has been limited to a few scholars, and generally to second millennium contexts. The following chapter will therefore go on to describe the inductive research methodology of this thesis with regard to the evidence discussed in this chapter, and with reference to maritime archaeological studies of ports elsewhere in the Indian Ocean.

Chapter Three

Methodology

*"The pessimist complains about the wind; the optimist expects it to change;
the realist adjusts the sails."*

William Arthur Ward

3.1 Introduction

As discussed in the previous chapters, the maritimity of the second-millennium Swahili ports and stonetowns is frequently regarded as one of the defining features of Swahili culture right the way through from the first settlement of the coast. The early history of these sites though, the growth of their maritime networks, and development of maritime traditions through daily practice are yet well understood. The literature review of Chapter Two demonstrated that although a number of archaeological ports of the Swahili Coast have been identified and excavated, the investigation of the harbour spaces within those sites has been limited. Previous investigations have focused primarily on the urban centres or terrestrial settings, and it is only since the late 1990s that underwater surveys, and the intertidal and foreshore zones have become an area of interest (Breen and Lane 2003; Pollard 2008a; Christie 2011; Fleisher *et al* 2015). At present therefore, we still have very little concept of what a proto-Swahili harbour actually entailed, or of the design and capabilities of first millennium East African watercraft.

The aim of this thesis, as outlined in Chapter One, is to identify maritime activity and patterns of spatial organisation through archaeological survey at first millennium coastal settlements in the Zanzibar Archipelago, in order to explore the nature of proto-Swahili harbours and evaluate the role of maritime activity as a component of proto-Swahili settlement in the region. The inductive methodology and rationale of this thesis is based on observations of industrial and maritime activity in open areas along the shorelines of multiple Swahili and Indian Ocean settlements. It is hoped that the thesis will open up new avenues of discussion regarding the roles and relationships between proto-Swahili coastal settlements within the regional maritime cultural landscape of East Africa.

In order to achieve this, and having already discussed specific maritime archaeological themes in Chapter Two, Section 3.2 will review a range of relevant methodologies from previous harbour studies, and Section 3.3 will present a detailed methodology with reference to the specific thesis objectives laid out in Chapter One. The methodology itself is not unprecedented, drawing on a range of studies from both the Swahili Coast and maritime studies elsewhere, but the field surveys and

analyses carried out in fulfilment of the thesis project represent the first attempt to specifically investigate a first millennium East African harbour area, and to evaluate the role of such harbours in the proto-Swahili world of the Zanzibar Archipelago.

3.2 Identifying Ports and Harbours

McGrail's (1995: 36) recommended requirements for basic maritime archaeological training included "oceanography and coastal and riverine geomorphology; site formation in the maritime zone; sea levels, currents, tides, winds and the weather generally...studies of settlement/discovery and trade/exchange to be focused on overseas routes, landing sites and harbours and associated overland routes, cargo handling and stowage". The review of methodologies presented here, together with those aspects discussed in Chapter Two, will cover the means of fulfilling these requirements.

3.2.1 Maritime Transport

A port, according to Karmon (1985: 2), "cannot be regarded as an isolated phenomenon, but as part of the political, social and economic life of a region". As noted in Chapter Two, and in relation to McGrail's recommendations (1984), Westerdahl's (1992) maritime cultural landscape, and the requirements of predictive analyses of maritime networks (Broodbank 2000; Knappett *et al* 2008; Tartaron 2013), in order to understand the maritime use of a harbour and its coastscape, it is also necessary to have some understanding of the nature of the boats and watercraft utilised by relevant contemporary societies. Thomas Dhoop (2014: 109) has followed Karmon, as well as Westerdahl's vision of a maritime cultural landscape, in describing a 'deeply entangled' relationship between ships, harbours, and towns. He uses Actor-Network Theory to argue that as well as the inhabitants, merchants, and sailors who deliberately shape the organisation of a port settlement, the ships themselves might be considered to have a degree of non-human agency in shaping the maritime cultural landscape, since changes in ship technology or cargo may by necessity affect the development of related activities and spaces (Dhoop 2014: 3). An increase in the size and draught of ships, for example, not only necessitates access to deeper anchorage for safe harbour, but might be associated with changes in terrestrial harbour and market spaces, since larger craft are able to transport larger cargoes. This process is described with reference to the medieval harbour of Lübeck, Germany, where until the twelfth century, goods were brought in and traded at a beach market by the merchants from the ships; from the thirteenth century however, increasing trade pressures meant that larger ships brought larger cargoes to the town, and the beach market was replaced by a town wall and facilities for loading and unloading, whilst storage facilities and the actual business of

trade transactions moved into new and redesigned merchant's houses within the town itself (Dhoop 2014: 7). Since the livelihood of a port revolves around the business of the ships that populate its harbour, Dhoop concludes that the study of port topography and harbour spaces must be integrated with the study of these ships themselves.

In order to assess the role of harbours in the Zanzibar Archipelago it is therefore necessary to consider the types of boats and vessels which are used and sailed them. As was also described Chapter Two however, apart from limited evidence of maritime activities and architecture at Swahili sites, at present we have very little evidence of the types of boats and ships used in East Africa between the first and thirteenth centuries CE (Breen and Lane 2003; Whitewright 2016; Pollard 2016). In order to investigate and understand the origins, practice, and development of the proto-Swahili and Swahili maritime cultural landscape therefore, one of the first aims of this thesis will be to review the evidence for ships and maritime technology in the region across the first and early second millennia. This review will then inform the evaluation in the rest of this thesis of the location and environmental conditions of potential harbour areas in and around the case study ports; the function and purpose of maritime activities, such as subsistence and trade; necessary services, maintenance activities, and structures related to these functions; and the artefacts and archaeological features that might indicate traces of all of the above.

3.2.2 Harbour Archaeology

Of particular relevance to the this inductive investigation, Seán McGrail has argued that as well as those artefacts and remains found in the underwater and marine zone of this landscape, maritime archaeology should encompass "the study of landing places, boatbuilding sites and all the other maritime structures found in the coastal zone and in the vicinity of rivers and lakes" (McGrail 1984: 11). These sites, McGrail explains, may be represented by both formal harbours or by informal landing places. Formal harbours are those constructed in order to adapt a site for use by water transport, whatever the purpose of that transport, whilst informal landing places are those sites which do not require formal harbour architecture in order to discharge cargo or conduct maritime activity, but which may include mooring posts, causeways, or reinforced hards as well as areas suitable for beaching (McGrail 1995). Since the nature of these sites is dictated by a combination of environment, maritime activity, and maritime technology, it follows that these factors may also be inferred and investigated by the study of these interface zones, and the identification of particular features preserved in the archaeological record (Westerdahl 1992, 1995). One of the primary objectives of this thesis is therefore the identification of maritime activity at the three case study sites through a combination of new archaeological surveys and a review of existing archaeological evidence.

An example of the success of such as methodology can be found in the survey of Myos Hormos/Quseir al-Qadim in the Red Sea (Peacock and Blue 2006, 2011). The reinvestigation of the site of Quseir al-Qadim by the University of Southampton between 1999-2003 followed earlier excavations which named the site as the minor Roman port of Leukos Limen (Whitcomb and Johnson 1979; Blue 2002; Peacock and Blue 2006). Whitcomb and Johnson's (1979) excavation had established two sequences of occupation at the site, with a Roman settlement dating to the first century BCE – third century CE, and a second, Islamic occupation of the site between the twelfth – sixteenth centuries CE. The reappraisal of the site was aimed at exploring the early site and the harbours of both occupations. Work was conducted through a combination of wide area surveys to identify infrastructure related to the site, topographic and geophysical surveys and augering to explore the hypothesised harbour sites, and targeted excavations. The site lies at the head of a bay on the Red Sea, but the ancient harbour lay in a now silted lagoon inland of the shoreline, connected to the bay by a similarly silted channel (Peacock 1993; Blue 2002).

The area of the lagoon at Myos Hormos was confirmed through wide area topographic surveys and augering, which provided a sub-surface profile of harbour sediments in a now dry basin. A subsequent magnetic gradiometry survey revealed that it was possible to distinguish the relict shoreline as a line of transition between the magnetic signatures of inland and the intertidal regions of the ancient harbour (Peacock and Blue 2006: 37). Linear, negative anomalies were identified in the magnetometry results as walls, and a series of circular, highly magnetic positive anomalies were noted as probable hearths or furnaces. Subsequent excavation showed that an area of magnetic disturbance in the same area, and close to the foreshore was the result of a dump of basalt ballast material (2006: 42). The excavations also showed that an artificial foreshore or 'hard' had been constructed along the foreshore using amphora trampled down into the intertidal muds at the edge of the lagoon, and a jetty had been similarly constructed as a means of reclaiming land from the mangroves. These areas appear to have formed a working surface along the edge of the lagoon on which boats could beach or be hauled up for repairs, or to unload from lighters serving ships at anchor (Peacock and Blue 2006: 175). A number of hearths and areas of heating associated with iron slag close to the shoreline on the point overlooking the entrance to the lagoon were hypothesised to represent iron-smelting in a down-wind and deliberately harbour-front location. Goose barnacles found on the preserved remains of planks in the same region was taken as evidence of ship repairs, and further evidence for ship repairs was also found in the area of the Islamic waterfront (Peacock and Blue 2006: 60).

This multi-strand survey and excavation project therefore provides an extremely useful model of integrated maritime archaeological investigation combining pedestrian and topographic survey with geophysical survey. Unfortunately, given the nature of the coral intertidal zone around the coastline of Zanzibar, augering is unlikely to prove either feasible or particularly useful. The example of Myos Hormos does demonstrate though that magnetic gradiometry can, with careful calibration and

under suitable conditions, be used to identify magnetic anomalies associated with maritime areas and activities. It is worth noting however that in contrast with the Roman harbour, no artificial harbour facilities were identified in the second millennium Islamic harbour, and the authors point out that "due to the nature of Islamic harbours the likelihood of locating any constructed harbour works is extremely slim as the general practice [in the Islamic period] was to beach your boat or moor offshore" (Peacock and Blue 2006: 60). In spite of this, the planned integration of techniques enabled a detailed plan of the port site to be built up with reference to the maritime nature of the site, and due regard for the role of maritime activity as a component of the daily life of the site, as well as the changing use of the site over time.

3.2.3 Port Topology

As well as the survey of Myos Hormos, the survey of the Roman port of Adulis, on the Red Sea coast of Eritrea, provides another example of how maritime perspectives can fundamentally affect the interpretation of social spaces and structure within a port or coastal site (Peacock and Blue 2007). Adulis was occupied from at least the early first century through to the seventh century CE, and contemporary textual sources indicate trade links with Arabia and the Mediterranean (Peacock and Blue 2007). A survey of the site and surrounding landscape conducted in 2004-2005 revealed the apparent separation of the port into two parts; a harbour area on the coast, and a hilltop settlement set back from the relict ancient coastline, which itself is now 3km inland following the post-abandonment retreat of the shoreline (Peacock and Blue 2007). Peacock and Blue suggested that the functional separation of the town from the harbour isolated the Roman civilian population from the busy harbour area which hosted the market and trade activity, and that this separation appears to justify the use of the phrase 'legally designated emporion' in relation to Adulis in the *Periplus of the Erythraean Sea* (Casson 1989; Peacock and Blue 2007). It was suggested that as in the Greek *polis*, some Roman ports may have barred foreign merchants from the main city in order to maintain control and prevent attack or the influence of potentially subversive elements (Peacock and Blue 2007). The example demonstrates that elements of a settlement's functional and political infrastructure may be inferred from the distribution of materials across the total area of the site.

The Persian Gulf port of Siraf, famous as one of the principle ports of the Early Islamic Indian Ocean trade alongside Sohar and Basra, provides another example of the potential for identifying distinct urban regions related to different town and harbour activities even within a limited geographical area. The remains of the town at Siraf lie halfway along the northern coast of the Persian Gulf, and the town occupies a narrow coastal strip between the shoreline of the Gulf and the steep and rocky foothills of the Zagros Mountains (Figure 3.1). The foundations of Siraf in the third-sixth century, and the excavation of a probable Sasanian fort and possible curtain wall suggests that the site may

originally have served as a fortified natural harbour for the Sasanian Empire (Whitehouse 1968, 1970, 1983; Mason & Keall 1991; Whitehouse et al 2009; Priestman 2013). Whilst the headland of the site is low, and the bay is generally open and exposed, the curve of the surrounding coastline means that close in to the beach is one of the few areas of relative shelter in the region from the powerful *shimal* prevailing winds from the north-west (Lamb 1964). The site was substantially redeveloped as a port of trade around the seventh century, and according to a record of the mid-ninth century, the apogee of Siraf's wealth and fame, the town was the common starting point for trade voyages to China, as well as the Mediterranean, India, and East Africa (Whitehouse 1970, 1983; Whitehouse et al 2009). According to contemporary sources, 'teakwood', which Whitehouse hypothesises actually refers to mangrove timber, was commonly imported from Africa, along with ivory and gold, in exchange for Sasanian-Islamic glazed ceramics (Whitehouse 2009; Priestman 2013). By the end of the tenth century however the city was in decline, a change of fortune attributed by some to an earthquake in 977 CE, and the move of many merchants to the nearby island of Qais, as well as to Sohar, in Oman (Whitehouse et al 2009). The continued minting of coins at Siraf until around 992 CE though, as well as the repair and maintenance of large houses and mosques between the tenth - twelfth centuries indicates continued investment in monumental architecture, although the poor quality of these repairs demonstrates the general continuation of the towns decline (Whitehouse 1983).

Extensive survey undertaken by Whitehouse, Williamson, and Wilkinson in the 1970s has established that although this coastline is arid and prone to salination under irrigation, the mountain slopes behind the town and the valleys behind the first ridgeline have been extensively terraced in order to provide a basis for agriculture. Furthermore, an extensive and complex system of aqueducts, qanats, wells and tanks provide freshwater to the town in what has been labelled a 'belt and braces' approach to supplementing the seasonal wadis that run through the valleys and down to the shoreline (Wilkinson 1982; Whitehouse et al 2009). The pressure on land space means that the area of the town was intensively occupied, and the stratigraphy demonstrates multiple phases of rebuilding and renovation on both sides of the perimeter wall (Whitehouse 1969). Several buildings have been hypothesised to relate to harbour activity, but an erosion of the shoreline has made this hard to verify (Khakzad et al 2015). Sir Aurel Stein reported a 'quay wall' along the shoreline of Siraf, although no evidence can be found of this today and Whitehouse has argued that if such a feature did exist and has been lost, it is more likely to have represented an intermittent curtain wall fitting in with the eastern and western town walls, and indications of temporary beach defences dating to around the 10th century (Whitehouse 1970). Other beach front features include the congregational mosque (also described as the Great Mosque), along with three smaller mosques, and the *suq* (market), which contains evidence of metalworking during at least the ninth and tenth century. A potters quarter with several manufactories was also identified on the shoreline, 50 metres inside the gate of the western city wall, which Whitehouse points out was therefore well-placed to take

advantage of the arrival of raw materials from the hinterlands, and the loading of pots for sale and export by boat (Whitehouse 1970). Whitehouse concludes that the harbour was an anchorage in the relative shelter of the headland, and reports of possible anchor stones from a recent underwater survey of the bay appear to support this theory (Whitehouse 1970; Whitehouse *et al* 2009; Khakzad *et al* 2015). Whilst the survey and excavation of Siraf have not revealed substantive marine architecture, the remains of multiple examples of industrial areas, manufactories, and the *suq* in close proximity to the beach show both the importance of these activities to the early town, and the apparent value of these areas maintaining good access to the waterfront. The fact that these areas were later redeveloped and built over to make way for new mosques however, and the subsequent movement of these facilities outside the cramped confines of the city walls also reveals something of the possible changing character of the site, and a shift in orientation from a port of trade producing goods for export, to an entrepot of merchants quarters. This shift may also explain the rapid decline and abandonment of the town by the same merchants under difficult circumstances in the tenth century.

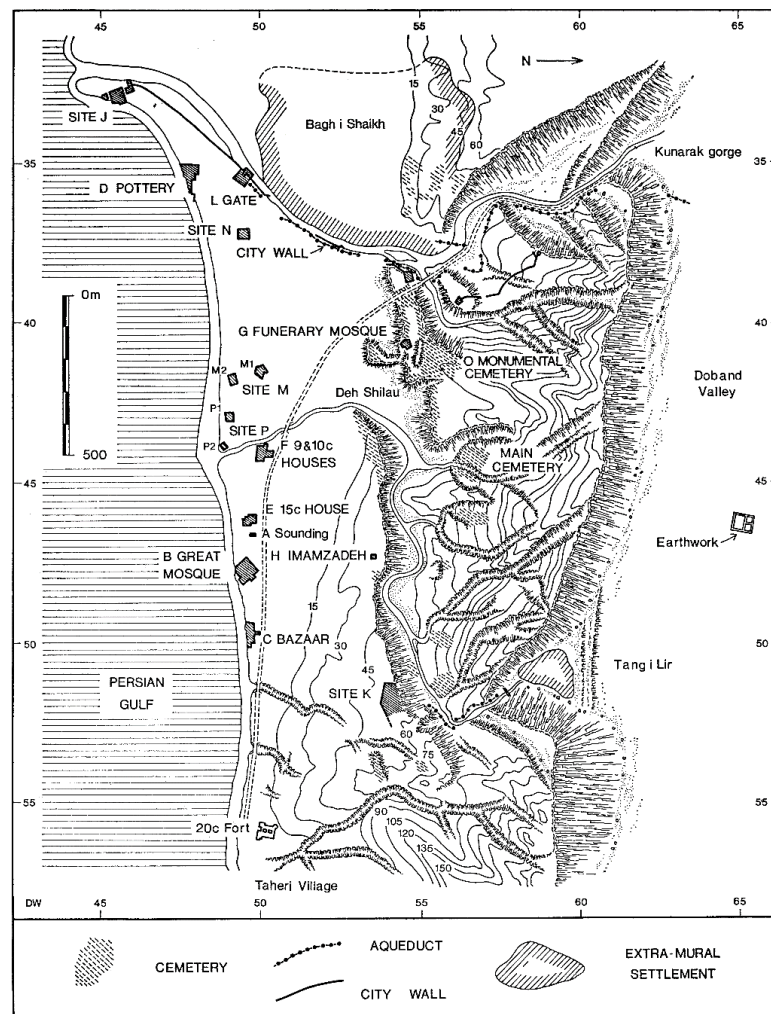


Figure 3.1 Excavations at Siraf, from Whitehouse (1974: 6)

3.2.4 Architecture and Open Spaces

Two of the more recent themes of investigation on the Swahili Coast have been the 'hidden majority' of daub architecture in both proto-Swahili and Swahili settlements, and the nature and function of 'open spaces' within Swahili stonetowns (Fleisher and LaViolette 1999a, 1999b; Fleisher 2010; Fleisher and Wynne-Jones 2012; Wynne-Jones and Fleisher 2014; Fleisher and Sulas 2015). These include areas between the coral houses and mosques, which although often sharing a common orientation do not appear to be linked by linear or radial streets, and areas between the houses and the symbolic enclosure of the town walls. Horton has suggested that central spaces may have formed ritual areas later redeveloped into markets as part of a strategy aimed at achieving social and economic access by traders and merchants, and notes a series of stalls within the central space at Shanga (Horton 1986, 1996). Kusimba (1993, 1999) has suggested that such open areas might be garden areas, ritualised liminal areas related to group membership, or zones marked for future development. Garlake suggested their use as open air meeting spaces or, like Kusimba (1993), as areas of industrial production. Surveys and excavations by Fleisher and Wynne-Jones aimed at investigating these areas at Songo Mnara have shown a range of activities, and indicate that it is likely that such areas may have had multiple functional identities, being the sites of industry, trade, burial and social commemoration, and impermanent architecture to accommodate these functions (Wynne-Jones and Fleisher 2014). Few of these debates however have ever dealt with the role of open areas between the town and the foreshore.

It is suggested here that the areas between the settlements and the shoreline are likely to be of significant importance to any maritime settlement, and to contain archaeological evidence indicative of the role of maritime activities within the port. The investigation of these areas as a key component of the life and use of the settlement would therefore provide valuable new data on the role of maritime identities within proto-Swahili and Swahili culture. A key objective of this thesis project is therefore to map the known extent of the early phases of the case study sites, and attempt to identify specific areas of activity, occupation, and 'open' areas within the overall plan in order to understand the role and activities related to the harbours.

The activity and occupation areas of the settlements might be identifiable and distinguishable for a variety of reasons. Swahili architecture is famous for the dressed coral architecture of doorways, niches, and arches seen particularly in mosque construction from around the ninth – tenth century CE (Wynne-Jones 2013). The coral used for this is porites, a soft coral that must be carved soon after it is quarried from the intertidal zone, but which hardens as it dries, and is immensely resilient to wear and weathering (Horton 1996; Wynne-Jones 2013; Lauren 2014). As well as carved porites

though, there is evidence for rough blocks and chips of coral being used as a foundation and temper in daub walls from around the eighth century, and quarried stone and coral were used extensively throughout the second millennium as the building blocks for the mortared walls of the classical stone towns (Chittick 1974; Horton 1996). The majority of architecture within the sixth – tenth century proto-Swahili settlements is of timber or wattle-and-daub (LaViolette 1996, 2004; Fleisher and LaViolette 1999; Wynne-Jones and Fleisher 2016). Both coral and daub structures are potentially identifiable through geophysical survey, as evidenced by recent surveys of Vumba Kuu, Kilwa Kisiwani, and Songo Mnara (Fleisher *et al* 2012; Welham *et al* 2014; Wynne-Jones 2012).



Figure 3.2: Derelict modern wattle-and-daub structure at Kilwa Kisiwani. Note coral rag bound into daub matrix, and concentration of coral pieces as a result of wall collapse, creating potential magnetic anomaly. Photo by author (2013)

In spite of the common use of geophysical survey as an archaeological technique in Europe and North America, in sub-Saharan Africa geophysical surveys are still remarkably rare (Magnavita 2016). However, excellent examples of the use and value of geophysical survey in East African coastal contexts are available in Wynne-Jones' survey of Vumba Kuu, Kenya (Wynne-Jones 2012), and in Fleisher and Wynne-Jones' surveys of Kilwa Kisiwani (Fleisher *et al* 2012) and Songo Mnara (Welham *et al* 2014; Sulas *et al* 2016). Magnetic gradiometry at all three sites has demonstrated that it is possible to identify both coral and daub architecture, as well as iron-working areas, and as noted in Chapter Two, the survey of Kilwa Kisiwani and Songo Mnara have demonstrated a dense clustering

of houses in areas previously thought to be open and free of structures. Subsequent test-pitting and excavation at Songo Mnara has demonstrated that some of the strongest magnetic anomalies represent burnt daub structures, with high quantities of coins and imported ceramics found inside, between the stonetown and the shoreline (Fleisher and Sulas 2015; Sulas *et al* 2016). The literature review of Swahili sites contained in Chapter Two also demonstrated that the sites of the Zanzibar Archipelago, as well as the mainland coast, may well have had iron-working, trade, and resource processing activities in beach contexts and within the area of settlement at proto-Swahili sites, and that fish-traps and intertidal causeways have been identified in the intertidal zones of a number of second millennium Swahili period sites.

Based on the surveys of Adulis and Myos Hormos in the Red Sea (Peacock and Blue 2007, 2008), and of Vumba Kuu, Kilwa Kisiwani, and Songo Mnara on the Swahili Coast (Wynne-Jones 2012; Fleisher *et al* 2012; Welham *et al* 2014; Sulas *et al* 2016), it is suggested that geophysical survey offers a convenient and effective means of generating interpreted settlement plans informed by previous excavations. Magnetic gradiometry is a proven method of detecting evidence of iron-working and thermoremanence, and has already proven useful in detecting coral and burnt daub architecture on the East African Coast. New magnetic gradiometry surveys at Unguja Ukuu, Fukuchani, and Tumbwe therefore offer an opportunity to create interpreted plans of settlement and spatial organisation, informed by previous surveys and published archaeological excavations. As well as potentially helping to identify architectural features and activity areas, this combination of data might also offer the opportunity to explore social divisions between harbour and occupation areas, as seen at Myos Hormos, Adulis, and Siraf.

3.3 Research Objectives

The following section describes in detail how the research objectives outlined in Chapter One will be fulfilled. As noted in Chapter One and above in Chapter Three, this thesis is intended as an inductive investigation of proto-Swahili harbours in the Zanzibar Archipelago, based in part on previous archaeological observations of maritime and industrial activity on the shoreline of Swahili settlements, described in Chapter Two. The research methodology is therefore based upon the exploration and testing of three linked hypotheses which relate directly to this review of maritime evidence from Swahili and proto-Swahili coastal contexts, and the rationale that even before the rise of the classic Swahili culture, shoreline and harbour spaces are likely to have been extremely important to the daily use, activity, and organisation of East African coastal settlements.

The three hypotheses are as follow;

Hypothesis One: It is hypothesised that the maritime traditions of ‘classic’ Swahili culture were rooted in maritime activity as a common component of life in first millennium proto-Swahili coastal settlements.

Hypothesis Two: Given the occurrence and nature of maritime activities such as coastal fishing and maritime trade known from the evidence of urban contexts, the shoreline areas of proto-Swahili coastal settlements hosted activities related to the maritime functions of the sites, including trade and iron-working.

Hypothesis Three: Given the apparent lack of maritime architecture such as wharves or jetties in Swahili contexts before the second millennium, the proto-Swahili settlements of the Zanzibar Archipelago may have been deliberately sited to exploit some common factor, such as the depth of harbour spaces, topographic features such as mangrove creeks or peninsulas, or the availability of a particular type of marine resource, which benefitted the maritime function and use of the site.

As described in Chapter Two, the Zanzibar Archipelago arguably represents an example (or two related examples) of Tartaron’s maritime small worlds. The islands are known to have hosted several of the earliest permanent settlements of the Swahili Coast in the mid-first millennium, and as a dense cluster of sites appear to have represented a gravitational hub of trade between at least the eight – fourteenth centuries CE (Fitton 2018; Horton forthcoming). The archipelago therefore offers the rare opportunity to explore contemporary, related proto-Swahili port settlements and coastscapes within this maritime small world. The case study settlements of this thesis have been selected for their broadly contemporary and well-published first millennium occupation sequences, and for the availability of comparative sources of archaeological data to complement the geophysical surveys, excavations, and GIS analysis planned for this project. Following the examples laid out here, the research objectives of this thesis, which were outlined in Chapter One, will now be discussed in detail with reference to the project methodology.

3.3.1 Objective One – Evolution of Ship and Harbour Technologies

The first research objective of this thesis is to analyse the archaeological use and predicted evolution of ship technology in the western Indian Ocean as evidence of potential co-dependent development of maritime activities and harbour spaces in the Zanzibar Archipelago.

Varying uses of the physical space of the maritime cultural landscape may require various forms of maritime ability and technology. Fishing within the intertidal zone, for example, requires an awareness of tidal systems, the behaviour of fish, the local marine environment, and the cognitive ability to use this knowledge to craft a fishing strategy, such as planning and building an effective

trap system in the appropriate location. Crossing a given water body, meanwhile, requires again a knowledge of the local environment and possible natural variables of wind, waves, and weather, and also the technical ability to construct a suitable vessel, whether a raft, dugout canoe, sewn-plank craft, or multi-masted schooner. Westerdahl (1995) has argued that the creation, selection, and use of suitable vessels is therefore intrinsically linked to the given 'transport zone', as well as to the maritime ability of the sailors. The 'wrong' choice of craft can have severe implications, and lead to loss of the vessel, representing a potentially significant investment even before a cargo is considered, and at worst the irreplaceable loss of life. Thomas Dhoop (2014) has built upon this type of argument to suggest that the modification of either the craft or its intended transport zone, in this case particularly the harbour, can have repercussions across multiple related maritime cultural categories. In order to evaluate the use of harbours, and patterns of harbour and maritime activity in the proto-Swahili settlements, it is therefore necessary to analyse the types of ships and watercraft which were being built, used, and sailing to or from such harbours.

Unfortunately, the relative side-lining of sub-Saharan African maritime archaeology, poor preservation of wood in the warm waters of East Africa and, until recently, the lack of systematic marine surveys in the vicinity of Swahili ports means that our knowledge of the development of East African boats and ships is limited at best (Vernet 2015). An evaluation of the broad technological characteristics of ships, boats and watercraft in use along the East African coast will be presented in Chapter Nine using the available resources of both classical sources and existing maritime archaeological studies of the Indian Ocean. Classical texts such as the *Periplus of the Erythraean Sea* refers to sewn boats and log-boat canoes being used on the island of Menouthias in the mid-first century CE (Casson 1989), and graffiti found in coastal contexts, as at Husuni Kubwa on Kilwa, apparently shows the continued use of sewn-plank technology in the mid-second millennium (Garlake 1966; Lane 2012; Pollard *et al* 2016). The origins and capabilities of the class of the wide array of vessels described loosely by Europeans as 'dhows' have been discussed by various historians (Hornell 1941, 1942; Prins 1965; Sheriff 2010) and various ethnographic texts, geographies and travellers accounts, icons and models are also available from the later second millennium. Fortunately for the purpose of this analysis, East African vessels were not the only craft using the proto-Swahili and Swahili ports. The maritime networks of the Indian Ocean mean that a broad range of other craft are likely to have visited, each with their own capabilities and requirements, but the common use of these vessels for trade, and the fact that technological innovations are equally likely to have been carried may enable the tracking of a median of maritime technology across the entire region. Examples of maritime technology from across the Indian Ocean, and particularly known trading partners of the Swahili coast will therefore be reviewed and used alongside other sources of evidence. The aim of this analysis will be to build a model for the likely development of various forms of maritime technology on or around the East African coast in order to discuss the potential capabilities of sailors in a given period, achievable limits of maritime activity, and the

predicted uses and requirements of harbours. The results of this analysis will be presented in Chapter Four.

3.3.2 Objective Two - Survey and Excavation

The second objective of this thesis is to conduct geophysical surveys and ground-truthing excavations at the three case study proto-Swahili sites in the Zanzibar Archipelago, in order to identify archaeological features related to maritime activity and settlement plans.

The use of magnetic gradiometry survey is based on the success of this technique at the Swahili-period coastal sites of Vumba Kuu, Kilwa Kisiwani, and Songo Mnara. Magnetic gradiometry survey will enable the identification of coral and daub architecture and activity areas in both shoreline and inland settlement contexts. It is hypothesised, based on the previous excavations of Manda, Shanga, and Kilwa that iron-working and craft activities are likely to have taken place in near-shore contexts in the early Swahili coastal settlements, and these are likely to be represented as either thermoremanent or ferrous magnetic anomalies if present within the range of the magnetic gradiometer. The surveys of Unguja Ukuu, Fukuchani, and Tumbe will be followed as necessary by targeted excavation of magnetic anomalies of potential archaeological interest. The details of these surveys are described in the relevant chapters, and in detail in Appendix B, on the theory, use, and interpretation of magnetic gradiometry. The results of both of these methods of investigation will be digitised as necessary and georectified for inclusion in a project GIS. Anomalies of particular interest will also be examined in ArchaeoFusion to identify signal strength and range across the anomaly, in order to help identify ferrous metals, thermoremanence, and to compare types of anomaly across sites. These comparisons will enable the predictive modelling of the cause and nature of anomalies and clusters of features in spite of local variations in average field strength due to geology.

Excavation of particular anomalies is intended to aid in the identification of the source and cause of the magnetic anomaly, and to record archaeological features and recover artefacts and materials for analysis. Stratified deposits will be dated using a combination of relative pottery sequences and carbon dating, assuming suitable assemblages and materials for dating are available. Contexts and sections will be planned and photographed for inclusion in the GIS database, enabling the mapping of harbour and settlement activity areas across the site, and later inter-site comparison. The results and interpretations of these surveys and excavations, as well as previous investigations, are presented in Chapters Five, Six, and Seven, and in Appendix A.

3.3.3 Objective Three - Identifying Harbour Features

The third objective of this thesis is to identify harbour spaces, related activity areas, and evidence of spatial organisation at each site based on a GIS analysis of collated geophysical survey and archaeological excavation results, and topographic and hydrographic datasets.

Based on the review of evidence from previous surveys of Unguja Ukuu, Fukuchani, and Tumbe, as well as other mainland proto-Swahili and Swahili sites, the identification of both activity and occupation areas may be possible through the combination of geophysics and excavation in a GIS database, alongside published or archival material from previous investigations of these sites. Whilst the population of this GIS and problems associated with its construction are described in detail in Appendix A, the intention is to integrate the new geophysical survey data, survey and excavation results collected as part of the thesis project alongside digital topographic maps, hydrographic charts, satellite imagery, and the scanned publication plans of relevant archaeological reports. This combination of data will support the mapping of activity and occupation areas within each of the proto-Swahili case study sites. This map will be used to identify probable harbour activity areas at each site, based on the type and location of archaeological remains, and the types of activity present in both harbour area and port settlement as a holistic unit.

As noted above, the second hypothesis of this thesis posits that the beachfronts of proto-Swahili ports hosted resource processing and industrial activity areas between the harbour areas and the main settlement. This was based on the identification of quantities of iron slag on or close to the beach at Manda (Chittick 1984), Kilwa (Chittick 1974), and Shanga (Horton 1996). In theory, this positioning would allow for an initial sorting and selection of goods after unloading from incoming vessels, or before loading for an outward journey. As noted in Chapter Two, ocean-going vessels must be regularly maintained, scraped free of barnacles which create drag and weaken timbers, and undergo minor, or major, repairs to hull, mast, and sails. The reservation of beach areas for processing might also allow for maintenance activity related to both shipping and other maritime activities. Fishing nets, for example, require regular checking for tears, breaks, and the replacement of missing weights. Small maintenance activities by local inhabitants may have taken place in the home, but ship-maintenance and repairs are likely to have taken place on or just above the shoreline where the vessel could be beached, pulled up, and turned over as required. The close proximity of iron-working or industrial activity areas to the shoreline would therefore benefit sailors as well as any inhabitants of the settlement looking to trade or provide goods and services to visitors. Regardless of their size, these industrial and iron-working areas may be identifiable by geophysical survey because of negative or dipolar ferrous and thermoremanent magnetic signatures created by ferrous artefacts and thermoremanent areas created by burning. Certain buried ferrous artefacts, including ore and worked goods may even be detected beyond the theoretical limit of the magnetometer because of the strong magnetic influence exerted by iron.

It is also hypothesised that such processing areas may have been accompanied by small or impermanent market areas used for the resale and exchange of goods after the initial break of cargo by incoming merchant and fishing vessels. As mentioned in the previous chapter, Horton acknowledges the possibility of market trade outside the central space of the Swahili towns, but predicts the existence of social and ritual penalties maintained by institutional authorities to prevent this occurrence. There is some textual evidence to support this in the second millennium, but the theory has not been tested for the earlier first millennium towns. Fish markets can be seen today on the waterfront areas of a number of Swahili towns and villages, where fishermen sell their goods to locals, visitors, and secondary traders alike. Unguja Ukuu hosts just such a market today in the shelter of an unfinished structure above the beach, just west of the modern tourist lodges. Here, fishermen unload their cargo to be auctioned, and buyers travel from as near as the modern village and as far as Zanzibar Stone Town, around 30km away. Once the catch has been sold and distributed, it is cleaned, gutted, and washed on the beach beside the impromptu market, or taken away for resale at a larger market elsewhere. Barring the obvious issue of rapid transport, and accepting the limitations of distance, it is possible a similar system was practised in the late first millennium by inhabitants of nearby satellite or networked sites near fishing settlements and ports. Horton (1996) discussed the possibility of such markets at Shanga, and Fleisher (2010) has suggested that similar markets might predate the formalisation of trade practices in the Swahili period, and noted the impermanent remains of fish-markets on Pemba today. It should be noted that these impermanent activities, which may or may not require dedicated structures, may create only ephemeral traces in the archaeological record, and may therefore be difficult to identify positively. The research will explore the evidence for these markets and activity areas at the three main case study sites by attempting to identify and excavate magnetic anomalies indicative of clusters of ferrous artefacts, which may indicate accidental deposition of artefacts lost during trade; and thermoremanence, which may indicate processing or iron-working areas. This investigation will contribute to new debates on the development and variation of trade and exchange amongst the Swahili generated by Fleisher and LaViolette's survey of settlements on Pemba (2010, 2013), as well as providing indicators of specialised craft areas at these sites. The results and interpretations of individual surveys and excavations are presented in Chapters Five, Six, and Seven.

3.3.4 Objective Four – Comparative Analysis

The fourth objective of research is to identify patterns and variations in maritime activity and settlement organisation across the archipelago.

Building on the review of Swahili ship technology, the results of geophysical survey and excavation, and the analysis of archaeological features and activity areas within the individual port settlements,

the intention is to compare the results of the three case study sites against each other, and attempt to identify similarities or differences in types of activity, and harbour and occupation areas. The location and environment of harbour areas on the Swahili coast has not been a significant topic of debate in the past, beyond the study of individual port sites. The physical context of these sites will be addressed in this thesis, and an assessment made of whether or not any pattern of settlement in certain types of environment can be recognised as a matter of active selection, or whether similarities between site locations are due to broader environmental and topographical trends along the East African coast. An assessment will be made of the suitability and convenience of each of the harbour sites in relation to the predicted watercraft in use along the coast, and with reference to issues of hydrography, wind direction, and currents where possible, based on available charts and records.

Whilst the investigation of each port site individually is essential, it is the comparison of sites which will allow patterns of settlement activity, organisation, and maritime behaviours in the proto-Swahili occupation of the Zanzibar Archipelago. This comparison will be based on both the data collated in the GIS database, and of new and existing investigations of the sites. The analysis will explore the evidence of settlement size, plan, architecture, harbour features and maritime activity areas, predicted ship technology, local topography and access to water, and potential resources in the local area.

The excavation and investigation of numerous Swahili ports since Kirkman's (1954) survey of Gedi in the 1950s has provided a wealth of archaeological data, but comparison of the evidence between and across sites has been relatively rare. Fleisher and LaViolette (2010, 2013) have previously cited this lack of direct comparative analysis as an issue in the assessment of Shanga as a major port of trade, when the excavation of Tumbe demonstrated far higher quantities of imported ceramics in the proto-Swahili period than were found at Shanga. This is not to imply that Shanga was not a major port of trade, but simply that by comparison it would appear that it was not as large or as wealthy as Tumbe (Fleisher and Laviolette 2010). This analysis may therefore also have significant implications for the discussion of economic roles and network organisation of ports within this region of the Swahili Corridor.

The comparative assessment of spatial plans and the hypothetical development of various types of activity areas across sites, as well as the identification of common archaeological and environmental features, might also enable the comparison of patterns of settlement and spatial organisation before and after the discontinuity of occupation and resettling of port sites around the tenth – eleventh century. Whilst describing a predicted pattern of movement to more isolated locations such as peninsulas in the second millennium, Horton has hypothesised that the shift in site locations may have been tied to religious or cultural factors rather than to topographic or landscape features (Horton 2004). An examination and comparison of the physical context of harbour sites may

demonstrate trends of occupation or environment to support or refute these claims, and to demonstrate settlement patterns in both the proto-Swahili and Swahili periods.

3.3.5 Objective Five – Evaluate harbour spaces

The fifth and final objective of research is to evaluate and characterise the role and importance of harbour spaces and maritime activity to proto-Swahili settlements of the Zanzibar Archipelago between the sixth and eleventh centuries CE.

This evaluation will be based on the results and interpretations of individual surveys and excavations presented in Chapters Five, Six, and Seven; the inter-site comparison of landscapes, harbours, and maritime environments presented in Chapter Eight; and the discussion and model of the development of ship technology presented in Chapter Nine. Chapter Ten will consist of a discussion of these results and interpretations, patterns of maritime activity, harbour and settlement organisation, and the related development of maritime technology throughout the proto-Swahili period.

3.4 Chronology and Dating

A final note must be made on the means of dating and sequencing used in this research. As stated above, the aim of this thesis is the evaluation and characterisation of maritime activity and harbour-related areas of settlement in the proto-Swahili settlements. This requires some comparison to earlier and later periods, but it is not the intention to build detailed, high-resolution dating sequences within these periods in order to achieve this characterisation. As such, the relative dating of contexts will be reliant on the identification of ceramic and artefact markers following existing models and typologies. Although samples of charcoal were recovered during the excavations of Unguja Ukuu and Tumbe described in Chapter Five and Seven, due to the time constraints and costs of analysis, and the previously noted problem of radiocarbon dating marine woods, these have not yet been tested.

3.4.1 Kwale Ware

An Early Iron Age occupation dating back at least as far as the first century CE is evidenced by the textual record of trade with East African coastal sites in the *Periplus of the Erythraean Sea* (Casson 1989), and by the identification of sites across the coastal hinterlands with a predominance of bevel-

rimmed Kwale ware ceramics (Chami 1994, 1998; Crowther *et al* 2016). Various Early Iron Age sites featuring Kwale ware have been identified in the hinterlands of the coast, and others are predicted on the basis of sherds of possible Roman wares found in the Rufiji River (Chami 1994, 1999; Horton 2004). A predominance of Kwale ware is therefore generally used to indicate first to sixth century occupation sequences (Fleisher and Wynne-Jones 2011). Although some Early Tana Tradition sites feature occasional fragments and sherds of Kwale ware, no site has yet been identified with unequivocal evidence of an occupation sequence bridging the broad first-fourth and sixth-eleventh century occupations of the coast. An early Iron Age site at Juani School in the Mafia Archipelago for example has recently been found to have two entirely separate occupation sequences radiocarbon dated to between the fourth-sixth centuries CE and the ninth-thirteenth centuries CE respectively (Crowther *et al* 2014). The earlier phase of occupation had a ceramic assemblage consisting almost entirely of Kwale ware, whilst the later site consisted of typical Tana Tradition and imported ceramics, and the few anachronistic Kwale sherds found in the upper phases of the site appeared to be the result of a disturbance of underlying contexts, rather than contemporary use of Kwale ware. No evidence was found at this site, or at the nearby contested site of Ukunju Cave of any temporal overlap or transition between the two phases of use (Crowther *et al* 2014; Crowther *et al* 2016: 221). Notably for the purposes of this thesis, sherds of Kwale ware have been reported at both Unguja Ukuu and Fukuchani on Zanzibar, but their rarity, especially in comparison to the dominance of ETT, suggests that this is more likely to indicate trade connections and curation during an early phase of occupation, than a phase of cultural transition (Crowther *et al* 2013a; Horton forthcoming; Juma 2004). Although Juma (2004) has also reported fragments of Roman ceramics at Unguja Ukuu, the identification of Roman ceramics has been strongly contested (Crowther *et al* 2013a, 2013b).

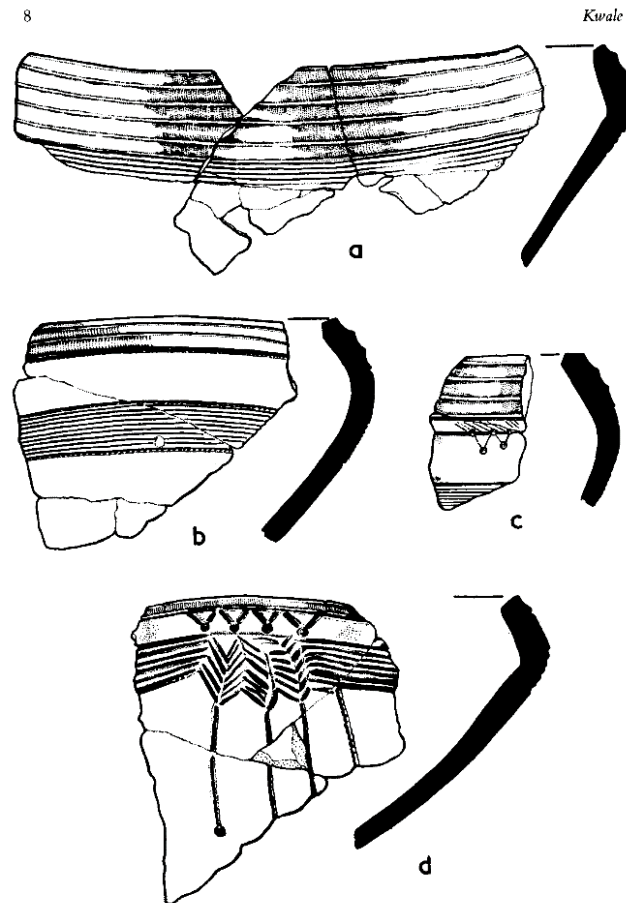


Fig. 5. Kwale Ware. Bowls with up-turned rims. Scale 2/3.

Figure 3.3: Bevel-rimmed bowls from Kwale, from Soper (1967: Figure 5)

3.4.2 Early Tana Tradition (ETT)

The new wave of proto-Swahili coastal occupation that occurred around the sixth century is by comparison associated with the predominance of Early Tana Tradition ceramics (ETT). Horton's PhD thesis (1984) based in part on his excavations at Shanga united an array of 'local' ceramics from multiple coastal sites into a single coastal ceramic tradition which he termed the Tana Tradition after the river which flows into the Lamu Archipelago, and along which were found a number of sites with local ceramics related to this tradition (Horton 1984, 1996; Abungu 1994; Fleisher and Wynne-Jones 2011). Influenced by Abungu's study of these sites, Horton suggested that the Tana Tradition was likely to have developed out of such Iron Age ceramic wares in the coastal hinterlands around the early sixth century CE (Horton 1984; Abungu 1994). Horton defined this ceramic tradition as one recognisable by "the common use of incised and punctuate decoration" (Horton 1996: 253), but his scheme allowed for reasonable variation even within his published types. The use of the phrase 'Tana Tradition' subsumes a number of regional variations in decorations and percentage of forms in a given assemblage.

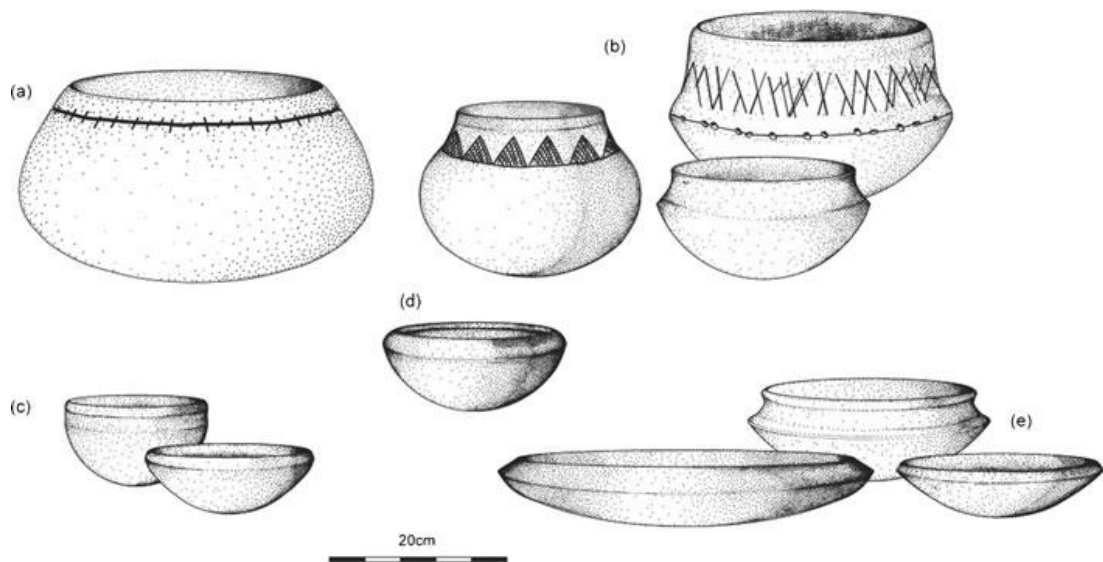


Figure 3.4 Forms of Early Tana Tradition (ETT) include a) globular jars, b) necked jars, c) open bowls, d) closed bowls, and e) carinated bowls. Illustration by Matilde Grimaldi, from Fleisher and Wynne-Jones (2011: 265).

A recent study of form and stylistic variations within the ETT by Fleisher and Wynne Jones (2011) recorded variations in form, decoration, and the location of decoration on ETT ceramics from multiple sites. Their analysis confirmed the dominance of necked jars with rounded bases in the early assemblages of proto-Swahili sites, and the relatively limited range of decorations on such vessels. Such decorations frequently included incised triangular patterns, zig-zags, or parallel lines around the neck and shoulder, but no single regional pattern to these could be identified (Fleisher and Wynne-Jones 2011: 273-274). Although a general trend for the shortening of jar necks and opening of jars to bowls is acknowledged between the first and second millennium, Fleisher and Wynne-Jones' study suggested that over short periods of time the dominant forms of vessels at different sites may have more to do with site location and related questions of diet, than regional identities or temporal trends (Fleisher and Wynne-Jones 2011: 275). Variations in the dominance of jars or bowls in a given assemblage were hypothetically linked in the study to the nature and location of sites in the landscape, and thereby to possible patterns of diet and consumption (Fleisher and Wynne-Jones 2011: 274). The authors noted therefore that the study had succeeded in identifying new variables, but this success denied the possibility of simple classifications of form.

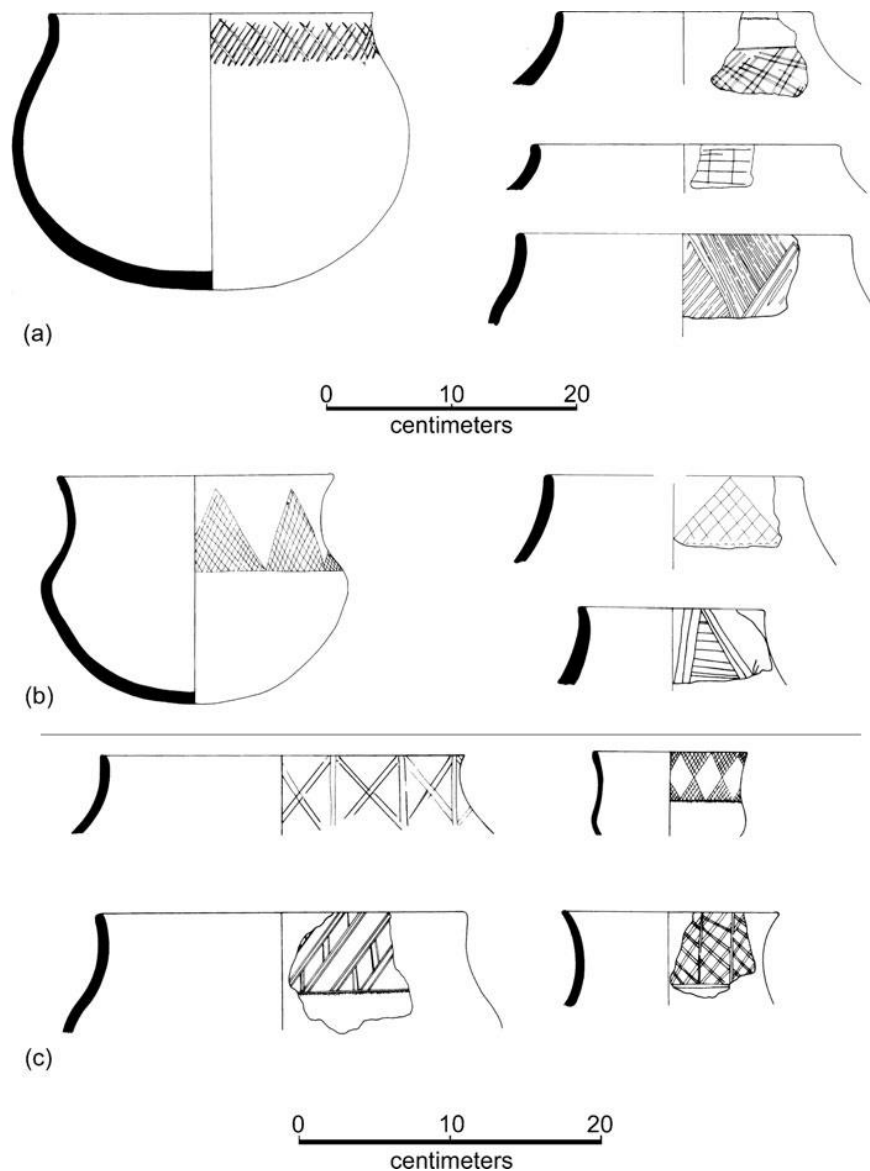


Figure 3.5: Illustrations of a) Type 1, b) Type 2, and c) Type 3 Tana Tradition from Horton (1996: 250-252)

Stylistic decorations, particularly incisions, were also found by the study to have a greater probability of being related to region than to chronological periods, but the reoccurrence and continuity of decorative motifs between sites likewise prevented simple classification. Crucially, the findings demonstrated that the dating of sherds with triangular incisions as Triangular Incised Wares (TIW) belonging to the ETT was problematic, because it tended to exclude other decorated sherds which might also belong to the ETT but originate from a different stylistic region. In this the nature of the maritime network which bound the Swahili Corridor is itself liable to prevent regional classification, since the very existence of the shared culture is proof that both materials and concepts were constantly being carried in flux between sites and regions along the coast. As the authors

themselves noted, "The patterning of the ETT along a continuum [between north and south] suggests a vast interaction sphere in which communities were most in contact with those nearest to them, while cognizant of a larger sphere that included them all" (Fleisher and Wynne-Jones 2011: 274).

For the purposes of identification and dating of Tana Tradition ceramics within this thesis, Horton's (1996) model and classification has been adhered to, although Juma's (2004) classification of ceramics from Unguja Ukuu is referred to for comparison in Chapter Five.

3.5 Summary

Chapter One of this thesis outlined a brief summary of the occupation of the East African Coast between the first and second millennia, and the history of archaeological research of the coast since the 1960s in Chapter One. Chapter Two described the underlying theoretical framework of the thesis, and presented a review of the literature on ports and harbours of the first millennium proto-Swahili period. Based on the evidence of maritime activity areas gleaned from the literature review, Chapter Three has described the methodologies of previous studies of ports in the Red Sea and on the coast of East Africa, and the effective use of geophysical survey in East African coastal contexts, and presented an inductive project methodology. This methodology involves the analysis of the development of maritime and ship technology in the Indian Ocean as a proxy for similar trends on the East African coast during the first millennium; geophysical survey and limited excavation of three proto-Swahili case study sites of the Zanzibar Archipelago, in order to identify evidence of maritime activity and occupation areas at individual sites; comparison of patterns of maritime activity and harbour topographies between sites; and finally to evaluate, based on the collated evidence, the range and role of maritime activities in the proto-Swahili sites, and the importance of such activity, as evidenced by the relationship between settlement organisation and maritime areas. Additional details on the construction of the project GIS, the population of the database, and discussion of problems encountered and solutions devised in the digitisation and georectification of datasets are provided as extraneous, though useful data in Appendix B at the end of the thesis.

Following the chapter scheme described at the start of this thesis, Chapter Four will now examine the archaeological and ethnographic record of maritime technology in East Africa and the western Indian Ocean, and Chapters Five, Six, and Seven will then discuss the individual case study surveys and excavations of the proto-Swahili sites of Unguja Ukuu, Fukuchani, and Tumbe respectively.

Chapter Four

Swahili Ships and Maritime Technology

*“Here is a harbour without ships, a port without trade, a fishery without nets,
a people without business”*

Daniel Defoe

4.1 Introduction

In order to begin this investigation of maritime activity and harbour spaces in the Zanzibar Archipelago, and the entangled use of harbour spaces and ship technology in East Africa more broadly, this chapter comprises a review of current knowledge regarding the ships and maritime technologies known on the Swahili Coast and western Indian Ocean between the early first and mid second millennium. This chronological range is deliberately extended slightly before and after the main period covered by this thesis, in order to account for the hypothetical evolution of maritime technology, and to try to resolve gaps in the maritime archaeological record of the East African coast. The review is divided broadly between archaeological and ethnographic datasets which provide a basis for analogy in the consideration of the harbours and seascapes of the Zanzibar Archipelago. The archaeological evidence is subdivided into discussions of the textual and archaeological record of ships and sailors on the East African coast; and a relatively brief review of contemporary East Asian ship technology, in order to explore the possibility of direct, long-distance trade voyaging across the Indian Ocean. More recent ethnographic accounts and records of ships in the western Indian Ocean are then briefly discussed as branching endpoints of maritime technological evolution in the region.

The potential capabilities, strengths, and limitations of vessels have implications, particularly in mooring and maintenance requirements, for the use and development of ports and harbours in the period. This review will be therefore be used to build a theoretical model for the evolution of these technologies, and the final section of this chapter offers several predictions, with allowance for technological evolution and local variation, regarding the types of vessels which might be expected to have been in use on the Swahili Coast between the eighth and thirteenth centuries. These prediction will inform the archaeological analysis of the maritime cultural landscape in the later chapters of this thesis.

4.2 Archaeological and Textual Evidence

Unfortunately, relatively little is known about the boats of the East African coast in the first millennium and early second millennium. Poor organic preservation conditions in the warm, shallow waters of this coast means that only a few shipwrecks from this period have so far been identified (Breen and Lane 2003; Bitu 2011, 2014; Bitu and Tripathi 2015; Breen *et al* 2016; Pollard *et al* 2016). Only a few textual accounts exist of shipping between the first and eleventh centuries CE, and most illustrations and graffiti images of ships in East Africa post-date this period. The archaeological investigation of ships and sailing in the western Indian Ocean has therefore tended to focus on periods for which we have more information, such as earlier Roman or later Islamic trade networks, and to rely necessarily on analogy and extrapolation to fill in the blanks of the first millennium (Blue 2003). The comparative under-development of maritime archaeology in the region has meant however that such extrapolation has not always accounted for the gradual process of technological evolution, regional variation of form even within vessel classes, or the functional specialisation of different types of vessel (Hornell 1941; Prados 1997; Falck 2014). Almost any discussion of pre-eighteenth century sailing in the region, for example, is likely to refer either to 'dhows' or to the extinct but well-recorded *mtepe* of the Kenyan coast.

A brief assessment of the use of the term 'dhow' in this context provides a useful demonstration of both the variation to be expected in sailing craft of the first millennium, and the need for a greater programme of maritime archaeological study in the western Indian Ocean and along the coast of East Africa. The word *dhow* is used loosely in Europe today to describe any 'Arab' sailing vessel, but the term may have originated on the East African coast with the ship known as a *dau la mtepe*, which is discussed later in this chapter (Agius *et al* 2014; Hornell 1941; Howarth 1977; Gilbert 2017). The European usage of 'dhow' may have its roots in the anti-slavery British naval patrols of nineteenth century, where it appears to have been used as a convenient catch-all term for foreign or 'native vessels' alongside the phrase 'dhow trade' (Sheriff 2010: 79; Gilbert 2017). The term disguises the reality of a massive array of ship designs, sailing rigs, construction techniques, local maritime traditions, and uses. In the western Indian Ocean at large the term includes craft of varying sizes such as the Arab *boom*, the *baghala*, and *sanbuq*, vessels from the western coasts of India and Pakistan such as the *ghanja* and *kotia*, and a number of types found primarily on the East African coast, such as the *jahazi*, *mashua*, and the *dau la mtepe* (De Leeuwe 2005; Hawkins 1977; Gilbert 2017) (Figure 8.1). Each of these is recognised in its own context as distinct in form and purpose, so that whilst the *mashua* and *jahazi* both have nail-fastened, edge-to-edge plank hulls, lateen-rigged sails, and square transoms, the greater size and proportional breadth of the *jahazi* makes this the more popular choice of vessel for the transportation of bulk cargo, whilst the *mashua* is better known as a fishing vessel. The purpose and design characteristics of each craft may also enhance or limit the vessels usage under certain sailing conditions, making them more or less suitable for near-

shore, coastal, and deep-water sailing. Not only is the notion of a singular type of 'dhow' therefore clearly unrealistic, the array of sailing craft seen today is far smaller than in past centuries, due to the replacement and extinction of wooden sailing craft in favour of metal hulls, screw propulsion, and ever larger cargo, tanker and container ships over the nineteenth and twentieth centuries.

This technical evolution also has consequences for the use of ethnographies in exploring the use of ancient watercraft (McGrail 2004; Whitewright 2009). The *mtepe* of the Kenyan coast, for example, is frequently cited as an example of a traditional Swahili ship, but this usage may disguise regional variations and technological evolution over the course of at least 300 years (Adams 1985: 12). Adams (1985) is at pains to emphasise that the *mtepe* seen in ethnographic records, photographs and nineteenth - twentieth century models may not be an 'ancient' design, as it is so commonly described, but probably represent the latest versions of a product with an unknown lineage (Prados 1997; Gilbert 1998). The qualities of the *mtepe* as recorded in nineteenth or twentieth century ethnographies cannot therefore be ascribed to older craft without due justification based on archaeological evidence. On the other hand, such qualities did not come about by chance, but were the result of observation and innovation on the part of boat-builders and sailors; "the speed of a vessel is a direct result of efficiency in design. In other words, a very fast boat like the *mtepe* is not swift by accident" (Adams 1985; 64). What this means is that maritime ethnographies and descriptions of the *mtepe* provide a comparison to the archaeological evidence and a guide towards the eventual outcome of technical innovation, as well as indications of the common uses and qualities of vessels on the East African coast.

The archaeological and historical evidence of shipping relevant to this discussion of the Swahili Coast and its trade is reviewed here in broadly chronological order. Since the variety of ship design and use must be taken into consideration, vessels have been classified in this chapter in terms of near-shore, coastal, and deep-water/ocean use, with allowance for probable crossovers in daily use. Due to the paucity of evidence relating to either indigenous or foreign vessels on the East African coast in the first millennium however, the discussion that follows is hypothetical and qualitative, rather than quantitative, and further survey and excavation in intertidal and underwater contexts of the kind proposed by Breen and Lane (2003) amongst others, will be required to change this situation.



Bagbla

Batil

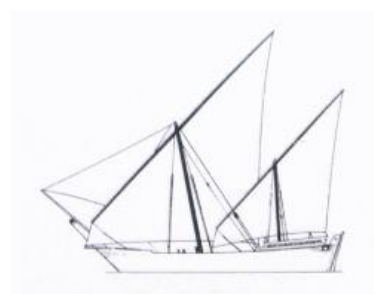
Arabian *bagblas*, *batils*, *baqarabs* and *butairas* no longer exist. Likewise the East African *chebar* and *mtepe* are extinct types. Becoming rare is the *kotia* with its stern windows and carved transom. Indeed, this class of vessel has already disappeared from the Maldives and Sri Lanka. The *nauri* which has a hull similar to a small *dbangi* but carries a *kotia* type of stemhead figure is an elusive dhow that must also be near to extinction. However there are numerous oddities, nondescript hybrid dhows, that sail more particularly in Arabian waters. And occasionally a cut-down square rigger, like the *Vanketswarloo* of Bedi, ventures into Omani and Arabian Gulf ports.



Baqarab



Butaira



BOOMS

Throughout the Arabian Gulf, South Arabia and East Africa (seasonal).



BEDANS

Oman, South Arabia. Occasionally voyage to East Africa. Few exist.



JAHAZIS

East Africa, particularly Lamu and Mombasa (Lamu dhow), Zanzibar and Dar es Salaam.



SAMBUKS

Red Sea, Gulf of Aden, South Arabia, Somalia, East Africa (seasonal), occasionally Arabian Gulf.

Figure 4.1: Various types of 'dhow', illustrated in Hawkins (1977: 138-141)

4.2.1 The *Periplus* and square sails

The earliest reference to maritime activity on the coast of East Africa appears in a reference to the island of Menuthias (Pemba) in the *Periplus of the Erythraean Sea*, which describes “sewed boats, and canoes hollowed from single logs, which they use for fishing and catching tortoise” (Schoff 1912: 28). Sewn-plank hulls are constructed by drilling and stitching upper and lower strakes (planks) together edge-to-edge with cord (Figure 8.2). This means that the hulls are flexible, which may or may not be an advantage, but the semi-independent movement of planks against each other means that they are liable to leak, so caulking or coir is often bound into the join beneath the stitching to try to make the hull more watertight. The comment in the *Periplus* may reflect the novelty of the technique in the eyes of the Greek or Roman author, since by the mid-first century CE the technique was being replaced in the Mediterranean with nailed plank hulls (McGrail 2004). The brief description of the *Periplus* also tells us little about the size of the vessels used on Menuthias except that the use of the diminutive form of boat in the Greek ‘*ploiaron*’ implies small vessels (Chittick 1980:297; Huntingford 1980). The description of logboat canoes is similarly brief, but since no mention is made of the presence of outriggers, which would otherwise help stabilise the craft, it may be assumed based on modern ethnographic parallels in the *hori* and *mtumbwi* of the East African coast that these fishing canoes were primarily near-shore craft (Hornell 1934). The sewn-plank boats meanwhile are likely to have fulfilled the role of coastal and fishing vessels, and the means of crossing the deep-water channel between the Zanzibar archipelago and the mainland coast.

No mention is made in the *Periplus* of the sailing rigs used on Menuthias, but given this absence of comment, as well as the fact that the first unambiguous depiction of settee sails in the Mediterranean dates to the second century CE, and the earliest evidence of settee sails in the Indian Ocean dates to the ninth century (Whitewright 2012), it seems likely that these were square-rigged ships (Horton 1987: 88). The discovery of a deadeye pulley block, block sheave and brail rings at the ports of Berenike (Wild & Wild 2001) and Myos Hormos (Blue *et al* 2011), in keeping with similar contemporary technology in the Mediterranean certainly supports the use of square sails at these Red Sea sites (Whitewright 2015). Square rig refers not merely to the shape of the sail (which is often trapezoidal), but to the rig of the sail on a horizontal yard, which is mounted or hung from the mast perpendicular (square) to the line of the ship (Figure 8.3). A square rig harnesses down-winds from behind the vessel for propulsion, and may be optimised for courses by adjusting the sheets (lines) to the yard, boom, or to the sail itself and allowing wind to ‘spill’ from the edge of the sail. Lateen sails are triangular and settee sails are near-triangular quadrilaterals on a long ‘fore-and-aft’ yard aligned with the ship, rather than perpendicular to it. This arrangement takes advantage of side force to allow a vessel to sail closer to the wind than a square rig, although the success of this is dependent on the combination of hull, mast, and sail design attributes, rather than one single factor (Palmer 2009; Whitewright 2015). This means that, in theory at least, a square-rigged ship is more

likely to be limited in its course by the direction of the wind than a lateen or settee rigged ship, although in practice such characteristics are also subject to the design of the hull and the ability of the sailors. In the context of the Indian Ocean therefore, with its regular and powerful monsoon cycle, the technological evolution of the sail and technical ability of a ship's crew in handling either square rig or settee/lateen rigs can be seen to have been a key factor in maritime activity and trade.

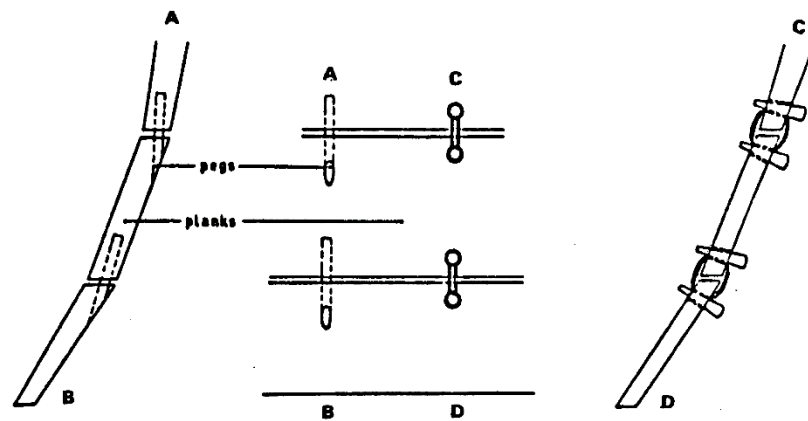


Diagram XII - The mtepe: principles of pegging and sewing

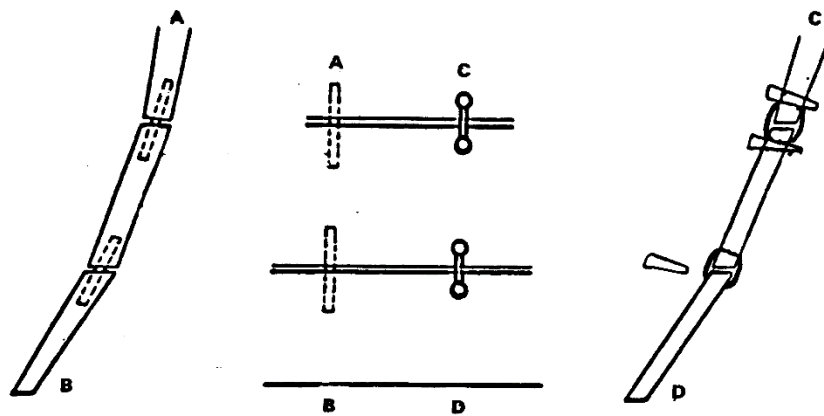


Figure 4.2: Schematic diagram of stitched and dowel pegging in *mtepe* hull, from Prins (1965: 120)

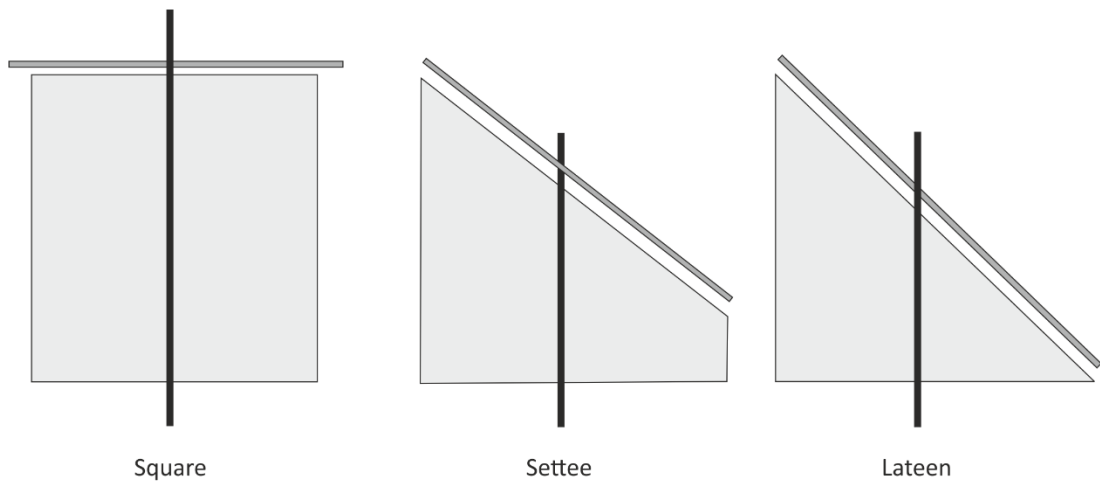


Figure 4.3: Illustration by author of square-rig, settee, and lateen sails.

4.2.2 Shipwrecks of the Indian Ocean

Two unexcavated seabed scatters of ceramics, and a fifth-seventh century CE wreck site were identified off the coast of Eritrea in the Red Sea in 1995, and investigated in 1997 (Pederson 2000, 2008). From the cargo of amphora found scattered across the seabed, the excavators predicted an intended coastal voyage from Aila to Adulis by a sewn-plank Byzantine ship indigenous to the Red Sea (Pederson 2008: 89; Lane 2012). It should be noted however that since no confirmed hull remains were discovered, the identification of this vessel as a sewn-plank craft is entirely theoretical. It used to be generally assumed that although nailed plank construction of hulls had become common in the Mediterranean in the first millennium BCE, and the norm by around 300 BCE, the technique was not known in Indian Ocean boatbuilding traditions until a presumed introduction of the technique by the Portuguese in the sixteenth century (Tomalin 2004: 255). Iron nails found in reused boat-timbers in a twelfth century grave context at Qesir al-Qadim (Blue 2006: 281), and the structure of the Thaikkal-Kadakkappally ship from the coast of Kerala, India (circa. ninth-fourteenth centuries) indicates however that the use of nails to fasten strakes as early as the ninth-tenth century, and could represent a local adoption of Chinese and Sri Lankan techniques seen on visiting merchant ships (Tomalin 2004: 256). To date, no evidence has been found of this technique on the East African coast, but as noted previously, the lack of any shipwreck remains before the thirteenth century may mean that this is simply a case of the absence of evidence, rather than evidence of absence.

The controversial salvage of an Arab shipwreck discovered just off the coast of Belitung Island in Indonesia provides evidence of the survival of sewn-plank construction techniques through to at least the ninth century in the western Indian Ocean. According to the salvagers and excavators it is

likely that the Belitung wreck, also known as the *Batu Hitam* wreck, was originally a double-ended, sewn-plank vessel around 18m in length from prow to stern, around 3m deep, and perhaps as much as 10m in width at the gunwales (Flecker 2001; Wang 2010). The wreck was apparently lying collapsed on its port side on the sea bed, and not all the hull was preserved by the silt. Furthermore, the initial destructive salvage of the cargo and questionable recording of the later excavation of the site means that the archaeological record of the wreck is less than complete. It would appear however that the joints of the hull timbers were tightly packed with wadding both inside and outside the hull, and sewn together with cross-stitches, with no evidence of either dowels or nails to reinforce these joins (Flecker 2010: 101). The cargo was almost entirely of Chinese ceramics, mostly bowls and large storage jars of varying quality, and tightly packed stacks of ceramics demonstrate that these were stored in the base of the hull. The ceiling timbers above this cargo appear to have been removable to allow relative ease of access for loading, and may have formed a partial deck at sea (Flecker 2001). The 10 tons of lead ingots stacked on top of these timbers are likely to have served as a 'paying ballast' to be sold at the final destination of the voyage. The wood of the hull timbers was identified as *Afzelia Africana*, a sub-Saharan African species, the deck timbers were *Juniperus*, and the through-beams and stem posts were teak and rosewood respectively, probably from the Indian subcontinent (Flecker 2008, 2010; Belfioretti *et al* 2012). The design and materials of the ship indicates a possible construction origin on the coast of Oman or Yemen, and the cargo therefore indicates a probable return voyage from a Chinese port of trade. In commenting on the ships design, the excavators suggest superficial similarities with the cross-section and shallow draught of the later thirteenth century Chinese Quanzhou shipwreck, noting in particular Green's comment that the ship was "seemingly designed to carry a relatively light cargo and to sail lightly over the water rather than drag a deep and capacious hull through the water" (Green *et al* 1998; 299). Since the vessel was clearly used for long-distance voyaging, it is reasonable to assume that similar merchant ships were also used for voyages to the coast of East Africa, and the description of both the Belitung vessel and Green's analysis of the Quanzhou ships similarly broad, shallow design therefore provides a useful analogy for this consideration of the Zanzibar harbours.

Evidence of sewn-plank boats has also been found in a twelfth century context at the port of Quseir al-Qadim in the Red Sea, where Indian teak ship timbers were found reused to seal a mudbrick cist tomb (Blue 2006: 280). All but one of these planks had holes pierced along their edges and recessed cuts for cord stitching, and four had remains of coconut coir fibres and pegs to plug the holes after stitching still *in situ* (Blue 2006). A pair of holes found next to a possible frame impression suggest that the frame was lashed to the shell, and bitumen found on the outside of most of the planks indicates its use as a sealant for the hull (Blue 2006).

4.2.3 Shipwrecks of South East Asia

The increase in the quantity of Chinese ceramics found particularly in northern Swahili settlements from the eleventh century onwards demonstrates growing trade connections between the ports of South East Asia and East Africa (Horton and Middleton 2000; Fleisher *et al* 2015; Zhao 2015; Horton forthcoming). Brass ‘Yongle Tongbao’ coins with square holes of the early fifteenth century Ming Dynasty have been found recently at Mambrui (Greste 2010) and Manda (The Field Museum 2013), and apparently in Kuumbi Cave on Zanzibar (Vigano 2014). Whether such finds represent indirect trade connections or direct voyaging around or across the Indian Ocean, and by whom, is debatable. There are some indications of a route known to Indonesian sailors, and later to Red Sea merchants, across the Indian Ocean from Indonesia via the Maldives to East Africa utilising the *waq waq* winds (Hall 2010). Chinese records of imperial voyages in the early fifteenth century however, indicate a coastal route around the northern shore of the Indian Ocean (Hsu 1988). Since the intention here is to review the range of boat and ship types which may be relevant to the use of harbours in the Zanzibar Archipelago, this section addresses those South East Asian or Chinese vessels which could have made the voyage into African waters.

As well as the above-mentioned ninth-century Belitung ship, the number of ship remains identified in the waters around South-East Asia is slowly increasing (Manguin 1993). From the fragments of a number of wreck sites around the coasts of Vietnam and Thailand, it would appear that the hulls of South East Asian vessels in the late first millennium were generally constructed from planks held together using treenails, lashed to an internal frame (Manguin 1993; McGrail 2015). Evidence of the persistence of this lashed-lug tradition has been found in the tenth century Intan and Cirebon shipwrecks of the Java Sea (Wu 2016). The Intan ship contained tin and is presumed to have been engaged in regional trade around the Java Sea (Hall 2010). The Cirebon vessel appears to have been an open cargo ship around 32-35m in length (Musée royal de Mariemont 2009). Unfortunately, as with the Belitung wreck, both ships were salvaged, and the publication of results and related materials has yet to occur. As such, few details of either vessel are currently available, and the quality of their respective archaeological records remains to be seen and judged.

The Quanzhou (or Houzhu) ship, of the Southern Song Dynasty, appears to have been a trading ship which was sunk or deliberately scuttled circa 1275 CE whilst returning to China (Green 1983a). This three-masted merchant junk had a v-shaped, keeled hull in the style of the East Asian shipbuilding tradition, a pointed prow and rectangular transom, and a wide deck (Green 1983a; Kimura 2011). It measured 34.6m in length and at least 9-11m in width, was divided internally by 12 bulkheads into 13 cargo compartments, and was estimated to have a load capacity of more than 200 tons (Green 1983a; Guo-Qing 1989; Green *et al* 1998). Amongst the cargo found aboard the Quanzhou ship was incense from South East Asia or Indonesia, black pepper, 2000 cowrie shells, ambergris from Somalia, frankincense from Arabia, and Dragons Blood resin from Socotra (Green 1983a). The variety

of goods has been used by the excavators to highlight the ships involvement in Indian Ocean trade networks, and to predict a return voyage from a South East Asian port. Given the two-year voyage from China to Africa using the monsoon winds, it is likely that this trade was conducted in stages through regional networks (Hall 2010). The division of Chinese vessels into separate cargo compartments with watertight bulkheads was described by both Marco Polo and Ibn Battuta in the thirteenth and fourteenth centuries respectively (McGrail 2015:117). The fourteenth century Shinan ship discovered off the coast of Korea had a similar keel and v-shaped hull to the Quanzhou ship, and was also divided into 8 hold compartments (Green 1983b). The Nanhai No. 1 wreck (also known as South China Sea 1 and the Chuanshan ship) dated to the thirteenth century Southern Song dynasty (1127-1279 CE) and discovered in the mouth of the Zhu Jiang (Pearl River) in Guangdong Province, China in 1987, may also belong to the same boatbuilding tradition, and the extant remains measure 30.4m long, 8.8m wide, and 3.5m deep (Jiao 2010). Kimura classes all of these examples as part of an East Asian shipbuilding tradition used as versatile cargo vessels in coastal and ocean-going trade (Kimura 2011).

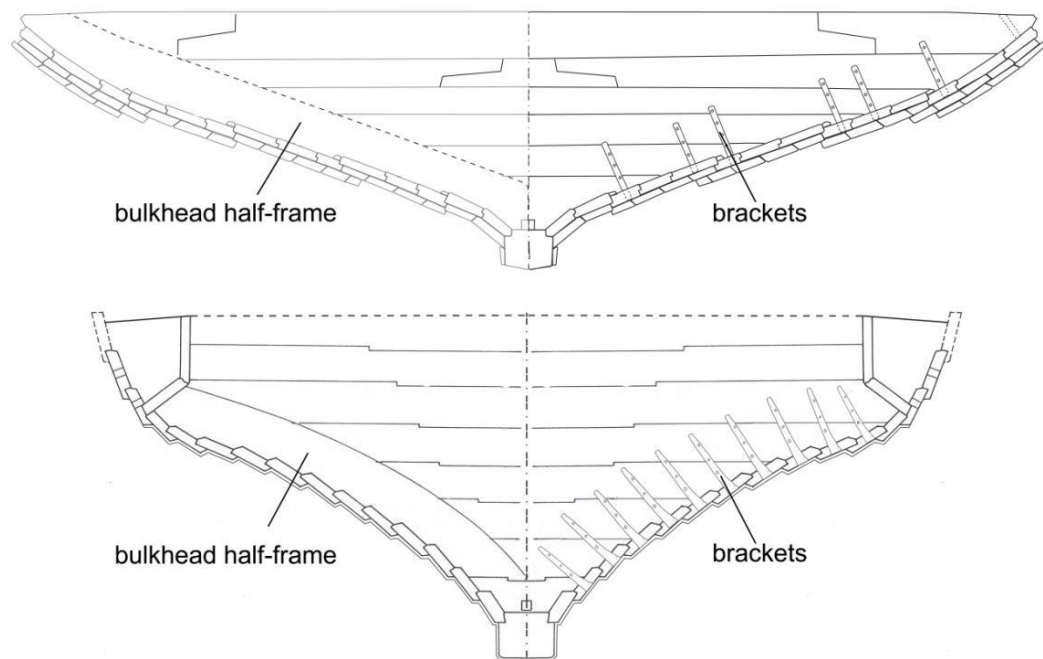


Figure 4.4: South Asian ship designs, from Kimura (2011: 7)

The history of the famous Chinese navigator Admiral Zheng He contains evidence of long-distance voyaging by ships from China to East Africa in the early fifteenth century, and descriptions of an even larger class of vessel than the merchant *jonq*. According to court histories, Zheng He commanded a fleet of around 300 ships, including 62 *baochuan* or large 'treasure ships' on seven missions of discovery and diplomacy on behalf of the Emperor Yongle of the Ming dynasty (Zhao 2015). After

visiting the Persian Gulf during the fourth such voyage in 1413-1415, a part of the fleet was sent on by Zheng He to explore Aden, The Red Sea, and the East African coast. A fifth voyage in 1417-1419 saw the fleet apparently revisit the Persian Gulf and then sail on a diplomatic mission to the Sultan of Malindi in Kenya, and bring back ambassadors to China. The ambassadors were returned to their homelands during the sixth voyage of 1421-1422, when a part of the fleet was again sent on and may have reached Sofala in Mozambique (Bitu 2011: 3). The size and nature of the actual ships in Zheng He's treasure fleet is a source of some debate. According to official Ming histories, the treasure ships were 44 *zhang* long and 18 *zhang* wide, equating to a colossal (and questionable) 137 by 60 metres (Church 2005; Ward 2006). Such massive vessels would have been not only entirely unprecedented, but also the largest wooden ships ever constructed (Ward 2006). Due to a change in imperial policy after the death of the Emperor Yongle though, the ships of the treasure fleet were apparently destroyed after the last treasure voyage in 1433, and all documents related to the voyages were confiscated by the Ministry of War in 1477. Lacking the remains of the ships themselves, excavation of the well-recorded Longjiang shipyards in which the treasure fleet was constructed indicates that the ships were constructed in batches in their basins (Lin 2005). Sally Church has hypothesised that although 130 metre ships may have been theoretically possible, the largest ships of the fleet are unlikely to have exceeded 60-70m in length (Church 2005; Ward 2006; Church *et al* 2012). Compared to the East Asian tradition of cargo vessels classified by Kimura (2011), these ships appear to have been significantly larger, but the lack of comparable remains suggests that they would also have been rare, requiring massive investment both for construction and daily maintenance. The East Asian tradition is therefore likely to have been the more common trading vessel, and may have made up the bulk of Zheng He's fleet.

The thirteenth century East Asian tradition exemplified by the Quanzhou, Shinan and Nanhai shipwrecks consisted of pegged and nailed clinker-hulled vessels, with keels and internal watertight bulkheads (Kimura 2011). The consistency of size and length-to-breadth ratios between these ships indicates a class of sea-going merchant vessels around 30m in length, and the available evidence indicates that they were capable of carrying around 200 tons of cargo, although it must be noted that this is based on shipwreck evidence, and may by implication indicate a dangerous upper limit rather than a safe sailing capacity. By comparison with the contemporary Arab vessels of the Persian Gulf and Red Sea these South East Asian craft were generally longer, broader in beam, and deeper in draught. Allowing for a larger class of *baochuan* craft in the treasure fleet, by the late fourteenth century some craft may even have been as much as 60m in length, with increases in beam scaled up according to a ratio of 2.47, similar to the Quanzhou and Shinan ships (Xi 2005; Ward 2006:13). Polo noted that the sea-going ships vessels at Zaytun (Quanzhou) carried or towed smaller boats as tenders and for fishing (McGrail 2015:118). Alongside the composite anchors found with each of these examples, it seems that these cargo vessels were designed and rigged for offshore anchorage, rather than beaching, and relied on their tenders for ship-to-shore loading and transport.

The African cargo discovered aboard the Quanzhou ship (Green 1983a), although it cannot be considered proof of voyaging across the Indian Ocean, demonstrates the participation of this class of merchant vessel in the long-distance trade between East Africa, South East Asia, and China by the thirteenth century. The history of Zheng He, meanwhile, records not only the ability of an entire Imperial fleet to sail all the way from China to East Africa by the fifteenth century, but the financial and politically invested confidence to launch such a massive undertaking. It is also worth observing that the dates of departure and westward sailings between October and March, and eastward sailings between April and September indicate that these voyages were timed to utilise the monsoon winds in following the northern route around the coastlines of the Indian Ocean (Hsu 1988). It seems probable then that investment in the treasure fleet was inspired and supported by the stories of sailors and merchants who had sailed or taken passage in the waters of the western Indian Ocean in previous centuries (Sen 2006). It is therefore possible that longer voyages into the Indian Ocean by South East Asian vessels may have occurred before the fifteenth century. Accepting the possibility that such vessels may have made the voyage around or across the Indian Ocean to East Africa, this need for anchorage must be borne in mind when considering the nature of East African harbours.

4.3 Ethnographic Parallels

Having reviewed the relatively limited range of archaeological evidence, the following section will examine ethnographic parallels of watercraft relevant to the Swahili Coast. Following the suggestion by Sheriff (2010), Falck (2014) and others that East African craft are best categorised by functional criteria rather than specific construction, the following section has been grouped according to maritime areas of operation as ocean-going, coastal, and near-shore craft.

4.3.1 Ocean-going ships

Many of the common cargo vessels seen around the coasts of East Africa and Arabia today are modified designs or replacements of older craft (Sheriff 2010). Design changes have occurred to allow for greater cargo capacity, requiring alternative construction techniques; for improved propulsive capability or manoeuvrability, as in the replacement of masts and sails with inboard engines; or in response to the development or availability of alternative materials with some beneficial property (Agius 2002). In some cases, this has meant modification of a vessel's design but the retention of a class name, as in the case of the *sanbuq/sambuk*, whilst in others new variants have been designed or found which have led to the replacement of one class with another for the same purpose, as in the case of the *baghala* (Sheriff 2010). Whilst the twentieth century saw many

such modifications and the near-extinction of many types of craft around the western Indian Ocean, such changes are not exclusively modern, and should be regarded as part of a constant process of adaptation to fit a changing maritime world (Agius 2002; Sheriff 2010). Sheriff (2010: 31) has also pointed out that such changes are not necessarily 'linear', but may occur in response to local requirements, leading to regional variants which remain ostensibly within a single class. Since his work already provides a useful classification of vessels and a brief discussion of modern variations in name, form, and use of 'dhows' in the western Indian Ocean, the following paragraphs will deal with those examples with most relevance to the Swahili coast.

The *baghala*², now known only in a few examples in the Persian Gulf, is a massive, high-sided cargo vessel up to 30m in length, with a deck and a high square transom stern (Hawkins 1977; Agius 2002; Sheriff 2010). The type originated in the Persian Gulf and was extremely popular in the nineteenth century as an ocean-going ship displacing up to 500 tons (Stigand 1913; Hawkins 1977). Stigand (1913) noted that some *baghala* were double-hulled for strength, and that a number of regional variations could be observed in Zanzibar, Somaliland and Muscat. Although there are some suggestions that the *baghala* was hard to handle in heavy seas, the vessel is noted as an example of the replacement of one type of vessel with another for reasons of cost and profit, rather than significant technical maritime advantage or 'improvement' (Hawkins 1977). It also provides an example of one of the deepest-draught vessels known to have originated in the western Indian Ocean and been used for trade on the Swahili Coast. In doing so, it was too large and heavy to risk regular beaching except for occasional maintenance, and was moored at anchor in deep water (Al-Hijji 2001; Agius 2002). As with many other mooring vessels, loading took place via tenders, which were often carried aboard ship or towed astern when not in use (Hawkins 1977).

The *sanbuq/sambuk* is a versatile ocean and coastal freighter, with a transom stern, and a long history of use. It was named in the tenth century by Buzurg as a trading vessel operating between Sri Lanka and China, and by Ibn Battuta in the fourteenth century as a coastal vessel at Mogadishu, and the type remained in use into the twentieth century (Sheriff 2010:95). The class demonstrates significant regional variation however, presumably according to local requirements and use. Whilst most *sambuk* have an escutcheon (shield) shaped transom, in Dhofar on the coast of Oman the *sambuk dhofari* is a double-ended sewn-plank craft (Sheriff 2010: 95). The references to the type over the span of a full millennium and these massive variations in form suggests a widespread acceptance of modification in order to fulfil local needs, and subsequent non-linear, branching development of maritime technology through incremental innovation. Unlike the massive *bhagala* and *boom*, the *sambuk* often appears to have been anchored close in to the shore in the intertidal zone, supported at low water on poles lashed inboard to the gunwales (Hawkins 1977).

² The name apparently translates as 'she-mule', "being the beast of burden of the sea, in the same way as we call the camel the 'ship of the desert'" (Stigand 1913: 139)



Figure 4.5: Double-ended Boom in Kuwait. Photo by author, 2009

4.3.2 Coastal vessels

The role of coastal sailing freighter is met on the Swahili coast today by the *jahazi*, itself a descendant and successor of the *sanbuq* used in East Africa, whilst the common fishing vessel is the *mashua*. Both ships are nail-fastened plank-built sailing vessels with transoms, with the *mashua* around 8 – 12 metres in length, and the *jahazi* ranging between 15 – 20 metres (de Leeue 2005:8). Either vessel may occasionally perform alternative and overlapping functions as required by local circumstances. Whilst the two classes are fairly similar in construction techniques, the *jahazi* is recognisable for the distinctive mat ‘curtain’ hung from a rail above the gunwales of the ship, and a removable cloth or *makuti* thatch roof, which serve together to extend the apparent freeboard and protect the cargo under voyage (Hawkins 1977; Falck 2014) (Figure 8.8). Both vessels are apparently constructed in an Arab style using iron nails, and are likely to have been introduced to or developed on Zanzibar in the nineteenth century during the period of the Omani Sultanate (de Leeuwe 2005). They should not therefore be considered examples of earlier first millennium craft, but are noted here as an example of the overlapping roles and design innovation of ostensibly different classes of coastal vessel, and for the insights which can be gained from their mooring practices. Both *jahazi* and *mashua* are almost invariably moored at anchor rather than being deliberately run up to the

shore and beached for landing and loading, albeit moored in the intertidal zone. The reasons for this are discussed below in relation and contrast to the sewn-plank *mtepe*. In order to prevent the craft tipping over as the tide recedes and flooding as it rises, both types of vessel may carry support ‘legs’ which are usually lashed to a stout boom just forward of the mast-step. The purpose of these legs is compared to those recorded in use on the *mtepe* below.



Figure 4.6: Jahazi under sail in Kilwa Archipelago, Tanzania. Photo by author, 2013

The *mtepe* of the Kenyan coast, although now extinct, has become the go-to example of a ‘traditional’ Swahili coastal vessel. The *mtepe* (pl. *mitepe*) was a shell-first, sewn-plank ship with a square-rigged palm-matt sail, an overhanging prow and a square transom at the stern (in contrast to the double-ended *dau la mtepe*) (Adams 1985: 5). The *mtepe* was frequently named and recorded in the nineteenth and early twentieth centuries as a coastal cargo and slaving vessel. The full antiquity of the *mtepe* is unknown, but the earliest report of a craft resembling the type appears in Duarte Barbosa’s sixteenth century account of the East African coast, in which he describes in the Zanzibar Archipelago “small vessels, very loosely and badly made, without decks, and with a single mast; all their planks are sewn together with cords of reed or matting, and the sails are of palm mats” (Barbosa 1866; 14). By the nineteenth century a second variant of the craft was known as the *dau la mtepe*, probably the source of the term ‘dhow’ so widely adopted by European sailors (Hornell 1934; Gilbert 1998). The *dau la mtepe* was distinguished by its shorter keel, longer overhanging prow, and overlapping bow breasthooks without stem-post in the *dau la mtepe* compared to the affixing of

strakes directly to the stem- and stern-posts in the *mtepe* (Hornell 1941; 56). The unusual breasthook construction of the *dau la mtepe* appears to have been a later design innovation to strengthen the bow of the craft for regular beaching, and should not be considered a part of the older *mtepe* tradition (Prins 1982).



Figure 4.7: Mashua moored in intertidal zone of harbour at Unguja Ukuu, Zanzibar. Note legs lashed to a boom just forward of the mast. Photo by author, 2014

On the rationale that a technological product may be considered the combined result of both collective experience and innovation, it is likely that the East African *mtepe* bore some resemblance to older craft of the Swahili coast. However, since *mtepe* have undergone various modifications in overall design and detail even since the sixteenth century (Hornell 1941; Adams 1985), direct comparisons with the ‘sewed boats’ of the *Periplus* (Casson 1989) which have been proposed by some (Stuhlman 1910; Stigand 1913; Pearce 1920;) are unjustified. For the purposes of this analysis however, the careful and thorough qualitative analyses of individual components of the *mtepe* design, especially those by Hornell 1941), Adams (1985), and Gilbert (1998), provide important and valuable observations for the consideration of the development of maritime technology and spaces in East Africa in the first millennium.

By most accounts, the *mtepe* was a versatile and popular craft, carrying up to 20 tons of cargo depending on the size of the vessel (Burton 1872). Recorded examples appear to have varied

considerably in size with keel lengths between 16.5 and 28.5 metres (Gilbert 1998). It is reported to have been fast and agile, and surprisingly effective even when sailing towards the wind for a square-rigged ship, able to outperform even lateen and settee-rigged contemporaries (Burton 1872; Stigand 1913; Pearce 1920; Hornell 1941). Sir Richard Burton himself appears to have been particularly struck by the vessel, noting in typically poetic fashion that the *mtepe* “swims the tide buoyantly as a sea-bird...and can go to windward of everything propelled by wind” (Burton 1872:73-74). Adams uses the efficiency of the craft to suggest that “the design which produced this efficient sail system may have been a relatively recent innovation, but a more plausible explanation, considering the antiquity and efficiency of the hull and mast assembly, was that the design was the product of thousands of years of refinement” (Adams 1985; 68).



Figure 4.8: Undated photo of *mtepe*, beached prow-first in intertidal zone. The *makuti* thatch roof is visible over the deck behind the mast From Mann (2013) <http://www.rafikiproductions.com/films/>

As well as its speed and the efficiency of its rig, the craft appears to have been deliberately designed and modified to take advantage of the flexibility of its sewn-plank hull. Gilbert (1998) attributes the survival of the craft into the twentieth century to its ability to cater to its environment which, as noted elsewhere in this thesis, consists for much of the East African coast of coral reefs, platforms, and wide beaches, or else by dense mangrove forests with narrow and shallow tidal creeks. Like most sewn-plank vessels, the hull of the *mtepe* was flexible enough to endure daily beaching in the

course of landing and loading in all of these environments (Burton 1872; Steere 1872; Ingram 1931; Chittick 1980; Gilbert 1998). Adams theorises that the stitches of sewn-plank craft may absorb the shock of impact, and even if damage is eventually accumulated, the stitching is more likely to suffer than the planks or strakes (Adams 1985: 91). Adams (1985) contrasts this with nailed-plank hulls, which being more rigid may suffer more from this type of impact, and the nails which bear the brunt of the shock can snap or work their way loose over time³. On the other hand, this theory must be contrasted with the evidence of the remains of the fifth century BCE Ma'agan Michael sewn-plank shipwreck discovered off the coast of Israel (Linder and Kahanov 2003). Whilst the sewn-plank shell of this ship was nailed to an internal frame, it was fastened to the stem and stern posts by stitches, and the holes of these stitches show considerable wear and stress caused over a significant period (Kahanov *et al* 1999; Linder and Kahanov 2003: 126). It is not clear how the planks of the *metep* were fastened to the stem and stern posts, although Chittick notes that they appear to be fitted into a rabbet on the posts (Chittick 1978: 4; Adams 1985: 38). The posts were themselves constructed of two parts joined by a cylindrical mortise and tenon, which Adams (1985: 38) allows for twist to relieve torsional pressures at sea. Observations by Burton (1872) and Stigand (1913) may offer some support of Adams (1985) theory though. Burton noted that the hull of the *mtepe* enabled it to withstand "any amount of bumping and grinding, nor is it ever beached for the S.W. monsoon" (Burton 1872:74). Stigand similarly noted that "it can sail as close to the wind or closer than any of the vessels of this coast, it is swift and steady, and does not have to lie idle during the greater part of the year waiting for favourable winds, as does the baghalah, while the elasticity of its make allows it to stand any amount of bad weather and hard usage" (Stigand 1913:142). The durability of the craft undoubtedly made it popular, but its windward sailing capabilities and continued use even during the winter season of the south-west monsoon winds must have been enormously valuable to local communities before the widespread availability of motor vessels. These windward sailing capabilities and the flexibility and durability of the hull also have implications for the value of sewn-plank hulls on this coast.

The combination of features which enabled this ability have been analysed in detail by Adams (1985), and are summarised here for value as insights into older sewn-plank craft in this environment. The *mtepe* is a shell-first craft, meaning that the first few lines of strakes are attached directly to the keel and edge to edge with each other to form the 'shell' of the hull before frames are then laid inside the hull to maintain the growing shape of the craft (Adams 1985: 30). Caulking was laid into the plank edge joins and bound in by the stitching as part of the sewing process, so that it formed an integral part of the attempt to waterproof the join, as well as providing a shock-absorber between the strakes to account for twisting under sail (Adams 1985: 32). This may not have succeeded in entirely preventing leakage, but may have reduced it enough to support the continuing

³ This factor might add context to a reported superstition from Madhya Pradesh that if iron was used in ship construction "magnetic rocks would drag iron-fastened vessels to their doom" (Mookerji 1912:14 cited in Tomalin *et al* 2014: 257)

use of this type of craft rather than converting to nailed or pegged hulls. The frame of the *mtepe*, inserted after the lower strakes of the hull has been connected, was only lightly bound to the planking, and served both to maintain the shape of the hull and to distribute the weight of cargo and pressures placed upon the frame within the vessel (Adams 1985: 42). The loose binding did not prevent the movement of planking against the frame, however, which allowed for a certain amount of twist in the hull whilst at sea (Adams 1985: 74). End to end scarf joints between strakes in each level were also relatively loose to allow for movement and twist in the hull. The stem and stern-posts meanwhile were lashed, rather than scarfed, onto the keel to allow for twisting which might otherwise snap them, whilst focusing movement of the posts around a single point and retaining some control of this movement (Adams 1985: 73). Furthermore, the scarf which joined the two halves of the stem-post was long and rounded to a cylinder, rather than rectangular as might be found on a western vessel, which allowed the two halves to twist and rotate independently, reducing torsional pressure (Adams 1985: 91). These innovations may have improved both the performance of the craft at sea and the durability and lifespan of the vessel, although Adams (1985) himself notes that these theories are untested and remain theoretical given the loss of 'living' *mitepe* and of associated boatbuilding or sailing knowledge.

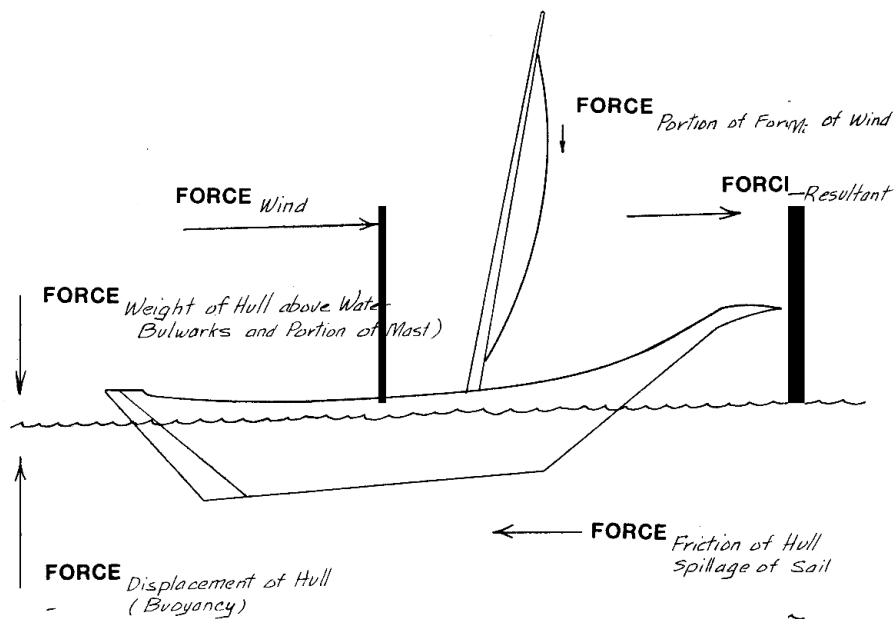


Figure 4.9: Schematic diagram of *mtepe* hull design demonstrating theoretical forces exerted on vessel, from Adams (1985: 61)

The use of the sail and rig of the *mtepe* also presents an intriguing combination of features for consideration. Whilst the matted palm-frond sail is known to have leaked wind, and according to experimental reconstruction added considerable weight compared to a cloth sail, it would have

been relatively inexpensive to produce or replace, and could indeed have been replaced every season to counter rotting of the fibres (Lydecker 1919: 88). The mast that carried this sail on the *mtepe* was stepped above the keel, and according to Adams (1985: 66) was canted forward in such a way that it rested in a notch in the lower thwart and against the upper thwart. This arrangement transferred the weight of both the mast and sail, as well as downward pressure exerted by the force of the wind upon the sail, through the thwarts into the bulwarks, pressing down upon the strakes and thereby increasing the 'competency' of the hull (Adams 1985: 95). That is to say, the weight of the mast and sail and increases in wind actually improved the hull strength against the increased pressure of the water exerted upon it by the vessels speed. "Therefore, the hull was essentially self-tightening or self-compensating" (Adams 1985: 95). In the western tradition, hull strength is drawn from the rigidity of the frame, and significant flexibility may be considered a weakness but the combination of the *mtepe* design characteristics allowed for the absorption of the considerable and varying pressures of movement and flex which are a constant factor of any voyage (Adams 1985: 92).

As well as the surprising versatility of its square sail, Steere described the *dau la mtepe* he encountered on Zanzibar as utilising alternative means of propulsion; "When there is no wind they generally keep in the shallows, and push the boat on by means of long thin poles" (Steere 1872: cxlv). The shallow draught of the vessel apparently makes the vessel well-suited for near-shore as well as coastal sailing, and Gilbert similarly notes that the crews often carried oars or poles for punting, enabling access to creeks for mangrove harvesting (Gilbert 1998). On the other hand, the stitching of the craft creates some drawbacks. Adams emphasises that the "structural competency of the hull coming from the applied buoyant force of the water" (Adams 1985: 293) means that the *mtepe* is designed in such a way that the water contributes an essential component of the overall design, and without which the vessel is structurally weakened. Whilst unsupported by the pressure of the water though, it is possible for the hull to sag out of shape, or along a plane and in a direction in which it is not intended to flex. Although its ability to withstand regular stranding made it popular for creek work and for harvesting and carrying mangrove timbers, the hull of the *mtepe* was unable to endure being laid up or stranded on its side, as the weight of the craft had the potential to twist and break the boat. Sewn plank boats frequently require support in an upright position when beached in order to prevent damage from sagging, twisting, and ultimately collapse, and the *mtepe* was supported during beaching by a pair poles lashed to the beams or thwarts, so that as the tide receded the vessel would simply settle or tilt slightly on these 'legs', remaining upright and in shape. Adams also draws attention to Pearce's report that *mtepe* were never used to carry cargos of coconuts, and hypothesises that far from being the "deep-founded superstition" postulated by Pearce (1920: 30), this may have been because the size of individual coconuts meant that the overall density of the cargo would have rested directly on the planking, rather than on the transverse frames of the craft, placing a potentially compromising strain on the stitched seams of the hull

(Adams 1985: 77). The example provides evidence of both the limitations of sewn-plank craft and the probable need for a variety of boats for different purposes.

The elasticity provided by the stitching also came with a maintenance cost; according to Hornell (1941), the craft were taken apart every winter and restitched in the spring. According to Hornell (1941) the *mtepe* was apparently replaced in common use by the *sanbuq*, itself originally a shell-first, double-ended sewn-plank sailing craft, but which has evolved incrementally into a frame-first nailed craft with a transom, powered by an inboard engine (Hornell 1941; Prados 1997). Before the adoption of the engine Hornell lamented that the lateen rigged *sanbuq* was “inferior in speed to the square rigged *mtepe* and *dau*, nor can it point so close to the wind” (Hornell 1941: 55). In spite of this, the maintenance cost of the *mtepe* probably explains why the craft was eventually replaced by the less manoeuvrable, but conveniently low-maintenance modern form of the *sanbuq*.

As noted at the start of this review, the *mtepe* represents a unique combination of all its design innovations, and one which may only have been produced in the second millennium. However, either by chance or design, it is likely that some of the advantages of the craft can be considered as long-standing features of older sewn craft, retained for deliberate advantage. We know from the *Periplus* (Casson 1989) for example, that sewn-plank craft were being built and used on Pemba in the first century CE, and from the example of the *mtepe* that in one form or another they remained in use on the Swahili Coast into the twentieth century (Burton 1897; Stigand 1913; Hornell 1941; Adams 1985; Prados 1997; Sheriff 2010). The deliberate continuation of this boatbuilding technique alongside alternatives may therefore be theorised to be due at least in part to its durability in the face of regular beaching on the sandbanks, mudflats, and coral of the East African coast. The relative simplicity of replacing individual strakes in the course of annual maintenance and restitching is also likely to have held long-term practical appeal. On the other hand, the flexibility of the hull under-sail means that leaks are an inevitable and potentially serious problem. Adams (1985) argument suggests that the *mtepe* was designed with various features intended to either minimise this risk, or provide alternative advantages which outweighed the problem. The origins of these features are unknown, but are likely to have been the product of many years of small, evolutionary innovations. At present for example, there is no evidence to suggest use of the *mtepe*'s canted mast, or rounded stem and stern-post scarfs on ancient East African watercraft. Palm frond sails were certainly used in the western Indian Ocean in the ninth century, and may have had economic advantages over the use of valuable cloth. It is therefore possible that the weight and design of this square rig contributed unintentionally to hull strength in sewn-plank craft in ways that were later deliberately developed and built into more recent craft such as the *mtepe*.

4.3.3 Near-shore canoes

As well as coastal craft, a good deal of ethnographic information is available on the use of canoes on the East African coast from both nineteenth and twentieth century sources. Two types of dugout canoe are common on Zanzibar; the *mtumbwi* and the *ngalawa* outrigger. Both of these small craft are used for fishing and as tenders to vessels at anchor. *Mtumbwi* (Figure 8.10) are dugouts driven by paddles or poles, which are generally restricted to rivers, estuaries, and shallow waters within the protection of reefs, probably due to the relative instability, especially in surf (Weiss 1973:177). Similar dugouts on the mainland coast are known as *hori*, presumably a variation on the *huri*, an extended type of dugout or sewn-plank vessel originating in India, transported and sold across the Indian Ocean and built, until recently at least, in Somalia (Chittick 1980). *Mtumbwi* are frequently used on the Swahili coast today as lighters to ferry passengers and cargo between the shore and ships at anchor, and for fishing within the near-shore coastscape. *Ngalawa* on the other hand are expanded logboats with a pair of plank outriggers lashed to long booms stretching across the gunwales (Figure 8.11). The outriggers of the *ngalawa* provide dynamic stability (as opposed to the static stability of floats), whilst plank gunwales, wash-strakes, and a shovel shaped bow are frequently added to the better craft to improve the seaworthiness of the vessel in coastal waters (Falck 2014). The vessels are rigged with a small mast and lateen/settee sail, and Burton's account provides a typically vivid description of the use of the *ngalawa* in Zanzibar harbour, where "mosquito fleets of 'ngarawa' or monoxyles cut the wavelets like flying proas, under the nice conduct of the sable fishermen, who take advantage of the calm weather" (Burton 1872:71). Stigand similarly noted that "the outriggered *ngalawa* is much used by native fishermen, who often manage to get several miles from the shore in this craft; on a calm day they can be seen in all directions plying their trade in these quaint little boats..." (Stigand (1913:136). The repeated comment in both accounts about the crafts use in calm weather is an indication of the limitation of these vessels, which again contextualises and explains the popularity of the versatile *mtepe*.



Figure 4.10: Mtumbwi canoe in Bandarikuu harbour, Pemba. Photo by author (2015)



Figure 4.11: Ngalawa outriggers on beach at southern end of Makime Peninsula, near Unguja Ukuu, Zanzibar. Photo by author (2014)

The use of both the *mtumbwi* and *ngalawa* canoes enables the efficient exploitation of the near shore and shallow waters around the coast of Zanzibar by individuals, as well as by assembled crews. The antiquity of the use of *ngalawa* is uncertain however. Haddon (1918) and Hornell (1919) noted the lack of outriggers around the coasts of Africa anywhere other than East Africa, the Comoros and Madagascar to suggest the *ngalawa* was adopted following contact with visiting Indonesian sailors. Similarities in the attachment of outrigger booms to the hull are particularly noted between Indonesian and Madagascan canoes, whilst Hornell explains the different dual arrangement of outriggers on the East African coast, as opposed to the single float of the Comoros and Indonesia, to 'degeneration' from an earlier form (Hornell 1919: 98). This diffusionist argument is overly simplistic and downplays the innovative agency of African sailors, but the lack of any other type of outrigger in either the historical literature or archaeology of the Swahili coast does seem to support an adoption or adaptation of Indonesian designs, perhaps as late as the nineteenth century (Haddon 1918; Weiss 1973). This late introduction means that the *ngalawa*, or any similar outrigger technology, should not be considered a feature of the first millennium maritime environment. The dugout canoes noted in the *Periplus* (Casson 1989) as being used for fishing are therefore more likely to have resembled something like the *mtumbwi* of Zanzibar or *hori* of the mainland coast, driven by paddles and limited to use in shallow reef waters, rivers and estuaries.

4.4 Predicted development of East African maritime technology

The ethnographic evidence demonstrates that modern Swahili sailors have access to a broad range of vessels which allow them to exploit a wide variety of marine environments in craft adapted for the purpose. The archaeological evidence is not sufficient however to demonstrate the same range in the first millennium. Based on the account of the *Periplus* (Casson 1989) we know that in the early first millennium the occupants of Pemba used dugout canoes as well as small sewn-plank craft for reef and estuarine fishing. It is reasonable to assume that the dugouts were not entirely dissimilar to the *mtumbwi* and the *hori*, and are therefore likely to have been restricted by a relative instability in surf to areas of sheltered water within the protection of reefs and estuaries. We may speculate, based on the forms of later vessels, that the sewn-plank craft are likely to have been double-ended, undecked, and rigged with square sails, presumably of reed matting. Given the islands' positions we can also assume that the craft and their pilots were capable of crossing the deep waters of the Pemba channel, and therefore of conducting at least limited coastal voyages. Having said this, the narrative of the *Periplus* implies that it was foreign merchants who were responsible for the long-distance trade of the time, and we have little evidence to suggest that the African sailors were inclined to make long-distance voyages themselves (Vernet 2015).

After a period of possible abandonment of the archipelago, Pemba and Zanzibar were resettled in the sixth – seventh centuries. The nature of the early coastal settlements, their subsistence strategies, and notable cultural connections indicates a level of sailing proficiency, if not yet an outward maritime identity. In terms of the form and technology of the vessels used in this period however, we are forced to speculate on an intermediate position between known data from the first and tenth centuries CE. We may assume that the dugout canoes were little changed from the earlier period of occupation, since they remain in use with little predicted variation today, except for the addition at some point of wash-strakes on the better examples of the craft. We can also assume that sewn-plank craft with square sails were still the norm, since as noted at the start of this chapter, there is little evidence for the adoption of settee sails in this region of the western Indian Ocean until around the ninth century, or for the adoption of nail-fastenings until the sixteenth century. Whilst the ubiquity of the Tana Tradition at settlements up and down the Swahili Coast in this period demonstrates a common maritime ability, it is suggested here that the nature of the predicted maritime technology indicates that this coast was bound primarily by local and regional maritime networks, rather than by long-distance voyaging from one end of the coast to the other.

We must set aside the lingering negative attitude towards sewn-plank craft embodied in statements like that of Marco Polo, who described the sewn boats he saw in Hormuz the fourteenth century as “wretched affairs... 'tis a perilous business to go a voyage in one of those ships, and many of them are lost” (Yule 1903:108). It should instead be recognised that these craft, in the hands of technically proficient sailors, were used to settle the Zanzibar Archipelago, exploit shallow- and deep-water marine environments for subsistence, and to establish a trading network which connected the entire Swahili Coast. Given the topography of the coast which was introduced in Chapter Two, and the flexibility and strength of the sewn-plank craft described above, they appear to have been used not because of a lack of alternatives, but because they were most appropriately equipped vessel for the environment and requirements. In making this conscious act of agency though we might expect some technical innovations and growth in the size of these vessels between the sixth and the ninth century in order to increase cargo capacity, or to improve the range and seasonal use of vessels, creating in the process a variety of craft for different purposes.

With this basic model in mind, there are some limitations which must be taken into account. The use of square sails has implications for a vessel’s ability to approach and tack into the wind, which may restrict sailing to particular seasons and favourable winds. Until the general adoption or development of settee sails in the western Indian Ocean around the ninth century, therefore, we must assume that sailing was occasionally or seasonally restricted by the wind and weather. If we take this assumption further, the use of settee and lateen sails from the ninth century onwards is likely to have aided in the expansion of both a ship’s potential voyaging range and sailing seasons. The versatile square-sailed *mtepe* is in this case a rare, but not unknown exception to this rule, capable of sailing closer to the wind than contemporary lateen-rigged ships, but the abnormality of

this example is emphasised by all parties (Stigand 1913; Hornell 1941; Prins 1965; Adams 1985; Prados 1997). The use or otherwise of settee/lateen sails by East African sailors may also help account for the slightly surprising absence of references to Swahili ships and merchants voyaging out to other ports in the Indian Ocean until the mid-second millennium. Having established that East African coastal vessels were used for a wide-range of activities, include deep-water fishing, it may be that a common use of square sails meant that even seaworthy vessels were unsuitable for long-distance ocean voyaging until the adoption of settee rigs. A note regarding the presence of African merchants from Kilwa, Mombasa, Malindi, and Mogadishu in Malacca appears in the account of the Portuguese apothecary Tome Pires around 1512-1515, but apart from this, references to the self-determined presence of East African merchants or sailors venturing overseas are few (Pires 1944; Vernet 2015). Again, this may indicate a predominance of local and regional links over long-distance voyaging in the Indian Ocean trade networks, but it is possible that, in turn, a part of the reason for this predominance may have been the common sailing technology up until the late first or early second millennium.

The range of watercraft indicated by the evidence of archaeology and ethnography serves to emphasise the need for a wide variety of craft to successfully work and exploit this coast, and to which ports and harbours must therefore have been required to cater. The development of such a range may be related to Westerdahl's concept of transport zones, within which specific craft may be chosen or developed for maximum advantage given the specifics of their environment and the purpose for which they are intended (Westerdahl 1995). The examples discussed therefore highlight the necessary maritime skill of the sailors, as well as the role of the boatbuilders and sailors in developing and modifying craft for specific purposes within the context of the East African coast. It should also be remembered however that the modification and adaptation of vessels may be "cultural or cognitive, meaning that the factual effects of it may not have been the intended" (Westerdahl 1995: 1). Whilst some features may be retained across design generations for a specific purpose, others may be unintentional features created by the technological or ritual agency of the mariner, as is generally assigned to the flags and tassels which respectively adorned the stem and stern posts of the *mtepe* (Hornell 1919, 1934, 1941; Adams 1985). Care must be taken therefore in assigning deliberate intention to the development or preservation of individual vessel features.

Having seen how the process of technical innovation can lead to change and branching evolution, but not necessarily advantage, the predicted trend of changing boatbuilding techniques from sewn-plank to nail-fastened hulls around the early to mid- second millennium may have had implications for landing and loading strategies and the exploitation of the coral coastline. Flexible sewn-plank hulls, although leaky, appear better equipped to withstand the regular shock of beaching than more rigid nail-fastened hulls. Since many of the first millennium harbours appear to have been shallow, and perhaps deliberately chosen for their broad intertidal zones, the move towards nail-fastened hulls may have caused some problems for hull maintenance. Many small nail-fastened craft can be

seen at low tide today lying on their hulls or propped on their legs as a preferable alternative to either deliberately running the vessel up onto the beach, as still occurs with *ngalawa* and *mtumbwi*, or to anchoring out beyond the intertidal zone. It is possible then that with the predicted trend towards nail-fastened hulls, the potential damage to vessels from beaching might have led to an increase in the number of ships mooring at anchor either in the intertidal zone or in deeper anchorages further from the shore.

On the same note, the predicted increase in the numbers and average size of visiting nail-fastened merchant vessels to the East African coast from the eighth - ninth century onwards may have put pressure on smaller harbours, especially those with limited shelter from seasonal monsoon winds. The gradual trend towards larger ships and greater variety of vessels means that if this was ever a concern, it is likely to have become one in the early second millennium.

4.5 Discussion

This chapter has presented a review and discussion of the evidence for maritime and ship technology in the western Indian Ocean in the first and early second millennium. The limited available evidence indicates both the technological modification of small, near-shore and coastal East African vessels over time, and the wholesale purchase of ships from around the Indian Ocean to create a wide array of vessels with different capabilities and transport zones by the mid-second millennium. This is likely to have enabled later second millennium Swahili settlements, for example, to have exploited a greater range of marine environments than the early proto-Swahili settlements, and at a greater distance from the point of origin. This in turn might have enabled improved contact within the regional cultural sphere as well as the maritime small world, or increased competition between settlements if outward-bound merchant traders were able to increase the size of their hinterlands and target markets.

It is also suggested here that the requirements of proto-Swahili and Swahili harbour spaces may have changed over time. Adams (1985) theories and Burton (1897) and Stigand's (1913) observations suggest that sewn-plank craft such as the *mtepe* were quite able to beach in most seasons, as well as anchoring. Larger Arabian and Persian vessels such as the medieval *bhagala* however, and the compartmented cargo ships of the East Asian tradition required deeper-water for daily anchoring (Sheriff 2010; Kimura 2011). This might mean, for example, that the need for sheltered anchorages increased over time, and perhaps especially after the eighth - ninth century period as interregional Indian Ocean trade with the East African coast is seen to have increased (Horton 1996; Fleisher 2003; Juma 2004; Flexner *et al* 2008; Fleisher and LaViolette 2013). This may also have had an effect on maintenance requirements and related shoreline activity areas. It may be,

for example, that settlements needed to accommodate an increased demand for iron-smithing in near-shore contexts, in order to cater to ship repairs. Shoreline iron-smithing for this purpose can be seen today at Nungwi and Mkokotoni, for example, on Zanzibar (de Leeuwe 2005). An increase in the number of ships anchoring rather than beaching, on the other hand, may have freed up shoreline space for alternative purposes, and might help explain the apparent expansion of settlements towards the beach and construction of shoreline mosques after the ninth century (Horton 1996; Fleisher *et al* 2015). The effect of increasing trade on shoreline areas is uncertain however, because, as was noted in Chapter Two and will be discussed in relation to Tumbe in Chapter Seven, the trend towards market privatisation around the tenth century (Fleisher 2003, 2010) may mean that trading areas were moving for a variety of reasons.

The analysis presented here and the possible implications of maritime technological change over time will inform the interpretation of the archaeological surveys of case study sites in the Zanzibar Archipelago which follow in the next three chapters. These interpretations will then be returned to in the evaluation of proto-Swahili harbour spaces in the final chapters of this thesis.

Chapter Five

Unguja Ukuu

“The Island of Unjuwa [Zanzibar]. There are twenty anchorages around it. It has a town called Ukuh”

‘The Book of Curiosities’, Savage-Smith and Rapoport (eds.) (2007: fol. 29b-30a, 2: 7)

5.1 Introduction

The earliest record of the place name ‘Unguja Ukuu’ appears to date to the eleventh century, where it appears as an annotation to Zanzibar on a schematic map of the Indian Ocean in *The Book of Curiosities of the Sciences and Marvels for the Eyes*, ‘*Kitab Gharaib al-funun wa-mulah al-uyun*’ (Savage-Smith and Rapoport 2007). The name can be translated literally as ‘The Great/Old town of Unguja’, and the site is regarded as having been the principal port of Unguja Island between the seventh and tenth centuries CE, and a key port of trade in the mercantile networks of the Indian Ocean (Juma 2004; Horton and Clark 1985). It is located on the south-western coast of Unguja island, at the base of a peninsula separating Menai Bay from a long mangrove creek running between Unguja Island and Uzi Island. The first part of the current chapter sets out the landscape of the site and previous surveys in order to convey the context of archaeological research. The second half of the chapter then describes the survey, excavation, and site-level analysis of the proto-Swahili settlement carried out in fulfilment of Objectives Two and Three of this thesis.

5.2 Setting and Landscape

The south-western coastline of Unguja comprises a series of peninsulas and open bays facing out towards the islands of Menai Bay. The archaeological settlement of Unguja Ukuu stands at the base of the Makime peninsula, with a beach on one side, and a mangrove creek on the other (Horton and Clark 1985; Juma 2004). The underlying geology of the area is of reef-limestone, overlain by white subsoils and probable-marl sediments close to the shore, and red laterite soils inland (Caistor 1968: 14). West of the site the soil transitions into apparently semi-exhausted *uwanda* soils (shallow loam on coral or limestone), and further north by shallow red soils, whilst Uzi Island, to the south east, is again thinly covered by *uwanda* soils (Caistor 1968: 14). The nature of these soils means that Unguja Ukuu itself can support more successful agriculture than most of the surrounding region, and the immediate area is still farmed extensively, if not intensively, today (Caistor 1968; Juma 2004; Horton forthcoming).

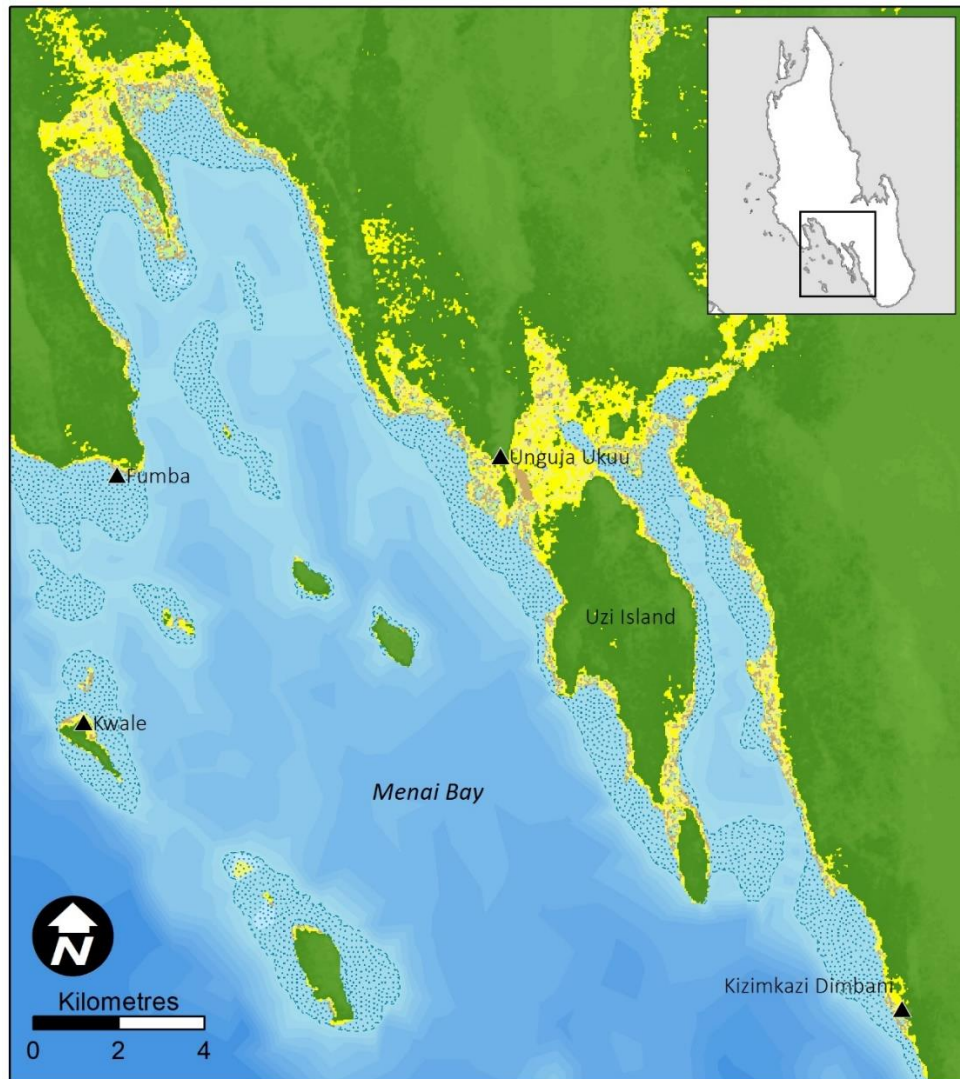


Figure 5.1 Map of Menai Bay in south-west Unguja, showing Unguja Ukuu and known proto-Swahili/Swahili sites. Background DEM is composited SRTM and digitised UKHO hydrographic charts

The open beach of Unguja Ukuu faces southwest into Menai Bay, and is composed of fine white coral sands fringing above a broad coral shelf which stretches from Ras Kigomani on the west, to the southern point of the Makime peninsula. This coral shelf appears relatively flat and even, sloping gently away from the beach into Menai Bay for around 300m, before dropping abruptly away into deeper open water. For the most part the coral is covered by a very thin layer of silt, and although its leading edge floods quickly with the rising tide, the water close to the beach remains shallow until late, with the beach itself only flooding within 2 hours of high tide (Nyandwi 1999). Several small hotels and beach houses, a daily fish-market, an unfinished mosque, and an unfinished museum have been built along the shoreline of Menai Bay, and in the past decade the low-lying area inland of

the raised beach has been cultivated by local farmers for use as cassava fields and a banana plantation.

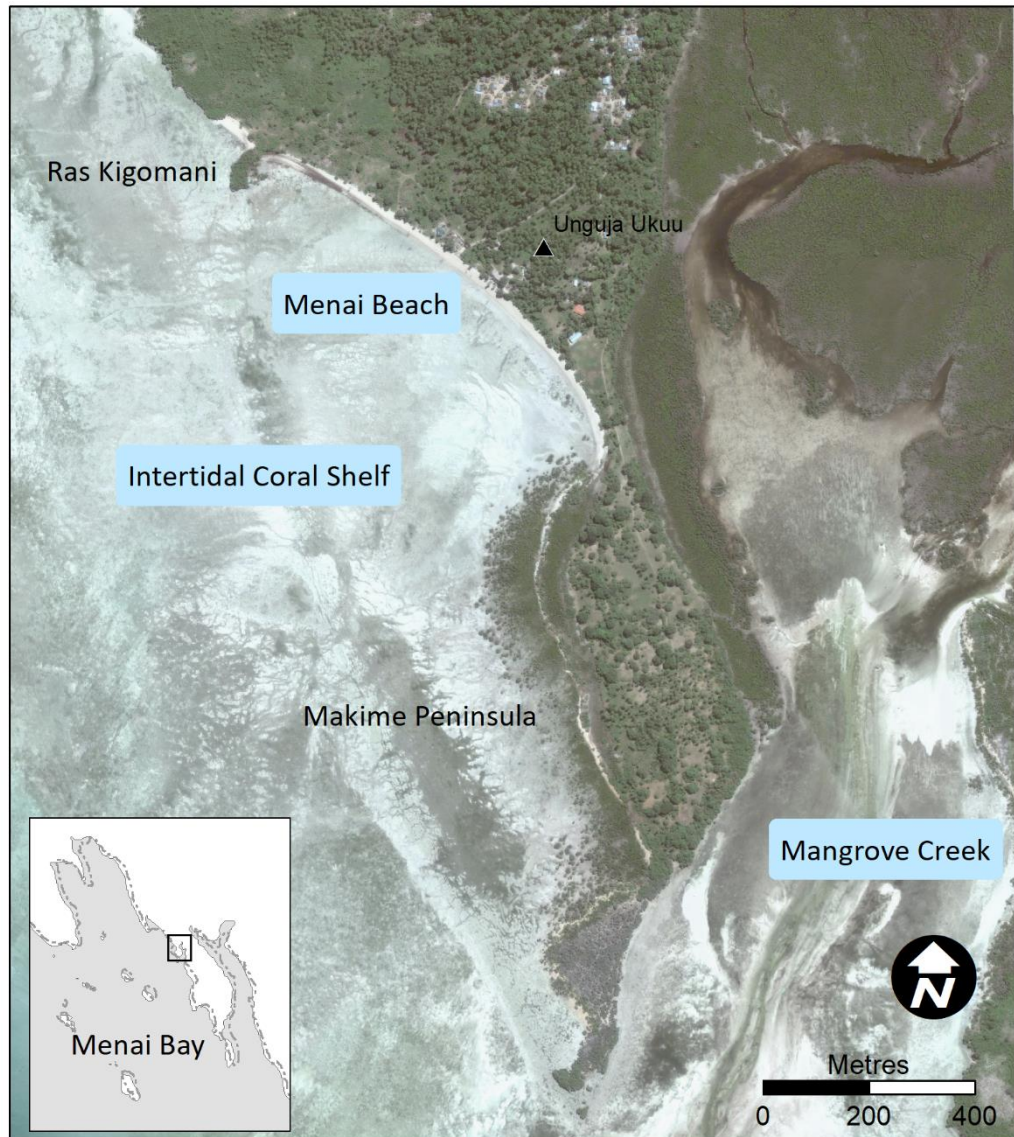


Figure 5.2 Compositing Google Earth satellite imagery in GIS, showing key features of landscape around Unguja Ukuu and Menai Beach

The modern village of Unguja Ukuu lies north of the main archaeological settlement, along a densely wooded ridgeline which descends from inland towards the neck of the peninsula. A Customs Department naval camp built in the 1990s, known as the KamKam, occupies the southern end of this ridgeline, covering an area of stone foundations identified by Horton and Clark, and excavated by Juma (Horton and Clark 1985; Juma 2004). Most of the archaeological site lies on the landward side of the narrow neck of the peninsula, extending from the open beach of Menai Bay on the west to the mangrove creek, and north onto the ridgeline. It is possible that given the apparent depth of

archaeological stratigraphy observed here and the results of Juma's excavations, the ridgeline has been enhanced by occupation and subsequent deposition, and should be considered a potential *tell* site (Juma 2004). Horton and Clark identified middens at the base of the ridge, on the neck of the peninsula, and their test pit UU1 apparently cut into one of these (Horton and Clark 1985: 12). These middens and associated pottery scatters also marked Horton and Clark's estimated southern limit of the site. Expansion of the KamKam in the past decade has involved the bulldozing of this area, although as the results below demonstrate this has not destroyed the archaeological remains entirely.

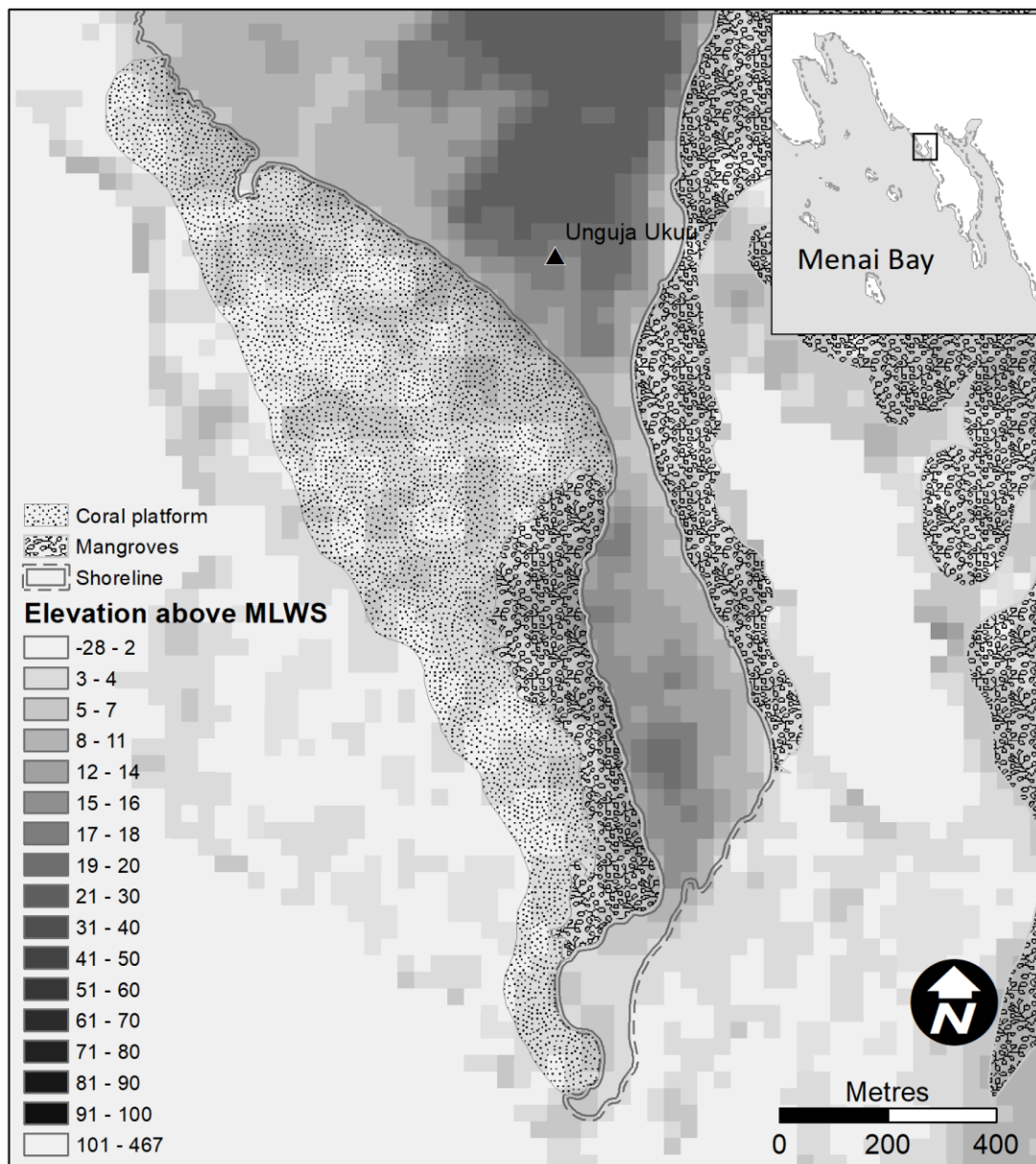


Figure 5.3 Georectified elevation model derived from SRTM GDEM v3. Note that archaeological settlement at Unguja Ukuu lies at base of elevated ridgeline running inland

East of the site a dense mangrove creek with deep silt sediments runs north from Menai Bay between the Makime peninsula and Uzi Island, before trending north-east into the dense vegetation and shallow red soils of Jozani Forest, one of the few remaining, and the only protected area of rainforest on Unguja (Punwong *et al* 2013). The shoreline facing this creek is marked by a narrow strip of beach sand, transitioning with the mangrove growth into deeper peat and silt sediments into the channel (Punwong *et al* 2013). Large quantities of pottery were reported by Horton and Clark (1985: 12) along this shoreline, and while much is still visible today, dumping of bulldozed spoil into this mangrove fringe appears to have changed the topography and make-up of this material.

South of its narrow neck the peninsula extends a further kilometre and a half, widening and rising to around 8m in height. The area is cultivated, with ridge and furrow all along its eastern bank. A tomb and building rubble halfway along its length mark the only recorded archaeological remains on the peninsula (Horton and Clark 1985: 12). A small rocky harbour used by local fishermen lies at the south-eastern tip of the peninsula, and a row of electricity pylons from this point across the channel to Uzi Island mark out an informal low-tide causeway to Uzi Island.



Figure 5.4: Facing east across mouth of creek towards Uzi Island from Makime Peninsula. Electricity pylons to right of cliff mark intertidal causeway. Photo by author (2013)



Figure 5.5 Photo of Menai beach at Unguja Ukuu, taken at mid-tide, facing north-west towards Ras Kigomani from Menai Bay Beach Bungalows (Photo by author)



Figure 5.6 Photo of Menai beach at Unguja Ukuu, taken at low-tide, facing south-east towards Makime Peninsula from Menai Bay Beach Bungalows (Photo by author)



Figure 5.7: Areas affected by bulldozing and shoreline retreat

Locals reported significant beach erosion at Unguja Ukuu, both during fieldwork for this thesis and during Horton and Clark's survey in 1984, and Horton has described substantial tidal damage to the 'Arab House' since his first visit (Nyandwi 2001; Horton and Clark 1985; Horton pers. comm.). To test the possible extent of this erosion and to determine potential taphonomic changes to the site, a GIS comparison was carried out between recent high-resolution QuickBird imagery and archived CORONA imagery captured in 1963, with additional reference material from British Admiralty hydrographic charts dating back to the nineteenth century (UKHO 1875a, 1881, 1897, 1900, 1910, 1916, 1964). The comparison of satellite imagery indicates that the lower line of the beach has receded by around 5-10m over the past 50 years, but the comparison of Admiralty hydrographic charts does not indicate significant variation between the nineteenth and twentieth centuries

beyond that expected through improving cartographic accuracy (Figure 5.7). A study of beach erosion in Tanzania and Zanzibar, published in 2001, concluded that the most significant cause of beach loss at Unguja Ukuu itself has been the quarrying of sand for road construction since the practice was legalised in the 1990s (Nyandwi 2001). The removal of sand and subsequent loss of anchoring vegetation has destabilised the beach, and the report estimated that over the two-year period of 1994-1995, the land-loss at Unguja Ukuu totalled around 5m (Nyandwi 2001: 126). This estimate helps narrow the date range of the erosion observed in the comparison of satellite imagery from an initial estimate of 50 years (between 1963 and 2013), to a far shorter period of 7 years between 1994 and the publication of the report in 2001. Although local reports of erosion prior to this date should not be dismissed, it seems that the most significant loss of beach material has been quarrying and consequential destabilisation, whilst the comparison of hydrographic charts indicates that prior to this the beach was relatively stable for at least 200 years between the nineteenth and the mid-twentieth century.

5.3 Previous Archaeological Investigations

Previous investigations and references to the site include a reconnaissance survey and speculative history by Major Pearce (1920), fieldwalking and test-pits by Horton and Clark in 1984 (Horton and Clark 1985), geophysical survey and excavation by Juma (2004), and further test-pitting for botanical remains by the Sealinks Project in 2012 (Crowther *et al* 2013a, 2013b). Pearce identified Unguja Ukuu as the 'Town of Zanzibar' attacked and raided in 1499 by Ravasco, a Portuguese sea captain (Pearce, 1920: 62). Ravasco reported the capture of four ships in the harbour as a result of his attack on the settlement, and noted the killing of the son of the 'King of Zanzibar' (Pearce 1920: 62). Pearce also wrote that the town was visited in 1591 by the *Edward Bonaventura*, an English vessel which reported the presence of a manned Portuguese factory at the settlement, and that good freshwater could be obtained from a well close to the shore (Foster 1940).

A large number of pegged and sewn-plank vessels, caulked with oakum made from coconut shells, apparently sailed out of the harbour to meet the *Bonaventura* as it rode at anchor (Foster 1940: 7). Pearce's identification of the settlement as Unguja Ukuu, rather than Zanzibar Stone Town, was based on his assumption that Stone Town was not settled until the mid-seventeenth century (Pearce 1920: 62). Horton has identified traces of the twelfth century remains of a settlement known as Shangani beneath the Portuguese fort at Stone Town, and argues that Pearce was mistaken in his identification of Unguja Ukuu as the settlement visited by the *Bonaventura* (Horton and Clark 1985; Horton forthcoming). It is noted here that due to her draught the *Bonaventura* would probably have been unable to approach either the coral shelf of the bay or the mouth of the creek at Unguja Ukuu for fear of running aground, particularly in unfamiliar waters. Whilst the harbour and bay will be

discussed in detail in Chapter Eight, British Admiralty maps of the nineteenth and twentieth centuries suggest a healthy respect for this shoreline, in which the shelf is represented to extend up to a kilometre south of the peninsula (UKHO 1875a, 1881, 1897, 1900, 1910, 1916, 1964). Far from riding at anchor in the mouth of the harbour, the *Bonaventura* would have had to anchor exposed at some distance in deep water offshore, or in the sheltered lee of one of the islands of Menai Bay. By comparison Horton notes that by the late sixteenth century the settlement at Shangani, Stone Town had both a factory and a noted supply of good water (Horton forthcoming).

On the strength of his own visit to Unguja Ukuu Pearce noted that “to land, except at high tide, is a difficult matter, owing to the extreme shallowness of the water close to the shore” (Pearce 1920: 416), setting out his own belief that the main harbour of this settlement must have been situated in the mangrove creek, where he observed vessels both sailing and at anchor (*ibid*). He goes on to state that this is no surprise, since:

“the last thing [the inhabitants] sought was a locality where deep water was contiguous to the shore. The sea, it must be remembered, was in ancient times the resort of slavers and pirates of all nationalities, and it was a supreme necessity for shore folk to sacrifice convenience, so as to preserve themselves and their town from sudden raids.” (Pearce 1920: 416)

Pearce’s interpretation of the harbour appears in this account to be based on an anachronistic and extremely pessimistic assessment of maritime technology which assumes little technological development or landscape change between the occupation of the site in the first millennium and his own experiences in the twentieth century. The account of his visit to Unguja Ukuu also records a single house on the beach, a stone wall described by locals as the remains of a mosque, and a masonry-built well which was apparently the approximate site of a coin-hoard excavated in 1866 and noted by Livingstone during his tenure on Zanzibar (Pearce 1920: 417).

Three more recent episodes of excavation have been carried out at the site, and been used to establish a basic chronology of the site’s occupation. Horton and Clark’s (1985) survey of the site in 1984, as part of a government-sponsored survey of the archipelago’s heritage, included three test pits labelled UU1, UU2, and UU3, and mapped the extent of the site at around 15ha using surface sherd scatters (Horton and Clark 1985: 11). They reported a sequence of occupation extending from the seventh to the tenth century, and a later reoccupation around the fifteenth century based on their ceramic analysis, as well as a series of middens apparently indicative of the limits of the site (Horton and Clark 1985: 12). Test pit UU1, on the low, narrow bridge of the peninsula, was deliberately sited on top of a midden, and demonstrated a 2m sequence of loams, bone, oyster shell, and iron slag, but no evidence of structural remains (Horton and Clark 1985: 12). UU2 was located close to the stone well near the shore, and revealed an 80cm sequence with a limited quantity of daub, whilst UU3 was a little way inland of the area reported locally as the site of the

mosque, and revealed the robbed-out remains of a coral rag and daub wall associated with multiple occupation contexts (Figure 5.8) (Horton and Clark 1985:12). This survey also recorded robbed out coral walls just north of the beach of Menai Bay, attributed by locals to a fifteenth century ‘Arab’ house, and, like Pearce, a local tradition of a mosque which once stood close to the beach (Horton and Clark 1985; Pearce 1920). Beach erosion has significantly damaged the house since 1984, and it is likely that recent construction has either buried or destroyed the remains of the Mosque. The location of the site is speculatively attributed here to the area of the recently constructed ‘Menai Bay Beach Bungalows’.

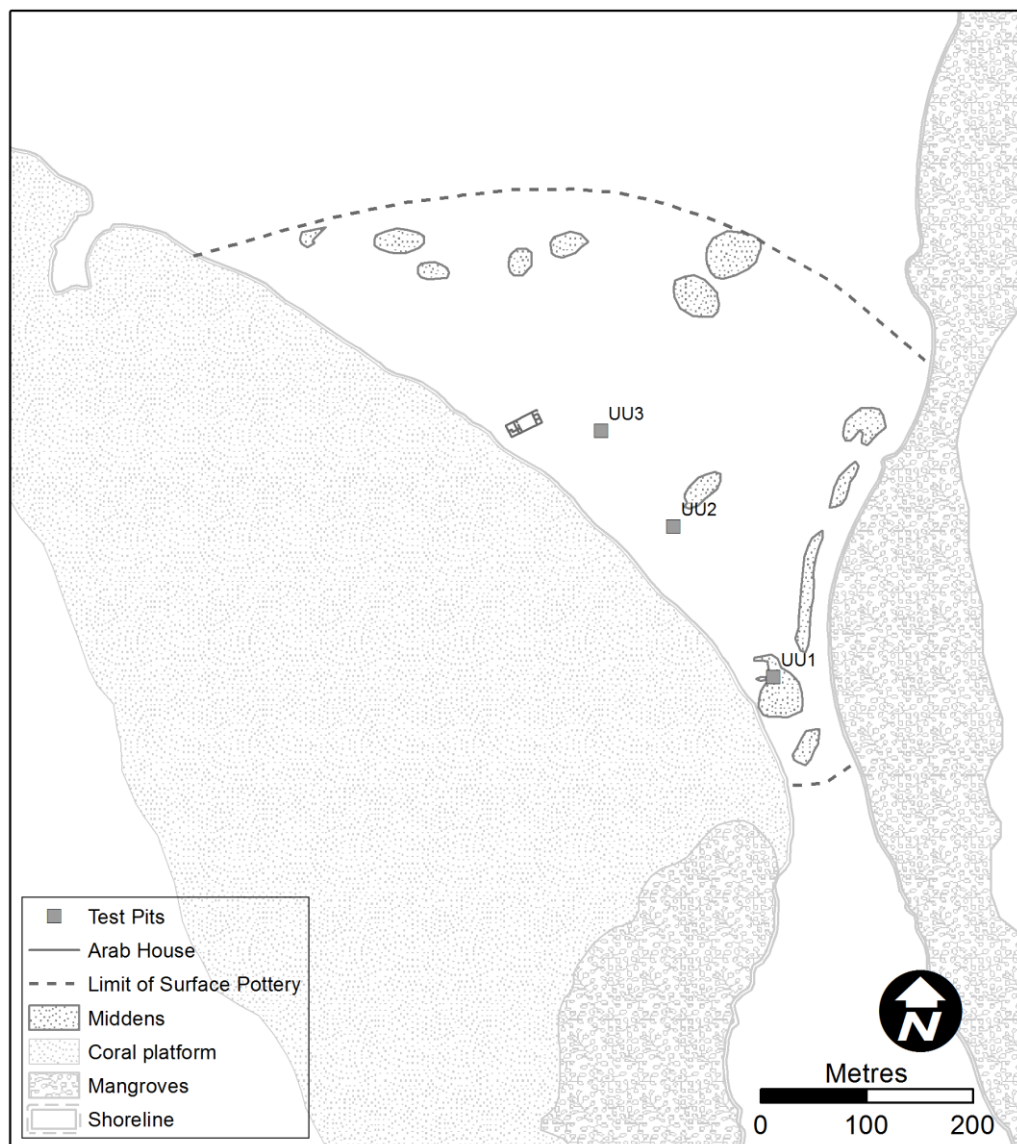


Figure 5.8: Results of Horton and Clark’s survey of Unguja Ukuu (after Horton and Clark 1985: 67)

The results of Horton and Clark’s survey suggested that the main concentration of the site was spread across the northern base of the peninsula and extended 300m inland, and this theory was used as a basis for Abdurahman Juma’s (2004) geophysical surveys and excavations. Juma, who was

involved with the initial survey, returned to the site for several seasons of fieldwork between 1989-1994 as part of his PhD studies at Uppsala University (Juma 1996, 2004). Juma's investigations included both invasive and non-invasive geophysical survey, and a series of trenches which contained the remains of various coral rag buildings and a mosque across the ridgeline which stretches north from the peninsula, in what may be considered the urban zone of the settlement (Juma 2004: 55). Although theoretically complementary geophysical techniques were employed at the site, it must be noted that the methodology of these surveys is not well reported, and Juma (2004: 62) himself noted that an attempt at magnetometry failed, although the reasons for this are not described.

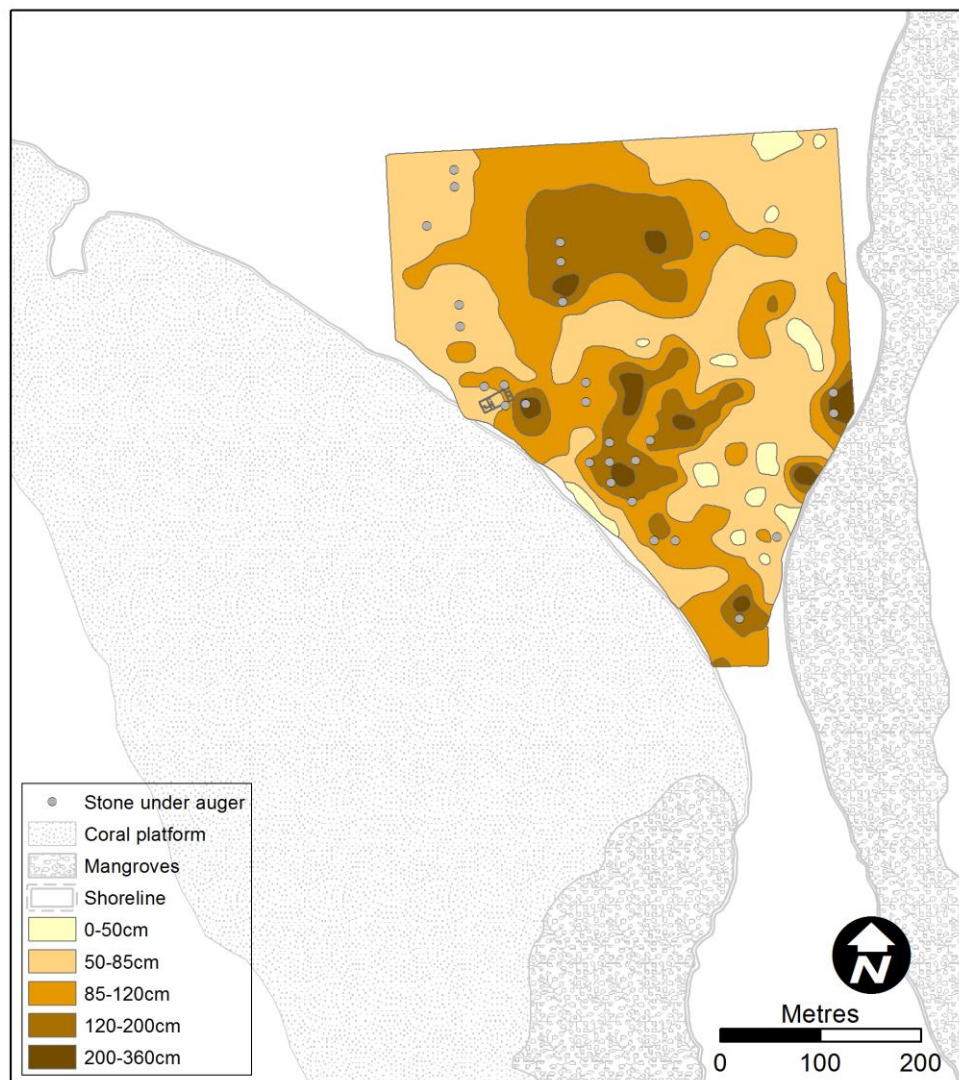


Figure 5.9: Map of average depth of archaeological sediments across Unguja Ukuu according to Juma's auger survey (after Juma 2004: 60)

The aim of Juma's coring survey was to sample across the site for archaeological deposits and to test for phosphates, whilst the stated intention of the resistivity survey was to identify areas of low resistance which it was believed would indicate deeply stratified deposits (Juma 2004: 59-60). The results of both surveys have been digitised and included in the current GIS (Figures 5.9). According to Juma, the results of the auger survey indicate that across the 9m high ridgeline running through the site the archaeological sediments above natural clays have an average depth of between 0-85cm, whilst the sequence of archaeological deposits along the shoreline areas of the site may be up to 3.6m in total depth. Various points are marked on the survey to indicate that drilling was stopped because of the presence of stone, but no explanation is provided for why drilling was stopped on the ridgeline at depths of less than a metre (Juma 2004: 60). It must be assumed that some criteria were established for stopping upon reaching assumed natural deposits, or given a lack of clear archaeological remains. Juma attributes the apparent presence of stone to archaeological structures, but comparison with the electrical resistivity survey, as well as the excavation sequences provided by Juma and more recently by the Sealinks Project, suggests that some of the points marked as 'stone' may represent underlying coral bedrock at a depth of around 3 metres (Juma 2004: 60).

The results of the resistivity survey are also interesting. This survey was conducted behind the shoreline in the area assumed to be the site of the mosque. The results indicate the presence of a line of sub-surface, high resistance features around 30-50m inland of the current line of the beach (Juma 2004: 61). This area has been the subject of numerous excavations, including Horton's Trench UU3, Juma's Units A and F-J, and most recently the Sealinks Project trenches UU11, UU13, UU14, and UU15 (Horton and Clark 1985; Juma 2004; Crowther *et al* 2013a, 2013b). Juma's Unit A, a little way inland of the beach of Menai Bay, was located to investigate the transition between high and low areas of resistance identified in the electrical resistivity survey (Juma 2004: 68). Juma suggested that the earliest phases of this trench were likely to date to the early sixth century based on a radiocarbon date, although a number of the samples from these excavations have since been questioned due to issues with Juma's phasing of stratigraphy, and questions regarding the species and age of the wood at the point of charring (Crowther *et al* 2013a). Two skeletons in a grave cut from the upper levels of this unit were radiocarbon dated to the fifteenth century, indicating burial during the later reoccupation of the site (Juma 2004: 71). Although the two skeletons were found in the same grave cut, they were buried facing north, indicating a probable Islamic identity, and signs of a violent death may explain why the two were buried together (Juma 2004: 71).

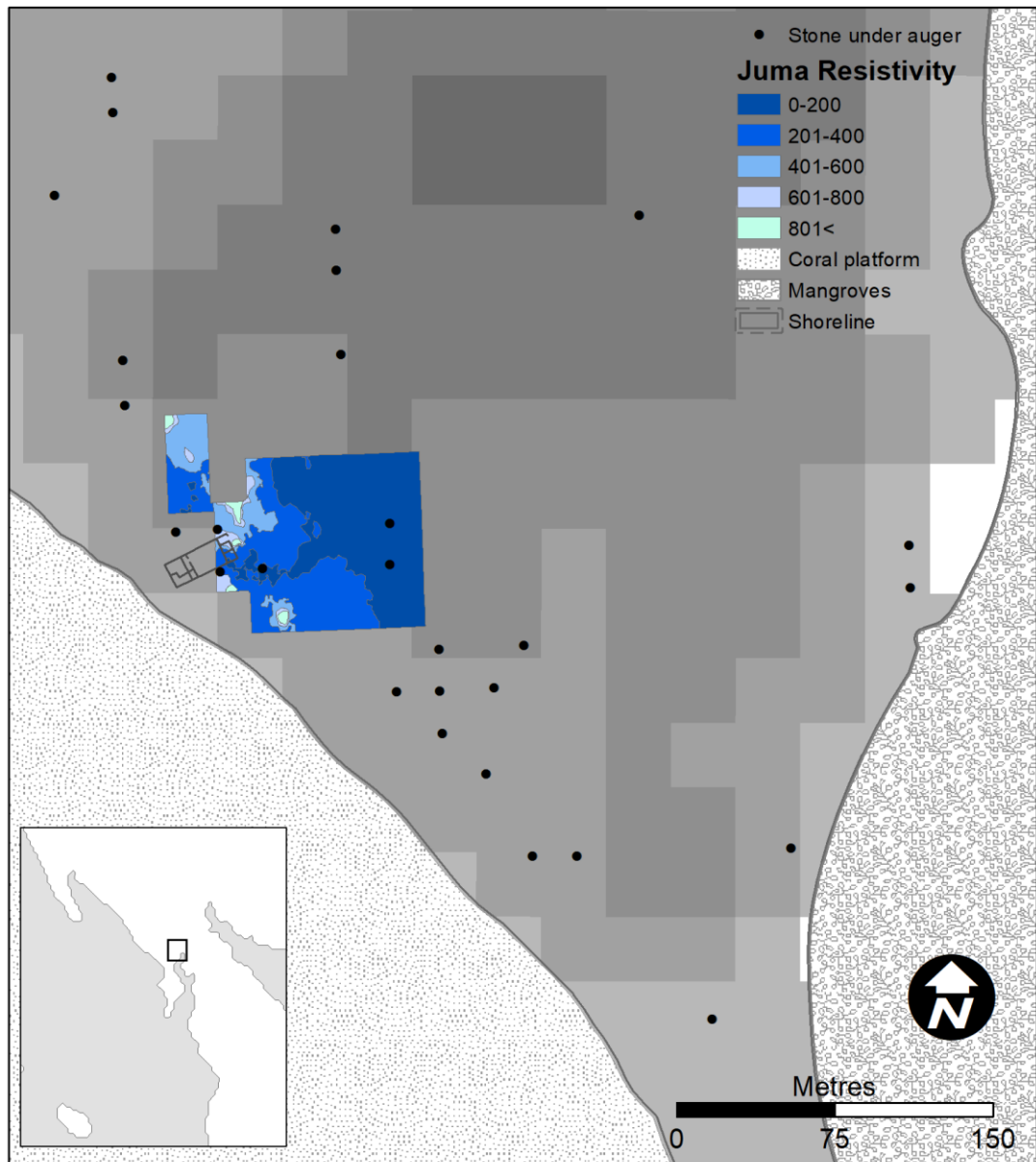


Figure 5.10 Map of Juma's resistivity survey, and areas where auger apparently struck stone or bedrock (after Juma 2004)

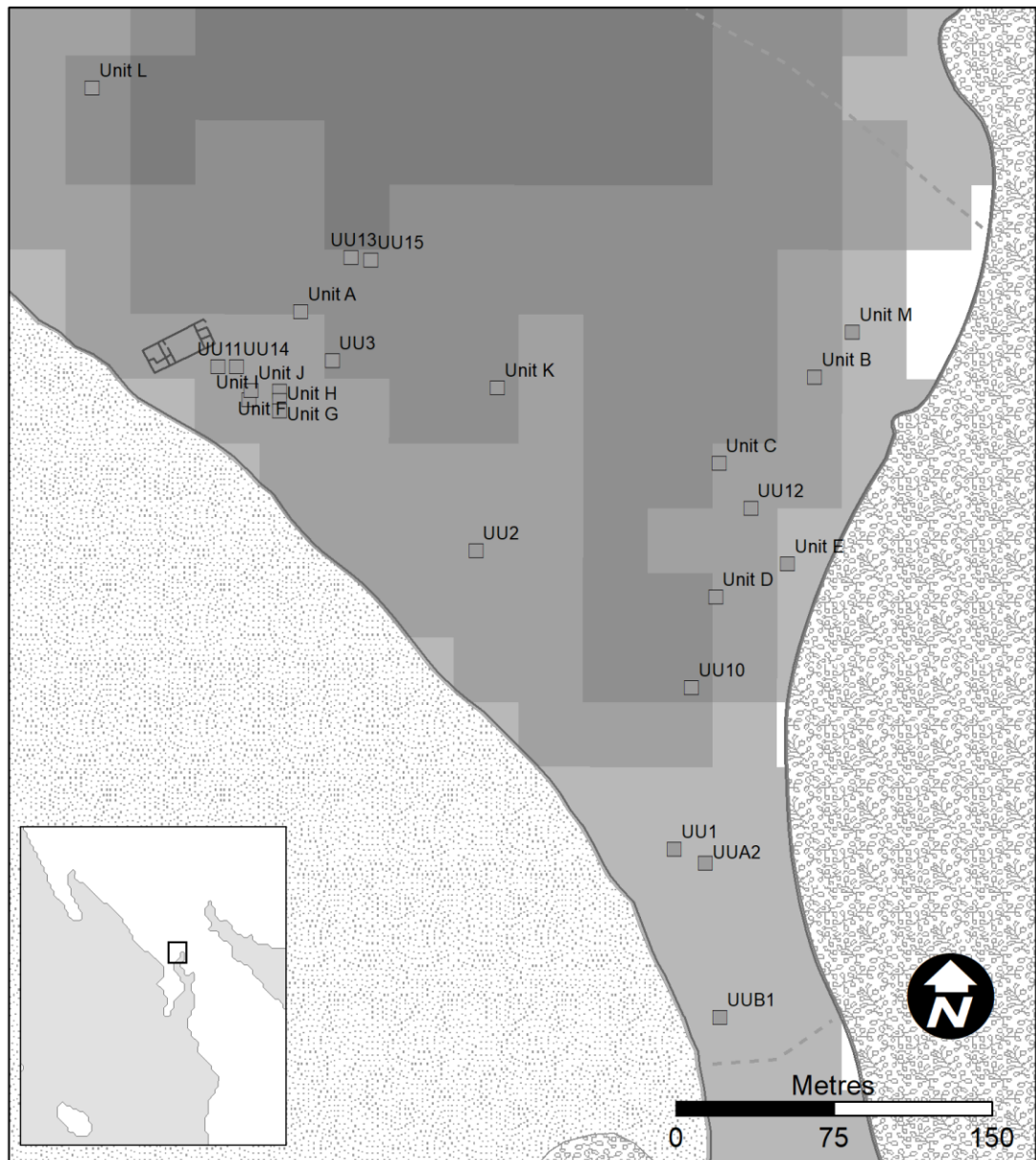


Figure 5.11: Map of all excavation units at Unguja Ukuu (after Horton and Clark 1985: 67; Juma 2004: 71; Crowther *et al* 2013a, 2013b)

Juma's Units F, G, and H were essentially subdivisions of a single trench, whilst Unit J was a deeper sondage within the open-area excavation of Unit I. This entire area has since been buried by the construction of the Menai Bay Beach Bungalows, and it is not clear how much of the site may have been destroyed. Unit I revealed the robbed-out remains of a coral structure with fragments of dressed porites and preserved fragments of lime plaster, with a deliberate deposit of white sand beneath the foundations which was not excavated (Juma 2004: 75). The sondage of Unit J demonstrated further coral remains below the level of the white sand, and finds of Longquan green celadon and lead-glazed sgraffiato wares and silver coins indicating that the coral structure above

dates to the reoccupation of the site around the fifteenth century (Juma 2004: 77). Earlier deposits apparently included red clay surfaces and ceramics of Susa ware dated by Juma to the seventh century, and a pit cut into natural beach sands containing fragments of what Juma identified as fifth century Roman ceramics from the southern Mediterranean and a 'local' pot apparently characteristic of material from the sixth century Mozambican coast (Juma 1996, 2004: 77). A late Roman dish was also reported in Unit L, to the north-west of these excavations, beneath what appears from Juma's descriptions to be a 1m deep sequence of thin occupation surfaces, the latest of which he dates to the eleventh century on the basis of finds of sgraffiato and Islamic monochrome (Juma 2004: 80). The identification of these late Roman ceramics has been controversial however, and no evidence of an actual occupation prior to the sixth century has yet been found at this site (Crowther *et al* 2013a, 2013b).

Unit K, on the western side of the ridge contained a possible tenth century midden pit, an Islamic burial of a juvenile possibly dating the eleventh century, and a wall foundation dated to the fifteenth-sixteenth century (Juma 2004: 79). Units C and D were small excavations on top of the ridgeline, and both revealed shallow archaeological sequences of around 20-45cm before natural red clays were struck. The lower levels (II and III) of Units C and D were 'culturally rich' and contained late types of sgraffiato and 'local' pottery, glass beads and vessels, and slag (Juma 2004: 74-75), suggesting limited settlement of this area during the reoccupation of the site. Unit E represents the section cleaning of a sand 'borrow' pit cut during nearby construction, and does not appear to have contained any archaeological stratigraphy. Unit B, on the eastern side of the ridge, above the mangrove creek, was located to investigate a surface mound indicative of a building, and excavation revealed part of the wall of a coral structure with probable eighth-ninth century foundations. The excavation profile shows a sequence of possible midden contexts beneath this structure, containing layers of charcoal and shells, and a small quantity of seventh-tenth century ceramics (Juma 2004: 72). Unit M was a broad open-area excavation of the structure identified in Unit B. The full structure measured 23.9 x 17.1m in size, and Juma notes the orientation of the structure to 273° magnetic, although georectification of his plans suggests that this may be a mistake, and that the actual alignment was around 323° magnetic (Juma 2004: 81). The structure was found to have a stone pavement at its western end, and an underlying double wall running down slope towards the beach, which Juma suggested might represent a retaining wall (Juma 2004: 82) Although Juma described the structure as an 'aristocratic house', Horton has suggested that the lack of internal division may instead indicate a mosque (Juma 2004; Horton forthcoming).

Juma's excavations have significantly improved the understanding of the chronology of the site, and his interpretation has placed the occupation of Unguja Ukuu within a framework of the development of urbanisation in the Zanzibar Archipelago around the tenth century. Juma divides the occupation of the site into two major periods, each with two phases; Period I from 500 – 900 CE, divided into Period Ia, from 500-750, and Ib, from 750-900; Period II covering 1050 – 1600 CE, divided into Period

Ila, from 1050 -1100, and IIb, from 1450 – 1600 (Juma 2004). His dating of the site highlights a sudden and unexplained abandonment of the site around 900 CE, and a short-lived phase of resettlement in the eleventh century. His explanation for grouping together the two apparently discontinuous phases of site occupation during Period II outlined as a theory of chronological epochs related to the development of urbanism and ‘important innovations’ (Juma 2004: 14). His identification of trends of urbanisation at the site during the tenth century, such as a proportional growth of trade imports compared to a decline in local crafting, as well as the advent of coral-rag architecture at the site, recommends the reclassification of the site after the tenth century as a short-lived phase of the urban ‘Later Horizon Cycle II’ (Juma 2004: 159). Yet his excavations also indicated that the site may not have been abandoned altogether after the twelfth century. Although not discussed in Juma’s work, for the current thesis one of the interesting implications of Juma’s survey is the apparent lack of deep archaeological sequences on the ridgeline, and the positions of the identified coral architecture within the known extent of the site. It should be noted that gaps in his methodology mean that the limitations of this survey are difficult to gauge.

In 2011 and 2012 test-pit excavations were conducted by the Sealinks Project with the primary aim of recovering archaeobotanical, zooarchaeological, and palaeoenvironmental evidence of Indian Ocean trade networks (Crowther *et al* 2013a). Test pits were spread across the northern half of the site, but four trenches were concentrated in the area north of Menai Bay beach around Horton and Clarks original UU3, and Juma’s Units F-J (Crowther *et al* 2013a, 2013b). Trenches UU11 and UU14 were excavated 3m apart, and revealed early phases of an ephemeral but recurrent occupation of the site dating to around the seventh century (Crowther *et al* 2013a, 2013b). The initial phases of this recurrent occupation were dated by two sherds of Kwale ware found alongside ETT and turquoise-glazed Sasanian-Islamic wares. The excavations revealed a sequence of shell-middens and dumping of organic material corresponding to Juma’s Period Ia, and a rich cultural assemblage with evidence of increasing trade activity after the eighth century, corresponding with Juma’s Period Ib (Crowther *et al* 2013b: 18). A fifteenth-century Islamic burial was also identified in the upper phases of UU14, providing evidence of a third Period IIb burial in the same area as Juma’s Unit A double-burial (Crowther *et al* 2013b: 16). Trench UU15 was deliberately sited close to UU13 to investigate the area identified by Juma as evidence of a fifth century occupation (Crowther *et al* 2013b). The lower contexts of UU13 were found to have been disturbed by a pit apparently used for lime burning, but UU15 contained indications of a possible seventh century timber structure, and both trenches contained evidence of occupation in the tenth – eleventh century (Crowther *et al* 2013b: 36). The period between the tenth and eleventh centuries contains some indications of ‘low-density’ activity and deposition of small quantities of refuse (Crowther *et al* 2013b: 35).

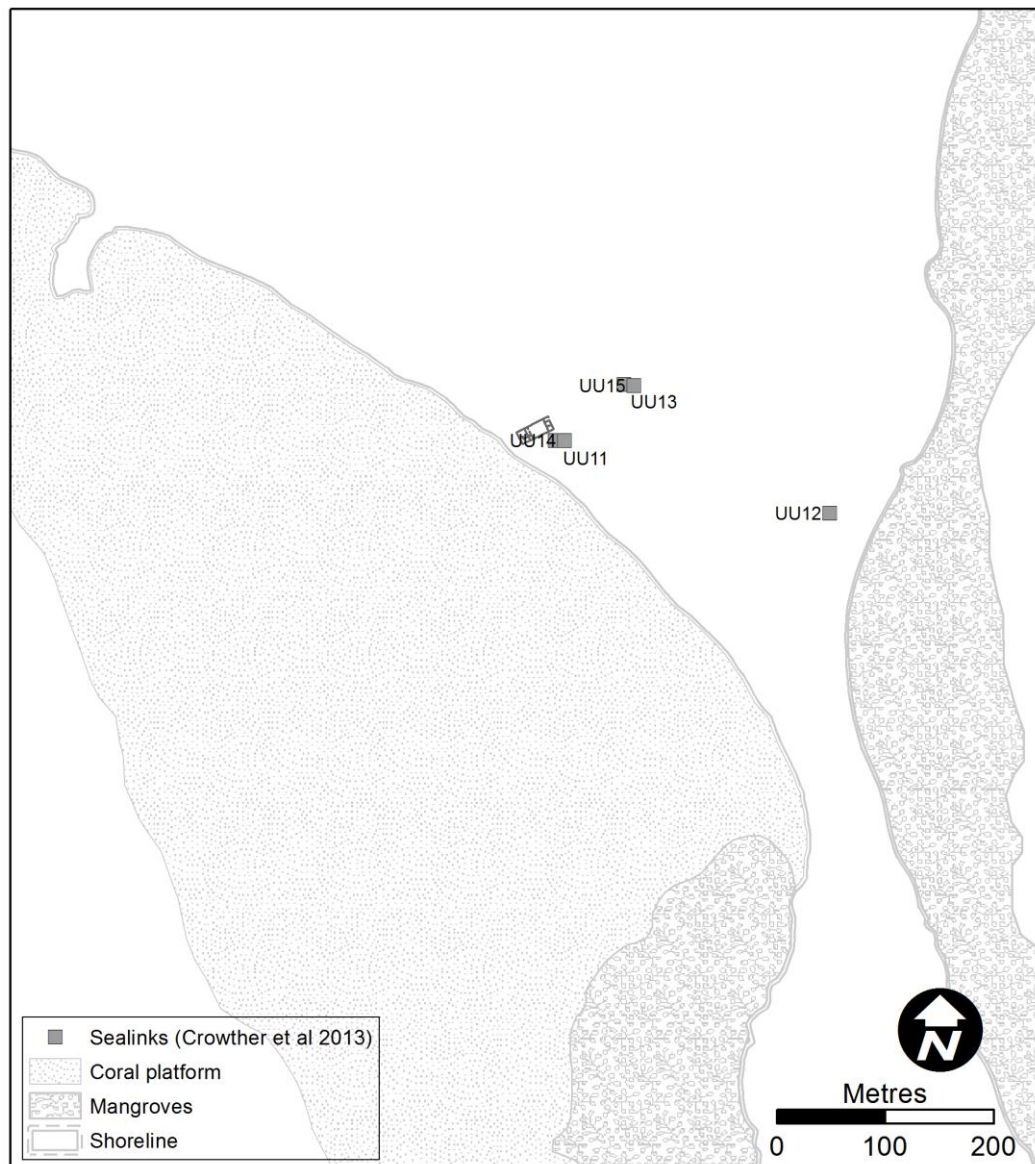


Figure 5.12: Sealinks excavation units (after Crowther *et al* 2013a, 2013b)

UU10, on the northern edge of the bulldozed ‘parade ground’ revealed evidence of a large midden pit dug into natural red clays, which was dated by its contents, including turquoise-glazed Sasanian-Islamic wares, to the eighth – tenth centuries (Crowther *et al* 2013a: 40). Trench UU12 was excavated in the same area as Juma’s Units C, D, and E, but was abandoned due to time constraints. It was found to contain iron slag and several bead grinders on imported sherds indicating possible industry and crafting, and a single sherd of sgraffiato (Crowther *et al* 2013a: 53, 66)

The radiocarbon dating of the early phases investigated by the Sealinks Project does not accord with Juma’s estimates of a fifth century date of occupation, and it was suggested that the earliest verifiable date of occupation was likely to be the early seventh century CE (Crowther *et al* 2013b:17).

The nature of previous investigations means that there is now a reliable dating sequence, albeit with some contested early outliers, to account for the temporal span of the site between at least the seventh – tenth centuries CE. The site is widely recognised as the earliest port of trade on the East African Coast, as well as one of the wealthiest. What is not yet understood is the organisation or plan of the site regarding activity areas and maritime spaces.

5.4 Project Survey and Excavation

In keeping with the thesis aim and research objectives laid out in Chapter Three, the purpose of fieldwork carried out in preparation of this thesis was to attempt to identify patterns of harbour activity in the archaeological record through geophysical survey and targeted excavation. The geophysical survey and excavation of the site was carried out over two fortnight-long seasons of work in October 2013 and February 2014, and an attempted Kite Aerial Photography (KAP) survey across the intertidal zone was carried out in September 2015 to provide supporting and topographic data from the harbour area. The results were integrated into an inter-site GIS database alongside the results, maps, and data extracted from previously published surveys of the site, although as described in Chapter Four, the KAP photogrammetry was not successful owing to the problems of reflected light off the surface of the sea. Data gathered during the process of survey has proved useful however, and been incorporated.

The October 2013 season was a collaborative geophysical survey between the Departments of Archaeology at the University of York and the University of Aarhus⁴, funded by the Entrepôt Project (Danish Research Council). Survey was conducted across three areas of the site: Area A, a strip of land running from the estimated urban zone of the settlement towards the narrowest point of the Makime peninsula; Area B, bridging the Makime peninsula as it begins to widen again towards the south; and Area C, covering two areas of ground on the ridgeline above the western, Ras Kigomani end of Menai Bay beach, and the lower ground inland, north of this ridge (Figure 5.13).

Following the successful identification of several features of archaeological interest, a second season of work was conducted in February 2014, funded again by the Entrepôt Project. This season was directed by the author with the aim of investigating the magnetometry results from the first season, and of conducting further magnetometry in a new sector, Area D, at the far end of Menai Bay beach following the recovery of a possible Kilwa coin whilst fieldwalking. To minimise possible contamination of the results by metal debris from the modern occupation and use of the site, and to

⁴ The 2013 Entrepôt team was directed by Dr Stephanie Wynne-Jones, and assisted by Dr Søren Sindbaek and Dr Jason Hawkes of the University of Aarhus. Geophysical survey was conducted by the author, with subsequent interpretation supervised by Stephanie Wynne-Jones (Fitton, Wynne-Jones, forthcoming).

complement the results of the magnetometry survey, a metal detector was used to sweep the survey areas, and minimally invasive recovery occurred of artefacts estimated to lie within 10-20 cm of the ground surface⁵. Finally, a single 50 x 50 cm test pit in Area A, and a 1 x 4 m trench in Area B were excavated to ground truth the results of the geophysical survey.

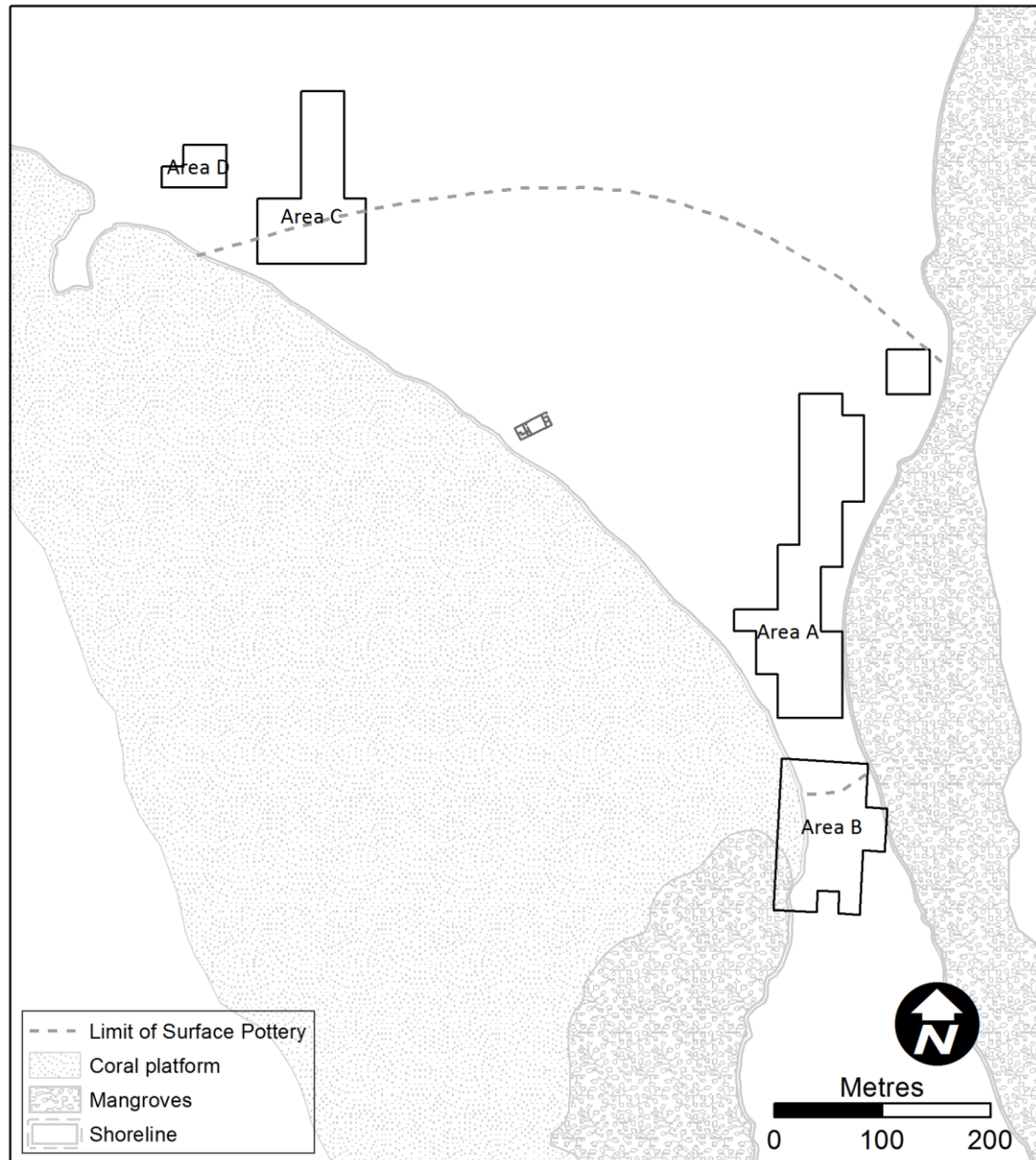


Figure 5.13: Project survey areas, 2013-2014 seasons

⁵ The metal detector survey was carried out Dr Mateusz Bogucki, and additional fieldwork assistance was provided by Elizabeth Bogucki and Dr Sarah Croix. Dr M. Bogucki is a metal detectorist and archaeological numismatist specialising in Viking and north-west European Iron Age coinage, and both he and Dr Croix were employed at the time as Viking specialists on the Entrepôt project at Aarhus University, Denmark. All three assistants kindly volunteered their time with the recommendation of Dr Søren Sindbaek.

5.5 Area A

The limits of Area A were laid out with the intention of investigating the assumed urban zone of the archaeological settlement, and potential harbour activity area in the narrow neck of the peninsula between the open beach of Menai Bay and the mangrove creek. The strip of land therefore extended from the elevated ridgeline of the site onto the low-lying neck of the peninsula, taking in the eastern, unoccupied part of the KamKam Customs camp, and a small part of both the current road from the modern village along the eastern edge of the ridge and an abandoned road running straight down the ridge to the peninsula (Figure 5.13). Within the northern part of this Area Horton and Clark (1985) reported stone building foundations, and Juma (2004) recorded middens and a possible mosque. The bulldozing of the current road has cut deeply into the side of the ridge above the mangrove creek, exposing a section ranging from 0.5 – 1.5 m deep through a series of both natural and archaeological deposits. Deep loam sediments can be seen to overlie archaeological materials, including what appears to be a clay-like degraded daub, and the walls of several coral-rag buildings are visible and in the process of being destroyed by traffic in the heavily-rutted base of the road. Experimental testing with the magnetometer determined that these coral rag walls can be clearly identified in the plot of results, but the depth of sediment to either side of the road-cut means that the continuations of these walls/foundations are beyond the estimated 0.75 m limit of the Bartington gradiometer, and therefore too deeply buried to detect and trace. The southern part of Area A covered the neck of the peninsula where Horton and Clark recorded and excavated middens in 1984.

5.5.1 Area A Geophysical Survey

The results of the Area A gradiometry survey can be seen plotted and processed in Figure 5.14, and interpreted in Figure 5.15. A typology of magnetic anomalies used in interpretation of the results is included in Appendix A, along with comparative Raw and Processed plots from every site and area. Of the few magnetic anomalies visible in the northern part of Area A, the majority can be attributed to modern and/or surface features which were recorded in the field using sketchmaps and a DGPS. These features include farm buildings, an unfinished concrete, breezeblock, and iron-rebar structure, rough pieces of painted coral lining the road, pits for the burning of rubbish, and recent, but currently abandoned areas of ridge and furrow. A few anomalies are of uncertain cause, but by their similarity to modern features are equally likely to be of modern origin. Despite Juma's relatively shallow auger survey results and his excavations in this area, no archaeological anomalies appear to be visible in this northern part of Area A. A small area of 4-partial grids was surveyed north-east of the main part of Area A on the slope of the ridgeline, across an access track to the creek where pottery sherds were spotted on the shoreline (Feature a, Figure 5.14). Again however, no anomalies

were visible in these grids, despite archaeological remains of coral and daub visible in the roadway, which were confirmed as magnetically identifiable in the experimental transect described above, and in spite of proximity to the area of Juma's Unit M 'aristocratic' house (Juma 2004: 81). The results indicate that although coral rag building remains can be seen in the road cutting, the remains are unburned and not magnetically distinct from the surrounding area, and the post-occupational and agricultural deposits along the ridgeline may be too substantial to allow detection of archaeological remains buried beneath them (Feature b, Figure 5.15).

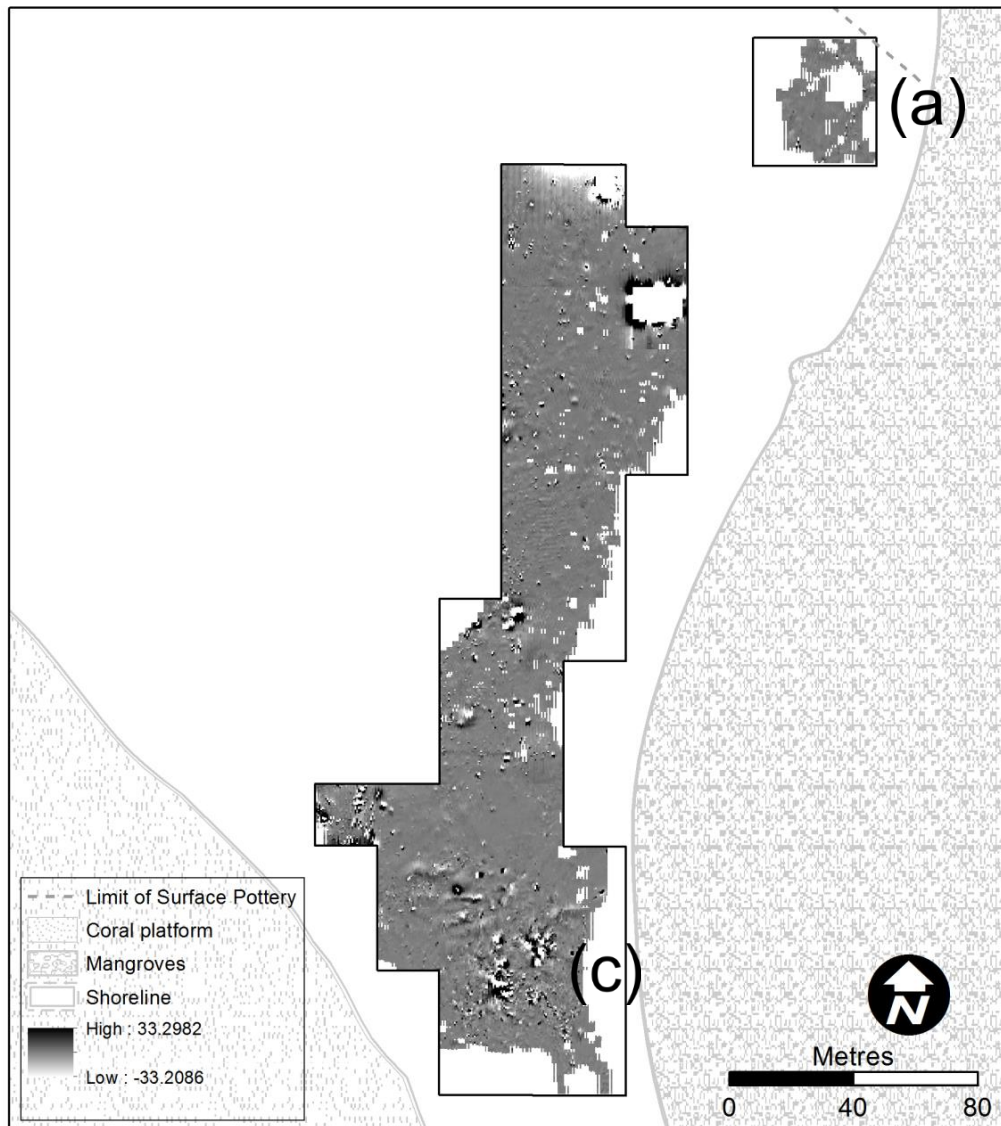


Figure 5.14 Processed results of magnetic gradiometry from Area A

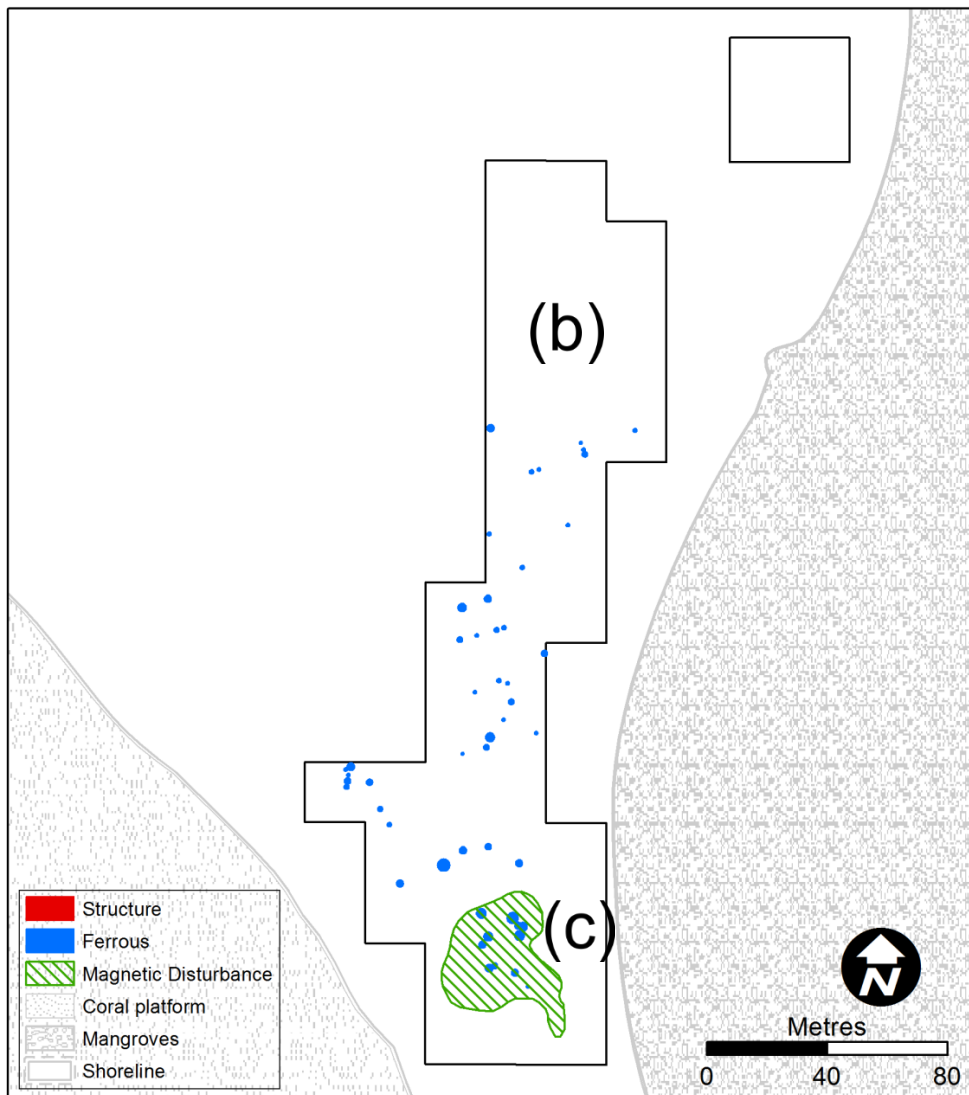


Figure 5.15: Interpretation of Area A magnetic gradiometry survey

By contrast the southern part of Area A revealed several clear magnetic anomalies across the low-lying neck of the peninsula which are attributable to archaeological features (Feature c, Figure 5.14 and 5.15). These anomalies include a series of high-range, sub-circular bipoles, and a small number of both positive and negative linear anomalies (Figure 5.14). Bipolar anomalies are usually the result of induced magnetism, and may be indicators of ferrous material or *in-situ* thermoremanence (Appendix A). The orientation of such anomalies can sometimes be used as an indicator of the cause. In this case, the sub-circular anomalies appear to indicate a combination of ferrous material sources and possible areas of thermoremanence. The integration of these results into the GIS demonstrates that these features lie not far from one of the middens mapped in 1984, and from test pit UU1, in which Horton reported large quantities of iron slag and possible haematite ore (Horton and Clark 1985: 12; Horton forthcoming). It is possible therefore that as well as a midden, the area may have

been a site of some level of industrial activity. The cause of the linear anomalies is less certain. The parallel positive/negative linear patterning of these anomalies may be indicative of ditch-and-banked earth, or of walls, and the length of these anomalies may support this interpretation. However, given the lack of information on the bulldozing of the site, it is also possible that they may have been caused by the movement of earth in front of a machine blade. These features cannot therefore be deemed archaeological without excavation and further investigation.

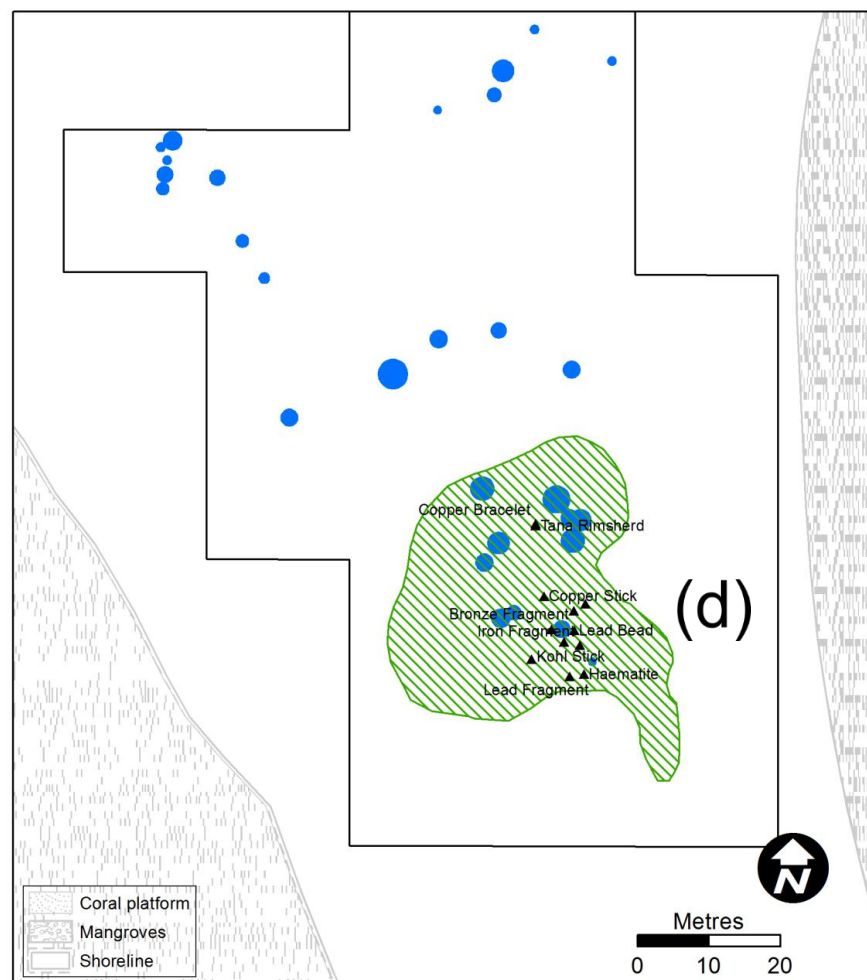


Figure 5.16: Plot of artefacts from metal detector survey of Area A

5.5.2 Area A Metal Detection Survey

In the second season of survey the cleared low ground of the peninsula was fieldwalked to remove metal debris, and swept with a metal detector to rule out modern contamination of the magnetometry results. This survey confirmed no traces of modern debris around the geomagnetic anomalies, although recovery of shallow-buried artefacts within 10-20 cm of the ground surface

resulted in a number of metal artefacts. These artefacts, which are undergoing XRF⁶ and isotope⁷ analysis included a number of lead roll fishing-net weights (Thomas 2009), copper alloy wire which might also have been used as fishing-line weight (Thomas 2012), a copper-alloy cylinder container, and a possible flask or gourd cap. The majority of these artefacts were found in the vicinity of the sub-circular magnetic anomalies described above, supporting both Horton's midden identification, and the possible use of this part of the site harbour for trade or activity (Feature d, Figure 5.16). After the recovery of these few artefacts no further metal detector signals were excavated, so as to preserve *in situ* any remaining artefacts within their archaeological contexts.

5.5.3 Excavation Trench UUA2

In order to assess the cause of the magnetic anomalies and the surviving depths of archaeological deposits after bulldozing, a small 50 x 50cm test pit was excavated over the edge one of the high-range geomagnetic anomalies using co-ordinates extracted from the GIS (Figure 5.17). Cleaning of the surface context immediately revealed archaeological deposits and ceramics, indicating that the bulldozing of the site has stripped both post-occupational topsoil and an unidentifiable quantity of archaeological strata, but excavation demonstrated that at least 90cm of archaeological contexts still survive beneath the surface.

The sequence can be divided into 3 broad phases, although the poor quality of ceramics and absence of diagnostic sherds in these contexts prevents reliable dating.

Phase 1, the earliest phase in the sequence, was a dense shell and fish midden (Context 107) with indications of multiple deposition events in the changing dominance of fish to shell remains through the context. The size and limited access of the 50cm wide test-pit prevented excavation beyond 90 cm depth, and therefore made it impossible to estimate the size or depth of this shell midden, or of any lower strata. This may represent an early, seasonal occupation of the site predating the seventh-century occupation hypothesised for Phase 3. Similar sequences of contexts containing dense shell middens, separated by apparently barren deposits were also noted by Horton in UU1 (Horton and Clark 1985: 12), and by the Sealinks Project in UU11, UU13, and UU15 (Crowther *et al* 2013a, 2013b), but were not dated.

Phase 2 is represented by a barren deposit of dark silt (106), indicating the abandonment of the site, or at least non-use of this area of the site.

⁶ Copper-alloy artefacts are currently being studied by Professor Thomas Fenn, Yale University

⁷ Glass vessel fragments are currently being examined by Professor Gry Barfod, Aarhus University

Phase 3 appears to represent the reuse of this site, with a small but presumably deliberate deposit of clay (105) with some unidentifiable sherds of pottery, followed by mixed midden deposits of silt (104) with lenses of ash containing pottery, glass, and slag. This may indicate industrial activity taking place in the vicinity. These deposits were sealed by a silt context (102) resembling and immediately below the sun-baked topsoil. Given the bulldozing of this site, this phase is unlikely to represent the last occupation of the site, and it is hypothesised that (102) represents a truncated context in a seventh-tenth century phase of occupation.

More reliable dating of the sequence has not been possible based on these excavations, but the presence of *in situ* sequences demonstrates that wide area survey may still be worth conducting in this area.

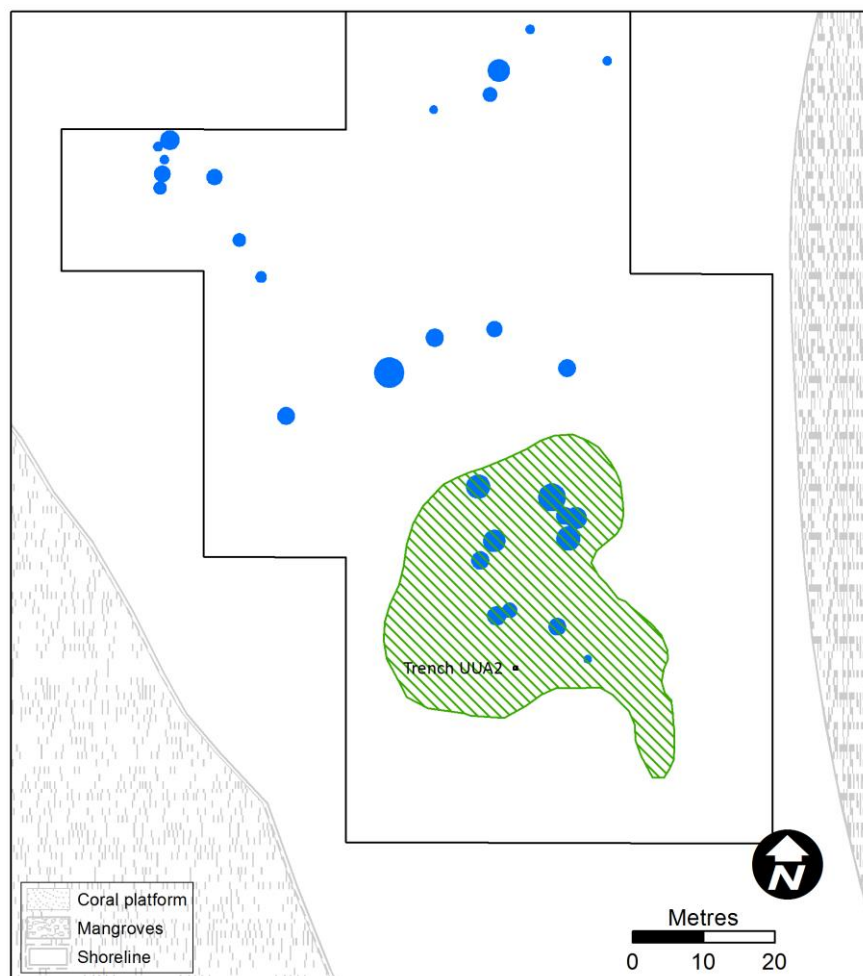


Figure 5.17: Location of Trench UUA2

5.6 Area B

Area B was originally intended to test the boundaries of the settlement as estimated by Horton and Clark, and to identify possible shoreline traces of archaeological activity. The area lies a short distance south of Area A, covering the narrowest point of the Makime peninsula and extending up onto the ridgeline, and down to both the eastern and western shorelines, except where dense tree- and mangrove-growth prevented survey.

5.6.1 Area B Geophysical Survey

This area featured the densest concentration of magnetic anomalies, many of which are likely to be related to archaeological causes. On the eastern side of the ridge the extensive ridge and furrow systems described previously are visible as negative linear features, reflecting their built-up creation through hoeing, rather than cutting of plough furrows and subsequent positive, magnetically-enhanced anomalies more typical in northern Europe. These more recent features are included in the interpretations of Appendix A, but are not included in the current chapter. No clearly archaeological anomalies are identifiable on the eastern shoreline of Area B.

Several bipolar anomalies on top of the ridge may indicate ferrous material of unknown origin and date. There is also one large anomaly almost 5m across with a positive, magnetically-enhanced centre and surrounding negative feature, the origins of which are uncertain, but which does not have an obvious modern or surface cause. Similar patterns can sometimes be seen in relation to quarrying or open pits, but the amplitudes of such features are relatively low. The amplitude of this particular anomaly is relatively high, comparable to the ferrous bipoles and thermoremanence seen elsewhere on site. Whilst no indications were observed on the ground surface it is theoretically possible therefore that this anomaly could have been caused by intense heating within an enclosing structure, similar to that of a kiln or furnace, although further work is necessary to test this.

The magnetometry plot of the peninsula's western shoreline in Area B demonstrates a significant number of magnetic anomalies, especially along the ridgeline of the beach (Feature e, Figure 5.18 and 5.19). These include small regions of magnetic disturbance, characterised by speckled positive and negative magnetic readings, and several linear negative anomalies. Similar areas of magnetic disturbance are generally interpreted as the result of a collection of ferrous material, such as ceramics or ferrous metals. Bipolar anomalies within these areas may represent pieces of iron large enough for the gradiometer (at a suitable survey resolution) to record both the positive and negative poles of the object. The negative linear anomalies could be caused by coral, or banked clay or daub, in which case these features could indicate structural remains. Neither Horton and Clark or Juma recorded archaeological remains in this area to aid interpretation of these remains. However, a shell

midden and quantity of poor quality, low fired local ceramics of no identifiable diagnostic styles or traditions were discovered during survey being eroded by the tide out of the beach, indicating undated middens in the area. This process of erosion may be being hastened by the existence of a trough behind the beach running parallel to the shore, which given the quantity of flotsam in its base appears to act as an occasional tidal catchment pool. The cause of this trough is not known, but is hypothesised here as being related to the quarrying of sand for construction, and subsequent tidal action is now eroding the bank of the beach between the trough and the shore. Due to time and tidal constraints, the test-pitting and excavation of many of these features has not yet been possible. The magnetic anomalies identified do however represent evidence of archaeological activity beyond the previously estimated limits of the settlement set by Horton and Clark (1985) (Figure 5.13).

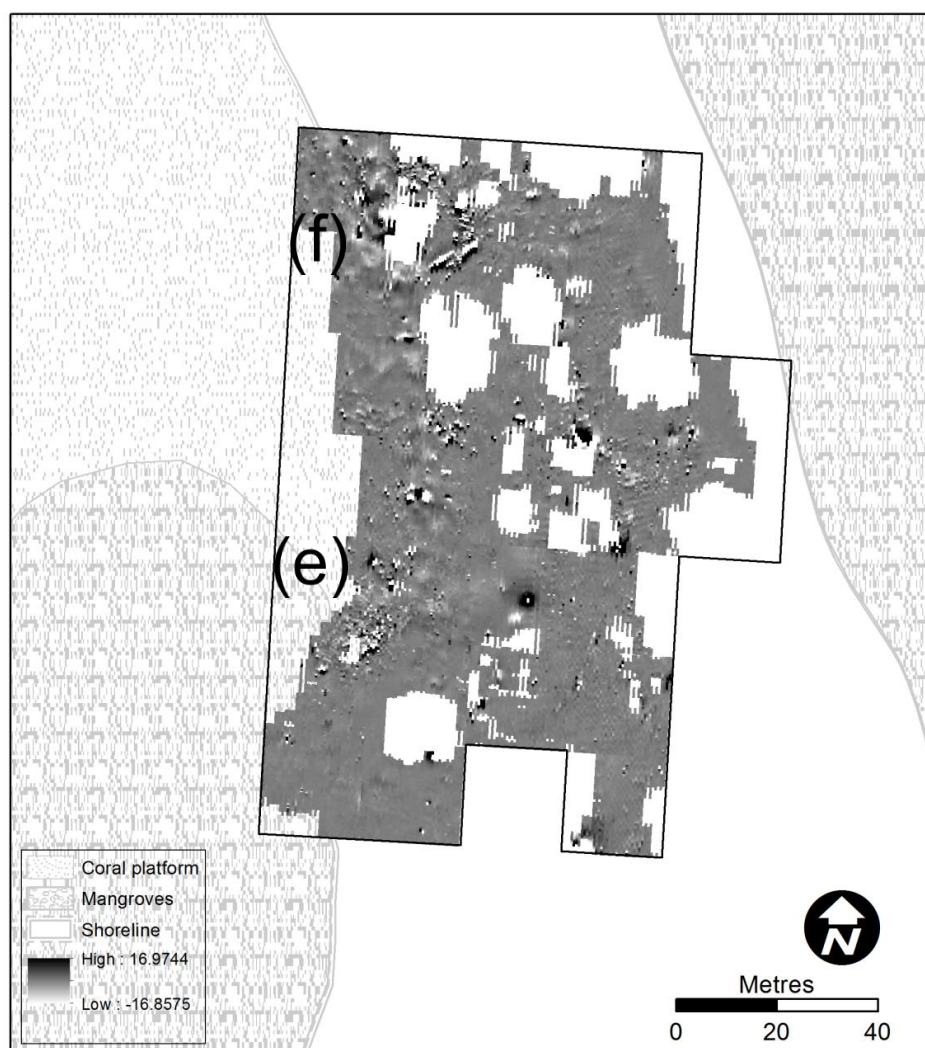


Figure 5.18 Processed results of Area B magnetic gradiometry survey

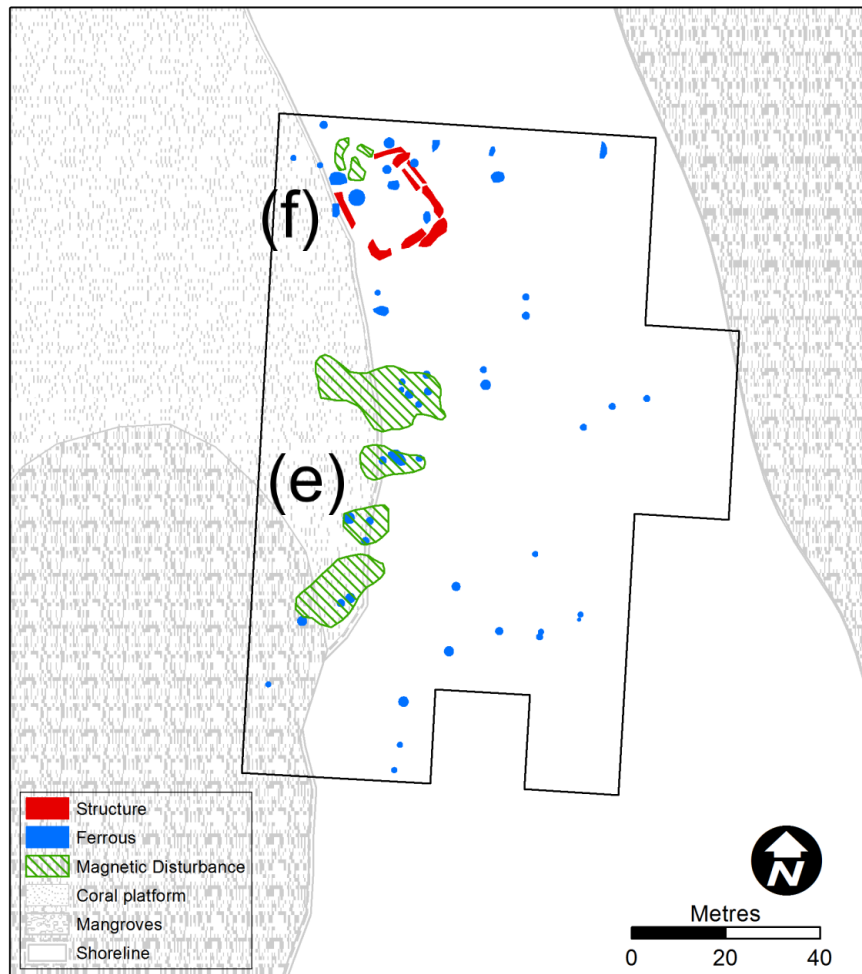


Figure 5.19: Interpretation of Area B magnetic gradiometry survey

The largest magnetic anomaly of Area B is at the top of the beach in the north-western part of the survey area, where a series of linear magnetic anomalies form a distinct rectangular feature (Feature f, Figure 5.18 and 5.19). The eastern and southern linears are the most distinct, and coincidentally represent the higher ground above the beach, whilst the western and partial northern linears which map onto the sandy slope of the beach itself are fainter and more disturbed. The dominant negative magnetic signature is suggestive of the presence of a coral or coral-rag structure, and the difference in magnetic amplitude is likely to be due to the erosion of this structure along with the beach. The eastern linear has indications of a parallel double-wall, and an area of positive magnetic enhancement parallel to the southern linear may indicate windblown material or disturbance of the ground outside the south wall of this feature. The structure appears to measure approximately 18 x 13m, with a bearing of 328° through its longest axis. The orientation of the structure therefore draws comparison with those early mosques of the East African coast analysed by Horton, the alignments of which fall apparently within a 50° range of error from a true *qibla* alignment towards

Mecca, dependent on the navigational accuracy and position-finding ability of the builders at the time of construction (Horton 1991, 1996: 227). This structure lies at the southern limit of settlement estimated by Horton and Clark (1985) based on the positions of middens, in an area assumed to have been unoccupied in any period.

5.6.2 Excavation Trench UUB1

In February 2014, a 1 x 4m trench was sited across the eastern linear of this feature in order to test the hypothetical identification of coral-rag architecture from the magnetometry results, to investigate the nature of the structure, and to obtain datable evidence (Figure 5.20). The limits of this trench were located using a Trimble DGPS, and based on georectified magnetometry plots. Excavation revealed 3 phases of activity, and demonstrated that the double linear appearance of the magnetic anomaly was indeed caused by two wall lines of coral-rag fragments.

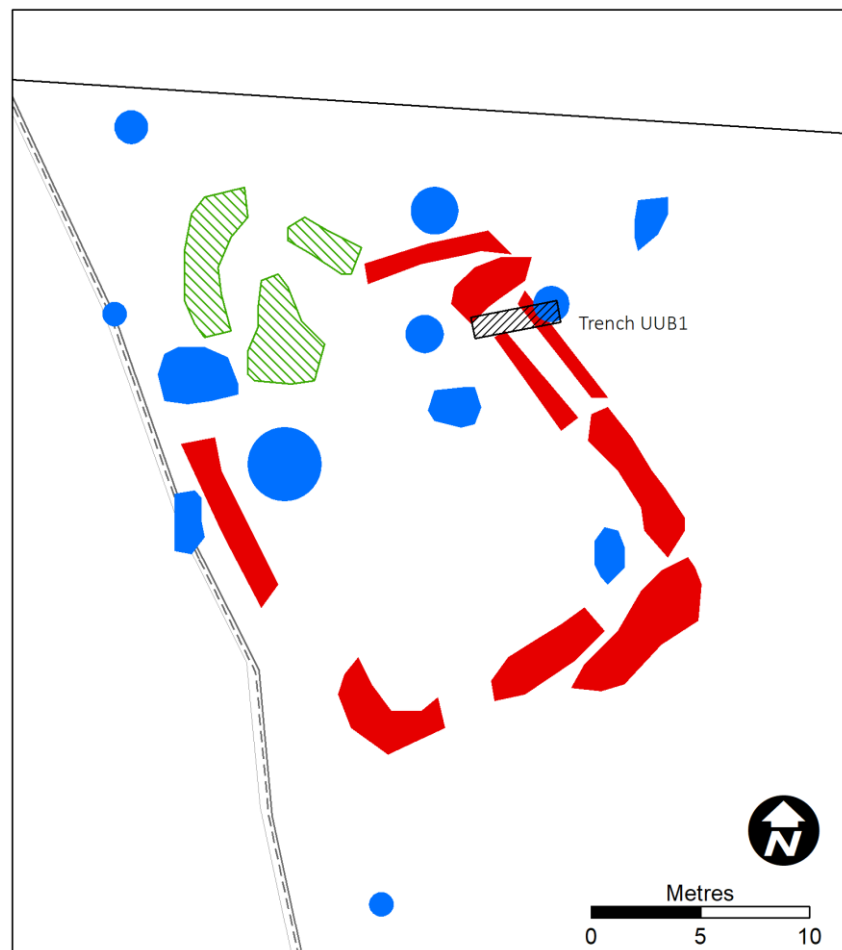


Figure 5.20 Location of Trench UUB1, investigating nature of 'walls' of predicted mosque

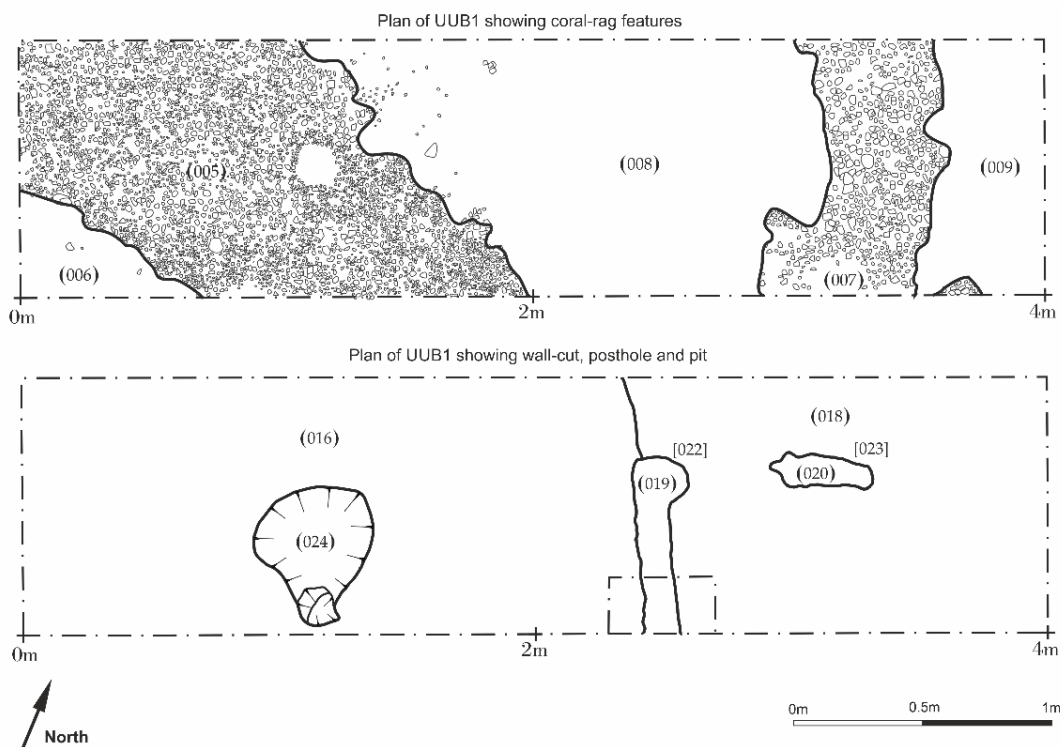


Figure 5.21: Trench UUB1 plans showing (Top) coral wall contexts (005) and (007), and (Bottom) wall of timber structure and shallow pit west and outside of the structure

Phase 1 in this trench is represented by the construction and occupation of a timber structure (019 and 020) and a mottled sand floor (016 and 018) above natural beach deposits (026) (Figure 5.21). The ceramics recovered from the floor surfaces were fragmentary but two diagnostic fragments of an ETT jar and bead grinder indicate a seventh – tenth century date of occupation. Shell and glass beads, bone and iron fragments, a porites washing stone, and what appears to be a grinding or hammer stone indicate a household structure with craft activity. Vessel glass and bitumen demonstrate connections in this phase with Indian Ocean traders. Faint traces of a possible wall cut were seen in plan underlying context (013) close to the west section wall of the trench, but excavation was inconclusive. A shallow pit (024) was found cut into the surface of this context with few finds and of unknown purpose.

Phase 2 represents the abandonment and probable collapse of the structure. Midden remains (013 and 017) rich in artefacts, and containing large potsherd fragments with clean breaks, including significant portions of two vessels, were found overlying the earlier floor surfaces. The clean breaks and large fragments of ceramics, and the deposition and spread of the fragments indicate that this was a mounded midden dump in what appears to be the interior of the structure. Context (014) represents further accumulation of windblown or slumped deposits, and is partially overlain by (015)

which may represent structural collapse on top of this midden. The phase is then sealed by sandy deposits (011) containing further undiagnostic fragments of ceramics which may represent a levelling of the site.

Phase 3 appears to represent the reuse of the site and the construction of a porites-coral building, potentially a mosque, on the shoreline of the site. The initial floor of this new structure is represented by a densely compacted red sandy deposit (012) with few finds, and a silty deposit (010) which may represent accumulation on this floor during use. Several small sherds of blue-green glazed ware were found on the edge of (012), along with a small ETT sherd with triangular incisions on the shoulder, possibly from a carinated bowl. Context (010) contained an undatable spoon carved from shell. The probable remains of a porites coral wall (005) lie on top of (012), and the remains of a second wall or outward structural collapse (007) lie on approximately the same orientation around 1m to the east of (005), above windblown sands (008) which abut the foundations of (012) and (005). The structural remains of (005) and (007) were composed of coral fragments, varying between 2-10cm in the western line (005) and 5-15cm in the eastern line (007), and were oriented on bearings of 328° and 330° respectively. The coral fragments are smaller than the rag blocks of Units J, B, and M reported by Juma, but it is possible that they represent the remaining chips of robbed-out larger blocks, or an early architectural practice previously described by Horton of binding coral chips into a clay matrix (Horton 1996; Juma 2004). It is hypothesised therefore that these represent the collapsed and robbed-out remains of a structure, and that (007) collapsed outward from wall (005) onto sands (008) which had accumulated around the base of the structure. Very few finds, and no diagnostic potsherds, were associated with these contexts, but two glass- and two shell-beads, and small fragments of vessel glass were recovered from context (005). The glass may conform to similar finds from Juma's Period Ib, (750-900 AD). The coral structure does not directly overlie the timber structure, and is on a different orientation. Small fragments of Sasanian-Islamic green glazed ware in (008) suggests that the robbing occurred in the early second millennium. Further excavation through the central area of this structure may be necessary to confirm the purpose and chronology of the structure, but the use of porites coral and the apparently linear alignment of the walls on bearings of approximately 330° support the mosque hypothesis put forward above based on the magnetic gradiometry results.

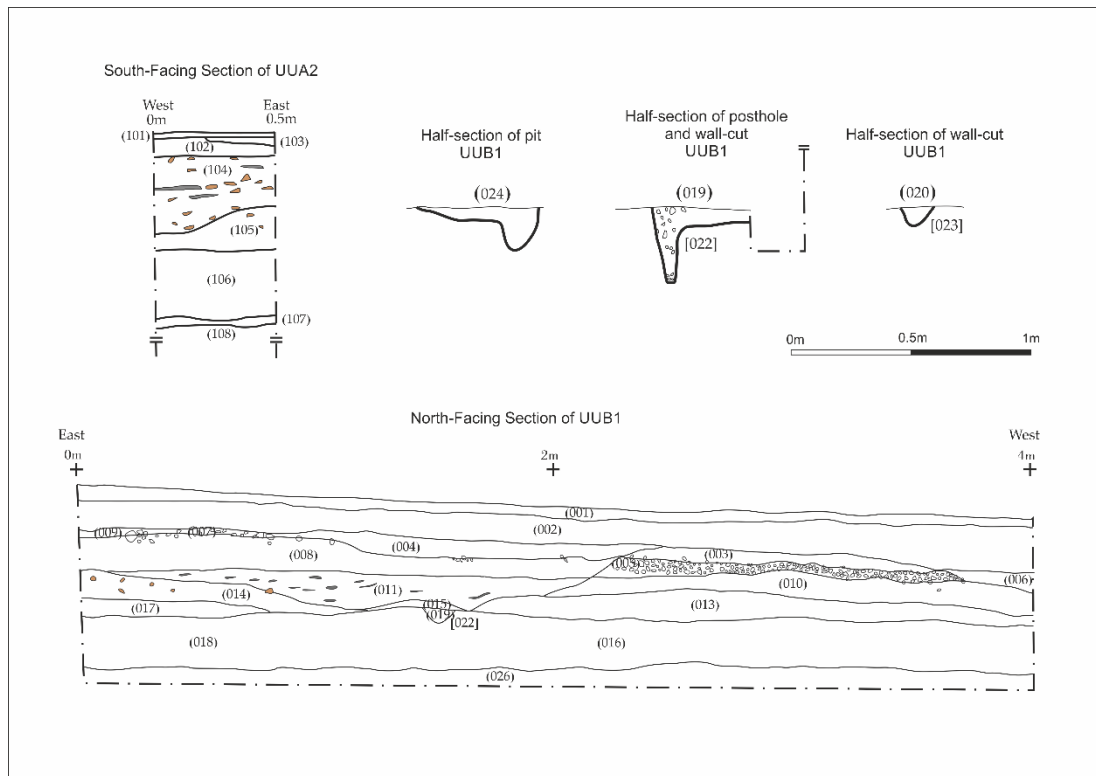


Figure 5.22: Sections of Trench UUB1 and UUA2

5.7 Area C

Area C, to the west of the main site, covers a ridge behind the beach of Menai Bay and a small area of low-lying land beyond, and was again intended to test the boundaries of the site established by Horton and Clark (1985), and investigate whether trade and industrial activity were likely to have been a part of harbour-related activities, or to the central spaces of early settlements (Figure 5.13). The survey area close to the beach is used today for boat-building and maintenance, whilst the inland low-lying region has been turned over in the past decade to cultivated fields and allotments producing banana and cassava. Fieldwalking of this ploughed area was productive, returning significant quantities of semi-fired daub fragments, and ceramics dated to the eleventh to thirteenth, and nineteenth, centuries.

5.7.1 Area C Geophysical Survey

The magnetometry results from Area C include a large cluster of sub-circular bipolar and linear anomalies on the raised beach (Feature g, Figure 5.23), and several small dipoles indicative of ferrous material on the beach itself. Whilst the linear features may be structural, it was initially

thought that the clustering of bipolar anomalies could be related to modern boat-building activity. The limited survey area of November 2013 was expanded in February 2014 to test the limit of this cluster of anomalies. The survey area covers the boundary of Horton and Clark's (1985) estimated site limit, and a quarry pit at the northern edge of the survey area contained quantities of undiagnostic ceramics, possible haematite, and one piece of iron-slag, but nothing which could be used to provide dating evidence. The survey area in the low-lying area inland of the beach, beyond Horton and Clark's site limits (Figure 5.13) contained a number of small dipolar anomalies, but no obviously structural features, in spite of the partially-fired daub fragments recovered from the cassava fields (Feature h, Figure 5.23). It is possible that this structural material has been spread by ploughing from modern structures a short distance to the west, whilst the ceramics indicate that it could also be related to relatively recent occupation in the nineteenth and twentieth centuries.

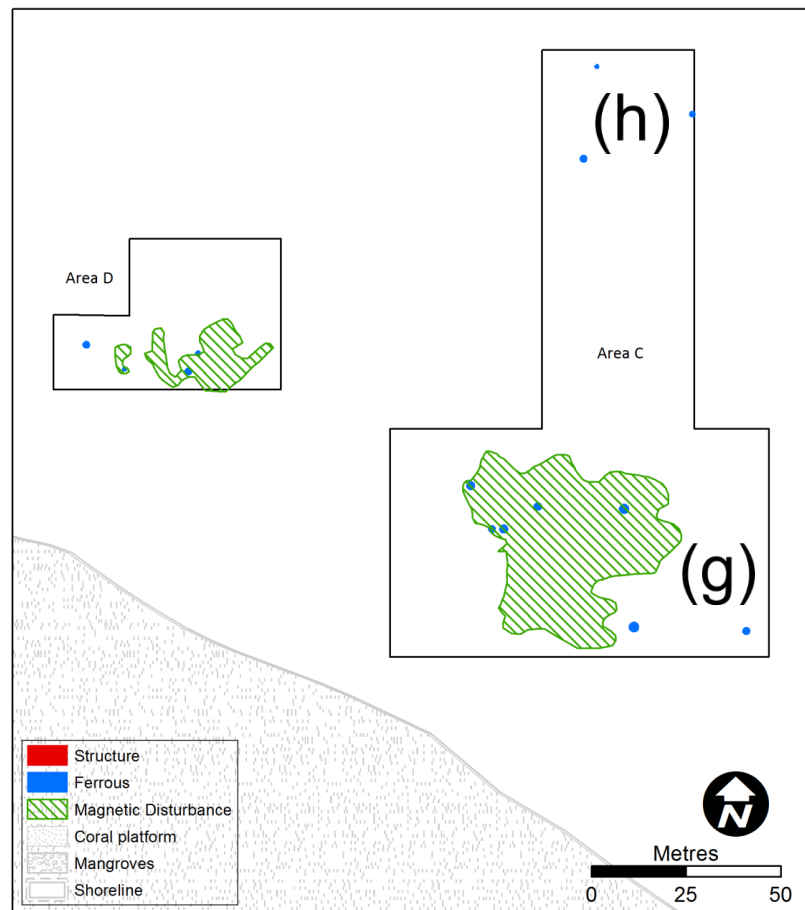


Figure 5.23: Interpretation of Areas C and D magnetic gradiometry survey

5.7.2 Area C Metal Detection

Metal detector survey in February 2014 confirmed that the clustering of bipolar anomalies above the beach was not caused by either modern debris from nearby boat-building activity, or from buried metals, suggesting that these anomalies may represent magnetic disturbance related to ferrous artefacts or thermoremanence (Feature g, Figure 5.23). The small dipoles on the beach were located and confirmed using the metal detector, and shallow excavation revealed a series of thick iron posts and degraded concrete buried upright in the ground. Several early-twentieth century coins were also found in the area, including 4 British shillings, one of which was identifiable as a 1930s coin of George V, indicating the likelihood of an unidentified structure or shelter erected here in the early- to mid-twentieth century. Whether all of the anomalies in this area are related to the same period is unclear, and likely to be determined only by excavation.

5.8 Area D

Survey Area D was established inland of Ras Kigomani in February 2014 in order to investigate the area in which a single copper alloy coin was found during fieldwalking in October 2013. The coin is similar in style to a Kilwa-type coin, but is too worn to identify or date based on the stamps. This basic identification suggests a date range of the twelfth to sixteenth centuries, whilst our existing knowledge of occupation at Unguja Ukuu supports a narrowing of this to the thirteenth to fifteenth centuries.

5.8.1 Area D Geophysical Survey

The magnetometry survey revealed faint traces of possible magnetic enhancement and disturbed ground in the ploughed field where the coin was discovered, as well as linear features in the roadway running past the field (Feature i, Figure 5.24). It is not clear from this survey what caused the positive magnetic readings within the field. Some magnetic enhancement visible at the western end of the survey area is likely to be related to deposition within a natural coral formation which breaks the surface here, and forms the boundary of the field. Within the field itself, some broad correlations of positive readings may indicate an underlying structure, but whether this is artificial or related to further natural coral formations is unclear. The linear features were partially visible on the surface as coral rag, perhaps the remains of buried walls, and the magnetometry plots demonstrate a greater length not apparent on the surface.

5.8.2 Area D Metal Detection

During survey in 2014 it was noted that the field had been recently ploughed, and further surface finds and those identified with the metal detector within 10cm of the ground surface included a fragment of a flat bronze disc with incised decoration, believed to have been part of a mirror; one silver and three copper-alloy Kilwa-type coins; and a small number of other copper-alloy fragments (Feature i, Figure 5.24). No diagnostic ceramics were found at this location, but on the basis of the coins it is again estimated that this area of the site is likely to date to the thirteenth to fifteenth centuries CE. Despite the difficulty in assigning cause to the magnetic anomalies described above, it would appear from the clustering of artefacts that there is evidence for some archaeological activity in the immediate vicinity of Area D in these centuries.

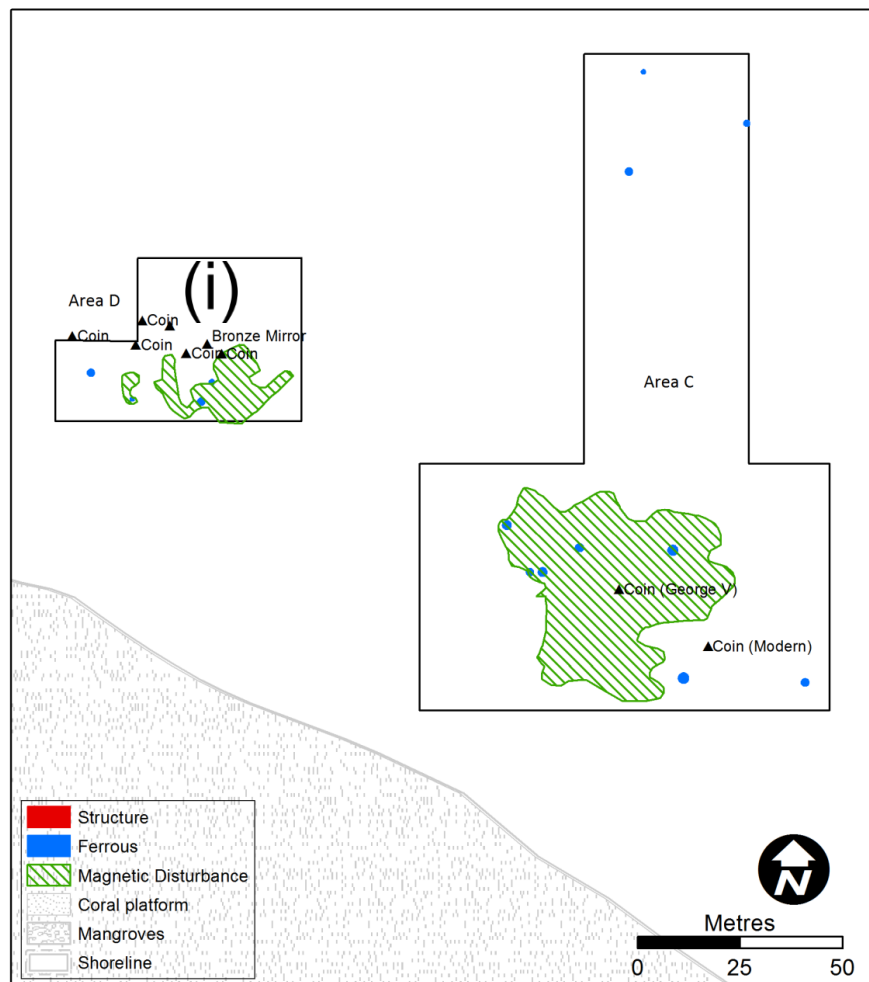


Figure 5.24: Plot of artefacts from metal detector survey of Areas C and D

5.9 Shoreline and Intertidal Zone

The aerial and pedestrian survey of the harbour area and coral shelf facing Menai Bay indicated that the sand layer covering much of the coral shelf of the bay is relatively shallow, averaging 10cm or less. The topography of this shelf is relatively flat, but a slight channel was observed, filled with soft sands and silts, running north-east from the deep water of Menai Bay towards the shore and turning east to run parallel to the shoreline up to the base of the Ras Makime peninsula. The extension of this channel to the edge of the shelf means that it is the first part of the shelf to flood with the rising tide, around 45 minutes before most of the rest of the shelf, and is therefore the deepest part of the harbour at high tide. It is used today as a routeway and channel for the fishing vessels which anchor in the bay to approach the beach before high tide. The top break-of-slope along the western edge of this depression appears slightly raised above its surroundings (approximately 20cm) and is used today as a causeway between the mid-point of the shelf and the beach. The daily, but unmarked fish market on the beach lies close to the turn of the depression at the end of this causeway. It is worth noting therefore that although only one or two small dugouts are usually to be seen beached or anchored in this area today, the lack of vessels is not necessarily a sign of the inconvenience of the harbour, but reflective of the location of the modern use of the shoreline, since there is no current occupation area at this end of the beach other than the military KamKam.



Figure 5.25: View of intertidal zone, facing west from beach beside mosque anomaly in Area B. Note flooding channel in mid-bay, and *ngalawa* outrigger beached at eastern end of channel.

Photo by author (2014)

5.10 Discussion and Interpretation

The interpretation of the settlement plan of Unguja Ukuu is based on the integration of survey and excavation results collected as part of this thesis, with previous archaeological data collected by Horton and Clark (1985), Juma (2004), and the Sealinks Project (Crowther *et al* 2013a, 2013b). The results of these surveys and excavations were digitised and compared in the GIS, and are discussed below in relation to key areas of the site.

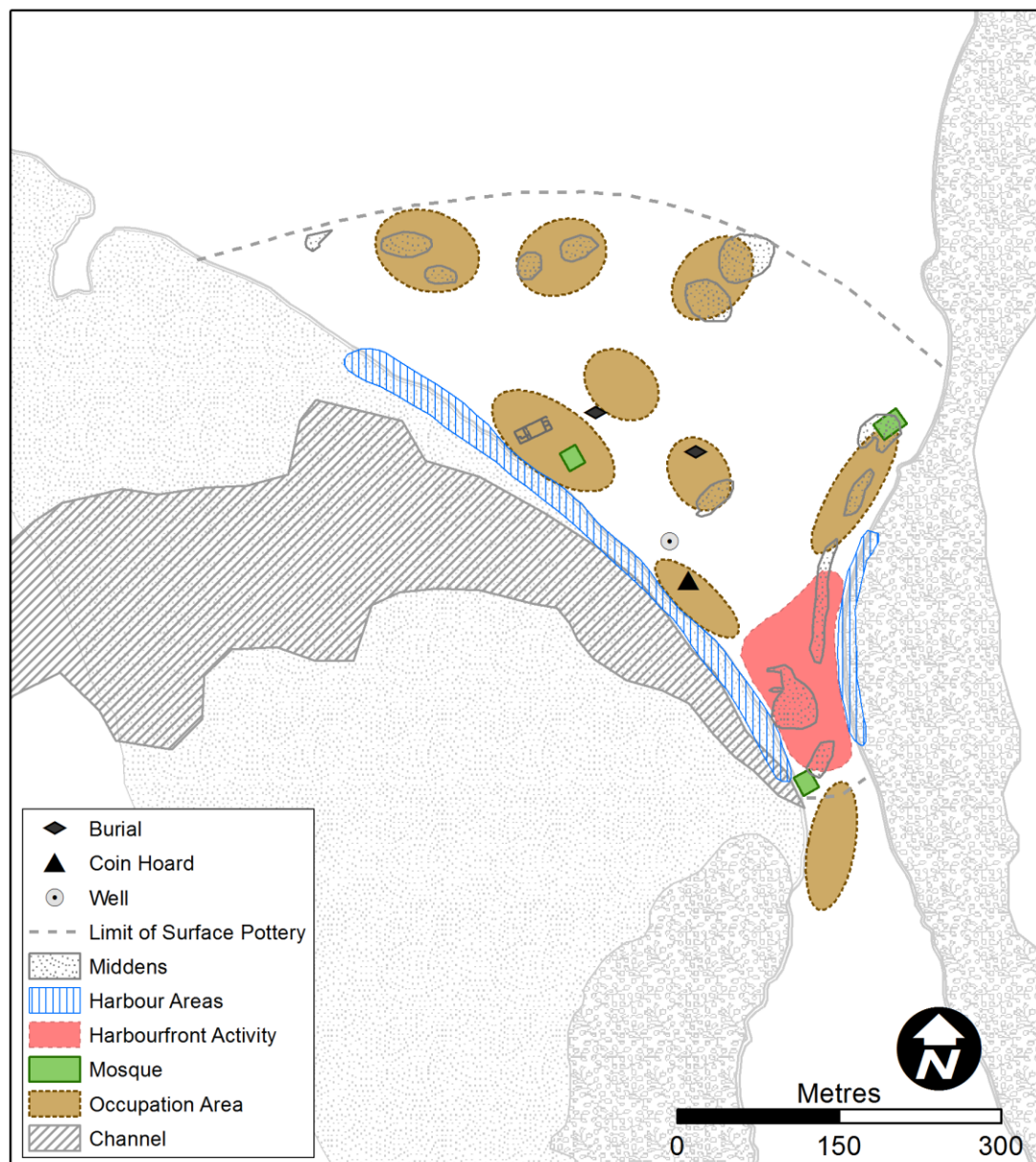


Figure 5.26: Interpretation of the sixth-eleventh century proto-Swahili settlement plan of Unguja Ukuu, based on geophysical and shoreline survey and excavations

5.10.1 Occupation Areas

Horton and Clark's original survey of the site established the estimated boundaries of the settlement based on sherd scatters and middens identified across the area (Horton and Clark 1985: 12). Setting aside for the moment the question of the contested Roman ceramics, evidence of the early occupation of the site in the seventh century seems to be concentrated just north of Menai Beach. The survey and excavation results presented in this chapter have shown that similar shell-midden contexts to those identified by Juma (2004) and by the Sealinks Project (Crowther *et al* 2013a, 2013b) north of the beach are also to be found beneath the bridge of the peninsula. It is suggested therefore that the early, ephemeral occupation of the site at the start of Juma's Period Ia was arrayed around the north-eastern end of Menai Beach.

The identification of stone remains in Juma's surveys, and the clustering of previous excavations in particular areas north of the beach, has also created the impression that occupation activity in all periods was concentrated north of Menai Beach. Whilst there is some indication in the comparison of results that the area north-east of the beach was one focus of occupation in every period of use, this project has demonstrated that the proto-Swahili settlement extended south-east around the entire beach, and onto the peninsula. This hypothesis is based on the identification of a timber structure below a later coral mosque in Area B; of faint linear negative anomalies reminiscent of walls and magnetic disturbances on the beach south of this mosque; and of extremely worn ceramics and a shell-midden eroding out of the shoreline nearby. The timber structure identified in Trench B1 has been given an estimated date of the seventh – tenth centuries based on the bead-grinders, and the potentially redeposited sherd of Kwale ware overlying the remains of the structure. The build-up of ceramic materials in a midden against the walls of this structure and the collapse of the structure onto this material indicates abandonment rather than destructive burning or catastrophe (Fleisher and LaViolette 1999). Similar structures might explain several faint linear positive magnetic anomalies identified south of this trench, and indicate the presence of an extensive area of timber or wattle and daub buildings on the beachfront of Menai Bay.

Based on Juma's auger survey, the shallow stratigraphy on the ridgeline and eastern shoreline, and Juma's excavations it is suggested that the occupation of the eastern half of the site above the mangrove creek is likely to represent an expansion of the site around the eighth - ninth centuries. Juma's units K and L on the western side of the ridgeline suggest a limited occupation only after the ninth century, and Units C, D, and M provide similar indications of occupation starting in Period Ib, although some evidence of industry in the area is discussed below.

5.10.2 Industry and Trade

Although no comment has been made on the similarity in previous surveys, a possible correlation is noted here of mentions of iron-slag and crafting in test-pits in and around the narrow, low-lying 'bridge' linking the peninsula to the mainland. Horton and Clark's test pit UU1 on the bridge of the peninsula cut into a midden at what was then the estimated southern limit of the settlement, and which was found to contain large quantities of iron slag, and no evidence of either daub or coral structures. The Sealinks Project's test-pit UU10 revealed a large midden pit at the northern edge of the 'parade ground', and UU12 indicated crafting and iron-slag close to the shoreline of the mangrove creek. Although not dated in the site report, the discovery of bead-grinders and sgraffiato in UU12 suggests that this activity may have taken place around the tenth – eleventh centuries either at the end of Juma's Period Ib or the start of IIa.

The results of the magnetic gradiometry survey presented in Section 5.5 showed a considerable and apparently unusual concentration of ferrous and potentially thermoremanent anomalies across this narrow bridge, as well as magnetic disturbances along the shoreline of Menai Beach. The integration of the magnetometry results and scanned maps of previous surveys in the project GIS has also revealed the remarkable similarity between the shapes of middens mapped by Horton and Clark in 1984 with the area of magnetic anomalies (Figure 5.15). Field walking and metal detection in Area A has helped rule out the possibility that the strong magnetic anomalies were caused by modern debris or disturbance, and led to the identification and recovery of a cluster of copper artefacts associated with ETT across the same concentration of magnetic anomalies. Trench A2 of this project was located around 16m south-east of Horton and Clark's UU1, and similar midden contexts and a lack of structural material were observed.

Based on a comparison of new and previous excavations of the site, it is hypothesised here therefore that the low-lying area of the peninsula in Area A may have been a site of industrial activity related to the maritime use of the site. The orientation and topography of this part of the site may lend itself to both maritime and industrial activity. As well as connecting the mainland and the peninsula, the bridge offers a narrow and simple connection between the beach of Menai Bay and the mangrove creek to the east, and is therefore offers the possibility of convenient portage between the two maritime zones of the settlement. It is also the least sheltered and most windswept area of the site, which whilst a disadvantage from the point of view of occupation, may have been a useful trait for an industrial area; quite literally fanning the flames of industry, and carrying the smoke and ash of iron-working and lime-burning out to sea and away from the areas of occupation in the shelter of the ridgeline and peninsula.

The discovery of lead fishing line and net weights is of course to be expected at a harbour site of this period, but alongside the evidence of industry and resource processing, their discovery in Area A and

in Trench B1 may indicate that as hypothesised in Chapter Three, this area of Unguja Ukuu is represented by a mosaic of overlapping activities and identities, including iron-working, equipment maintenance, and resource processing. The fact that this area is in close proximity to the beach, the creek edge, and the assumed position of the urban area may raise questions about precisely who was working in this part of the site, and how open it actually was to visitors, but the arrangement and location certainly indicates that access was available from both potential harbour areas. As noted above in relation to the early ephemeral use of the site, the discovery of fish and shell middens at some depth below these industrial traces also indicates a long use of the beach site for resource processing. It is suggested therefore that this area of activity represent a long-term use of the area for a combination of industry and trade related to both the main harbour area of Menai Bay, and perhaps a secondary harbour facing the mangrove creek to the east.

5.10.3 Mosque

As noted above, magnetic gradiometry survey has demonstrated that the area of settlement extended further to the south than originally estimated, to the south-eastern end of Menai Beach and onto the peninsula (Fitton and Wynne-Jones 2017). The most prominent feature of this area identified so far is the magnetic anomaly described in section 5.6.1 as indicative of a large coral structure. Excavation has demonstrated that the remains of this structure comprise a coral structure on an alignment of 328°, supporting the interpretation of this structure as a mosque. Based on the estimated seventh – tenth century date of occupation for the underlying timber structure, and the similar alignment with the mosque found in Juma's Unit M, it is hypothesised that the beach mosque dates to a similar phase of construction around the ninth – tenth century, at the end of Juma's Period Ib. The fragmentation of the coral suggests the possible robbing of larger coral blocks from this structure, and small fragments of imported ceramics suggest this robbing may have occurred during the later reoccupation of the site around the fifteenth century. The location of the mosque on the western beach is close to the end of the intertidal depression running across the coral shelf of the bay. Based on Horton's (forthcoming) theory of shoreline mosques providing a neutral meeting ground for the both inhabitants and visiting sailors, it is suggested that this mosque may have been directly related to the use of the beach, and therefore of maritime activity areas, and was perhaps for the use of sailors and merchants arriving at the site. Potential differences between the uses of the mosques are not discussed here, since further excavations will be necessary to compare the dates of construction and use of the two mosques, and to determine how their function and status may have been related to the use of the two different regions of the site.

It is also highlighted that Juma's description of the robbed out coral structure in Unit J includes a reference to a deliberate deposit of white beach sand foundations, a feature noted elsewhere at

Shanga and Songo Mnara in the foundations of elite houses, and at Tumbatu and Mtambwe Mkuu in the Zanzibar Archipelago as a deliberate fill within the platforms of mosques. This use has potential ties to both Islamic notions of white as a sign of purity, Swahili conceptualisation of white as a colour related to spirits, and beach sands as a possible symbol of maritime identity (Horton 1996, forthcoming; Middleton 2002; Wynne-Jones 2013). Given both this feature and the local references to a mosque in the region, it is possible that this coral structure, with its plaster surfaces and porites moulding, may represent that mosque. As predicted in section 5.3, this structure has since been buried by the construction of the Menai Bay Beach Bungalows, and its preservation or destruction by this process is not known, although it is to be hoped that the high concrete foundations of the current structure above may have sealed, rather than destroyed, the remains which Juma deliberately left unexcavated.

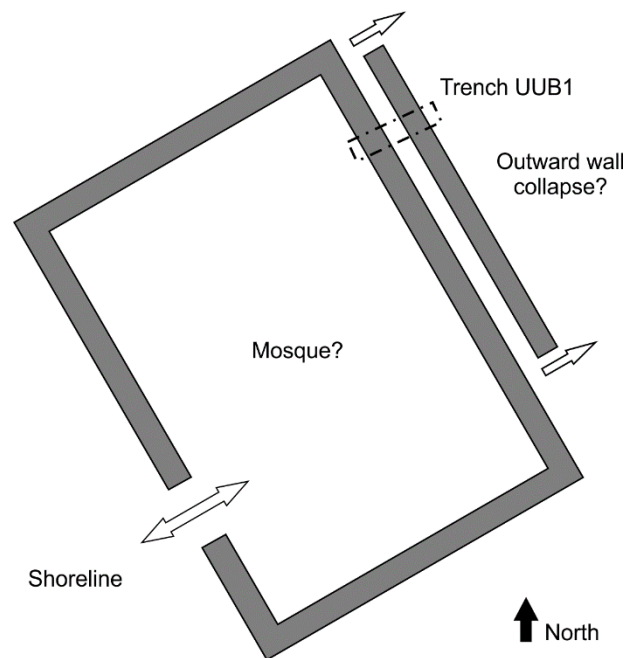


Figure 5.27 Interpretation of Area B coral structure as shoreline mosque based on results of magnetic gradiometry and excavation

5.10.4 Harbour Area

As will be discussed in detail in Chapter Eight, the site of Unguja Ukuu occupied a prominent coastal location which enabled maritime access to the site from the sea via Menai Bay, and exploitation of the various resources of the mangrove creek east of the peninsula. On the basis of the geophysical survey and excavation presented here, and by comparison with the evidence of occupation from previous investigations laid out above, it is argued that the settlement faced south-west from Menai Beach into the open waters of Menai Bay. On this basis, the main harbour area of the site is likely to

have been in the intertidal bay, visible and accessible to maritime visitors, and marked by at least one shoreline mosque, as well as occupation structures. It is possible that the mosque referred to in local reports, and potentially identified in Juma's Unit I provided the counterpoint to the southern mosque described here. As well as providing an indicator of social identity, these mosques might also have served as beacons to passing or incoming maritime traffic, and a first point of contact for Islamic ships and Muslim sailors arriving in the harbour. As well as being the more visible anchorage from the open water of Menai Bay, prior knowledge of the existence of the sandy channel in the coral platform of the bay enables a safer maritime approach to within 300m of Menai Beach (the breadth of the shelf) before high tide, in spite of the existence of the hard coral shelf. Whilst the harbour between Ras Kigonwe and Ras Makime offers a sheltered anchorage, the silt base of this depression also ensures a softer alternative for riding the incoming and outgoing tide whilst at anchor than the rest of the coral platform, and particularly for beaching at low tide. The turn and shape of this depression mean that it is possible to approach even the easternmost point of this harbour, at the base of the peninsula close to Areas A and B, although the shelter of the shoreline and peninsula mean that rowing, towing or punting might need to be employed in order to do so, according to the time of the approach relative to the tidal cycle.

However, the apparent concentration of industrial activity on the bridge of the peninsula, with access to both Menai Beach and the mangroves to the east, suggests that a second harbour area may have existed in this creek. As will again be discussed in Chapter Eight, this creek may well have supported local maritime connections along the creek and inland waterways beyond, and the industrial activity of the peninsula is therefore likely to have been related to the maritime activity of both harbours. The position of the mosque relative to the known occupation zone also suggests that this harbour industry area was an integral part of the settlement, perhaps hosting trade and maintenance activities in an area accessible by mariners, or those engaged in maritime activity from either side of the peninsula, as well as non-maritime identities from within the urban settlement. The apparent preservation of this area as an industrial zone throughout the sites use and reoccupation, with no evidence of occupation yet identified on either shoreline of the bridge, provides some indication of the importance of this area, the connection between the two harbours, and thereby the role of maritime activity as an essential component of settlement in the proto-Swahili period.

It is also suggested that the predicted expansion of the site to the east in the eighth – ninth century described above, and supported by the construction of Juma's (2004) Unit M mosque, might have been related to a growth of local activity in this secondary harbour, as well as visiting trade coming into the main harbour of Menai Beach. From this perspective it would be worth investigating the second millennium archaeological site identified by Juma on the northern tip of Uzi Island (Juma 2004: 63), and surveying for other sites along the fringes of the mangrove creeks. This interpretation suggests that the orientation of the site may have altered subtly over the course of its occupation.

As well as providing a new emphasis on the importance of maritime activity of maritime activity therefore, this theory also suggests that local connections, as well as long-distance trade, played a key role in the life and economic activity of the settlement.

5.10.5 Later Occupation

The discovery of minted coins and various copper-alloy artefacts in Area D, along with the possible remnants of ploughed-out coral rag walls, indicates that this area may have been part of the later reoccupation of the site in Juma's Period IIb. This activity may also indicate a movement of the settlement, rather than total abandonment, although the nature of these movements, their purpose or consequence is as yet unclear. Further work will need to be done in the future to investigate the size of the settlement in this period, especially given the recent development of buildings in the area.

5.11 Conclusions

The combination of magnetic gradiometry survey and limited excavations of the site has enabled a new interpretation of the layout and organisation of the proto-Swahili settlement at Unguja Ukuu. The discovery of a probable seventh – tenth century timber structure at the south-eastern end of the beach and likelihood of identifying further remains in this area demonstrates that the site was larger in the proto-Swahili period than had been anticipated. The construction of a possible shoreline mosque in coral rag, potentially dating to the ninth – tenth centuries supports both Juma's identification of a trend of urbanisation at Unguja Ukuu in keeping with contemporary regional sites, and Horton's theory of the early adoption of Islam in the Zanzibar Archipelago. The preservation of an area of possible trade and industrial activity on the bridge of the peninsula between the main occupation area and the peninsula extension to the site, suggests that this region was the lynchpin between two harbours in Menai Beach and the mangrove creek, and indicates that the maritime activity of the site was a primary concern of daily life. It also provides a possible explanation for the expansion of the site towards the eastern shoreline after the eighth century, and the potential for maritime connections along the creeks around Uzi Island might provide an explanation for the coincidental decline of crafting activity identified by Juma, as small goods may have been increasingly brought in via local connections, rather than crafted on site.

Having explored the evidence of the survey and excavations of Unguja Ukuu here, Chapter Six will present the results of the thesis survey of Fukuchani, on the north-eastern shoulder of Zanzibar.

Chapter Six

Fukuchani

“Zanzibar, city and island, is plentifully supplied with bad drinking water. Below the old sea-beach, and near the shore, it is necessary only to scrape a hole in the soft ground...the purest element is found at Kokotoni, a settlement on the N.W. coast of the island”

Burton (1872: 98)

6.1 Introduction

The palimpsest archaeological settlement at Fukuchani, on the north-western coastline of Unguja, occupies a broad beach facing west across the water of Mkokotoni Harbour towards the island of Tumbatu (Figure 6.1). The modern village on this site is built on the remains of the earliest known settlement on Zanzibar, dating to the sixth - ninth centuries CE; a later reoccupation dating to the late thirteenth - fourteenth centuries; and a stone farmstead of the sixteenth century (Figure 6.9). The site is one of several lying in close proximity in the region, including the ephemeral site of Pwani Deburi around 1km to the south; Mkokotoni, at the southern end of the bay, with a similar eighth – tenth and thirteenth – fourteenth century sequence of discontinuous proto-Swahili and later Swahili resettlement; and Tumbatu⁸, at the southern end of Tumbatu Island, the principal stonetown of Zanzibar between the eleventh – fourteenth centuries CE (Gray 1962; Horton and Clark 1984; Horton forthcoming).

It should be noted however that redefinitions of settlement boundaries, as well as physical resettlement, and mislabelling in texts and charts over the past 300 years mean that references to the various local archaeological sites at Fukuchani, Pwani Deburi, and Mvuleni are sometimes confused. Garlake’s (1966) survey refers to the stone structure at Fukuchani as Mvuleni, a name given to the whole area before the construction of the main road to Nungwi, but which is now used almost exclusively to refer to the small village with its similar and contemporary sixteenth century stone farmstead site 800m south and slightly inland of Fukuchani. Similarly, although as principal investigator of the site Horton has always been consistent in his naming of Fukuchani in reports, some of his early trenches at Fukuchani in 1984 were labelled ‘MV’ for Mvuleni, presumably to remain consistent with Garlake (1966) until the scale of the early site was fully appreciated. Furthermore, he has at different times used Pwani Deburi (Horton and Clark 1985) and an

⁸ The archaeological settlement is referred to by Yaqut in the fourteenth century as Tumbatu (Trimingham 1964: 17), although a more recent name for the site is Jongowe Makutani, ‘the place of ruins at Jongowe’ after the later and modern village

alternative spelling of Pwani Debuli, as well as Pwani Mchumgumli (Horton forthcoming) to describe the occupation of one, or possibly two beach sites around 1km south of Fukuchani, acknowledging the validity of both placenames and their alternative spellings. Sir John Gray's description of stone remains "near a portion of the beach known as Pwani ya Wadebuli" (Gray 1962: 25) actually refers to Fukuchani, and should not be confused with Horton's report of stone remains on a beach south of Pwani Deburi (Horton and Clark 1985: 11). For the purposes of clarity this thesis uses Fukuchani to describe the early settlement and modern village site, and Pwani Deburi to describe the more southerly beach site, which is referred to in Chapter Eight. Mvuleni is only used to refer to the inland settlement and ruins.



Figure 6.1: Beach at Fukuchani, facing south at mid-tide. Note coral carbonate, covered in the middle of the bay by light sand. Photo by author (2014)

6.2 Setting and Landscape

The site lies in what appears to be the basin of a raised, relict embayment, bounded on three sides by coral cliffs and bluffs. A few metres south of a sixteenth century Portuguese farmstead is a natural depression in the ground with exposed coral bedrock formations. Several small, shallow caves are visible, and Horton has previously speculated that the area may once have had a spring (Horton and Clark 1985: 7). A larger area of similar coral formations and caves in a depression were also observed east of the beach at Pwani Deburi, during the field research of this thesis. Today, at

least some of Fukuchani's water supply is piped in, but Horton (1985: 7) noted shallow wells dug through sand near the road in 1984, and least two have been maintained or dug in the base of the sand quarries since the construction of the modern road. The school's water supply also appears to draw from a ground supply at two separate points, and based on the results of the geophysical survey described below in Section 6.6, it seems likely that at least one of these, a standpipe in the courtyard of the school, may draw directly from an aquifer below, since no pipeline or significant ground disturbance that might indicate a buried tank is visible in the results of the survey.



Figure 6.2 Map of Mkokotoni Harbour in north-west Zanzibar, showing Fukuchani and known proto-Swahili/Swahili sites. Background DEM is composited SRTM and digitised UKHO hydrographic charts

To the north and east the cliffs rise into the line of hills which define the northern peninsula of Zanzibar. The modern road that cuts through the eastern edge of the site climbs onto these hills and runs along them to Nungwi, at the tip of the island. South of the site the low coral cliffs lead onto an undulating plateau of thin *uwanda* soils covering exposed coral bedrock, before dropping into another relict embayment and the beach site of Pwani Deburi a kilometre away. In spite of the thin soil cover this area is farmed extensively today by the residents of both Fukuchani and a settlement east of Pwani Deburi. There appears to be no evidence of archaeological remains in these fields.

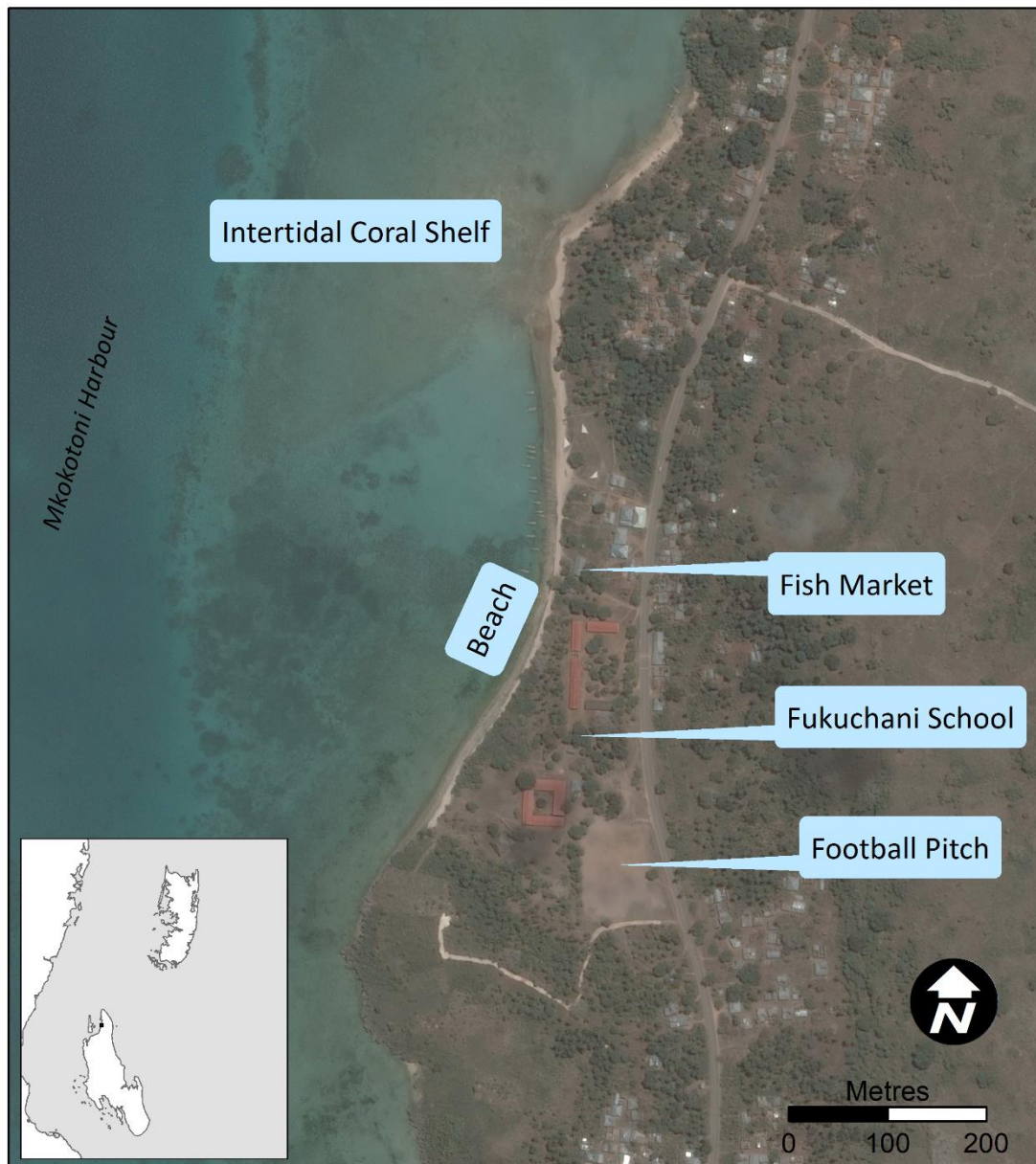


Figure 6.3: Satellite image of Fukuchani and (inset) location of site on Zanzibar.

Image dated 2013 © 2016 CNES/Astrium, captured using Google Earth Pro

In some ways the beach at Fukuchani is fairly typical of the coast between this area and Mkokotoni to the south, in that for the most part it is comprised of an exposed, intertidal beach coral, sloping shallowly down into the waters of Mkokotoni Harbour, a flooded valley between the north-western shore of Unguja Island and Tumbatu Island. The coral shelf extends anywhere between 50 - 300m from the shore before transitioning into sands and muds on the seabed. As a relict embayment Fukuchani has one of the few natural harbours in this stretch of coastline, with headlands of coral to the north and south sheltering a broad depression in the coral which approaches the centre of the shoreline from deep water. Whilst most of the beach and intertidal zone is of rough, shallowly sloping coral, the base of this depression is covered by muds, and the depression terminates at the shoreline end in two shallow, overlapping shelves of coral extending from the shore, which create a slight step up from the depression to the beach. The top edge of the beach, and a short stretch of sand just south of the end of the depression, are the only significant areas where sand covers and softens the coral to any degree. The continued growth of the beach coral is demonstrated by the many archaeological artefacts embedded in its hard carbonate matrix. These have previously been noted by Horton and Clark (1985), and will be referred to below in relation to the survey of the site.



Figure 6.4: Iron-slag embedded in coral carbonate at southern end of Fukuchani beach. Photo by author (2013)

The beach of Fukuchani is set back from the points of the northern and southern headlands of the bay by around 250m, running between the two points in a gentle curve. The southern headland is a cliff with a number of eroded stacks, whereas the northern headland slopes steeply up behind the shoreline onto the hill north of the site. Around this headland, the shoreline widens again into a series of sand and coral bays at the foot of the hills. The nearest of these bays are sandy, but backed by coral cliffs, with limited access between the shore and the settlements above. After about 1 kilometre a massive intertidal coral platform opens up to a maximum of 2km wide. The beaches behind this platform are well-known today for their expensive private resorts perched on rocky islets and cliffs, but the coral platform and the cliffs at the end of the hills mean that only a few of the beaches closest to Fukuchani are used by fishermen or settlements today, a point which will be returned to in Chapter Eight.

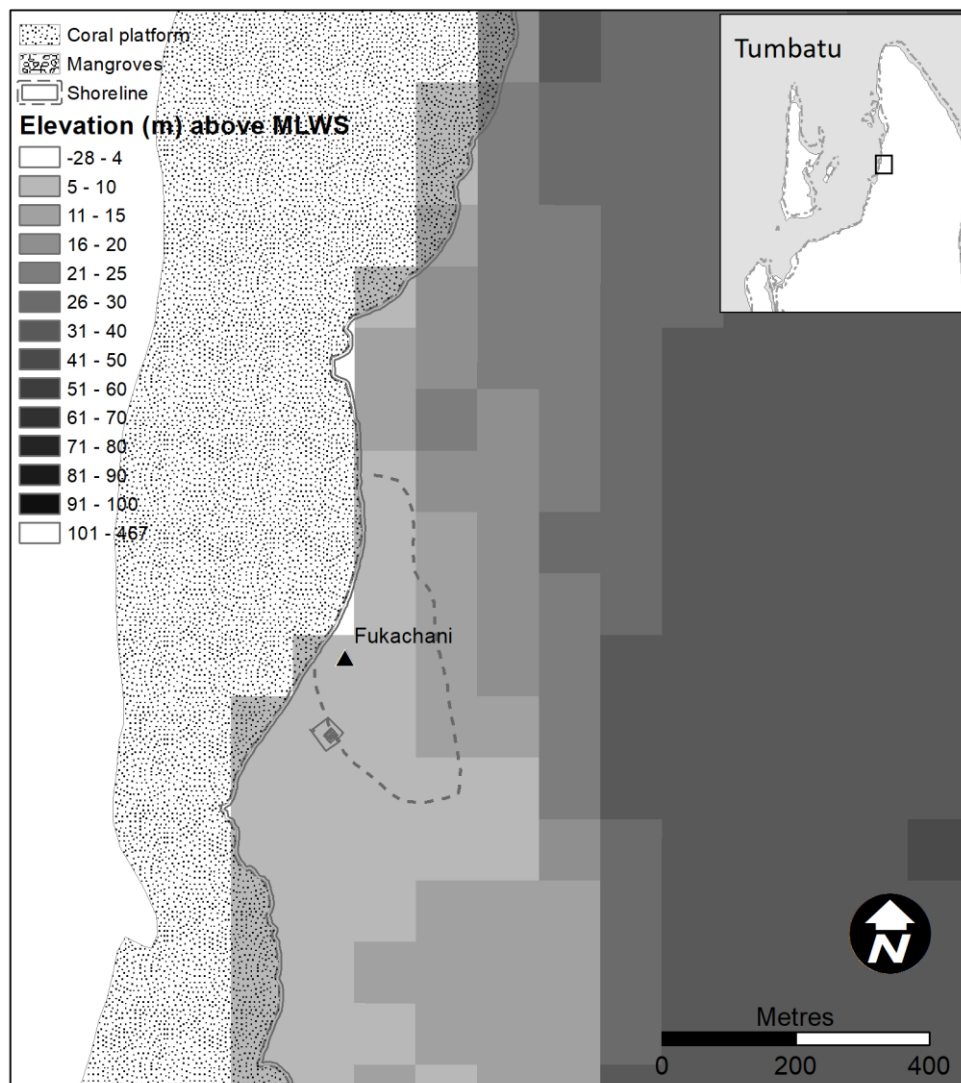


Figure 6.5 Location of Fukuchani overlaid on elevation model derived from SRTM GDEM v3.

Archaeological settlement lies in base of relict embayment

6.3 Previous Archaeological Investigations

The earliest reference to archaeological remains at Fukuchani appears in Sir John Gray's *History of Zanzibar from the Middle Ages to 1856* (Gray 1962), in which he describes a ruined stone building and enclosure with "the appearance of a fortified farm... facing the islet of Tumbatu" (Gray 1962: 25). On the basis of local traditions, he ascribes the structure to the waDebuli; a term which he suggests may refer to 'the people of Dahbol' a port on the western coast of India (Gray 1962: 26). Although Horton (2004b) and Walsh (2010) broadly concur regarding the origins of the term in reference to Dahbol/modern Dabul, they emphasise that varying interpretations and connotations of the word both in the past and elsewhere on the coast mean that it is unreliable as an indicator of archaeological origins. Garlake noted similarities in the shape of the sixteenth century structures at both Fukuchani and Mvuleni with the square houses found at Kua on Juani Island, near Mafia (Garlake 1966). Samantha Lauren has suggested however that this resemblance may be superficial, and that the double passages found at Kua suggest separate origins to the architecture of either Zanzibar or Kilwa (Lauren 2014: 124). Horton's initial assessment of the site described the structure as almost identical to that found at Mvuleni, and suggested that as well as the building being roofed with *makuti* thatch, the enclosure wall was likely to have extended further to the south-west, and since robbed out (Horton and Clark 1985: 7). He related that both the Fukuchani and Mvuleni structures were described locally as having been built by the Portuguese, and whilst agreeing with the period and commission of the building based on the unusual nature of the designs for the Swahili coast, noted that the arches and *vidaka* (small porches and niches) were likely to indicate local workmanship (Horton and Clark 1984: 7). A test excavation within one of the rooms showed no contemporary remains, but fourteenth and fifteenth century remains found below and outside the building, and the loopholes in the outer wall support the idea of a post-fifteenth century date of construction (Horton forthcoming). Horton has therefore argued in favour of either Gray's fortified Portuguese farmstead, or a Portuguese factory, both of which are recorded in contemporary and later accounts on Zanzibar at Shangani and Chwaka (Horton forthcoming). He points out however that no artefacts have ever been found to demonstrate a Portuguese occupation or inhabitation of either the structure at Fukuchani or Mvuleni. Lauren, meanwhile, has suggested that the 'loop holes' in the enclosure wall bear some similarity to 'spy holes' found in the walls of other coastal towns such as Takwa and Gedi, and suggests that the buildings might have been "Portuguese or Swahili store-houses *cum* hotels – or even markets with storage – that were constructed to meet the demands of burgeoning trade activities" (Lauren 2014: 124). Although this is an interesting theory given the probable date and position of the structure, Horton's commentary (1985) on the highly eroded nature of the floors and lack of contemporary artefacts means that the archaeology may not support Lauren's interpretation.

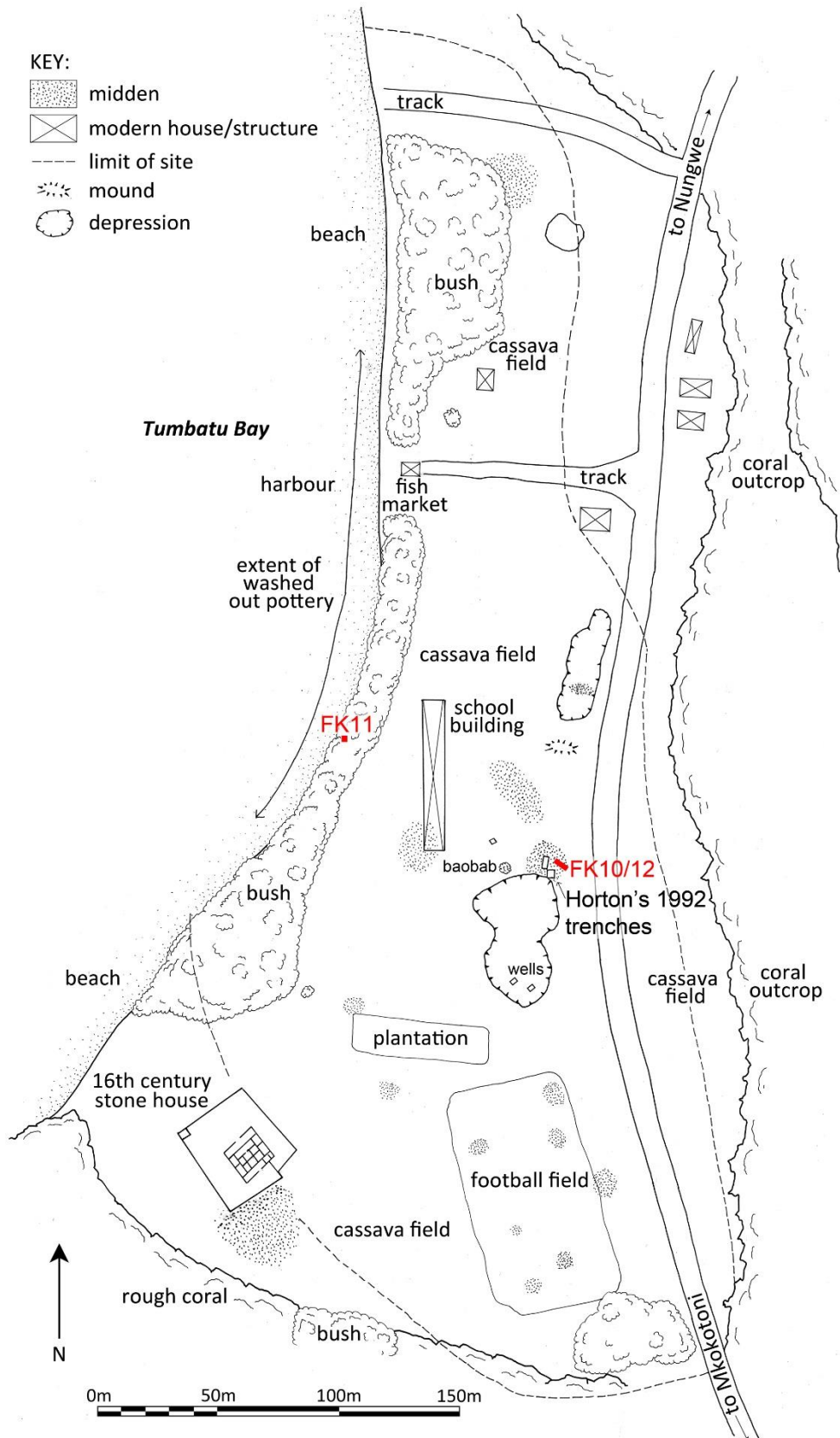


Figure 6.6 Map of Fukuchani from Crowther *et al* (2013a: 15), based on surveys originally conducted by Horton and Clark (1985), before the expansion of the school. This was georectified into the GIS, but coral outcrop marked here was not entirely confirmed on the ground

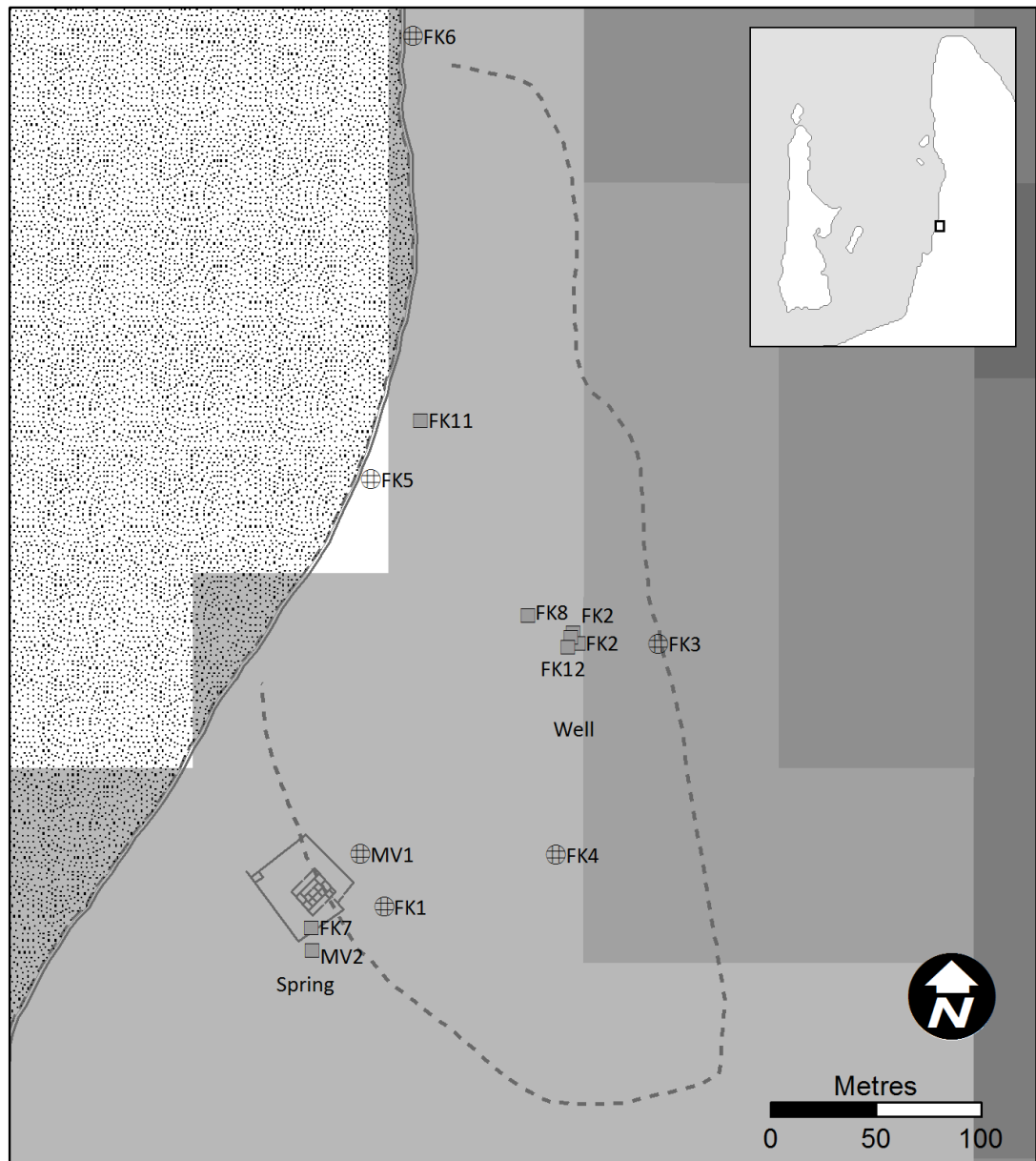


Figure 6.7 Map of excavation units at Fukuchani and limits of pottery scatters, after Horton and Clark (1985: 61) and Crowther *et al* (2013a)

Horton and Clark's (1985: 7) gazetteer of Zanzibar also includes the first identification of an early Swahili site at Fukuchani. Apart from their investigation within the walls of the stone house, the 1984 survey noted a spread of early midden deposits covering an area of around 5 hectares between the shoreline and the road, and test pitting immediately east of the stone structure revealed local and imported ceramics, beads, and coins dating to the fourteenth century (Horton and Clark 1985: 7). Horton returned to the site in 1989 and 1991 to conduct further survey and test excavations, and subsequently raised his estimation of the size of the early site to 10 hectares, with cultural deposits up to 0.5 metres deep across the whole site, and at least 15 large middens up to 2m in height and up

to 20m in length (Horton forthcoming). An Islamic cemetery with an estimated date of the eighteenth or nineteenth century was also recorded near the central area of the shoreline, standing around 3m back of the edge of a low, raised bluff above the coral beach (Horton forthcoming). Ceramics of all known periods of occupation were found spread along the shoreline of the bay, but based on their concentrations Horton suggests that the early site appears to have focused in the centre of the bay, whilst late thirteenth century deposits were found eroding out of the northern headland of the beach, and fourteenth - sixteenth century ceramics found primarily at the southern end of the bay (Horton forthcoming). Three middens were partially excavated over the two seasons; trenches FK2 and FK8 cut two of a cluster of middens more or less in the centre of the site's extent; and trench MV2 cut through a midden with fourteenth century materials, which partially underlies the sixteenth century structure (Figure 6.6).

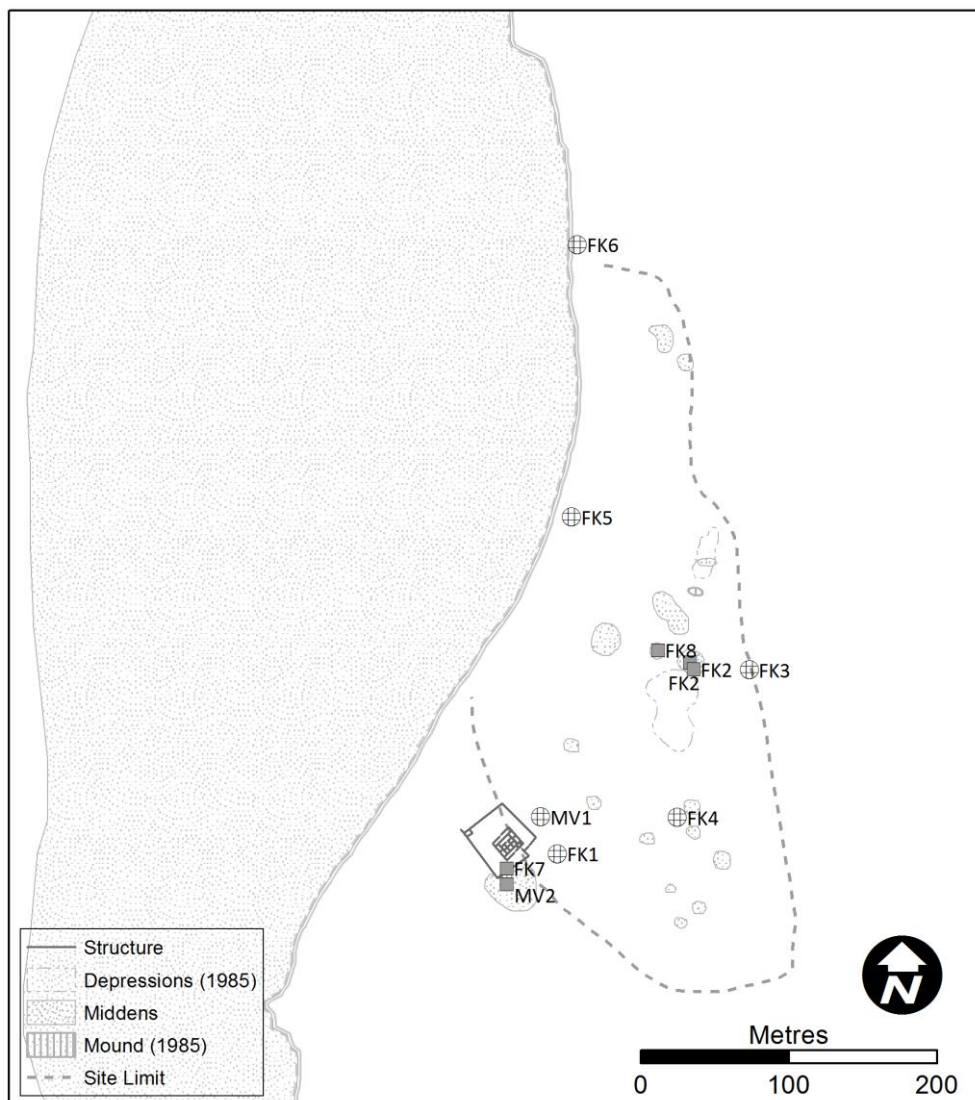


Figure 6.8: Results of Horton and Clark's survey of Fukuchani (after Horton and Clark 1985: 7)

Horton reports that the contexts of trench FK2, started in 1989 and subsequently expanded in 1991, could be grouped into 3 phases of use; the lowest and earliest phase of this midden contained some local pottery and occasional daub from timber buildings on a buried soil, whilst the mid-levels of the midden demonstrated multiple, thin layers of use and complex dumping, as well as bead grinders, large amounts of pottery and shell, and pockets of carbon, with occasional iron slag (Horton forthcoming). Trench FK8, just a few metres west of FK2, was comprised of horizontal lenses of shell and loam overlying white sand. The local pottery from both trenches was apparently all representative of ETT, with occasional sherds of turquoise-glazed Sasanian-Islamic ware, one Dusun sherd, the base of a torpedo jar, and a single rim sherd of an Indian ware (Horton forthcoming). Iron-slag that Horton associates with smithing, a stone bead and some fragments of vessel glass were also recovered from the earliest levels of the midden. In contrast with these early middens, Trench MV2, in the midden underlying the enclosure wall of the stone house, revealed dense fourteenth-fifteenth century deposits of beads, celadon, red slip and burnished wares, and a pair of thirteenth century coins. Test-pit FK7, located inside the enclosure itself, exposed occupation deposits with local and imported ceramics of the fourteenth century, and a single sherd of ETT pottery in the lowest context. The indication is that although there may have been some peripheral use of the southern shoreline area during the early occupation of the site, the most significant use of this southern area occurred with the fourteenth century reoccupation of the site.



Figure 6.9 View of 16th century fortified farmhouse from school, looking south. The thatched *makuti* roof on the farmhouse was repaired in 2013. Photo by author

Construction and expansion of the local school buildings in 1990 were apparently accompanied by a watching brief by the Department of Antiquities, Zanzibar, but whilst artefacts from this and a shallow excavation can be found in the archaeological store rooms at the House of Wonders Museum in Stonetown, no report has yet been published on the results. The school buildings now cover a very large area of the early site, and it is not clear how much of the site has been destroyed in the construction of their broad walkways and concrete foundations, or whether some areas may be preserved between buildings or inside the open courtyards.

Fukuchani was also one of the targets for excavation of the Sealinks Project in 2011. The interim report of this investigation notes that one trench and an extension, labelled FK10 and FK12 respectively, were excavated in the same midden as Horton's Trench FK2 in the middle of the site, and a further trench was excavated close to the shoreline, on the highest point of the eroding bluff above the coral beach, not far north of the Muslim cemetery (Crowther *et al* 2013a). Upon arrival at the site it was noted that a very large quarry pit, around 30 x 30m wide and between 3 - 5m deep, had been dug just west of the new road to Nungwi, apparently as a means of sand-extraction during construction of the road and the new school buildings (Crowther *et al* 2013a: 18). The pit and road are likely to have cut through and destroyed a significant portion of the eastern edge of the site, and have apparently destroyed much of the largest midden excavated by Horton in 1989 and 1991. One of the main aims of the Sealinks project was to excavate and analyse a comparative selection of wet- and dry-sieved archaeobotanical, palaeoenvironmental, and zooarchaeological materials from secure, stratified cultural deposits in order to study and date potential network connection around the Indian Ocean. Trench FK10 and its extension FK12 were located in the remaining portion of Horton's early midden because it was known to contain well-stratified, and therefore datable cultural, archaeobotanical and palaeoenvironmental deposits (Crowther *et al* 2013a: 18). These excavations were divided into 5 phases; Phase 1 contexts apparently marked the transition between natural and cultural levels and may represent an early, ephemeral occupation of the site; Phase 2 included a thin lateral spread of daub (including a square corner piece), local pottery, and later organic deposits rich in artefacts, and was interpreted as evidence of a timber structure on this spot. Phase 3 however consisted of multiple, thin layers of shell-midden deposits and possible levelling with sand and organic deposits, which was then cut by Phase 4, a square-bottomed pit- or trench-cut filled with further organic and shell-midden fill (Crowther *et al* 2013a: 19). Phase 5 represented modern topsoils. Of the ceramics in these contexts only 2 small sherds of Sasanian-Islamic ware were found, and a single sherd of Kwale ware which, given its position in the fill of Phase 4, may be part of a redeposited context and not a reliable chronological indicator. Nevertheless, its discovery on site, together with ETT ceramics, fragments of Sasanian-Islamic, other unglazed Persian sherds, shell beads and bead-grinders provides further evidence of site occupation during the sixth-tenth century, proto-Swahili period (Crowther *et al* 2013a: 22).

Trench FK11 is of particular interest here, since it was located close to the shoreline of the site, overlooking the harbour area. According to the report, it was hoped that the spread of artefacts and ceramics found on the coral beach below a low, eroding earthen bluff might indicate buried and *in situ* cultural materials (Crowther *et al* 2013a: 29). The trench was therefore positioned on the highest point of the raised beach, just 3m east of the high tide mark, on the assumption that this might be the result of occupation levels and therefore the most likely place to uncover *in situ* deposits. Beneath modern topsoil deposits the excavators reported a coral rag or “limestone block feature” (Crowther *et al* 2013a: 30) made of pieces of cut and occasionally dressed porites coral, above a laterite floor. Beneath the foundation of this floor were several contexts of sand and a possible thin shell-midden, which sealed a grave cut into natural beach sands. This grave contained an apparently pre-Islamic juvenile human burial in a flexed position with the head turned to face west (Crowther *et al* 2013a: 30). The body was investigated but not substantially disturbed, and various shells with possible ochre staining were noted in the region of the neck, indicating the remains of a necklace (Crowther *et al* 2013a: 31). The excavators interpreted the coral rag feature near the top contexts of the trench as either a burial cap or a structural foundation (Crowther *et al* 2013a: 30). Given the depth and nature of deposits between the coral rag and the grave cut the latter interpretation seems more likely, and a possible reinterpretation of both of these features is offered below in Section 6.9.3 on the harbour area of the site.

Having presented a brief review of previous investigations of Fukuchani, Section 6.2 will describe the landscape of the site and the local environment, and Section 6.4 will present the current investigation of the early settlement.

6.4 Project Survey

Following the aims and methodology laid out in Chapters One and Three respectively, the purpose of fieldwork carried out at Fukuchani was to attempt to identify patterns of maritime and harbour activity in the archaeological record. A geophysical survey of the site was carried out in November 2014, and a pedestrian survey of the shoreline and KAP survey of the intertidal zone were carried out in August 2015, as described in the methodology of Chapters Three and Four. It was originally hoped that small test-pit excavations could be conducted in two areas of the site, but due to time and local constraints, this was not possible. The results of the magnetic gradiometry surveys were again integrated in the project GIS alongside the digitised results, maps, and data extracted from previously published surveys of the site.

The geophysical survey of Fukuchani was carried out over a 5-day period in November 2014⁹. As with the survey of Unguja Ukuu, four areas were selected for geophysical survey. The location of these survey areas was planned using satellite imagery and notes taken during a brief reconnaissance in 2013. These survey areas were selected for their intended distribution across the known extent of the archaeological site, with acknowledgement of the physical constraints imposed by modern settlement and the continued expansion of the village school.

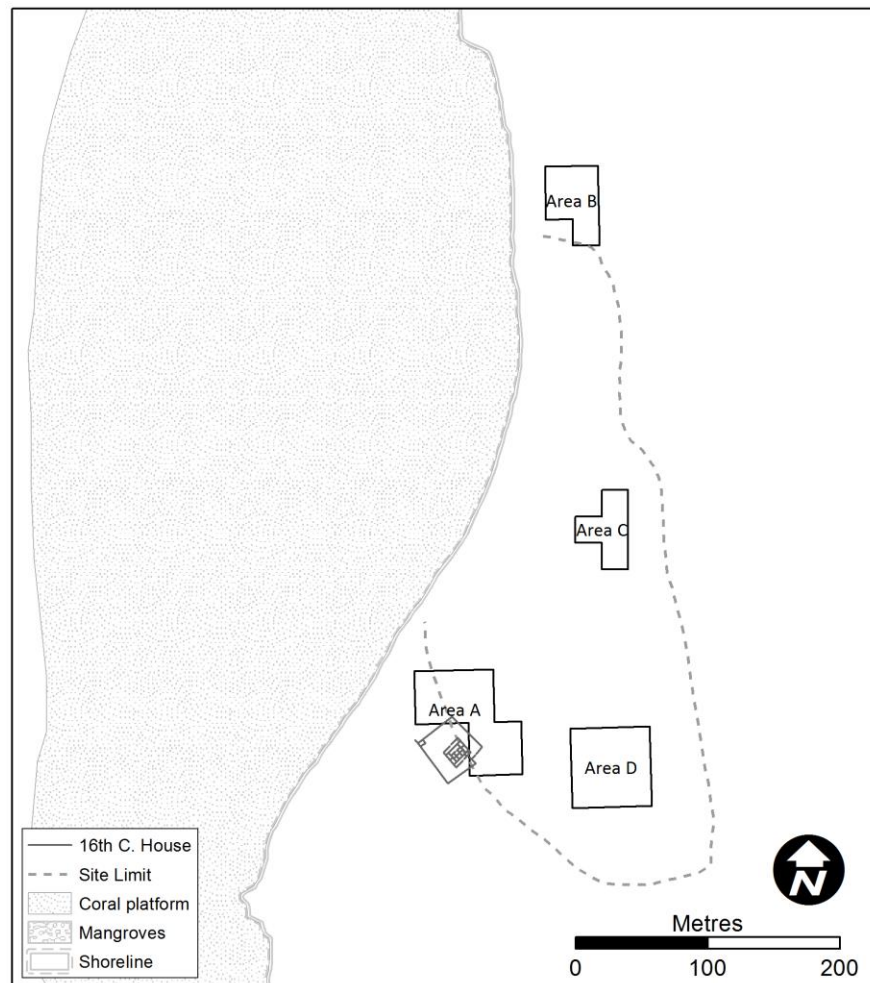


Figure 6.10: Project survey areas, 2014 season

Survey Area A was an area of open ground north and west of the stone house at the southern end of the village; Area B was above the erosion of the top of the beach, just north of the modern settlement; Area C was located between the buildings in the central space of the school; and Area D covered most of what is currently a bare-earth football pitch. The planned areas included the locations of iron slag and tuyere find-spots in Area A, and an area close to a midden identified by

⁹ This survey was funded by a Tweedie Exploration Fellowship from the University of Edinburgh

Horton in 1985 in Area B. However, due to rapid construction activity in the year between the initial reconnaissance and the survey season, the extents of both Areas A and B were necessarily reduced in 2014.

A KAP survey of the intertidal zone was carried out in August 2015, along with a pedestrian survey of the beach and a DGPS survey of Area D and the football pitch. The DGPS survey of the football pitch was carried out to map areas of possible degraded daub which had been noted in 2014, in order to determine whether these aligned with weak magnetic anomalies also identified in the gradiometry survey of Area D in 2014. The survey of the beach was similarly intended to allow further investigation of pieces of burnt daub and undated pottery sherds which had been observed eroding out of the bank of a field abutting the beach, north of the settlement, in 2014. Although the pedestrian survey and aerial photographs have proved useful, as noted in Chapter Four the KAP photogrammetry was not successful, due to reflections from water in the intertidal zone. In the end, only the line of the beach and small areas of the intertidal zone could be modelled.

6.5 Area A

Area A consisted of two linked, square areas of ground around the sixteenth - seventeenth century stone house and modern school buildings at the southern end of Fukuchani (Figure 6.10). These zones included an open, grassy area between the top of the beach and the school, and a sandy area inland between the school, the stone house, and a modern sand quarry cutting an early midden. The survey of this Area in 2014 was intended to investigate the early settlement of the area, represented by a midden in the south-east corner of the stone house (Horton and Clark 1985). A secondary aim was to investigate possible later structures related to the sixteenth century stone house and its enclosure. Due to known clearance and conservation activity within the enclosure wall around the stone house, the magnetic survey stopped at the outer wall. Survey was also stopped at a distance of 2m from the school building because of magnetic interference caused by the school structure and disturbances created by construction activity. The northern limit of this area was the edge of the woodland fringing the beach, which appears to cover further burials at the southern end of the Islamic cemetery. During a brief reconnaissance in November 2013, burnt tuyeres, iron slag, and ETT sherds were recovered from the spoil and upcast of a pair of enclosed *choo* toilets which had been recently dug just north of the school building. An extension of Area A was therefore planned to come close to the edge of these structures, to attempt to identify the magnetic signatures of kilns and iron-working areas related to the proto-Swahili occupation of the site. Unfortunately, by November 2014 the original toilets had been replaced with additional, larger structures, the construction of which had clearly involved tunnelling, the burial of a large underground septic tank, and the severe disturbance of such a large area of ground rendered geophysical survey pointless.

6.5.1 Area A Geophysical Survey

The processed results of the magnetic gradiometry survey can be seen in Figure 6.11, but their interpretation is made complicated by the potential overlap of three separate phases of occupation on the same site. A negative linear feature can be seen to the west of the enclosure, oriented NE-SW and running parallel to the shore (Feature a, Figure 6.11). This feature is likely been caused by a compaction of the ground, and a faint parallel positive anomaly indicates that these anomalies may represent the buried remains of a bank and associated ditch fill. It was hypothesised that this feature was related to the sixteenth – seventeenth century occupation of the stone house. By coincidence, an STP survey of the area by Adria LaViolette and Neil Norman in 2015 during an unrelated project came within 1m of this feature, and the small assemblage of post-fifteenth century ceramics and artefacts recovered from nearby pits supports this theory (LaViolette and Norman pers. comm., Norman and LaViolette 2016).

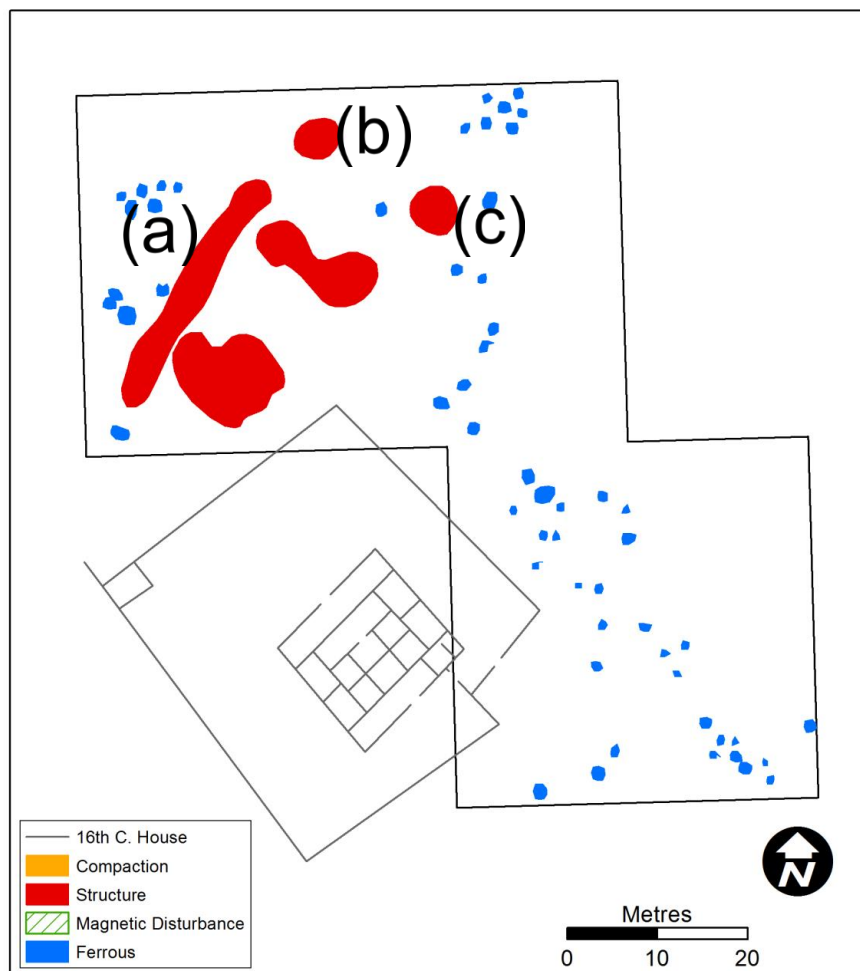


Figure 6.11: Interpretation of Area A magnetic gradiometry survey

Two circular dipolar anomalies can be seen north of the standing enclosure wall (Features b and c, Figure 6.11). These do not have the high field strength or distinctive sharp-edged qualities of ferrous anomalies, and may represent structural remains. In this hypothesis the negative part of these anomalies would be caused by a dense, compacted quantity of material, such as stone or coral. The westernmost of these (Feature b, Figure 6.11) measures around 3m in diameter and stands in line with the end of the linear 'bank-and-ditch' feature, and may therefore be similar in date. The eastern anomaly (Feature c, Figure 6.11) measures 4m across, but at 11m distant, it is not clear whether this anomaly is related to the first.

A sub-circular group of anomalies almost 6m across and indicative of magnetic debris is visible between the stone house and the school building. A small area of recent waste burning and ash which was marked with a GPS during the course of survey maps onto the edge of this anomaly, but this appears to be a coincidence, since this temporary hearth was less than 1m across, and not large enough to have caused the 6m magnetic anomaly. This feature is visible in the imagery in Appendix A, but is not included in the interpretation here.

Various small monopolar spikes and dipolar anomalies indicative of ferrous materials can be seen close to the western perimeter of survey, near the beach; around the school building; and close to the trees and quarry in the southern part of the survey area. Although no modern debris was identified close to the beach during survey, this area is frequently used by local women for the drying and sorting of seaweed harvested from the harbour, and it is possible that these may have been caused by modern materials. A scatter of small dipolar anomalies and spikes can be seen in the north-western corner of the survey area, not far from the find spot of the tuyere in 2013, and of one of Horton and Clark's middens (1985). It remains possible however, given their proximity to the school, that these anomalies may be related to modern waste, and note was made in the field of small pieces of rubbish and the burning of rubbish in shallow pits in the vicinity. The ferrous anomalies south of the school may be related to both modern surface, and to buried, potentially archaeological, materials. Fragments of modern metal debris were noted within the treeline, and thought to represent spread from a modern midden. However, the proximity of both an archaeological midden under the south-east corner of the stone house, and of a quarry cutting various archaeological deposits around 20m from these anomalies, demonstrates both the presence of archaeological materials in the area, and the potential for spread from these sources.

A series of positive and negative bipoles around the north-eastern perimeter of the survey area represent the magnetic disturbance caused by the school building, which may mask further buried anomalies under the school. This masking, which extends up to 10m from the school building, provides a useful demonstration of why further survey was not attempted close to the new toilet

blocks in the vicinity of the tuyere find spots. Some positive magnetic disturbance close to the eastern wall of the stone house is similarly attributable to a pair of modern display boards describing the protected status and oral history of the stone house.

6.6 Area B

Survey Area B was planned with the intention of covering a broad area of the shoreline at the northern end of the settlement, close to the foot of an intertidal coral platform extending out into the bay. The area covers the estimated limit of settlement established by Horton and Clark (1985), and appears to be close to two settlement middens also identified in the region, although georectification of the relevant map demonstrates some issues with scale at this northern end of the site (1985). Area B was a relatively open region of grass and thin scrub east of and adjoining the top of the beach, with a single large baobab marking the start of a path inland to the nearby houses. The ground level lies between 50cm - 1m above the level of the beach, and the area appears to have been enclosed in recent years, perhaps with the intention of either farming or construction, but has remained fallow. A short silty bank, held together by tree roots and grass cover, separates most of this grassy field from the beach. Some erosion of the bank was noted at its base during reconnaissance in 2013, but similar observations in 2014 and 2015 indicate that this is a relatively minor process related to the loose and thin condition of the soil rather than wave erosion. A quantity of shells, perhaps indicating a small, buried shell midden, was found related to this erosion a few metres north of the baobab, whilst what appears to be ash and broken coral rag was noted south of this baobab. This area was therefore surveyed for its convenient proximity to the beach, and for the chance of identifying *in situ* archaeological remains in an area without modern development.

The survey was planned using notes from the 2013 reconnaissance, Horton and Clark's (1985) published and subsequently digitised sketch map of the site, and freely available satellite imagery, as described in Chapter Three (Figure 6.10). The enclosure of the site is marked at its northern end by a cemented coral-rag wall around 1.5m high, which runs east up onto an exposed coral outcrop in the north-eastern corner of the area. This wall extends a little further inland on top of the cliff before turning south and descending the coral outcrop again, where it merges with a concrete boundary wall between 0.3 – 1m high. This wall extends through several turns west as property boundaries until it reaches the beach again. It was intended therefore that Area B would extend east from the shoreline, respecting the coral cliff and existing property walls, as far as the estimated eastern limit of occupation, and would include two settlement middens. On arrival however it was discovered that additional concrete structures, not visible on the satellite images, had been laid out for future construction, and the limits of survey were necessarily reduced to avoid magnetic interference and

masking caused by these foundations. It also became clear that although the southern part of Horton and Clark's (1985) sketch map, planned using a plane table and hand measurements, was generally reliable, issues with site visibility meant that the northern part of the map was not as accurate as originally anticipated. Correction and further georectification of the plan based on DGPS mapping of the coral outcrop and additional ground features demonstrated that the middens appear to lie under the modern settlement south of the track between the beach and the road, where both new houses and dense brush prevented survey.

The beach in front of this area is used today for boat and sail repair, and a thorough walkover of the whole of Area B was carried out prior to the gradiometry survey to mark or avoid obvious modern debris and features which might interfere with the identification of archaeological anomalies. Plastic waste and some tin and iron cans were noted on the beach, but not to a noticeable degree on the grass.

6.6.1 Area B Geophysical Survey

The processed and interpreted magnetic gradiometry results from Area B can be seen in Figure 6.12. The majority of the magnetic anomalies identified appear to be small spikes and bipoles indicative of clusters of ferrous material, along with a several larger bipoles and a large dipolar anomaly. Several anomalies close to the concrete boundary wall, and therefore likely to be of modern cause, are visible in the south-eastern corner of the survey area.

Several of the magnetic anomalies in this survey area are probably geological in nature, and can be related to features and coral outcrop plotted with a DGPS during survey (Feature d, Figure 6.12). These include several small dipolar anomalies with positive centres which can be related directly to coral outcrops up to 1m in diameter which were noted in the field during survey. The positive magnetic centre of these anomalies is attributed to the accumulation of material inside the circular coral 'bowl's which are visible on the surface. A large, amorphous, and weakly magnetic negative anomaly visible in the middle of Area B may be geological in origin, related to the coral outcrop almost adjoining it to the north-east. A linear negative magnetic anomaly is noted in the middle of this area, with no apparent modern cause. This may or may not be geological in nature, since faint linear anomalies are noted in relation to the foot of the cliff, but would require excavation to test.

The large cluster of spikes and small dipolar anomalies on the western side of the survey area covers the top of the bank and the slope to the beach, and indicates a probable spread of ferrous material (Feature e, Figure 6.12). The walkover of Area B carried out before the gradiometry survey identified some modern plastic and iron/tin waste at the edge of the beach, but the quantity and extent of this does not appear to have been comparable either in scale or density to the magnetic anomalies

identified here. A few small magnetic spikes also appear in the north-western corner of the survey area, at the top of the bank above the beach. Given the lack of notable modern contamination, these anomalies may be caused by a spread of *in situ*, ferrous archaeological materials in the bank overlooking the harbour area.

A distinct circular dipolar anomaly, around 3.5m in size is visible in the southwestern corner of the survey area (Feature f, Figure 6.12). The magnetic field strength in the centre of this anomaly is noticeably higher than any other anomaly in the Area, but the low range of its corresponding negative pole and the distinctive doughnut-shape of the anomaly suggests that this may represent a large ferrous mass, rather than thermoremanence. It is worth noting again however the presence of ash and broken coral rag found in the sloping bank to the beach nearby. This anomaly has no obvious modern cause, and is again noted as a possible archaeological anomaly

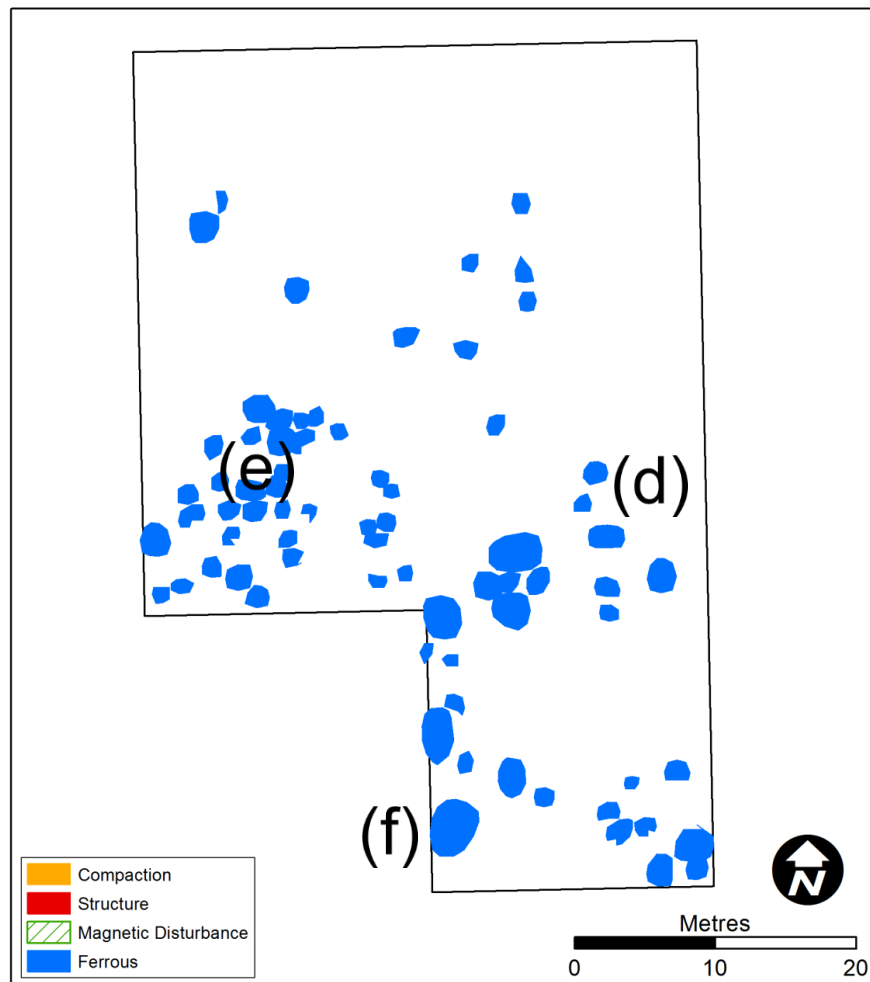


Figure 6.12: Interpretation of Area B magnetic gradiometry survey

6.7 Area C

Area C was established in one of the few relatively open areas in the central part of the site in order to determine whether it would be possible to identify archaeological remains in this region given the depth of buried remains reported by the Sealinks Project (Crowther *et al* 2013a). The survey consisted of four 20m grids laid out in the central area of the school, which is enclosed by school buildings to the north, west and south, and by a single row of trees fringing the main road to Nungwi on the east. The central area of the school contains a garden with trees, a bench, and a water pipe and basin. Depressions created by quarrying for sand were recorded by Horton and Clark to the north and south of this area, and it was observed that they appeared to cut through midden deposits and archaeological strata, since quantities of sixth - eighth century ceramics were found in the sides and base of these pits. Whilst conducting the gradiometry survey it was noted that the ground surface, which is a trampled and exposed sand and earth, appears to have been levelled, but it is not clear whether this was through the removal of earth for construction, or deposition to fill in one of the quarries or depressions which line the road.

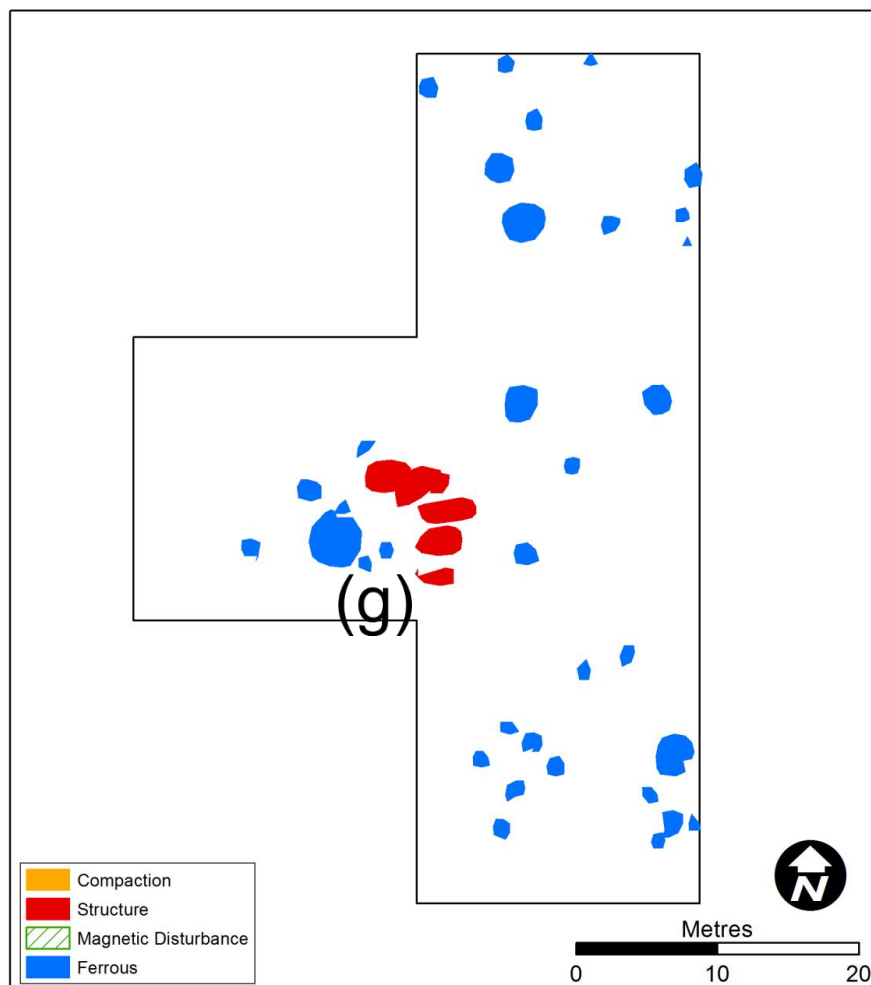


Figure 6.13: Interpretation of Area C magnetic gradiometry survey

6.7.1 Area C Geophysical Survey

The gradiometry survey of Area C was inconclusive. A number of separate small dipolar anomalies were observed, and are likely to represent buried ferrous metal objects, but given the hypothesised disturbance of the ground and the regular use of the site it seems unlikely that these represent *in-situ* archaeological features. Two positive anomalies in the central garden surround the water pipe and a rockery of coral rag, presumably collected during construction, and which may mark buried infrastructure related to the school (Feature g, Figure 6.13).

A series of six near-parallel negative linear features, each around 2m in length, are visible in the centre of the survey area, also within the designated garden. Although these appear to represent compaction or parallel banks, no trace of these features was visible on the surface. The georectification of Horton and Clark's plan of the site suggests that these features map onto the edge of one of the larger middens, which might explain the slope of the land up from the road to this area. Without excavation however it remains possible that these features are related to the construction of the garden or destruction of archaeological remains rather than *in-situ* deposits.

6.8 Area D

Area D covers a bare-earth football pitch at the southern end of the site on which Horton and Clark (1985) identified a series of middens during survey in 1984. The pitch is south-east of the school, fringed by a line of trees, and bordered by the main road to Nungwi on the east. Two tracks run north and south of the pitch, the former to the school, and the latter leading to fields and houses to the south. Behind the line of trees to the south-west of the pitch, and between Areas A and D, is the sand quarry mentioned in the outline of Area A which cuts through archaeological strata, including a possible midden containing large quantities of ETT. A further quarry with further ETT ceramics lies on the other side of the track to the school, north of the survey area.

Although the destruction of archaeological deposits has been reported in the clearance of this pitch (Crowther *et al* 2013a), the site was selected for survey in 2014 when a repeating pattern of soil marks across the pitch were identified in a sequence of satellite images taken between 2006 – 2013. These dark soil marks appear to correspond with the middens mapped by Horton and Clark in 1984, indicating the possible survival of the middens or associated deposits. Nine 20m grids were therefore laid across the pitch to investigate this possibility.

During the course of survey it was observed that although the pitch is composed of soft, silty-sand, occasional distinct regions of a hard compacted surface could be felt underfoot. A brief investigation of these areas revealed narrow linear alignments of a dense clay- or daub-like material thinly covered by the sand. Three such features were mapped as simple tracklines with a handheld GPS unit in 2014 and found to be of varying lengths between 3-7m long, and around 60cm wide. An effort was made in 2015 to map as many of these as possible with the more accurate DGPS unit, in order to determine whether they corresponded to either the parch marks or the results of the gradiometry survey. The results of this DGPS survey can be seen in Figure 6.15. On this occasion it was noted that as well as simple linears, several right-angled tangents, and two sub-rectangular 'rings' of the same dense material indicate the survival of structural remains in this area. Only a few sherds were recovered from the site, and these were found in the vicinity of the southern middens reported by Horton and Clark (1985), but it was noted that a number of these were examples of the Early Tana Tradition. Due to the obvious disturbance and quarrying of the ground in this area, these sherds were collected as a guide only, and should not be considered proof positive of dating evidence. It is hypothesised however that the position of the pitch between nearby, known deposits of ETT to the north and south-west supports the estimated dating of the archaeological remains and middens in this area to the seventh – tenth century proto-Swahili occupation of the site. The nature of the remains and their significance to the site is discussed below and in Section 6.9.

6.8.1 Area D Geophysical Survey

Although the raw, unprocessed gradiometry results of Area D appear relatively featureless, clipping of the data to remove the masking effect of the goalposts at the northern end reveals significant spreads of low-range magnetic disturbance, and of magnetic spikes and dipoles. Due to the low range of signals across the Area, plotting of the magnetic disturbances was carried out using two separate methods, to allow for comparison between them and a qualitative assessment of reliability.

The first method used to identify features of possible interest was a simply visual outlining of anomalies as vector polygons, based on a stretched colourmap in ArcGIS. Once areas of magnetic disturbance had been identified, the range of data values within these anomalies was used as the basis for raster reclassification and extraction to a new raster, and anomalies related to magnetic interference masking caused by modern features were removed from the dataset. This allowed for a comparison of qualitatively selected anomalies with a quantitative statistical selection of data. The overlay of these results demonstrated that although additional areas were highlighted using the mathematical extraction method, the orientation, shape and size of anomalies highlighted using each method was broadly similar, providing a measure of confidence in the visual identification of anomalies (Figure 6.15).



Figure 6.14: Comparison of satellite imagery available in Google Earth from 2006 (top) and 2015 (bottom). Note soil marks particularly visible in image 2015

Both methods highlighted a series of linear and sub-rectangular magnetic anomalies against a background, both 'inside' and 'outside' these features, of neutral or slightly positive magnetic readings. As at other areas of the site, the negative areas of these anomalies are likely to be the result of surface or sub-surface compaction. This theory is confirmed by the correlation between some of these anomalies with the areas of compacted clay described above and mapped using DGPS in 2015. Regular paths across the pitch were also mapped in 2015, and do not correlate with either the negative magnetic anomalies or the areas of compacted clay. Only one of these areas of negative magnetic readings overlaps directly with Horton and Clark's middens and the previously mentioned corresponding soil marks, although several others are found in close proximity. The broad areas of these anomalies and features are also visible in satellite imagery as dark soil marks, and appear to have no relation to known footpaths, structures, or to the structure of the pitch itself.

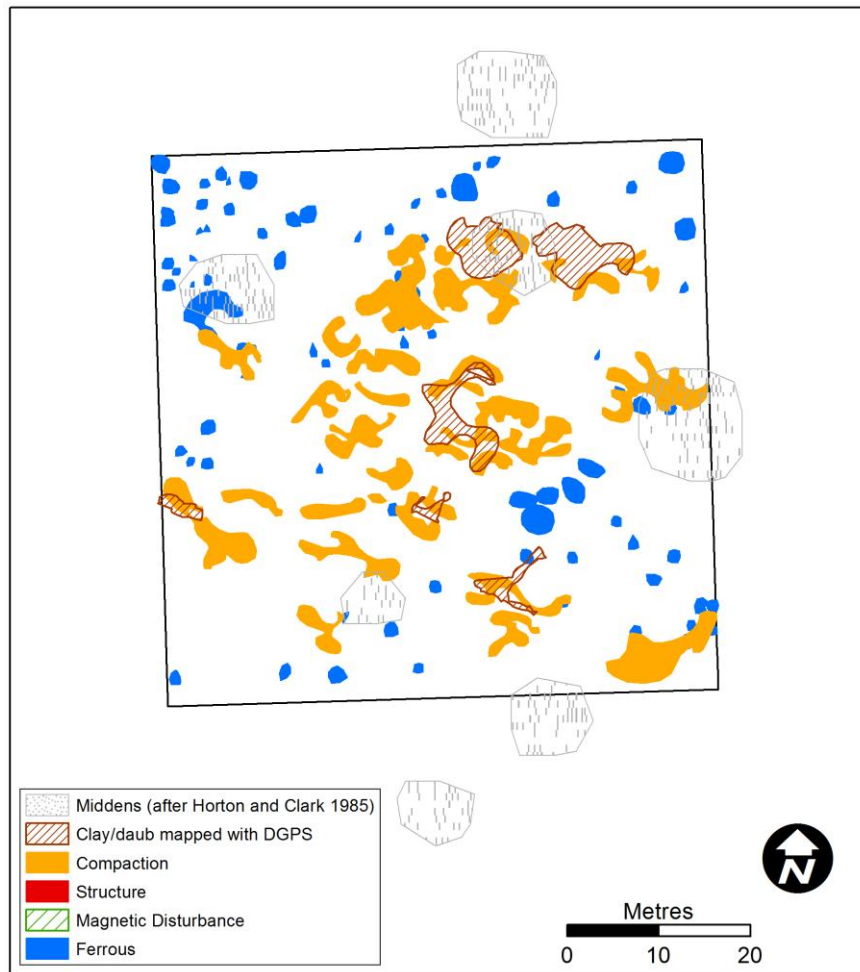


Figure 6.15: Interpretation of Area D magnetic gradiometry survey, with overlay of clay/daub features mapped with DGPS, and Horton and Clark's (1985) georectified midden map. Note the correlation of magnetic anomalies with compacted clay/daub, and concentration of middens.

The magnetic spikes and dipoles indicate a large number and broad spread of ferrous debris across most of the survey area, although it is interesting to note that these seem to be found in particular in the vicinity of the predicted structures, rather than Horton and Clark's middens (Figure 6.15). It is suggested here that the linear anomalies, each around 40cm wide, represent the degraded walls of rectangular daub structures, and that the dark soil marks visible in imagery represent the overall plan of individual buildings, affected by both occupation activity and structural decay. The clustering of these anomalies, features, and middens suggests that collectively they represent an occupation area.

The levelling of the pitch has clearly damaged archaeological deposits, and deliberate clearance of objects which might otherwise hinder its regular and energetic use has apparently resulted in the relative paucity of surface finds. Without surface scatters or excavation, the dating of this

occupation area is at best an estimate based on the location of the football pitch between two quarries with large quantities of ETT. This position suggests however that the occupation area is related to the sixth – ninth century proto-Swahili settlement.

6.9 Shoreline and Intertidal Zone

The initial reconnaissance of the site in 2013 noted considerable quantities of ceramics embedded in the beach-rock of the shoreline, and a pedestrian survey of the beach in 2014, conducted in part to identify potential areas for further geophysical survey, confirmed Horton's personal estimation that the area with the greatest concentration of these ceramics lay in the middle part of the beach, in front of the modern anchorage (Horton forthcoming). A considerable number were also noted in the extreme southern part of the beach, along with what appeared to be a slightly higher ratio of pieces of iron slag.

Following the initial reconnaissance of the shoreline in 2014 a KAP survey of the bay was carried out in August 2015 to capture imagery for photogrammetry. It was observed that the beach and bay curve around a sheltered depression in the centre of the bay which is today the anchorage of the site. This depression is around 300m in width, north to south, and extends from the open and deep water of Mkokotoni harbour right up to the beach. The base of the depression is buried in intertidal sands and muds. As noted in the introduction to this site, the southern half of the beach at Fukuchani is characterised by an actively growing coral carbonate surface, which extends in a shallow slope down into the intertidal zone. Halfway up the length of the beach however, where it meets the edge of the depression, this coral surface is buried by white sands, before rising slightly again to create a noticeable step around 30cm high at the edge of the beach above the end of the depression and the water's edge. This feature is described here as a lip rather than a wave-cut platform. From this point northwards, in spite of the visibility of the coral platform at the waterline, the upper half of the beach is buried in white sands. The northern tip of the beach has a similar underlying geology to the southern end of the beach, and here again the coral shelf extends up to 300m from the shore, although here the shelf has a high crest which seems to act as a breaker against the swell of which rolls down Mkokotoni Harbour from the sea. Given the nature of the sewn-plank craft discussed in Chapter Four, as well as the coral shelf running along much of this coastscape, this provides a convenient natural shelter for the bay in front of Fukuchani beach.

During the course of survey it was observed that of the areas of coral in the bay, the southern area was relatively flat, with carbonate plates lying higher up the beach than the sharp, fractured coral platform of the intertidal zone. By contrast the northern area of coral formed a slightly elevated, though still intertidal peninsula of sharp ridges and small shelves, with rockpools and pockets of mud

in between these outcrops. Whilst this peninsula provides a natural breakwater for the depression, the topography and curve of the ridge creates a potential maritime hazard for boats entering the bay, especially when partially covered and hidden at mid- and high tide.

The centre of the bay therefore provides a natural anchorage and harbour for the settlement, sheltered by coral breakwaters, and the beach adjoining this small area is the only part of the bay where boats can be run aground on sand, rather than sharp coral or hard carbonate rock. This is, incidentally, the area where the majority of boats are moored and beached in the harbour today, although a few are occasionally found beached and anchored on the flatter carbonate platform at the southern end of the bay, above the line of the sharper coral.

The depression of the anchorage and the pools of the northern coral peninsula are exploited as resource areas today by local women and children, who dig for molluscs and shellfish in the muds and sands. Net fishing also takes place in the anchorage, again carried out by groups of women and children, mostly female, who wade out across the anchorage from the peninsula at mid-tide carrying nets, whilst others drive fish towards them by beating the water with paddles. The practice demonstrates that although the site has no mangrove resources, the intertidal zone is still an important local subsistence resource.



Figure 6.16: Boats moored on sand below coral carbonate shelf in central part of Fukuchani beach.

Photo by author (2014)

6.9.1 Burnt-daub structure on beach

During the survey of the beach in 2014, large pieces of partially fired daub were identified in the eroding bank of a small field at the top of the beach, north of Area B. A brief survey of the field, which measures 16x10m revealed further daub and non-diagnostic ceramics within 3m of the bank, but no further inland. Pole impressions in the largest pieces of daub suggested a range of 3-8cm in pole diameter. Investigation of the same area in 2015 demonstrated that further erosion of the bank had exposed a quantity of large, fragmented, but relatively unworn ceramics including some TIW, and more partially fired and burnt and blackened daub. A segment of the bank 3m long was therefore cleaned and recorded as a section through a potential structure, in case of further erosion and collapse before additional investigation or excavation could be carried out. The burnt and blackened daub was found to have a particular concentration in one spot in the bank, along with what appeared at first to be a small fragment of melted glass of this area. Cleaning the area for recovery revealed that this was a single piece of what appears to have been glass bracelet composed of multiple strands of glass beads, which has partially melted in a fire and subsequently been shattered *in-situ* by either a structural collapse or later taphonomic processes. The melting glass has retained an impression of what appears to be a woven fabric on one side of the bracelet. Charcoal fragments were recovered from the centre of burning for radiocarbon dating, but have not yet been tested.



Figure 6.17 Burnt daub structure buried in eroding fields north of Fukuchani beach, marked on Figure 6.18 AS 'SPOT FIND'. Melted glass bracelet was found *in situ* at centre right of photo amongst burnt daub.

The remains indicate the burning and destruction of a daub structure containing probable second millennium Tana Tradition ceramics and glass artefacts. The location of this structure is more than 100m north of Clark and Horton's estimated limit of the early settlement, on the boundary between the harbour space of Fukuchani and the coral headland which shelters the harbour from the Tumbatu channel. No other ceramics or daub was found in the area north or east of this structure in 2015, but Horton reports that thirteenth century ceramics were found in the same area in 1991 (Horton forthcoming). Further survey will be necessary in future work to investigate the extent of this site, to confirm its date and determine whether it is related to the same area identified by Horton (forthcoming), and to establish whether the structure was a standalone or related to other structures.

6.10 Discussion and Interpretation

The investigation and interpretation of the settlement plan at Fukuchani is complicated by the location of the modern village across the area closest to the natural harbour, and by construction over the past 30 years of a school which has buried or destroyed a significant area of this earliest known proto-Swahili settlement on Zanzibar. The discussion offered here is based on the integration of survey data collected as part of this thesis, with previous archaeological data collected by Horton and Clark (1985), a series of as-yet unpublished excavations by Horton between 1989-1991, some of the data for which he has kindly provided for research (Horton forthcoming), and the Sealinks Project (Crowther *et al* 2013a, 2013b). The results of these surveys and excavations were digitised and compared in the GIS described in Appendix B. Based on the evidence presented in this chapter, various activity and occupation areas are hypothesised below, which suggest an overall pattern of settlement organisation during the proto-Swahili occupation of Fukuchani (Figure 6.18).

6.10.1 Occupation Areas

Horton and Clark's (1985) survey of the site established a map of the middens in the area before the expansion of the village and school, and the disturbance or destruction of archaeological deposits. The largest middens of this survey appear to lie in the central region of the site, whilst those towards

the south-east are smaller, but more frequent. Based on these surveys the extent of the site has been estimated at 10 hectares, and Horton has hypothesised that the early site lay more or less half way up the length of the beach, and stretched inland towards the south-east.

The results of the pedestrian and magnetic gradiometry survey carried out in 2014 have shown a direct correlation between a regular plan of weak negative linear magnetic anomalies, and dense clay or daub features identified on the surface of the football pitch almost at the south-eastern limit of the estimated extent of the site (Figure 6.15). In spite of the ephemeral nature of the magnetic anomalies and daub remains, these features were verified as being of probable archaeological cause in this survey by comparing the results of the gradiometry, pedestrian, and satellite surveys and noting the clustering of soil marks in aerial imagery within the limits of the magnetic and daub features noted on the ground. Based on this analysis, it is suggested that Area D corresponds to an area of sixth – ninth century occupation, which has recently been exposed and potentially truncated by the clearing and use of the football pitch.

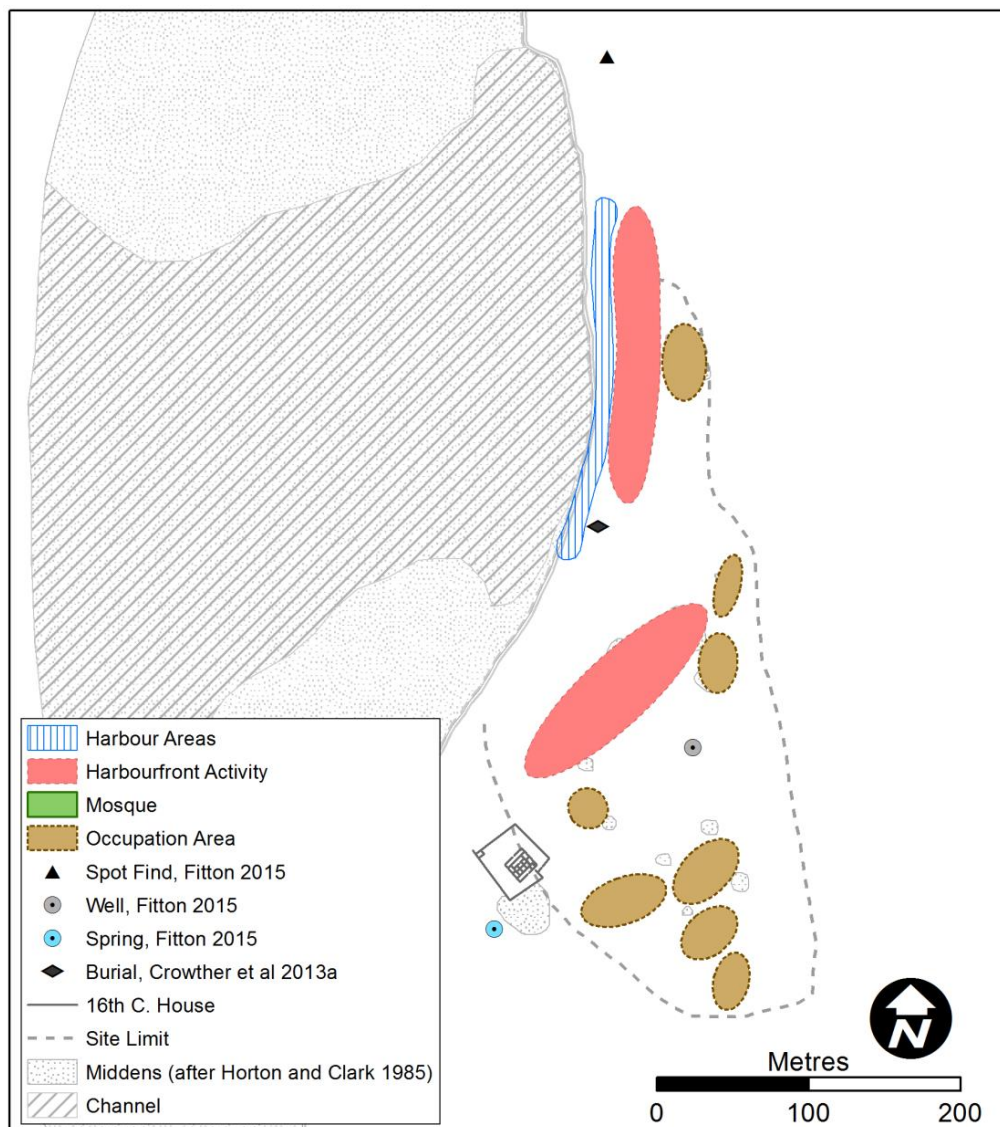


Figure 6.18: Interpretation of the sixth-eleventh century proto-Swahili settlement plan of Fukuchani, based on geophysical and shoreline survey and previous excavations

6.10.2 Industry and Trade

Horton has reported that scatters of iron slag were found eroding from the beach-side middens of the site, and that a heavily vitrified tuyere, presumed to have been inserted into the base of a furnace, was found in Trench FK2 in 1989 (Horton forthcoming). Although pieces of iron slag were found in every excavation trench at Fukuchani, the quantities appear to have been low, and FK2 in particular was noted by Horton for the rarity of slag. As described above in Section 6.4, a second tuyere, iron slag and ETT sherds were identified during reconnaissance for this thesis in 2013. Based on these two finds of tuyeres within 100m of each other, and the frequency of iron slag in excavations, as well as what appears to be a concentration of slag in the carbonate rock at the southern end of the bay, it is hypothesised that a band of iron-working and industrial activity extended from the central area of the site south-west towards the shoreline. This activity area lies just inland of the predicted landing area of the harbour, and might therefore have been a convenient meeting ground for incoming sailors and merchants, offering the potential for trade, resource-processing, and maintenance activity, as well as a convenient place from which to load. Since space in the relict bay is limited by the coral cliffs, the band of iron-working evidence also forms an arc around the assumed harbour area of the site which effectively, and perhaps deliberately separates the harbour from the potential occupation area described above. Unfortunately, the construction of the school, two toilet blocks, and burial of pipes leading to a water tank between the school buildings means that further geophysical survey to test the limits of the iron-working area would be problematic, but it may be possible in future to conduct a series of small test-pits or STPs at intervals to explore the possibility of a transition zone across this area.

6.10.3 Harbour Area

The coral peninsula at the north end of the bay at Fukuchani serves as a natural breakwater for the site, and means that the harbour is a naturally sheltered anchorage. In spite of the coral shelf at the southern end of Fukuchani beach and the peninsula to the north, the sand-mud depression at the centre of the bay does not dry completely at low tide, and floods quickly at the turn. The short strip of beach not covered by carbonate beach-rock or coral at the top of this depression means that provision can also be made for beaching, as well as anchoring. Fukuchani therefore provides a versatile harbour space, but one which is conceivably best utilised with prior local knowledge of the coral and sand topography of the bay. This topography also means that the best location for harbour

activities such as boat maintenance is likely to be close to the top of this depression, between the modern fish market and Area B, at the north end of the beach. Unfortunately, this also means that verification of these facilities is difficult because the expansion of the village and associated gardens in recent years has disturbed and buried this area, and associated metal debris visible across the surface of the site interferes with the results of gradiometry. However, the scatter of ferrous magnetic anomalies described in Section 6.6 are noted as possible evidence of archaeological activity just behind the beach of the natural harbour. This scatter may therefore represent a maritime activity area, although excavation will be required to test this hypothesis and date any remains in the area.

It is interesting to note the position of the Sealinks Project Trench FK11, containing an early burial presumed to be pre-Islamic, and the later Islamic cemetery which lies around 50m south of this trench (Crowther *et al* 2013a). Both sites lie above the beach along the highest point of the shoreline, in what is currently an area of wooded scrubland west of the school. No occupation materials are visible on the surface in the area, except for those embedded scatters previously described on the beach, and few remains were apparently recovered from the contexts above the burial in FK11. The burial in FK11 was apparently sealed beneath cut and dressed blocks of limestone and coral rag, which were interpreted by the excavators as either a tomb or structural foundation. Based on similar discoveries elsewhere, it is possible that if the coral represents a tomb, it may have been erected some considerable time later than the body was interred. The body itself was found flexed and facing west, and with 10 different types of sea shells found around the neck, and has been interpreted as a non-Islamic burial in what appears to be a deliberately prominent location overlooking the harbour. This area is clearly visible from the water, and it is suggested here that this burial ground may represent a symbolic marker of identity, both for the inhabitants of the settlement, and towards maritime visitors to the site.

6.11 Conclusions

The previous investigations of the site by Horton and Clark (1985), a watching brief by the Department of Antiquities (unpublished, referred to by Horton forthcoming), and by the Sealinks Project (Crowther *et al* 2013a) have revealed archaeological sequences which date the proto-Swahili occupation of the site securely to the sixth – ninth centuries CE, and indicate separate occupations during the fourteenth and sixteenth centuries CE. The excavations have also revealed large quantities of iron-slag and tuyeres beneath the area of the school; imported artefact assemblages which indicate some connection to long-distance trading networks; and a faunal assemblage which suggests a reliance on a marine diet of fish and shellfish (Horton and Clark 1985; Crowther *et al* 2013; Horton forthcoming). Once again however, what had not yet been discussed was the

organisation of the settlement in relation to its maritime activity and harbour spaces, or the active role of the site within a maritime cultural landscape.

Based on the results of the geophysical surveys described in this chapter, and a comparison of all of the data in the project GIS, it is hypothesised that the early settlement may have been divided into three areas of activity: a harbour area with maritime activities directly related to the use of the harbour; a band of industrial activity, including iron-working and possible smelting stretching at least from the centre of the site south-west towards the shoreline, evidence by slag and tuyeres; and an occupation zone further inland, separated from the littoral zone of the harbour by the industrial zone between them. It is also possible that the repeated use of the ground behind the beach for pre-Islamic burial (Crowther *et al* 2013a) and an Islamic cemetery indicates a long-standing expression of identity tied to the maritime cultural landscape. Further excavation will be required to test these hypotheses however, since it is now clear that the construction of the school has both severely damaged the archaeological remains, and created obstacles with such high levels of magnetic interference as to render magnetic survey between the buildings irrelevant.

Having discussed the evidence of the survey and previous excavations of Fukuchani here, Chapter Seven will present the results of the thesis survey of Tumbe, a creek site behind the north-eastern coastline of Pemba.

Chapter Seven

Tumbe

“Fishing is typically a man’s job. Yet women do catch fish, albeit in a simple manner, in which several women combine to surprise small fish on the mwamba reefs, and the pwayi [beach] at low tide, fish that cannot escape the extended veils the women use...picking up or collecting of small fish, shell fish or crabs in holes and crevices along the reef is also done by women”

Prins (1965: 136)

7.1 Introduction

The site of Tumbe is one of the earliest known settlements on Pemba, dating to the seventh - tenth centuries CE, but it is also one of the largest and wealthiest sites of the first millennium found anywhere on the Swahili Coast (Flexner et al 2008). It is a port site, and stands on a steep-sided peninsula looking out over Sisini Creek towards the Micheweni Peninsula, the north-eastern shoulder of the island which bears the brunt of the swell from the Indian Ocean. The settlement is the earliest of three sites of different periods on the short peninsula, partially underlying a much later Mazrui fort of the eighteenth - nineteenth centuries, and separated by only 200 metres from the twelfth - sixteenth century site of Chwaka, which occupies the southern tip of the peninsula.



Figure 7.1: View from Tumbe, facing north-east towards mouth of Sisini Creek

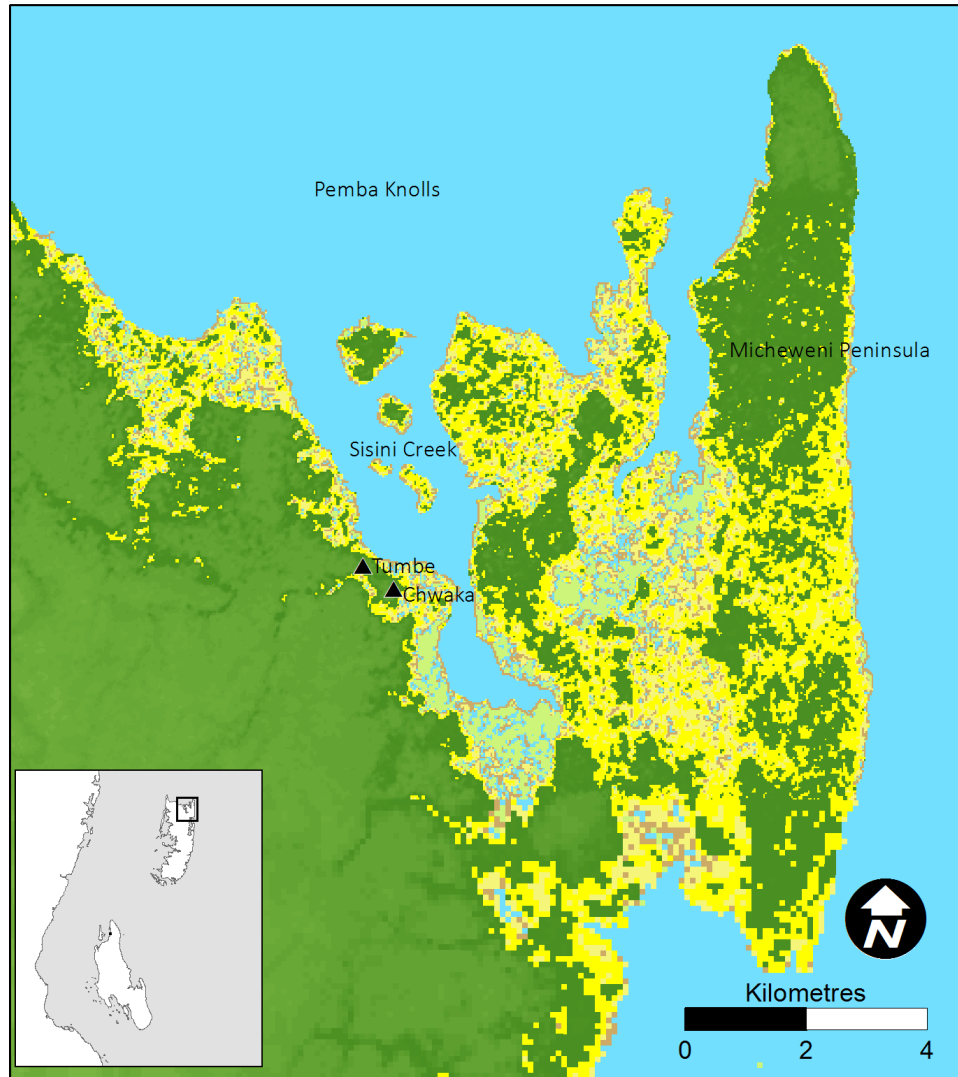


Figure 7.2 Map of north-eastern Pemba, showing Tumbe and Chwaka and names of landscape features. Background DEM is composited SRTM and digitised UKHO hydrographic charts. Estimated intertidal zone shown in yellow, and mangroves in light green.

7.2 Setting and Landscape

The peninsula that Tumbe and Chwaka were built upon is framed by Sisini Creek to the east, and the outlet of a stream into the mangroves to the west (Figure 7.2). The stream has been partially dammed where it enters the mangroves to flood the base of this low valley, which has been divided up into a series of rice fields. Sisini Creek is named in nineteenth and early twentieth century sources for the village of Sisini (now Sinawa) at its southern end, but is also referred to today as Micheweni Bay, reflecting the modern growth of Micheweni village. It is referred to in this thesis as Sisini Creek partly in order to simplify discussion of landmarks such as Micheweni village, Micheweni Peninsula, and the inlet. The borders of Sisini Creek are hidden by dense areas of mangroves, whilst the bay

itself is a network of sandbanks and thinly covered reefs, with a single, deep channel running down the centre. The boat traffic between settlements and villages around the bay is busy, but the strong current and the speed with which the sandbanks are exposed or covered by the changing tide means that the busiest time these days tends to be between mid-ebb and mid-flood, when the sandbanks can be clearly seen and avoided, rather than at high tide, when the water appears deep, but the sandbanks may be hidden by muddy water.

The peninsula itself is used today for farming, and Tumbe is covered by coconut plantations and cassava fields. According to Abdallah Khamis, the current Director of Antiquities, Zanzibar and Hamid Ali, the former head of Museums and Antiquities, these farms and fields are actively encouraged by the Government as a means of preventing construction in the area and protecting the buried remains (Abdallah Khamis, pers. comm). The cassava fields, in particular, created some difficulties during the survey of the area, since the ridges are comprised of the local loose, sandy soil, and range in height between 50cm-1m high.



Figure 7.3: Satellite image of Tumbe in Sisini Creek, and location of site on Pemba (inset). Image dated 2015, © 2016 CNES/Astrium, captured using Google Earth Pro

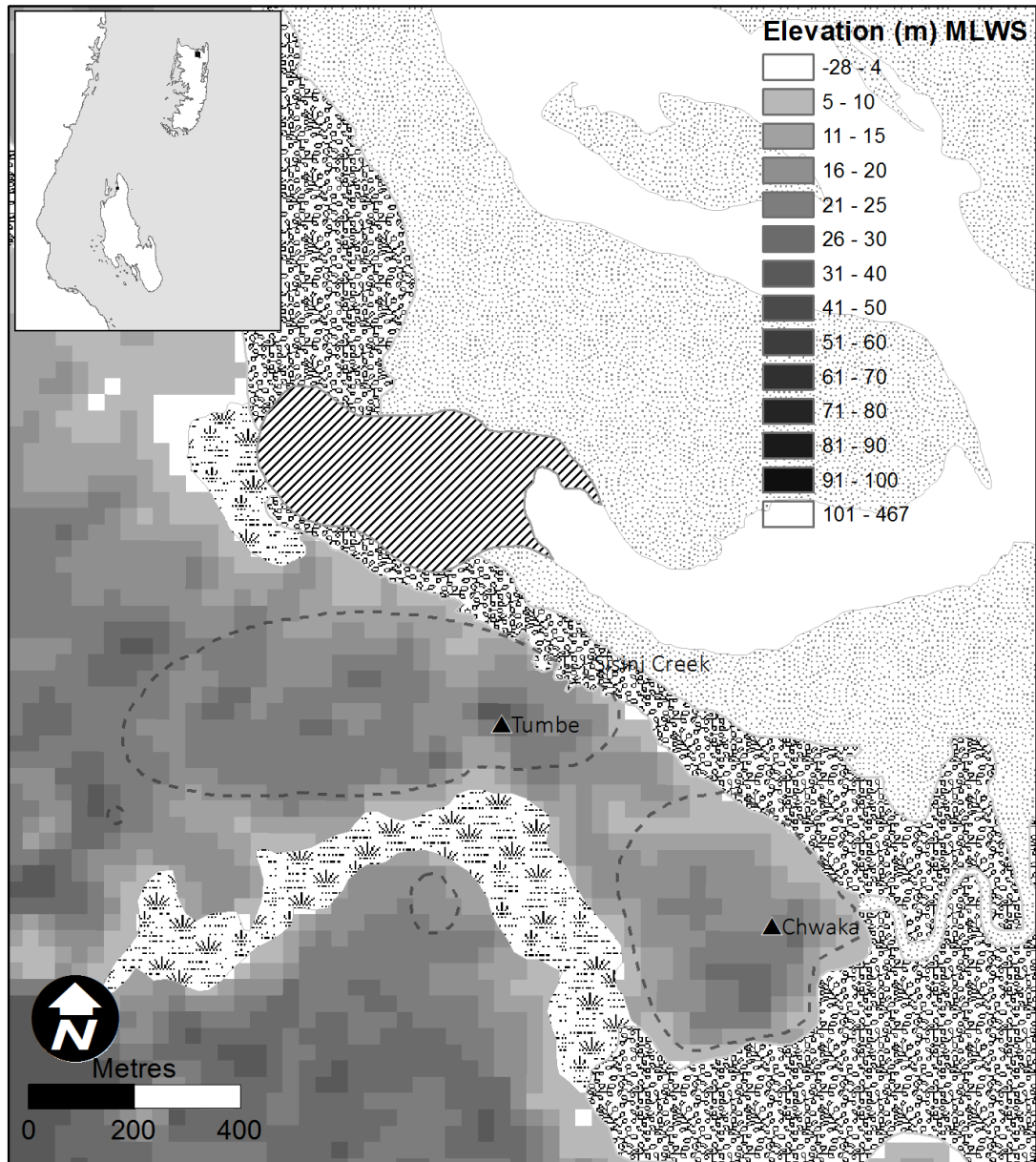


Figure 7.4 Georectified elevation model derived from SRTM GDEM v3. Note that archaeological settlements at Tumbe and Chwaka both stand on the high ridgelines of the peninsula

7.3 Previous Archaeological Investigations

Dense surface scatters of Early Tana Tradition¹⁰ and Sasanian-Islamic glazed wares were first noted close to Chwaka in 1993, during the excavation of Pujini by Adria LaViolette (LaViolette and Fleisher

¹⁰ Described in the preliminary reports as TIW, later articles by the excavators refer to this ware as ETT following the re-examination of Early Tana Tradition and decorations by Fleisher and Wynne-Jones (2011), covered in Chapter Three.

1995). LaViolette and Fleisher returned in 1997 and 1998 to investigate the site as a possible early phase of Chwaka. Over the course of a week in 1997 they carried out surface collection and a short transect of shovel test-pitting, and estimated the size of the settlement at around 2 hectares. As well as ETT and Sasanian-Islamic wares, surface collection yielded white-glaze ware, plain and embossed glassware, and bead grinders. Two 1 x 1m test excavations demonstrated that cultural deposits lay immediately under the topsoil and to a depth of 70cm, and produced further examples of those wares found in surface collection, along with iron slag, grooved glass, and daub (LaViolette and Fleisher 2000: 56).

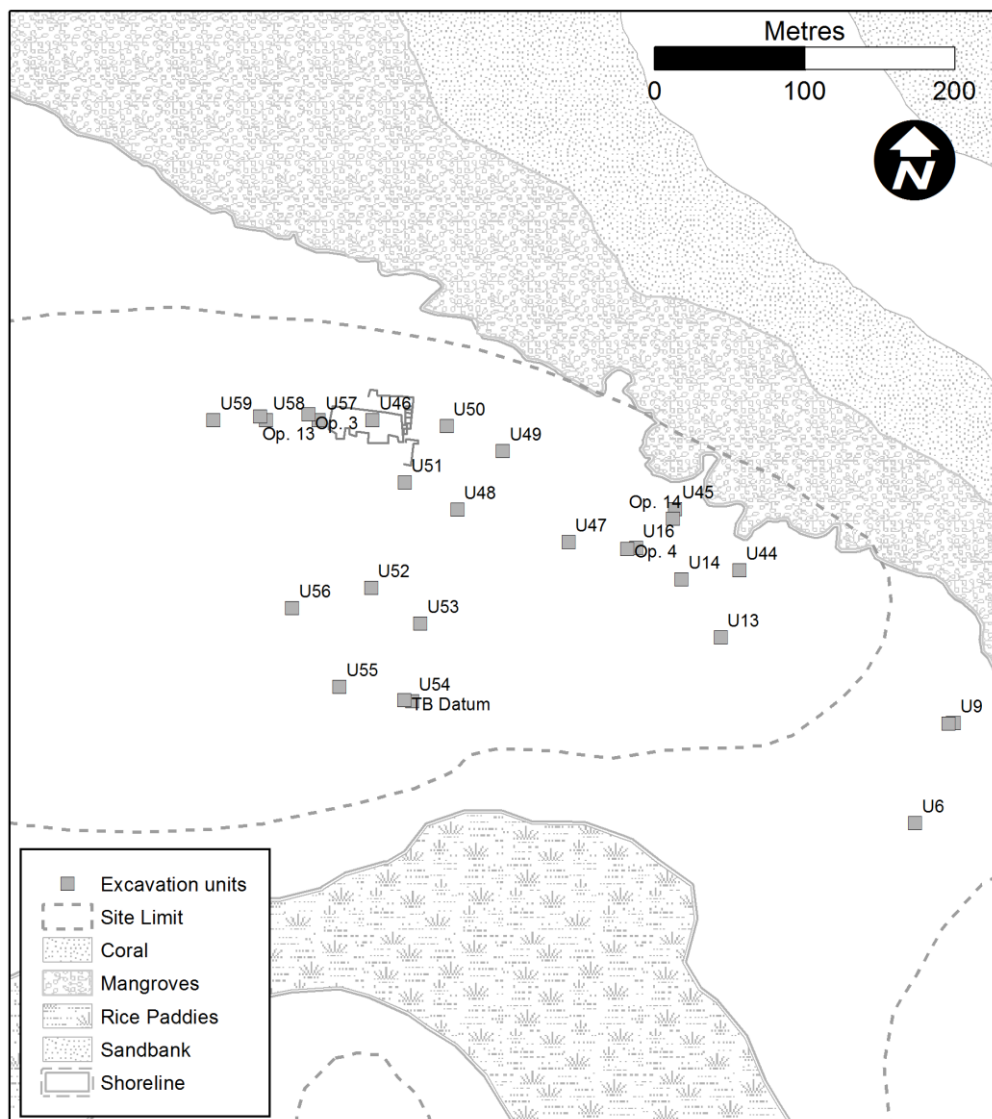


Figure 7.5: LaViolette and Fleisher's STP and excavation units at Tumbe, after Flexner *et al* (2008) and Fleisher and LaViolette (2013)

Longer STP transects carried out over 10 days in August 1998 demonstrated that only a small, south-western portion of the site had previously been recognised, and that the total site was likely to cover at least 30 hectares (LaViolette and Fleisher 2000: 56). The extended STP survey showed that the cultural deposits of the northern and eastern parts of the site were deeply buried with no surface indications. Along with ETT and Sasanian-Islamic wares, these STPs recovered additional glass fragments, bead grinders, daub, and iron slag, graphite-burnished red bowls with TIW decoration, and imports of green monochrome, sgraffiato, and tin-glazed white ware (Fleisher and LaViolette 1999). Outlying STPs showed some traces of ninth - tenth century activity, although no architectural remains, between the estimated limits of the main sites of Tumbe and Chwaka in two test pits, U6 and U9 (Figure 7.5). Due in part to the problem of sequencing based on ceramics from STPs, it was speculated that the neighbouring sites of Tumbe and Chwaka could represent evidence of either a single major centre of trade between the ninth – twelfth centuries, or of a series of small spatially and temporally overlapping village sites (Fleisher and LaViolette 1999: 70).

Fleisher's PhD study, the Northern Pemba Island Survey, was based in part on the success of the survey methods used at Pujini and Chwaka, and was designed to investigate patterns of settlement on the island by identifying ephemeral or deeply-buried timber-and-daub architecture through the use of systematic shovel test-pits (Fleisher 2003). The survey, conducted over 4 months in the summer of 1999, involved the excavation of STPs at 100m intervals along forty-two 1km long x 100m wide transects, which were evenly distributed across a 168km² region (Fleisher 2001). Wherever probable archaeological sites were identified, whether through surface or sub-surface remains, smaller STP transects were dug at 20m intervals in cardinal directions to obtain representative material samples and establish the probable size of the site. The results of the survey demonstrated the effectiveness of systematic shovel test-pit survey for identifying buried archaeological sites in densely-wooded and deeply-stratified environments, and provided widespread evidence of changing settlement patterns in northern Pemba between the eighth – tenth centuries (Fleisher 2001, 2003). In total 33 new sites of the eighth – seventeenth centuries were identified across the survey universe, as well as 30 additional sites of the eighteenth – twentieth centuries. The sites ranged between 0.1 – 6 hectares in size across the entire survey area, and based on a system of classes (Stonetowns/Small Towns, Villages, Hamlets, Field Houses) Fleisher estimated that 76% of these were village sites of 1.5 hectares or smaller, and that around 76% of all sites were located within 2km of a coastline (Fleisher 2010; Fleisher and LaViolette 2010). Of these, 9 sites of the eighth - eleventh centuries were identified within a 2km radius of Tumbe (Fleisher 2001, 2003; Fleisher and LaViolette 2010: 1154). The occupation sequences revealed a widespread depopulation of smaller sites and villages in the eleventh century, at the same time as Chwaka was founded, indicating a trend towards urbanisation, and the movement of people towards the growing coastal towns (Fleisher 2003; Fleisher and LaViolette 2013). The landscape survey and a nearest-neighbour GIS analysis also demonstrated that the sites were fairly evenly spread across the landscape, with no

clustering of 'second-order' sites around the emergent stonetowns of the second millennium. Fleisher theorised that the continuing absence of tributary relationships in spite of the trend towards urbanisation after the tenth century demonstrated that the settlements remained politically independent (Fleisher 2003: 386). However, he also suggested that changes in the rank-size distributions of sites across northern Pemba indicated that urban sites were increasingly dominating resource areas, and were likely to have been established with a competitive awareness of the potential resources of other sites, and the possible economic advantages of these resources for market trade (Fleisher 2003: 386). On this basis it is likely that trade links and infrastructure, whether related to land or sea routes, are likely to have become increasingly important in the early second millennium. It may be then that maritime trade and harbour activity should be considered as an increasingly important component of settlements, although it is noted here that there does not seem to have been a significant increase in Indian Ocean traded goods between the proto-Swahili and Swahili periods in sites spanning both phases.

Between 2002-2006 LaViolette and Fleisher conducted three seasons of excavation at Tumbe as part of the Pemba Archaeological Project, with the aim of investigating the domestic political economy, as opposed to the international Indian Ocean trade economy, through the range of settlements identified in the region around Tumbe and Chwaka (Flexner *et al* 2008). Twenty test excavations were dug in 2002 as part of a program of random stratified sampling at the site, whilst subsequent excavations in 2004 and 2006 were focused on wattle-and-daub structures within the sites of Tumbe, Chwaka, Kimimba, and Kaliwa, the latter being two sites of the seventh-ninth centuries and fifteenth centuries respectively, which had been identified during the course of survey in 1998 and 1999 (Flexner *et al* 2008). Their excavations at Tumbe helped establish a firmer chronology for the site from c. 600 – 950 CE, and identify a gap in occupation of approximately 100 years between the abandonment of Tumbe in the mid-tenth century, and the foundation of a new settlement at Chwaka, just 200m away, around the mid to late eleventh century (Fleisher and LaViolette 2013). Analysis of local and imported artefacts from Tumbe demonstrated that the town was wealthy and connected to Indian Ocean trade, with a density of imported goods higher than Shanga, and comparable to Unguja Ukuu (Horton 1996: 244; Juma 2004; Flexner *et al* 2008; Fleisher and LaViolette 2013). Of various forms and styles of ETT ceramics, the site was noted for its frequency of bowls compared to jars, which may indicate an emphasis on feasting as a prestige activity (Fleisher and LaViolette 2013). Based on their analysis of ETT from across the Swahili Coast, as well as their identification of triangular incised decorations characteristic of both the southern Tanzanian and northern Kenya coasts, Fleisher and Wynne-Jones have also suggested that Tumbe was involved in a "coastal sphere of ceramic distribution" (Fleisher and Wynne Jones 2011: 275) with similar trading sites from the wider Swahili coast. Fifty-one copper items were recovered, including various rings and earrings, and the density of glass found in excavations at Tumbe was apparently higher than at any other coastal site except Manda or Chibuene (Chittick 1984; Fleisher and LaViolette 2013;

Sinclair *et al* 2012). It is interesting to note however, that the results of the comparative excavations at Chwaka, Kimimba, and Kaliwa in 2002 and Fleisher's Northern Pemba survey in 1999 also demonstrated that very few of the imported artefacts found at Tumbe spread to settlements inland (Fleisher 2003; Fleisher and LaViolette 2013). This may indicate the reservation of imported goods as a status symbol or marker of a coastal trading identity in comparison to sites inland (Fleisher and Wynne-Jones 2011).



Figure 7.6 Bead grinders recovered at Tumbe (from Fleisher and LaViolette 2013: 1161)

Craft production was also noted at Tumbe, with slag and bead grinders providing evidence of both iron-working and bead production (Flexner *et al* 2008). Small quantities of iron slag were found in every excavation unit, but no concentrations or furnaces were noted, suggesting that smithing may have been a household industry within the settlement (Fleisher *et al* 2013). More than 3600 bead-grinders were found, the highest number and greatest density of any site, indicating that bead production for export is likely to have been a major component of Tumbe's trading economy, although, as was noted in Chapter Two, the consumers, direction, and purpose of this trade remain unknown (Flexner *et al* 2008; Fleisher and LaViolette 2013). Curiously though, not a single shell bead was recovered, a fact the excavators have theorised may be due to poor preservation conditions (Fleisher and LaViolette 2013). The greatest numbers of bead-grinders were found close to the shore in Unit 45 and Operation 14 (Figure 7.7), and although the excavators have indicated that it was not clear whether these quantities were the result of craft production areas or middens, it is suggested

here that for pragmatic discard purposes, the two types of area are unlikely to be particularly far apart (Fleisher and LaViolette 2013: 1159). It was also reported that whilst bead grinders were found at both of the investigated early sites of Tumbe and Kimimba, they were not identified at the later sites of Chwaka and Kaliwa, evidence that these artefacts were common only in early proto-Swahili periods (Flexner *et al* 2008). The indicators of craft production at all sites compared to the limited distribution of imported artefacts supported Fleisher’s theory that the smaller contemporary village and household settlements found in the vicinity of Tumbe were not closely tied to or reliant upon the port, but self-sufficient entities with local craft production facilities.

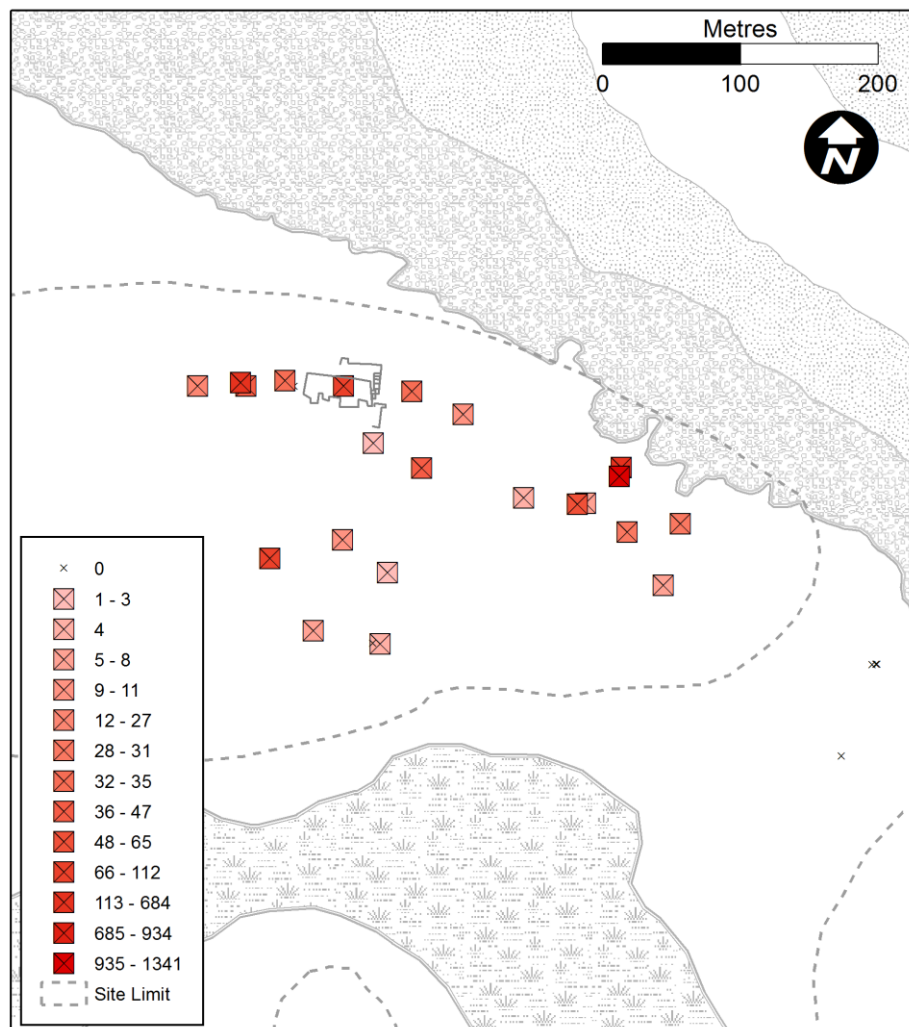


Figure 7.7: Quantities of bead-grinders found during excavations at Tumbe, after Flexner *et al* (2008)

As part of Fleisher and LaViolette’s overall project, Sarah Walshaw also conducted an intensive study of the macro-botanical remains from Tumbe, Chwaka, Kimimba, and Kaliwa in order to investigate patterns of plant-based subsistence strategies between the seventh – sixteenth centuries (Walshaw 2005). Her results demonstrated that processing of local plant resources for subsistence occurred

within households at every site, with no indication that processed grains were traded between sites. On this basis Walshaw suggested that all of the sites, regardless of size, were reliant on a household-level organisation of subsistence, and that there is no evidence of a hierarchical tribute structure for the benefit of larger urban towns. She also emphasised that there is no evidence that the production of food was ever related to settlement-level organisation of labour, either in the proto-Swahili or the Swahili period on northern Pemba. She theorised that evidence of the continuation of household-production strategies through the depopulation of the countryside indicated the movement of rural households into larger towns in order to free up valuable agricultural lands beyond the town. Feasting activities however did arise in the Swahili stonetowns, as indicated by increasing appearances of open bowl and platter forms of Tana Tradition and imported ceramics, and faunal remains of large sea fish and butchered cattle, which were probably imported by boat to the towns. Walshaw's evidence supports Fleisher's conclusions regarding the competitive nature of settlement, as well as his theory that feasting may have been organised by individuals within the growing towns as a means of acquiring individual elite social status, as well as attracting immigrants from the countryside and overseas to the competing stonetowns (Fleisher 2003: 413; Fleisher 2010; Walshaw 2005: 251).

7.4 Project Survey and Excavations

Following the aims and methodology laid out in Chapters One and Three, and as with the surveys of Unguja Ukuu and Fukuchani, the purpose of fieldwork at Tumbe was to attempt to identify patterns of harbour activity in the archaeological record based on a geophysical survey of the site. Fieldwork was carried out during a single, two-week season between August and September 2015, and consisted of geophysical survey across three areas of the site; two lines of exploratory STP survey from the top of the ridge towards the shoreline; two test excavations across geophysical anomalies; and a KAP survey of the intertidal zone.

The extent and boundaries of the site were estimated by Fleisher and LaViolette at around 20-30ha, on the basis of their STP survey (Fleisher and LaViolette 2013). The results of these STPs and their excavation trenches demonstrated a broad spread of daub and ceramics indicative of structures across the site, and particularly across the top of the ridge. One of the intentions of geophysical survey at Tumbe was therefore to test whether the settlement extended down the slope of the peninsula towards the waterline, and to attempt to identify potential differences in the types of geophysical anomalies, and therefore archaeological activity, in different areas of the site. Two survey areas were selected to investigate this possibility. Area A ran east-west across the southern part of the site from the edge of the mangroves into a known area of occupation, as far as the south-eastern corner of the ruins of the seventeenth century Mazrui fort. Area B extended along the beach

at the north of the site and up the slope of the peninsula, to the north of the Mazrui fort. A third area of survey, Area C, was later established to investigate the ruins of the fort itself, and to determine whether anomalies indicative of thermoremanent activity extended into the boundaries of the fort, and might therefore predate its construction.

Two test excavations were conducted in Area B in order to ground-truth geophysical anomalies identified in the course of survey. Excavations were not conducted in Area A, since Fleisher and LaViolette's own, well-recorded excavations were sufficient to provide an indication of the causes of anomalies encountered in this area. The two lines of STP were also excavated east and west of the Mazrui fort to investigate how the northern limits of the occupation area might have related to the top and sides of the peninsula, and whether the settlement extended onto the gentle slope towards the shoreline which lies north-west of the fort. The KAP and pedestrian survey of the intertidal zone was carried out to explore the topography of this possible harbour area.

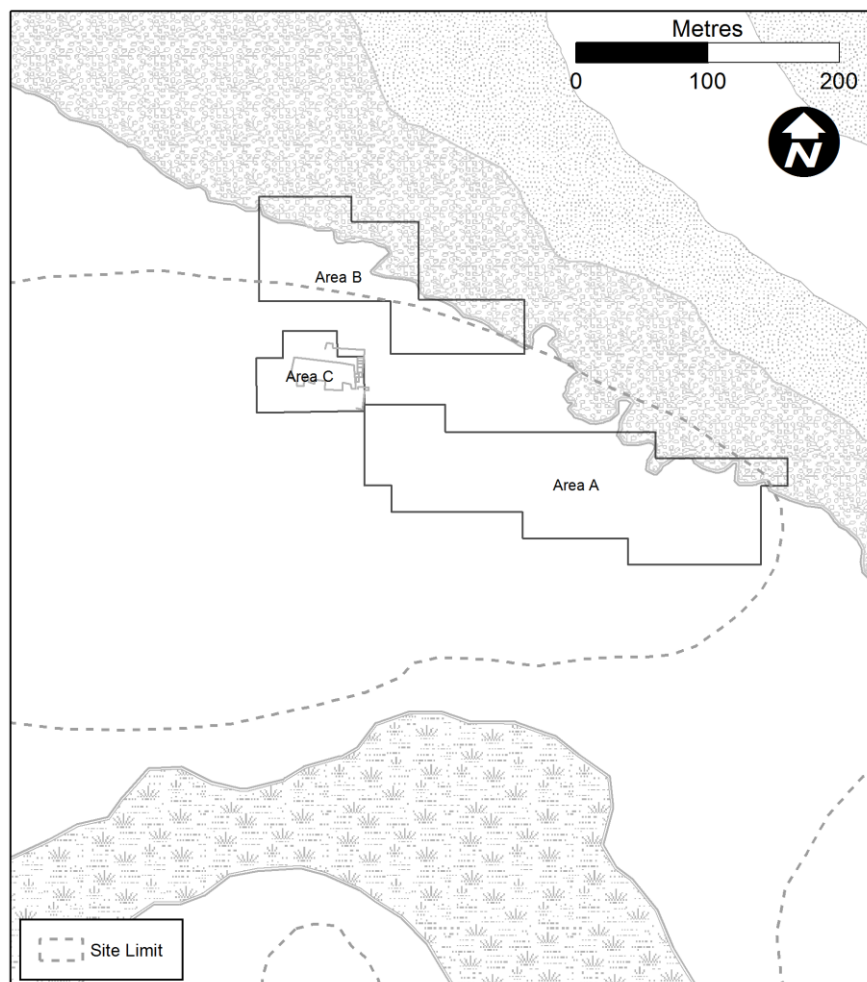


Figure 7.8: Project survey areas, 2015 season

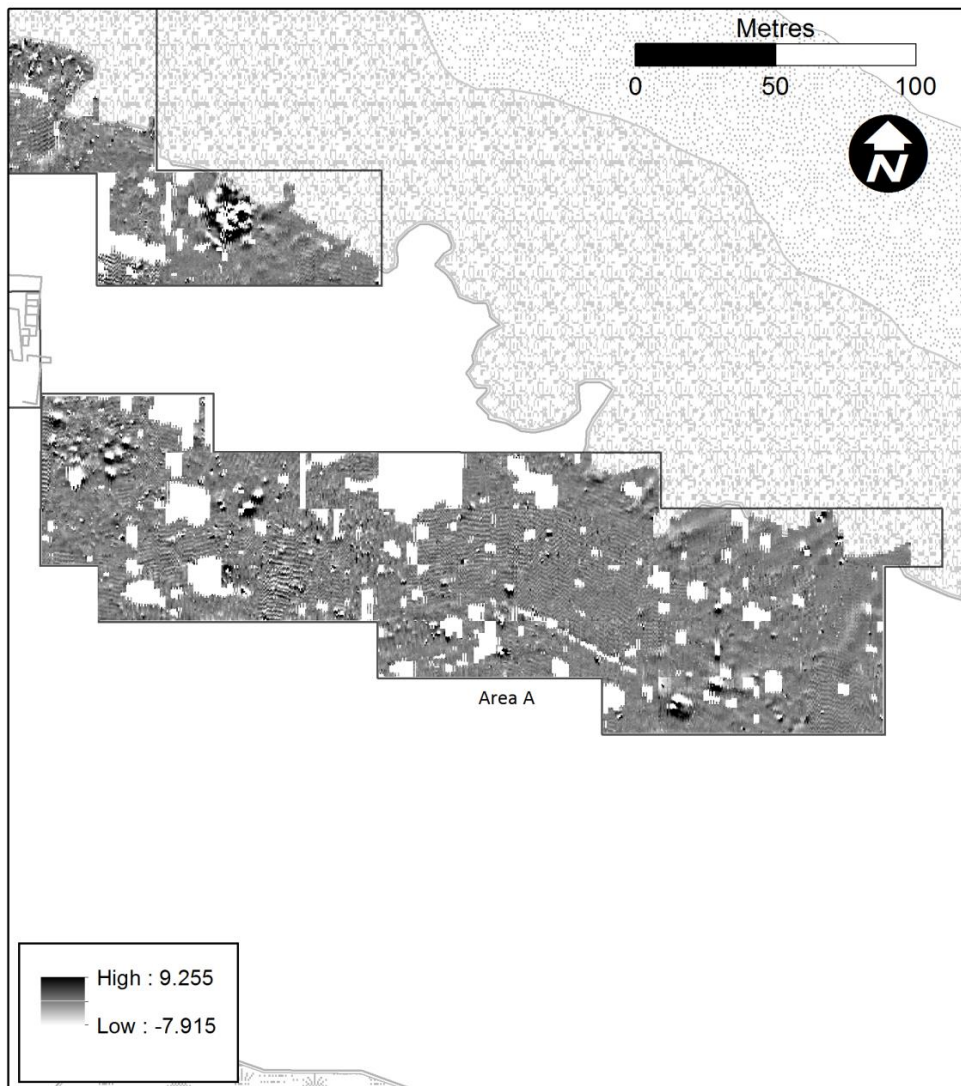


Figure 7.9 Processed results of Area A magnetic gradiometry survey

7.5 Area A

Area A covered a broad strip of ground 300m long, and averaging 80m wide, running east-west into the site. At its eastern limits the Area abutted the mangroves which line the steep bank of the northern edge of the peninsula, then ran west across open ground and up onto the slope of the mound which marks the highest point of the site. This mound is extensively cultivated, with a coconut plantation shading the distinctive, deep, hand-cut ridge and furrows of cassava fields. Area A extended across the highest point of this cultivated area and across the head of a shallow valley leading north to the shoreline, as far as the corner of the ruins of the Mazrui fort. As well as covering a range of the topography of the peninsula, the Area covered a large part of the region surveyed and excavated by Fleisher and LaViolette in previous seasons. The intention was to investigate whether it

would be possible to recognise any of the daub structures identified by Fleisher and LaViolette, and to determine whether these were restricted to the top of the ridgeline, or extended further down the slope towards the shoreline and a possible harbour. Publication of Fleisher and LaViolette's investigations provided a source of ground-truthing data for the interpretation of the geophysical results, and their survey maps were integrated into the GIS to enable a comparison of magnetic anomalies to their reports.

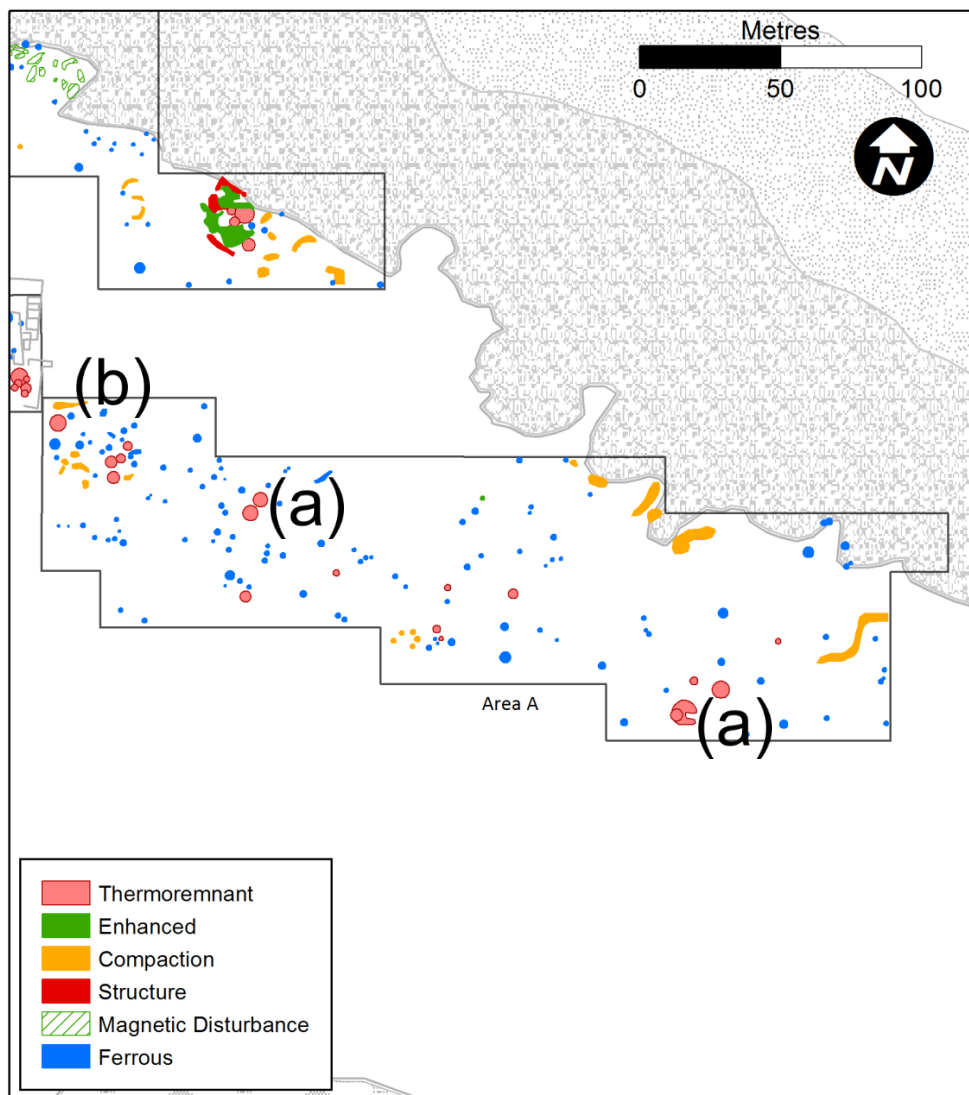


Figure 7.10: Interpretation of Area A magnetic gradiometry survey

7.5.1 Area A Geophysical Survey

Although the cassava ridges in this area created some difficulties in walking the survey grid, geophysical anomalies are still clearly identifiable beneath the pattern of this cultivation. A variety of geophysical anomalies can be identified across Area A. These include a number of probable ferrous

signatures and a series of potential thermoremanent anomalies, as well as significant expanses of cassava ridges, mostly aligned east-west. There also appear to be a number of compacted, linear anomalies of potential archaeological or geological origin running at tangents to the shoreline close to the top of the steep bank at the edge of the peninsula, which do not correspond to surface features.

Small spikes of ferrous anomalies can be seen across most of the survey area, with a distinct drop-off in occurrence towards the eastern end of Area A corresponding with a decrease in surface finds of potsherds beyond the highest point of the ridgeline. There also appears to be a drop off in occurrence close to the north edge of survey Area A, where the ridgeline begins to slope more steeply down towards the shoreline. At least 11 possible thermoremanent anomalies, between 2-4m in diameter, were identified as a spread across Area A (Feature a, Figure 7.10). Like the ferrous spikes however, no thermoremanence was identified beyond the eastern slope of the ridgeline, or on the northern slope above the shoreline. Two of these anomalies correspond to test-pits and excavations in which burnt daub remains and/or *mofa* ovens were recovered (Feature c, Figure 7.11), supporting the general identification of this type of anomaly as evidence of thermoremanent events (Fleisher and LaViolette 2013: 1155). Their Operation 4 excavation in particular, which occurred within the limits of Area A (Figure 7.11) exposed a 4x4m circular mound of highly-fired daub, with timber pole impressions in the daub indicating a vertical structure, and a rectangular plan of post-holes in the floor surface below the mound. The difference between the circular mound of burnt daub and the rectangular post-hole plan is taken as evidence that the original structure would have been rectangular, whilst the circular mound of daub is likely to be a consequence of its destruction and collapse (Fleisher and LaViolette 2013: 1160). The correlation between the size and shape of the daub mounds and the thermoremanent anomalies suggests that these magnetic anomalies are likely to represent further daub structures, and the correlating pattern of ferrous spikes and thermoremanent anomalies across the area suggests that the top of this ridgeline of the peninsula should be considered as the main occupation area of the site. Possible explanations for the declining incidence of ferrous and thermoremanent anomalies down the slopes of the ridgeline will be discussed below in Section 7.8.

A particular concentration of thermoremanent anomalies and ferrous spikes, along with magnetic indications of disturbed ground was noted at the western limit of the survey area, just outside the boundary of the fort (Feature b, Figure 7.10). The proximity, density and intensity of the anomalies in this location were noted as indications of a possible industrial, and especially iron-working area. Shovel Test Pits starting in this area and running through Area B revealed large concentrations of iron flakes and possible hammerscale which support this theory. The proximity of this area to the walls of the fort may indicate however that this activity was related to the later seventeenth century occupation of the site, rather than to the first millennium proto-Swahili settlement.

A series of linear, negative magnetic anomalies were noted on the slope above the shoreline in the north-eastern part of Area A. These anomalies do not correspond to the visible changes of topography or material on the surface, and could indicate either archaeological earthworks or naturally occurring geological features.

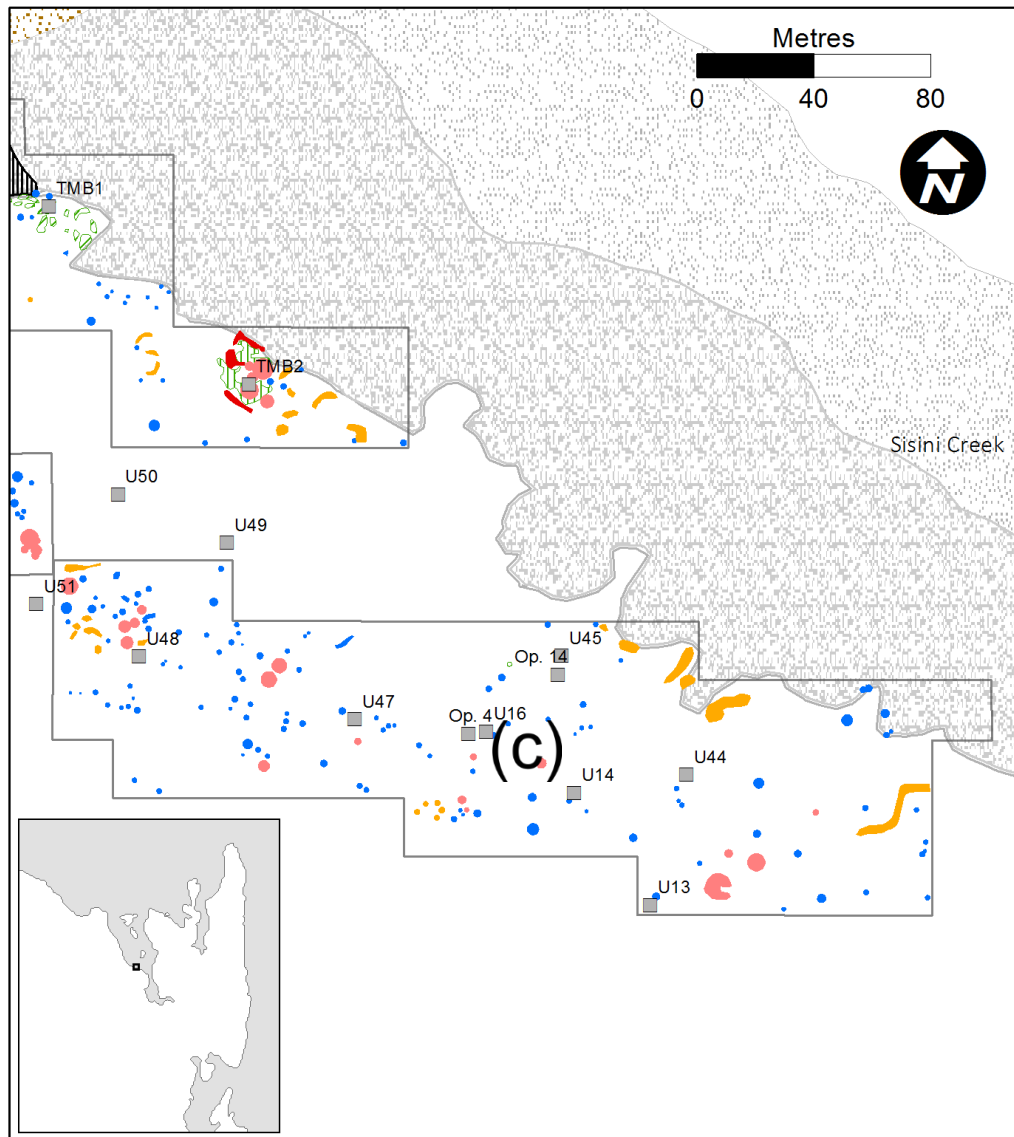


Figure 7.11 Interpretation of magnetic gradiometry survey overlaid with excavations by Fleisher and LaViolette (2013) and the current thesis project. Note correlation of Operation Unit 4, in particular, as well as Unit 14, located to investigate daub concentrations, with large magnetic anomalies

7.6 Area B

Area B of the survey extended 200m along the shore north of the Mazrui fort, running east up onto the end of a slight promontory of the ridgeline, and down into the lower end of the same valley crossed at the top by Area A. The shore area of the survey is currently separated from the beach and intertidal zone by a narrow, but dense, band of trees and mangroves, cut by occasional paths to the water. Above this area, the hill slope is composed of light silt and sand, and is covered in further cassava fields divided by occasional brush hedges. This area has little tree cover other than a few coconut palms, and a single grove and avenue of trees shading a path which leads up from the shore towards the ruined fort. Although Fleisher and LaViolette's survey of the area indicated little or no occupation of the slope, bead-grinders and glass fragments were noted during preliminary survey in 2015 amongst the sandy troughs of the cassava fields on the hillslope, and some accumulation of coral rag was noted at the bottom edge of the fields next to the beach. No pottery was observed along the flat beach however.

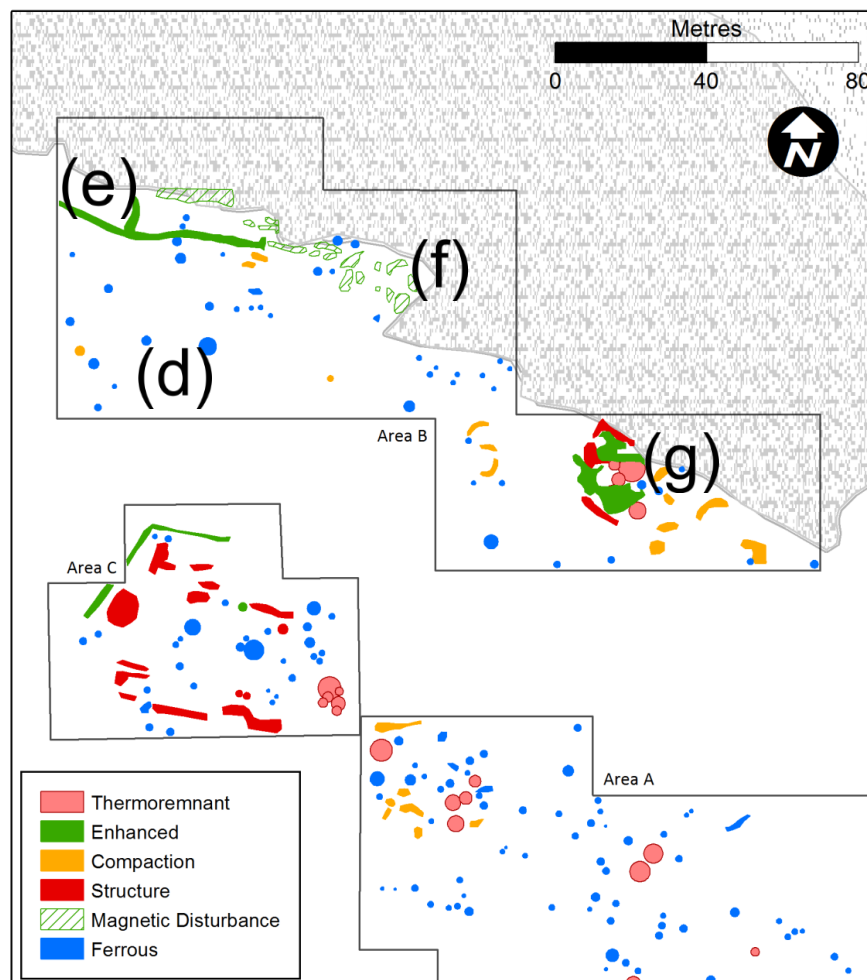


Figure 7.12: Interpretation of Areas B and C magnetic gradiometry survey

Area B was targeted for geophysical survey in order to investigate the possibility of archaeological activity on the hillslope between the broad, shallow intertidal zone of the sheltered bay, and the settlement known on the ridgeline of the peninsula (Figure 7.10). The elevated promontory (visible in Figure 7.4) was noted as a possible area of interest during an initial reconnaissance of the site, for both its viewshed across the bay, and its own potential visibility from the water. The lower end of the valley east of the promontory slopes down to another path cut through the mangroves to the water, and provides an area today for minor boat repair and the pounding of coconut husks to make coir for string and rope, sacking, and caulking material for ships hulls. It was therefore considered as a possible alternative harbour site to the more open bay to the west.

7.6.1 Area B Geophysical Survey

The geophysical survey results for Area B include further ridge and furrows, a number of bipolar anomalies across the northern slope, and linear negative anomalies along the shoreline. The southern part of the Area, including the promontory mentioned above, also features a large and complex mass of strong bipolar and positive anomalies, enclosed by a linear negative anomaly (Feature g, Figures 7.12 and 7.13). The bipolar anomalies across the northern slope of Area B have varying orientations, and are therefore likely to represent buried ferrous masses (Feature d, Figure 7.12). A number of bead grinders and fragments of glass were identified in the ridge and furrow of the cassava fields in this region, although given the extremely light, sandy soils these smaller fragments could quite easily represent hill-wash from the known archaeological settlement on top of the peninsula. The size and spread of the bipolar anomalies across the hillside, rather than clustering at catchment points, may indicate at least some *in situ* activity taking place on the slope.

Some of the linear magnetically enhanced and magnetically disturbed features along the shoreline of Area B align perfectly with recent, but no longer extant field boundaries (Feature e, Figure 7.12). A cluster of anomalies on the edge of the mangroves however seem to be beyond the limits of the recent fields, and have no obvious surface cause (Feature f, Figure 7.12). These anomalies vary in length and orientation, but appear relatively consistent in width, and all lie within 15m of the current tideline. Scatters of coral-rag fragments were found in the cassava fields nearby, and it was hypothesised during survey that the anomalies might represent buried structural remains. A 1 x 1m trench (Trench TMB1) was excavated to investigate one of these anomalies, described below in Section 7.5.2.

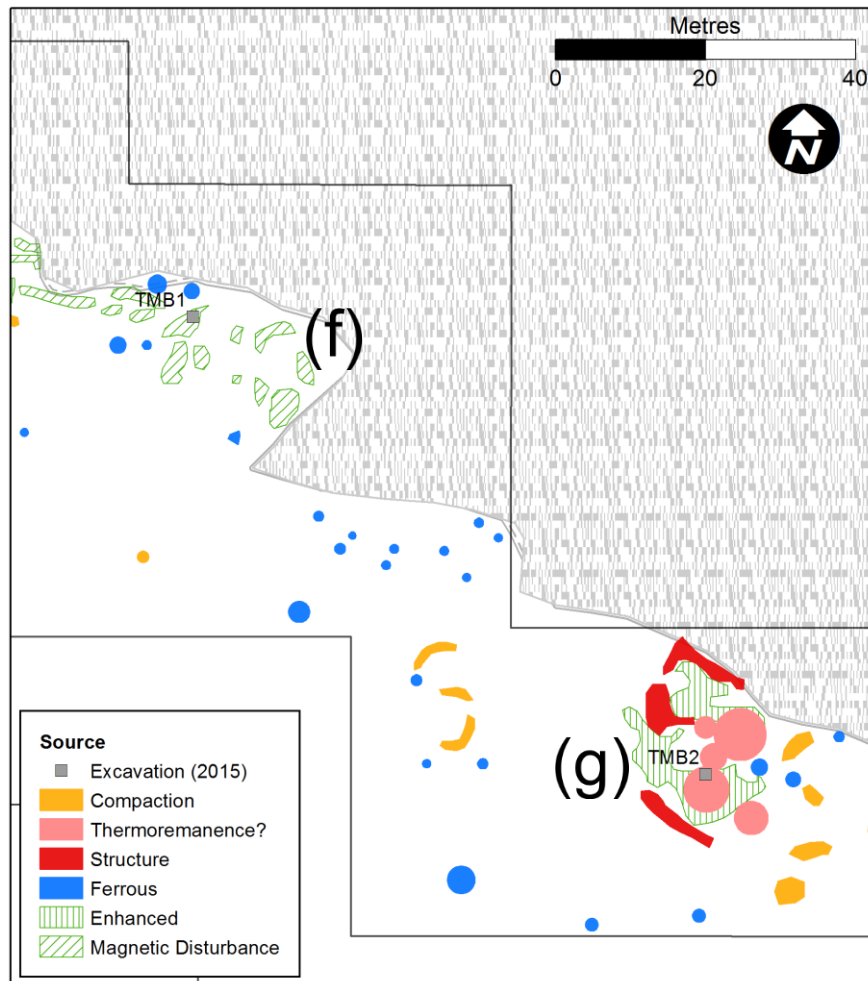


Figure 7.13: Excavation trenches in Area B

The large mass of bipolar and linear anomalies noted in the southern part of Area B (Feature g, Figure 7.13) is located on the eastern side of a promontory, at the top of a steep slope down to the shoreline. The affected area measures approximately 15 x 20m, and appears to be composed of several types of magnetic anomaly. The central part consists of 2-3 large, overlapping bipolar anomalies around 7m in diameter, and reminiscent of the thermoremanence seen elsewhere on site in both shape and intensity. These bipoles are located within an amorphous area with a relatively strong positive magnetic signature, which is partially bounded on three sides by linear negative anomalies around 1m in width, which may again represent stone or coral-rag structural remains. The alignments of the southern and possible northern walls of this complex match, oriented along a line of around 308°, although the western linear which connects these two is not set at right angles to the adjoining walls. A broader section of this western anomaly, around halfway along its length, and possible branching into the central mass may indicate further structural divisions. The appearance of this group is therefore suggestive of a burned building or adjoining complex of buildings enclosed by

a coral wall. A second 1x1m trench (Trench TMB2) was excavated in the central part of this anomaly, and is described below.

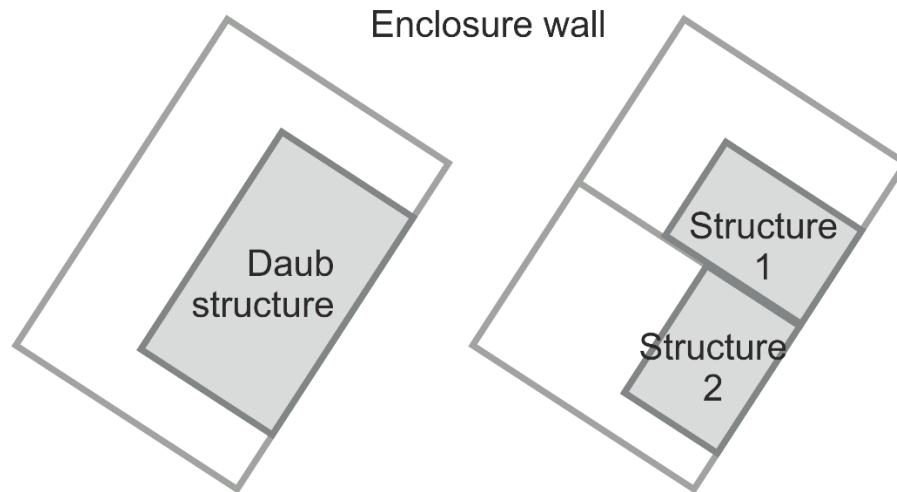


Figure 7.14 Two possible interpretations of the plan of the burned magnetic anomaly in Area B. In both cases, daub structures (identified in TMB2) are surrounded by enclosure walls which have retained human-activity related magnetically-enhanced soils

7.6.2 Excavation Trench TMB1

Trench TMB1 was a 1 x 1m unit to investigate one the linear magnetic anomalies in Area B. It was located at the base of the slope of the peninsula, around 2m from the edge of the bush and mangroves which fringe the beach. Contexts in this unit were labelled to reflect the trench number, beginning with (100) at the topsoil. The sequence in Trench TMB1 is divided here into 3 phases and assigned estimated relative dates on the basis of the known history of occupation at this site determined by Fleisher and LaViolette, the few identifiable sherds in Trench TMB1, and the stratigraphy of the trench which indicates two phases of activity separated by one phase of abandonment, or at least the absence of beach activity.



Figure 7.15: Excavation photo of Trench TMB1, showing west section and coral context (106), and relict beach surface with mangrove impressions (111). Photo by author (2015)

Phase 1, the earliest phase of activity in this trench, is represented by a posthole [109] cut into the surface of (108), a mottled, light grey sand overlying natural beach deposits (111). A worn sherd of ETT was found lying flat on the surface of (108) close to the posthole, along with small fragments of charcoal, and a single sherd of vessel glass. The finds from (108) were all within the top 2-3cm of the context and indicate activity taking place on or close to the shoreline. The mottling and vertical rooting of context (111), and the absence of this throughout (108) may indicate that either a shoreline mangrove area had retreated prior to this occupation, or that the shoreline was being deliberately cleared during the deposition of (108). The worn sherd of ETT indicates a *terminus post quem* around the seventh century, but radiocarbon samples were not possible given the extremely small and unidentifiable nature of the fragments of charcoal.

Phase 2 of the sequence is represented by context (112) which sealed (108). This context contained almost no artefacts, indicating abandonment, or minimal levels of occupation activity on this shoreline during the deposition of the context. The few inclusions in this context had no obvious

stratigraphic relationship to each other, and may be the results of material moving downslope or along the shore.

Phase 3 of this sequence is represented by the remains of a small coral rag structure (106). This probable wall represents the reuse or reoccupation of this shoreline, although the nature of the structure is unclear. The mounding of context (107) below and around this material may indicate deposition against either a foundation, or a structure beyond the boundaries of the trench, which has then collapsed onto the collected deposits of (107) and (105). Iron slag including molten splashes or droplets which have hardened *in situ* on the surface of coral pieces suggests that iron-working was taking place in a shoreline context during this phase of occupation. Unfortunately, a lack of identifiable diagnostic sherds from this phase means that at present this activity can only be dated by its superposition relative to the lower beach surface with its single sherd of ETT, and is therefore tentatively assigned to the Mazrui occupation in the seventeenth century. Inclusions of pottery sherds, iron slag, and bone in context (103) suggests that the area remained occupied through the collapse or dismantling of the structure of (106) and during the further decay of its rubble (104). The charcoal inclusions of (102) provide some evidence of activity beyond this point, though not necessarily settlement or occupation of the area. Some of these charcoal fragments were collected, but owing to the need to identify the wood and difficulty of dating mangrove charcoal, these samples have not yet been radiocarbon dated.

7.6.3 Excavation Trench TMB2

Trench TMB2 was a 1 x 1m excavation in Area B to investigate the group of geophysical anomalies on a promontory overlooking Sisini Creek, described in Section 7.5.1 as indicative of magnetic thermoremanence and structural remains. The trench was located at the centre of one of the predicted areas of thermoremanence, and provided evidence of a burnt daub structure dating to the first millennium occupation of the area. Contexts in this trench were numbered from (200) to reflect the unit label, but due to time constraints basal layers were not reached in this excavation. Cassava fields dominate much of the area up slope to the south and in the low valley to the east which leads down to the modern harbour area. The location of the trench and magnetic anomaly on the edge of the slope however means that this zone appears to have suffered little impact from fields just 10-15m away. It is possible however that hillwash may have impacted the deposition or removal of contexts across this site.

Topsoils (200) and (201) contained small fragments of charcoal and a lump of iron slag, although these were at such a shallow depth that they may not represent *in situ* artefacts, and could be the deposition result of hillwash or recent occupation. Context (202) was a 30cm thick strata of loose,

grey silty-sand with small fragments of charcoal and pottery, and a single piece of slag. The removal of (202) exposed a brown-grey layer of sand (203), cut by a shallow, sub-circular pit [204] extending into the south eastern corner of the trench. The top fill of cut [204] was a 5cm-thick shell midden labelled (208) with occasional pieces of coral, sealing a lower, sandy fill labelled (205). Context (214), a thin layer of shells on the surface of (203), and lying close to the edge of cut [204], was labelled in post-excavation and appears to have been an extension of (208).

The removal of (203) revealed a mottled-brown sandy fill (209) overlying a surface of partially-fired daub, pottery, and bone in a matrix of dense and friable grey sand (210). At the base of pit cut [204], and extending into the section, was a further, partially exposed cut [206] and fill (207). Fill (207) was similar to (205) above, indicating that the two cuts [204] and [206] may have been part of the same event. The steep-sided 15cm deep section of cut [206] revealed the burnt daub of (210) in its sides, but not in the fill of (207), demonstrating that cut [206] must post-date the creation or deposition of (210). Cuts [204] and [206] may represent robbing of a known, but destroyed daub structure, and fills (205) and (208) may represent midden fill in an open pit. Fill (207) contained a piece of green glazed Islamic Sasanian pottery and some slag, but no other datable remains. Cleaning of the daub remains of (210) revealed a further possible posthole cut at the base of the trench, and a diagnostic fragment of ETT and a probable bead grinder on the surface of the daub, indicating a probable date of occupation or use consistent with the first millennium settlement of Tumbé. Due to time constraints, however, excavation was not continued through the daub. The daub remains at the limits of excavation were covered with a cotton sheet and the trench was backfilled in expectation of wider excavations in the future.



Figure 7.16: Excavation photo of Trench TMB2, showing west section, and degraded remains of collapsed daub structure. Post-hole (206) is visible in the top left corner of the photo, with shell-midden deposit (208) visible in section above. Photo by author (2015)

7.6.4 Shovel Test Pits

Fleisher and LaViolette's STP surveys and excavations across Tumbe over several seasons of fieldwork established the significant extent of the first millennium settlement at Tumbe, and the existence of a number of burnt daub structures across the ridge of the peninsula. In order to explore the limits of settlement and activity in relation to the harbour however, and to complement the geophysical survey of the site, two lines of STPs were excavated running north-south from the early settlement area towards the shoreline. These shovel test-pits were excavated by hand, and clear changes in context were noted. Excavated material was sieved through a 2mm gauze to ensure comparable recovery rates in all pits. The test pits were aligned with the corners of the grid established for the geophysical survey, and the two lines, running west (Line E) and east (Line K) of the site of the later Mazrui fort, were 140m and 160m long respectively, with test pits at 20m intervals (Figure 7.17). The experiment demonstrated that archaeological materials could be found in every test pit between the site and the shoreline, but that the greatest concentrations of material came out of two clusters on the slope of the hill on the western line (E100–E102, E104-E107), and around the top of the slope in the eastern line (K98 - K103) (Table 7.1, STP Figure 7.17).

A limited clustering of artefacts which may indicate a nearby structure was noted between E100 – E102, with a high proportion of ceramics and ETT found in E100; small quantities of vessel glass and a glass bead found in E101 and E102; single bead grinders in E100 and E102; and a nominal amount of daub in E100. This area lies at the top edge of the slope, and within the limits of settlement established by Fleisher and LaViolette, but dense vegetation prevented magnetometry survey in the area. Corroborating evidence of one or more structures is provided by Fleisher and LaViolette's Operation 13 trench, which appears to have been situated half-way between E101 and E102, and which contained 142.5kg of burnt daub from a 4 x 4m structure (Fleisher and LaViolette 2013: 1160). Fleisher and LaViolette's Operation 13 trench also contained 418 bead-grinders, one of the highest densities found during their survey, supporting the idea of a resource processing and crafting area linked to the activity of the harbour area (Fleisher and LaViolette 2013: 1165).

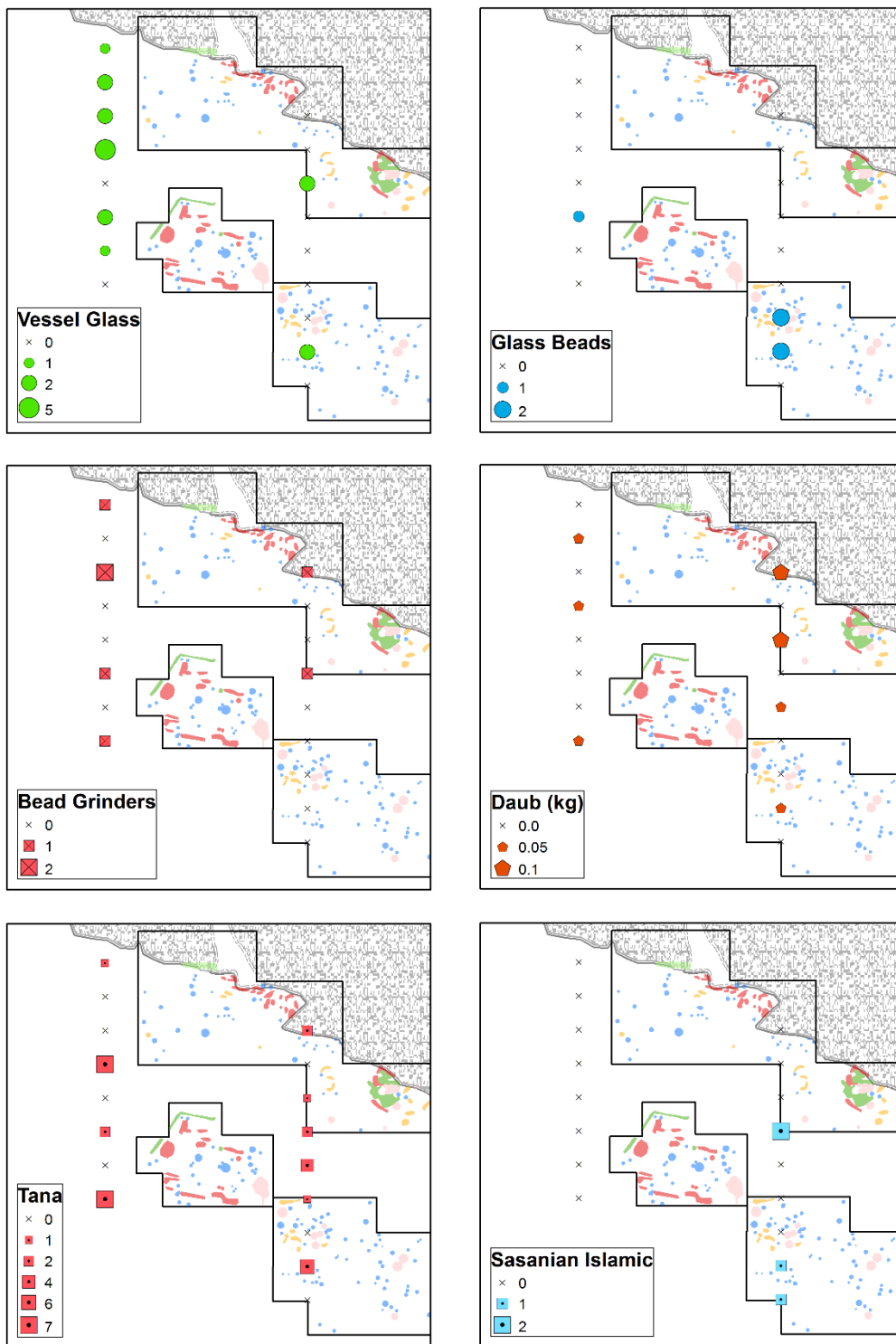


Figure 7.17: Comparative plots of artefact types and quantities recovered in 2015 STPs

STP	Eastings	Northings	Ceramic Count (#)	Ceramic Weight (kg)	Body	Rim	Shoulder	Tapa	Undecorated	Saamnan Blank	Sgraffito	Other Import	Motif?	Vessel Glass	Glass Beads	Bead grinder	Iron Sigs (kg)	Hammer-scale (kg)	Daub (kg)	Bone (#)	Other Artefacts
E100	588586	9451300	64	1	60	4		7	7			1							0.05		
E101	588586	9451320	8		6	2															
E102	588586	9451340	26	0.1	24	2		2	23			1				1	0.05				
E103	588586	9451360	0																		
E104	588586	9451380	131	1	120	9	2	7	121		1								0.05		
E105	588586	9451400	0	0.1																	
E106	588586	9451420	4	0.05	4				4												
E107	588586	9451440	18	0.1	18			1	17												
K97	588706	9451240	13	0.05	11	2			12	1			1								
K98	588706	9451260	77	1.1	74	3		6	69		1										
K99	588706	9451280	31	0.2	24	7			30												
K100	588706	9451300	13	0.05	9	3	1	1	12												
K101	588706	9451320	16	0.05	15	1		4	12									0.2	0.1	0.05	1
K102	588706	9451340	34	0.5	31	3		2	30	2											
K103	588706	9451360	27	0.3	27			1	19										0.1	0.1	12
K104	588706	9451380	1		1				1												2
K105	588706	9451400	10	0.1	7	3		2	8	1									0.1		

Table 7.1: Table of finds and ceramics recovered from Tumbé STP surveys, August 2015

A second cluster of artefacts was observed further north and downslope, just outside the estimated limit of settlement. E104 was noted for the highest numbers of ceramics found in any of the STPs (Table 7.1), including a quantity of ETT. Vessel glass was found in declining quantities downslope between E104-E107, whilst E105 contained 2 bead grinders. Small quantities of baked daub were

found in both E104 and E106. Due to time constraints this area was not covered by the magnetometry survey, but the clustering of glass and artefacts, the quantity of ceramics, including ETT, and small quantities of daub, may indicate the remnants of an early structure on this slope.

The concentration of artefacts in line K to the east is less easy to define, and a broad spread of material between K97 and K102 falls within Fleisher and LaViolette's estimated settlement limits, but within this spread there appear to be smaller concentrations of varying causes (K98 and K100-K103), indicating activity related to both the seventh - tenth centuries and the eighteenth - nineteenth century occupation of the Mazrui fort. Test pit K98 contained a large number of undecorated local wares, several ETT sherds, and single sherds of Sasanian-Islamic imports, along with vessel glass, glass beads, a broken half of a decorated copper-alloy ring, several pieces of daub, and a thick piece of a coarse ceramic fabric with finger marks which may be a fragment of a *mofa* oven. The majority of ceramics, the Sasanian-Islamic glaze, and daub fragments came from contexts more than 20cm below the topsoils. The broken half of a copper alloy ring was found in a sandy context just below topsoil, within 20cm of ground level, and may be related to a later period of use or taphonomic disturbance, but is similar in appearance to a ring with a moulded, round segmented design described by Chittick from the excavation of Kilwa (Chittick 1974: 453). K98, in Area A of the geophysical survey, was excavated within the radius of a 10m-wide semicircle of bipolar magnetic anomalies of varying orientations, which are likely to represent a scatter of ferrous objects. The assemblage may indicate an occupation or activity area close to the edge of the settlement. K97, 10 metres south of the magnetic anomalies, also contained glass beads and another sherd of Sasanian Islamic ware 20 - 80cm below the ground surface.

Moving north of this point, test pit K101 revealed relatively little pottery and only a small amount of daub, but the upper contexts of the pit contained a number of pieces of iron slag, and a quantity of hammerscale (Table 7.1). K103 also contained iron slag, and both K102 and K103 had small quantities of hammerscale in their upper contexts. Fleisher and LaViolette have indicated that they also recorded concentrations of iron slag in this area in 2002, and agree that the shallow depth of these deposits below topsoil suggests that this evidence of iron working is more likely to relate to the eighteenth-nineteenth century occupation of the Mazrui fort, 20m to the west, than the first millennium settlement (Fleisher and LaViolette, pers. comm. October 2015). Several pieces of ETT were found in the lower contexts of K100-K103, along with 2 sherds of Sasanian-Islamic ware and a bead grinder in K102, but an extensive scatter of coral rag fragments across the surface and topsoils of the cassava fields in the area, and of very small coral fragments in several contexts in K102 and K103 may indicate significant disturbance of the ground related to either construction or destruction of the Mazrui fort. Although these fragments provide evidence of first millennium materials, it is unclear whether they represent *in situ* remains or redeposited materials.

Sherds of ETT, a bead grinder, a small fragment of Sasanian-Islamic ware and a small amount of daub were also found in K105, the lowest test-pit of this line, just inside the edge of the mangroves. Given the very small quantities of all archaeological materials in this STP, and the position of this STP near the base of a reasonably steep slope, it is likely that this assemblage is the result of a downslope, taphonomic movement of material rather than *in situ* indicators of activity. The test pit is not far from an array of small bipolar, ferrous magnetic anomalies, which may equally represent the movement of material downslope.

7.7 Area C

Area C was an area 80 long and up to 60m wide across the main area of the Mazrui fort. This area of the site has been cleared in recent years by the Department of Museums and Antiquities, but the exact nature of the work is currently unreported. Satellite imagery demonstrates that until 2003 the area was cultivated, but since then most of the vegetation across the fort has been cleared, and the walls and gate to the north, south and east have been exposed and partially conserved. The magnetometry survey was extended into this area in part to explore the possibility that thermoremanent identified nearby in Area A might extend into this part of the site, and in part to assist the Department of Museums and Antiquities in tracing potential buried architectural remains.

7.7.1 Area C Geophysical Survey

Several faint linear and sub-circular areas of magnetic disturbance are visible in the magnetometry results of Area C which are likely to represent buried structural remains or foundations related to the Mazrui fort. The visible surface remains of the fort demonstrate that the eastern wall, with its substantial gate, was around 45m long, and that the southern wall was around 60m long. The position and orientation of magnetic anomalies in Area C indicates that the western wall may have been slightly shorter than its eastern parallel at 40 metres, but a large sub-circular anomaly half way along its length, directly opposite the eastern gateway may represent the foundations of a matching tower. A roughly rectangular set of linear anomalies measuring approximately 30m x 15m within the central part of the enclosure may represent a freestanding structure inside the fort. Two apparently ferrous anomalies are also visible in this central area.

An amorphous mass of high-intensity magnetic anomalies was also noted in the south-eastern corner of the fort. The pattern and orientation of positive and negative readings in this area indicates that the anomalous region, with no apparent surface cause, is the result of several

overlapping thermoremanent and possibly ferrous causes. It is not clear however whether these causes are related to the Mazrui-period fort or to an underlying, earlier occupation of the site.

As well as the faintly traceable remains of walls and features in the known extent of the Mazrui fort in the geophysical survey of Area C, there are a number of other magnetic anomalies which are likely to date to the same or more recent periods of site use. A comparison of the magnetometry survey results to Google Earth imagery captured between 2002 and 2016 demonstrates that a 2m wide, 1.5m deep ditch feature surrounding the edge of the Mazrui fort and clearly visible in the magnetometry survey, which was assumed during survey to have been cut during the unrecorded excavation of the fort by the Department of Museums and Antiquities, predates 2002, the earliest freely-available high-resolution satellite image. This period of use explains why the feature shows up as magnetically enhanced, as loose silts and minerals have had at the very least 13 years to accumulate in the base of the trench since it was opened. Imagery from 2003 indicates that the ditch borders the eastern side of a trackway running from the main road through the modern coconut plantation and down towards the shoreline. Parts of this track are visible on the ground today, and were noted during survey. Parts of the trackway are currently overgrown and not regularly used, and the fact that the track appears to skirt and respect the western wall of the Mazrui fort, and that various field boundaries appear in turn to flank the track itself, may indicate that the path has its origins in or shortly after the Mazrui-period occupation of the site. It is also possible that some coincidence of alignment between the track and the areas of magnetic disturbance on the shoreline of Area B, which appeared from the excavations of Trench 1 to date to the seventeenth - nineteenth century, may support this hypothesis.

7.8 Shoreline and Intertidal Zone

The shoreline and harbour area of Tumbe is a complicated arrangement of longshore sandbars, a shallow relict embayment, and sheltered deep water alongside the peninsula. The following interpretation of these features is supported by both field observations and a GIS analysis of SRTM topography, Google Earth imagery and composite Landsat 8 multispectral data.

The high-water line is hidden within a broad band of mangroves extending along most of the western edges of Sisini Creek (Figure 7.18). On the landward side of these mangroves and to the north west of the site is a narrow strip of fine beach sands. A small silted embayment is visible just to the north-west of Area B as a possible relict lagoon, cut off by what appears to be a smaller natural sandbar with a line of palms and bushes, rather than mangroves growing along the top. The silted embayment appears slightly lower in elevation than the bank of the sandbar which forms the modern shoreline, and may become swampy with spring tides, but is used today as cultivated land

and for cattle grazing. The silted foreshore of this sandbar is a bare strip of sand and mud, devoid of mangroves, around 50-70m wide. During the pedestrian survey of this area a narrow bar of white sand extending across the southern limit of this strip was noted and mapped with a DGPS. The orientation of this bar, which extends north-west from the shore, against the direction of longshore drift, suggests that its origin and foundations may be artificial. It is possible that this feature represents a causeway or harbour installation. A sudden drop of the foreshore slope and change of sediments to muds east of this bar demonstrates however that it has also acted as a sediment trap, accelerating the silting of the embayment. The white sand of this feature is easily discernible in satellite imagery (Figure 7.19).

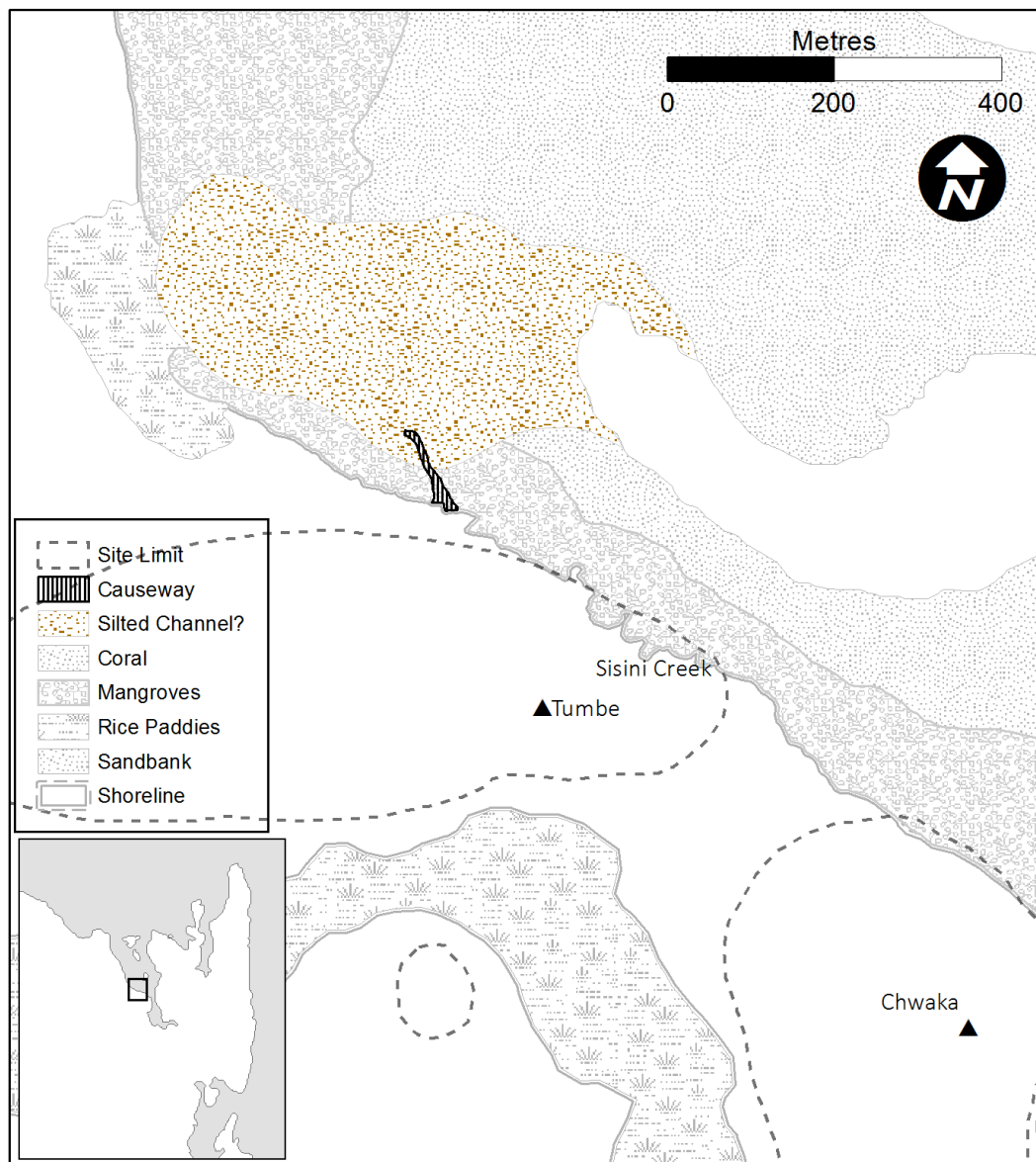


Figure 7.18 Map showing archaeological features noted during intertidal survey. Causeway marked goes against direction of longshore drift, and may have contributed to silting of intertidal zone

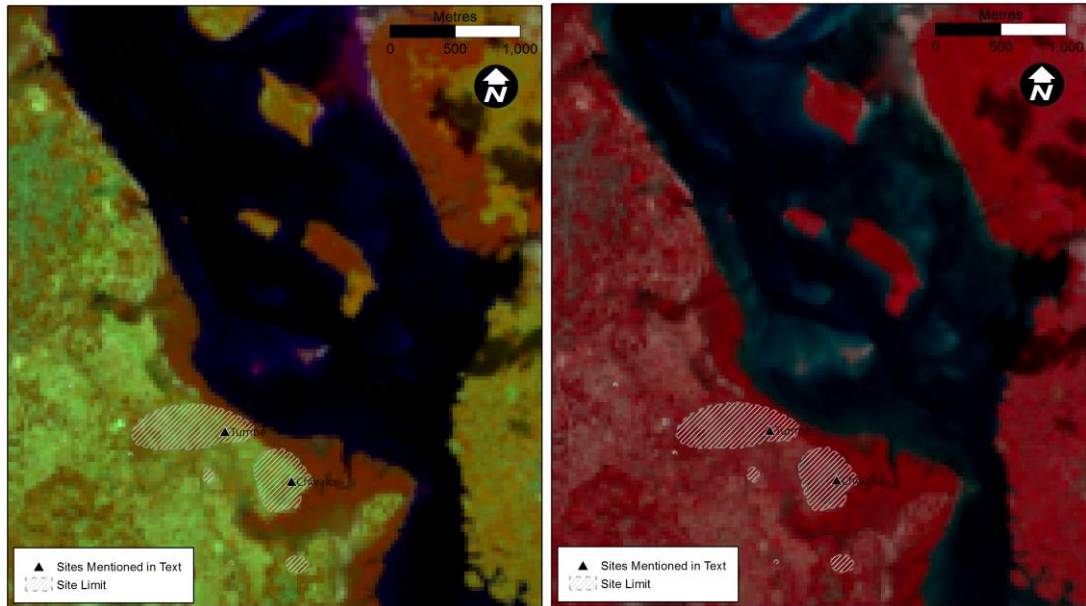


Figure 7.19: Landsat 8 False Colour composites showing Sisini Creek, and demonstrating sandbanks, and shallow intertidal zone. Left: Land/Sea differentiation (Band 5 NIR, Band 6 SWIR, Band 4 Red). Right: Colour Infrared vegetation (Band 5 NIR, Band 4 Red, Band 3 Green)

South-west of this embayment and causeway, where the sides of the peninsula start to become steeper as it extends into Sisini Creek, the sand beach becomes narrower and disappears altogether into the mangroves. These mangroves are rooted in deep mud deposits, which were observed at low tide to extend between 50 – 90m from the bottom edge of the mangroves.

Around 800 metres north of the site, and just to the south of the modern town of Tumbe is a mangrove creek which has been partially dammed to create rice fields. A submerged longshore bar extends across the mouth of this creek and south-west into Sisini Creek, running 500m parallel from the shoreline, to a total length of around 1400m (Figure 7.19). This bar, which is completely submerged at high tide, is covered by sand and shelters the bay formed between the southern headland of the mangrove creek and the end of the Chwaka peninsula. A pedestrian walkover of the bar at low tide demonstrated that the sand deposits on this surface conceal hard carbonate corals underneath much of this bar. Between this bar and the shoreline of the peninsula however there is deep water even at low tide, and the central channel of Sisini Creek north of the sandbar is also deep, with a fast and strong current. Fishermen use boats and nets to fish the channel (Flexner *et al* 2008), but the majority of boats observed during the course of survey in 2015 were engaged in ferrying passengers and goods between the various settlements and small harbours of Sisini Creek, landing on the mud flats and using access channels cut through the mangroves. This boat traffic appeared to be highest during the outgoing tide when the channels between the islands and

sandbanks of the channel were clearly visible. Today women and children from nearby villages dig for shellfish on the mud flats adjacent to the peninsula, and use the sandbar to build fishtraps and collect seaweed (Figure 7.20).



Figure 7.20: Boat traffic and locals digging for molluscs at low tide in Sisini Creek

7.9 Discussion and Interpretation

Fleisher and LaViolette's (2013) test-unit excavation strategy at Tumbe means that it has been possible to use their results to predictively interpret some of the magnetic anomalies identified in the magnetometry survey of the site. In particular, their excavation of burnt daub structures tallies with the identification of thermoremanent anomalies in the geophysical survey of the central part of the site, and their delimitation of the main area of the site may correspond to the hypothesised area of harbour-related activity described below.

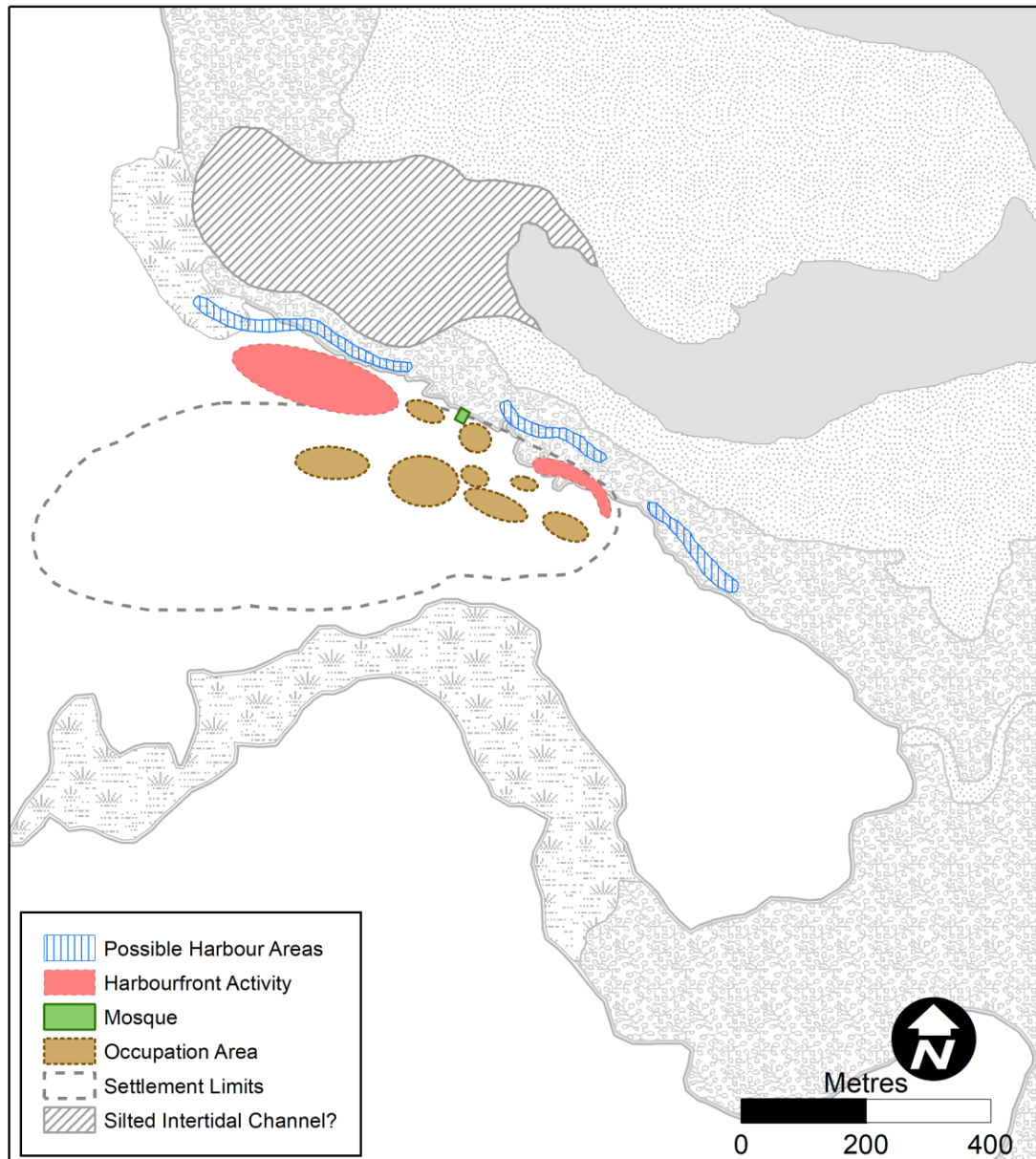


Figure 7.21: Interpretation of the sixth-eleventh century proto-Swahili settlement plan of Tumbé, based on geophysical and shoreline survey and previous excavations

7.9.1 Occupation Areas

Fleisher and LaViolette’s STP survey of Tumbé indicated dense, buried contexts of burnt daub across the peninsula, and excavation of Operation 4 and 13 (Figure 7.11) demonstrated that in both of these examples the daub represented the mounded remains of a burned and collapsed timber-and-daub structure (Fleisher and LaViolette 2013). Both daub mounds were apparently circular in plan and measured around 4m in diameter, but since the pattern of postholes found in Operation 4 did not match the shape of the mound it is likely that the pattern of collapse is not representative of the

shape of the original structure (Fleisher and LaViolette 2013). The 2015 magnetometry survey of the site has highlighted around 12 probable thermoremanent magnetic anomalies between 3-6m in diameter in Areas A and C, and around 10 smaller potentially thermoremanent anomalies up to 2m in diameter. It is hypothesised that these anomalies represent similar archaeological remains to those reported by Fleisher and LaViolette; specifically, that the larger thermoremanent anomalies represent the remains of burnt daub structures, and that the smaller thermoremanent anomalies may indicate domestic hearths or the type of *mofo* ovens reportedly associated with these structures.

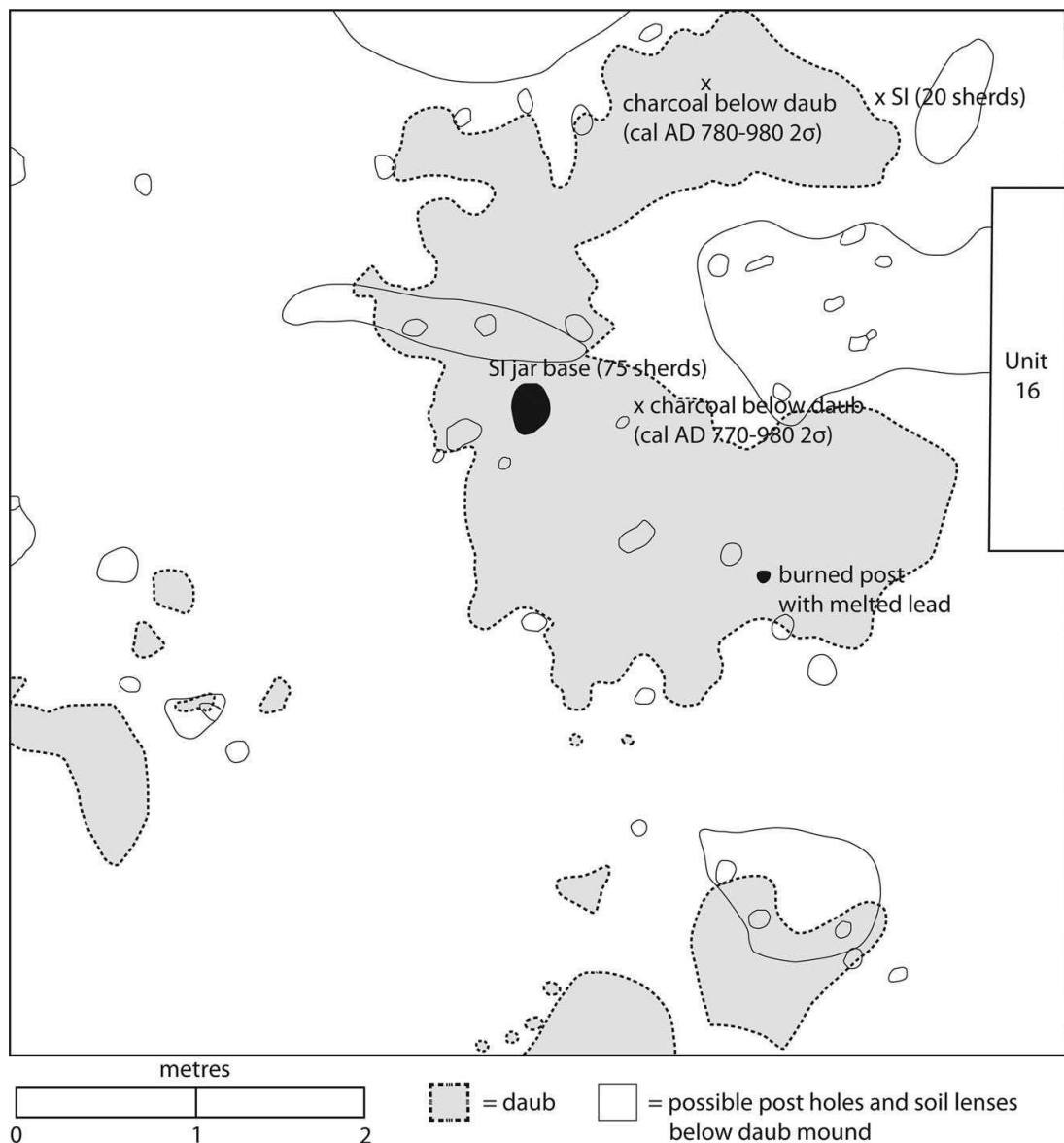


Figure 7.22 Excavation plan of Fleisher and LaViolette's (2013: 1162) Operation 4, identified through STP survey, and excavated to examine source of daub concentration. Plan shows 4m wide circular pattern of mounded, burned daub structure. The geographic correlation of this feature with magnetic anomalies provides probable explanation of large thermoremanent magnetic anomalies.

All of these anomalies were identified in Area A, and were spread out along the highest ridgeline of the peninsula. The anomalies were located only on the relatively flat and firm ground at the top of the ridge, rather than the shallow but sandy slopes to the north, or the increasingly steep sides of the peninsula to the east or west. Only one area of thermoremanence indicative of a structure was identified on the slope of the peninsula in Area B, and will be discussed separately below. Based on Fleisher and LaViolette's interpretation of these daub mounds as the remains of eighth-tenth century timber-and-daub houses, it is suggested here that the spread of thermoremanent magnetic anomalies in Area A may be used as an indicator of the extent of occupation areas within the site, or at least those areas primarily used for occupation.

7.9.2 Industry

Although the boundaries and furrows of the modern cassava plantations are relatively easy to identify in the magnetometry survey, the extent and density of these linear anomalies means that faint underlying anomalies and small magnetic spikes are effectively masked by modern agricultural disturbance. This means that although large and particularly intense features such as the daub structures have been identifiable, small magnetic spikes which might indicate ferrous artefacts are harder to identify. In spite of this, a large number of possible ferrous artefacts have been noted throughout much of the central band of hypothesised occupation in Area A, and particularly in the north-western part of this area. This north-western region was also covered by the STP survey and was noted for its quantities of iron slag and hammerscale as well as glass beads, bead grinders, daub and fragments of Tana wares and Sasanian-Islamic imports. It is therefore likely that at least some of the ferrous and perhaps thermoremanent geophysical anomalies may represent an area of iron-working and industry. However, as discussed above in relation to the shovel test-pit, close proximity to the fort and some clear disturbance of the ground in the cassava fields means that some context contamination is to be expected, and it is not yet clear whether this evidence of industry relates to the eight-tenth century Swahili town, or to the seventeenth-eighteenth century Mazrui occupation of the fort.

The results do however indicate some kind of activity area related to the eighth-tenth centuries on the shallow, sandy slope down towards the harbour area, just to the north-west of the later Mazrui fort, and just inside the estimated limits of the site (Fleisher and LaViolette 1999:70). Whilst it is clear from both Fleisher and LaViolette's survey and the limited 2015 STP results presented here that there is some evidence of settlement activity on this slope, the area appears less obviously settled in the results of the magnetometry survey than the densely occupied ridgeline of the peninsula. The limited 2015 shovel test-pit survey noted a concentration of Tana ware, vessel glass and bead grinders on the shallow slope just above the shoreline, and Flexner *et al* (2008) reported

that some of the greatest densities of bead grinders were recovered from contexts towards the shoreline edges of the early site. The map of these bead grinders¹¹ presented at the start of this chapter in Figure 7.7 supports this interpretation. On the basis of this collected evidence it is suggested here that this slope may have hosted an area of craft working activity, along with a number of temporary or ephemeral structures, between the main area of occupation at the top of the ridge, and a maritime activity area on the shoreline at the base of the slope. A second area of interest is also noted at the eastern end of the site on the basis of both mapped bead grinder densities and the declining frequency of magnetic anomalies within the estimated limits of settlement.

7.9.3 Daub structure

The large thermoremanent magnetic anomaly on a promontory overlooking the harbour was investigated in Trench 2, and confirmed to represent the collapsed, burned remains of a daub structure probably dating to the eighth-tenth centuries (Figure 7.13 and 7.14). The size of the anomaly, which measures around 15 x 20m in total, is far larger than any other yet identified at the early site of Tumbé. The purpose of this structure is unknown, but its position, size, and aspects of the plan visible in the magnetometry data provide some clues. Three possible interpretations are put forward here:

- 1) The anomaly represents the remains of a single, large timber-and-daub structure within a single, large enclosure. The clustering of thermoremanence on the eastern side of the anomaly and the excavated remains in Trench 2 certainly indicate the burning and collapse of at least one daub building, and it is possible that the enhanced magnetic signature within the boundary anomaly may represent the trapping of anthropogenic sediments within a boundary wall (Figure 7.13). The purpose of such a structure is likely to have been related to the harbour, and perhaps to the gradual privatisation of trade hypothesised by Fleisher (2003). This hypothesis would probably date the structure to the final phase of occupation leading up to the abandonment of the site in the tenth century, and could be tested with further excavation and analysis of artefact assemblages.
- 2) The size of the anomaly might be explained as an adjoining pair of structures in a terraced enclosure. This would mean that the size of each part of the adjoining structure would be likely to measure around 5 - 7m, closer to the estimated size of house structure found elsewhere at the site. The idea of terracing within the enclosure is based on the pattern of

¹¹The data was plotted using the tables of artefacts published by Flexner et al (2008: 167) and the map of excavation units published by Fleisher and LaViolette (2013:1155), as well as coordinate data kindly provided by Fleisher (pers. comm. 2015)

enhanced soils within the boundary wall, and on Juma's discovery of a structure with a retaining double-wall in Unit M at Unguja Ukuu, on the slope overlooking the mangrove creek (Juma 2004:81). Juma's interpretation of the structure at Unguja Ukuu, which measured a comparable 23.9 x 17.1m, was of an aristocratic house dating to the tenth century.

- 3) The orientation of this structure at around 308° is within Horton's 50° range of error for *qibla* alignments in the period, and it could be argued that the structure may fit within a pattern of evolving *qibla* orientations found in the mosques of the neighbouring but later settlement of Chwaka. This interpretation might also explain the position of the structure in relation to the harbour area below, and provide further evidence of a pattern of harbour mosques in the early settlements of the archipelago. At present however no evidence of an Islamic presence has been identified at Tumbe, and this hypothesis should be thoroughly tested by excavation to prevent erroneous attribution of religious purpose or an early Islamic presence.

Whilst the current study has not been able to confirm the use of this site, its identification as a result of the geophysical survey also highlights an area of potential maritime interest at the base of the slope and small valley east of the anomaly, which is a focus of maritime activity today and is discussed below.

7.9.4 Harbour Area

The survey of the harbour area of Tumbe demonstrates that a coral bedrock underlies the sandbanks in the bay, so that although deep water runs relatively close to the settlement at all times, navigation into the shelter of the harbour for vessels of any size is again difficult for maritime visitors without access to local knowledge and/or pilotage. Today boat traffic busiest during ebb and low tide, and this appears to be related to both the visibility of channels and sandbanks, and the daily use of intertidal flats as a subsistence resource area. A close survey of most of the shoreline was not possible because of the dense mangroves which fringe Sisini Creek, but two areas of potential archaeological interest have been identified on the basis of the 2015 geophysical survey, and the integration of Fleisher and LaViolette's (2013) survey into the project GIS. These include (i) the sandy beach to the north-east of the site; and (ii) the flat base of the valley just east of the promontory with thermoremanent daub structure (Figure 7.23)

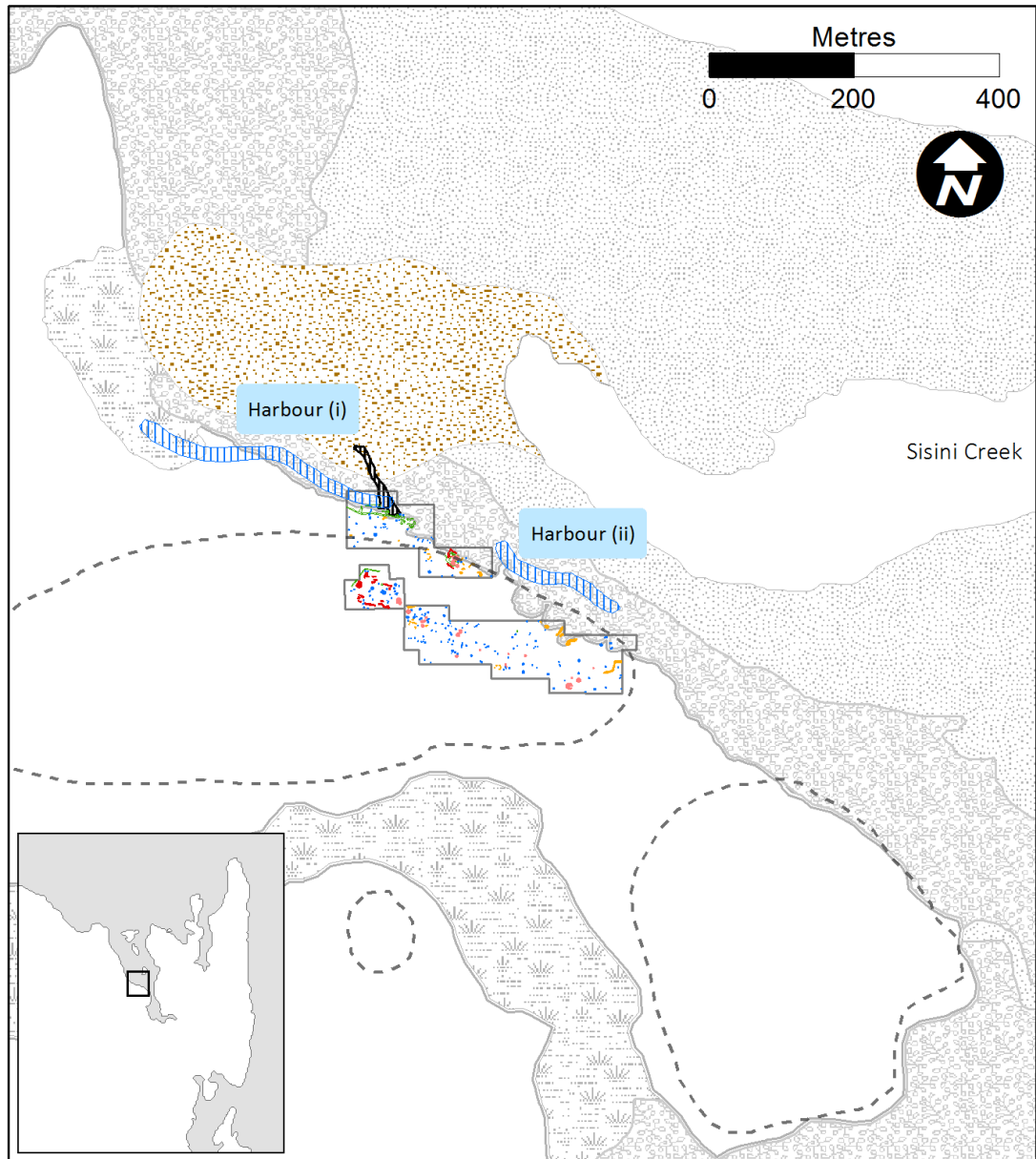


Figure 7.23: Map of possible seventh – tenth century harbour areas at Tumble

Harbour (i) is situated along the beach directly north of the site, at the base of the sandy slope on the edge of the settlement. The area appears to be the only region of the peninsula’s shoreline with significant potential for maritime working space, and is the closest to the potential anchorage in the shelter of the intertidal zone (Figure 7.23). A maritime activity area here would have convenient access to the possible craft area on the slope, and to the main settlement above. The beach is wide and flat with room for expansion onto the shallow slope, and with little clearance of the mangroves, the beach would be accessible to both boats coming in from Sisini Creek and by villagers and locals coming from the settlement on top of the peninsula. The intertidal zone in front of this beach is

shallow and sandy, and the bay is connected to Sisini Creek by a wide channel with sheltered deep water between the sandbar and the mudflats. Furthermore, although much of the bay in front of this beach has silted up, it is hypothesised here that this silting may be related to the creation (natural or artificial) of a causeway or breakwater extending from the beach in opposition to the prevailing longshore drift, which was noted during the pedestrian survey and described in Section 7.8. Given the predicted Mazrui-period remains associated with the geophysical anomalies on the beach in Area B, it is suggested that the topographic modification of the beach occurred either during or after the eighteenth century use of the site. The low ridgeline across the beach may also have been enhanced to act as a dam in order to retain water for the fields at the base of the hillslope. It is likely then that the shoreline of the beach has prograded some way into the bay since the first millennium, and the mangrove impressions and sherds of Tana ware identified on a relict beach surface during the excavation of Trench 1, several metres behind the current shoreline, support this hypothesis.

The potential Harbour (ii) lies at the base of a shallow valley, overlooked by the promontory on which the large thermoremanent daub structure was identified. Although most the shoreline of the peninsula here is backed by a steep slope, the narrow base of this valley flattens out into a broad area of level ground around 50m before the shoreline. This rare occurrence of level ground behind the shoreline is used today for processing of coconut husks to make fibres, cord, and caulking, and as an access route to sheltered deep water in the harbour. Boat traffic and trails cut through the mangroves today demonstrate that despite the additional distance along the peninsula from this point to the road and nearest settlements, the mudflats make this one of the preferred areas for landing boats in the bay, and the shallow slope at the base of the valley, a slight step up from the shoreline, makes this a potentially useful maritime activity area. Particularly high concentrations of bead grinders on the slopes of the valley east of this point, and the position of the daub structure on the promontory overlooking the site from the west also mark it as an area of potential archaeological interest. Unfortunately, due to dense vegetation and tall cassava crops in the valley in 2015 it was not possible to survey either the base of the valley or the shoreline east of this point.

7.10 Conclusions

The combination of magnetic gradiometry survey and limited excavations of the site has enabled a new interpretation of the relationship of the seventh – tenth century proto-Swahili settlement at Tumbe to the maritime cultural landscape, and the waters of Sisini Creek. The evidence indicates that whilst the main occupation areas of the site are likely to have run along the hard ridgeline of the peninsula, the shallow hillslope north-east of the site may have hosted timber and daub structures and crafting activities. The analysis of the shoreline and intertidal zones also indicates a

progradation of the shoreline north-east of the settlement, and that the beach and narrow channel of deep-water which approaches it hosted the main harbour area of the settlement. This suggests that the orientation and curve of the settlement on top of the ridgeline may be the result of the development and growth of the settlement away from this harbour area.

Having presented the evidence and interpretation of the survey of the settlement at Tumbé, Chapter Eight presents a comparative discussion of patterns of harbour and maritime activity at each of the three case-study settlements.

Chapter Eight

Harbours and Maritime Approaches

“It is not the going out of port, but the coming in, that determines the success of a voyage”

Henry Ward Beecher, 1887:56

8.1 Introduction

The review in Chapter Four of the archaeological and ethnographic evidence of first and early-second millennium ships and maritime technology in the western Indian Ocean raised a number of points for consideration in relation to the use of ports and harbours on the coast of East Africa. The analysis of that chapter suggested that the inhabitants of the first-millennium coastal settlements used sewn-plank craft, probably rigged with square sails, to navigate the coastal and deep waters around the archipelago. These vessels may have had some seasonal limitations on their use imposed by square-sail technologies and the variable south-eastern monsoon winds. However, the deliberate continuation of the type as an alternative to the pegged or nailed hulls seen in the contemporary Mediterranean indicates their value in East African contexts. One advantage of the stitched construction of these craft may have been the flexibility to endure either beaching, as an alternative to deep-watering anchorage, or the grounding and grinding necessarily associated with anchoring in an intertidal harbour. The relatively low investment cost in constructing and maintaining the various components of such vessels from local resources, from the wooden planks, to the coir stitches and ropes, and the reed-mat sails seen on the *mtepe*, may also have encouraged the continuing development of the technology. As well as sewn-plank sailing vessels, the inhabitants of the early settlements almost certainly used *mtumbwi*-type dugouts or *huri*-type extended dugouts propelled by paddles and poles to traverse and exploit the rivers, creeks, and near-shore waters of the islands. Prior to adoption and development of stabilising outriggers from East Asian vessels in the second millennium, these dugouts are likely to have been limited in range and use by their instability in waves and swell, but might have been improved for use beyond the shelter of the reefs by the addition of wash-strakes or gunwales. The hulls of these craft are tough enough to have been drawn up onto the beach when not in use, and have the benefit of being relatively simple to repair with wooden patches cut to shape and stitched into place.

With these capabilities, requirements, and limitations of maritime technology in mind, the current chapter brings together the evidence presented so far in this thesis on the maritime use of the three case-study coastal settlements between the sixth-eleventh centuries. Chapter Nine will then explore

and review possible patterns of archaeological harbour activity and urban features, and conclude with the implications of this research for the broader archaeological study of the Swahili Coast.

8.2 Port and Harbour Requirements

Lane (2012: 27) cites a longstanding scholarly recognition that “access to the sea and the utilisation of maritime resources...were important contributory factors to the rise of Swahili towns and the evolution of a distinctive Swahili culture”. The distinction between ports and harbours presented in Chapter Two is revisited here in order to discuss the coastal settlements in terms of maritime requirements, facilities, and potential relative roles. An anchorage, it was stated, is a place where boats may safely moor at anchor, but which may or may not have links to the shore, whilst harbours by comparison provide “an interface between land and sea and a conduit for the transfer of and storage of goods” (Blue, 2007: 266). A port is then a town or settlement with an associated harbour. The requirements or expectations of each of these maritime loci may of course change according to the skills and needs of the sailors using them, the type and technology of a given vessel, and the specific maritime activity, but for the sake of the current discussion these definitions serve their purpose for the examination of the maritime landscape.

Some evidence for the importance of the distinction between harbours and anchorages, at least, can be found in a description of the Somalian coastline south of the Horn of Africa in the *Periplus of the Erythraean Sea*: “Beyond Opone, the shore trending more toward the south, first there are the small and great bluffs of Azania; this coast is destitute of harbours, but there are places where ships can lie at anchor, the shore being abrupt; and this course is of six days” (Schoff 1912). The distinction made in this passage between types of maritime berths, and the emphasis on the lack of harbours, in contrast with the account of the Red Sea coast up to this point, contains a caution that ships venturing beyond should be prepared for a voyage without the opportunity for resupply. Later historical texts contain similar notes which provide scraps of information about the coastline from maritime and visitors perspectives.

According to Savage-Smith and Rapaport, the eleventh century map of the Indian Ocean contained in the Book of Curiosities (noted in Chapter Five) includes a brief annotation to the effect that Unjuja has twenty anchorages around it. The Arabic phrase that Savage-Smith and Rapaport translate as anchorage however is ‘*marσα*’, which might also translate as harbour or port¹² (Savage-Smith and Rapaport, 2007: fol. 29b-30a 2:7). In this context it is suggested that the use of *marσα*

¹² The full annotation in Arabic is *اكهلهها قال قرية وف بها //مرساين «...» حولها انجوة جزيرة* which is translated by Savage-Smith and Rapaport as “The Island of Unjuwa (Zanzibar). There are twenty (?) anchorages around it. It has a town called Ukuh (?)” (Savage-Smith and Rapaport 2007: fol. 29b-30a: Book 2 - Chapter 7)

refers to settlement-related harbours, rather than anchorages with no links to a settlement. It is also noted here however that apart from identifying Unguja Ukuu as a town on the island, the Book of Curiosities makes no other reference to settlements on the island apart from the issue of the twenty *marsa*. This raises two points; first, that a number of eleventh century harbour sites worthy of note in a contemporary Arabic text have yet to be identified around the coast of Zanzibar; and second, that it is likely that there is some variety in the size and role of these unknown harbour settlements.

As explored in Chapters Two and Three, the nature and purpose of this variation may be inferable from the material record of the relevant sites. Reference has already been made in Chapters Five and Seven to the relative quantities of imports found at Unguja Ukuu and Tumbe, which have been used to suggest that the two settlements represented major ports of trade in the contemporary, interregional maritime networks of the Indian Ocean. Smaller harbour settlements such as Fukuchani, as well as participating in varying levels of trade, may have maintained roles as shelters and resupply points for both local and international voyagers. According to Hawkins (1977) for example, Yaqut, writing in the thirteenth century, noted that vessels trading along this coast would come to Zanzibar to careen, although no specific reference is provided for this phrase in Hawkins' book. Careening refers to the necessary task of beaching a vessel in order to scrape the hull free from barnacles and shellfish, which slow a vessel's passage, and to deal with shipworm, which burrows into the timbers. This process requires time and effort, but it also requires either a suitable intertidal area where a ship can be propped up, or a beach where it can be hauled up out of the water. The common Swahili name for the island may also have some relevance to the topic. The etymology of the place name Unguja is debatable, but Sheperd (1982) suggests that it derives from the Bantu *ngoja*, 'to wait', and refers to the necessity of wintering whilst waiting for the change from the north-east to the south-western monsoons. Horton notes Angoche in Mozambique and Anjouan in the Comoros, both even further south, as two other possible derivations of *ngoja* (Horton forthcoming). It would appear then that as well as the growing sense of a maritime self-identity within Swahili society at this time, the overwhelming impressions of the Zanzibar Archipelago for outsiders were also tied to maritime themes, expectations and requirements.

In spite of these expectations, there is little evidence of landscape modification in order to meet or accommodate these requirements. It was noted in Chapter Two that apart from the presence of sea walls at Manda (Chittick 1984), which were probably intended for land reclamation (Horton 1986), and Pollard's (2007, 2008a) identification of artificially enhanced causeways on the coastline around Kilwa in the mid-second millennium, no artificial harbour installations such as wharves, jetties, or moles have been found dating from the first millennium on the East African coast. Rather than suggesting that this means that the early harbours do not fit 'traditional' (read European) models of ports and harbours, it is argued here that this lack of artificial facilities is due to the fact that the coast itself is naturally varied enough to be able to find an environment suitable for changing

maritime requirements, and that the boat technology of the first and early second-millennium was well-suited to the marine environment of the East African coast.

The use of waterfront facilities such as wharves and jetties is generally necessitated by the draught of vessels, shallow coastal hydrography beside a port, or the tidal range of the harbour which might leave a ship stranded or damaged (especially when laden) (Pollard 2007). A change, however, in any one of these may alter the balance and relationships between these criteria. An example of this can be found in the observations of Richard Burton, describing Zanzibar harbour in the late nineteenth century, who noted a 'curious' national contrast between European merchant vessels anchoring at half a mile from the shore in 5 or 6 fathoms, and the "various native craft [which] anchor close in shore...where the least sea would bump them to bits" (Burton 1872:73). Burton appears to assume that damage will be done to either type of craft in 'bumping' the seashore, but as was discussed in Chapter Four, the *mtepe* appears to have been both flexible and strong enough to cope with beaching. The harbour requirements of this craft are apparently different to the larger, deeper, and more rigid hulls of the European ships at anchor in Burton's description. Artificial facilities may not therefore have been needed until an increasing frequency of large ships requiring anchorage, predicted after the ninth century in Chapter Four, necessitated that harbours without natural deep water provided berths, or alternative berthing sites were found elsewhere. Mallinson (2012) has suggested that prior to the construction of quays at Suakin the common method of unloading was by beaching with the bow forward on to the shore. Given the apparent absence of artificial harbour structures in the ports of the Zanzibar Archipelago, the natural topography and hydrography of the coastline is likely to have played a significant role in the choice of location for both harbours and archaeological settlements in this period, and consequently for the use and relative roles of ports and maritime communities.

Having described the general marine environment of the islands and the prevailing climatic conditions in Chapter Two, the coastal zone around each of the case study areas will now be discussed with reference to the archaeological evidence presented in Chapter Five, Six, and Seven, in order to identify potential patterns in the location of harbours, and the varied types of maritime activity which are likely to have occurred or been possible at each.

8.4 Unguja Ukuu

Previous surveys of Unguja Ukuu have demonstrated that the sixth-eleventh century phases of this settlement stood just inland of the base of the Makime Peninsula, between the open beach of Menai Bay and the mangrove creek running north of Uzi Island. It was proposed in Chapter Five that the main harbour of Unguja Ukuu probably fronted the open beach facing south-west into Menai

Bay, with occupation areas arrayed behind and north of the beach, and that some industry, processing, or trade activities may have been sited on the narrow neck of the peninsula between the occupation area and the newly identified southern mosque. The harbour is framed by the shallow beach to the north, the peninsula to the east, and by low coral cliffs undercut by tidal erosion to the west, and Admiralty charts show that the whole of this coastline stands on a coral shelf which extends on average to around 1km from the shoreline (Figure 9.1). Based on the topography of the region, it seems likely that prior to the Pliocene sea-level rise which isolated Zanzibar from the mainland, the Makime Peninsula may have been part of a much larger peninsula or low hill range, the remainder of which is represented by Uzi Island. This would explain the shallowness of the mangrove creek to the east of Unguja Ukuu and therefore also the origin of the modern, artificially enhanced causeways which are used to cross to Uzi Island today.

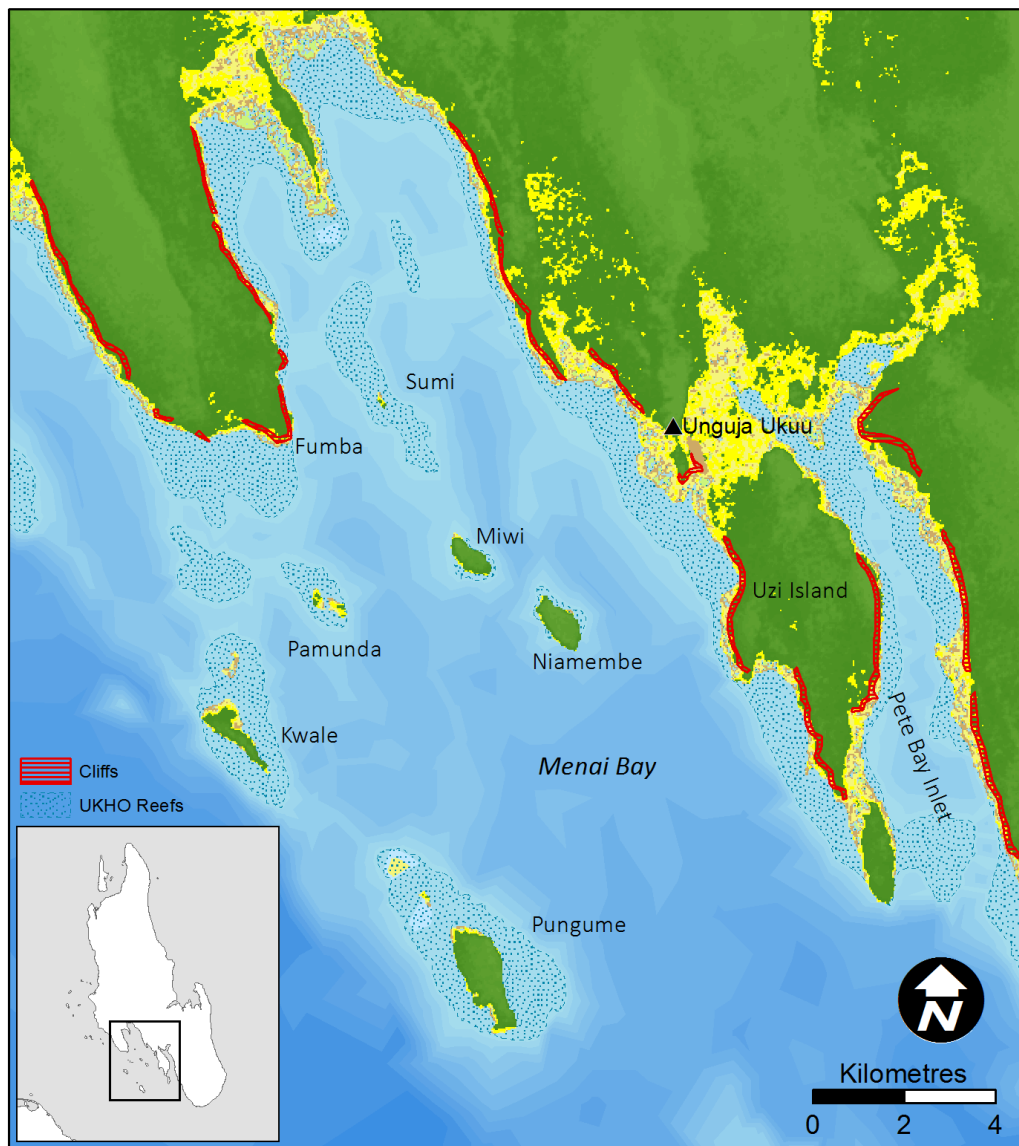


Figure 8.1: Digitised Admiralty hydrographic charts showing area of Menai Bay and coastscape around Unguja Ukuu

Today, the harbour itself dries at low tide to a height of around 1m above MLWS, and the coral that forms its base is covered today only by a thin deposit of intertidal sands. Although tidal range estimates are not available and were not measured for the harbour by this project, comparative figures are available elsewhere in the region. The spring tidal range of the Zanzibar Channel, for example, is 4m, and the neap tidal range is 2.7m, whilst at Stonetown the spring range is around 4.65m, and Chwaka Bay, on the east coast of the island, has an estimated spring tidal range of 3.22m, and a neap tidal range of just 0.90m (Cederlöf *et al* 1995: 462; NGIA 2015: 83). Given the location of the harbour in Menai Bay, on the south-west coast facing into the Zanzibar Channel, if we assume the highest spring tidal range of 4.65m, and accepting Admiralty estimates that the very edge of this coral shelf dries to around 1m above MLWS (Figure 9.1), the harbour area of Unguja Ukuu is likely to have a greatest depth of around 3m during a full spring tide. Whilst the capabilities and draughts of vessel in these waters varies considerably, the high tidal range of the south west coast means that at full water both the bay and the estuary to the east are deep enough for dugouts such as the *mtumbwi*, and small vessels such as the modern *ngalawa* and *mashua* which are based in the harbour today (described and discussed in Chapter Four).

Whilst the base of the harbour at Unguja Ukuu and its neighbouring, but more exposed bay to the west are covered by thin sands, moving south along the Makime peninsula the shoreline comprises shifting mudbanks anchored only by dense mangroves, and an intertidal zone of exposed and often jagged coral. As the peninsula rises the sides become steeper, and the southern part of the peninsula is surrounded by both the coral shelf and by coral cliffs around 3-5m high. Rounding the peninsula, the mouth of the estuary between Makime and Uzi Island is shallow and can be forded on foot between low and mid-tide. Even at low tide though a channel in the middle of the creek is potentially navigable during spring tides by near-shore and small coastal vessels, but the narrow channel mouth means that the current in this channel is fast and strong, leaving little room for error in manoeuvring.

The coastline around Unguja Ukuu faces south-west into Menai Bay. From the digitised Admiralty hydrographic charts in Figure 9.1 it can be seen that the waters of Menai Bay are both deep, and relatively free of maritime hazards. One of the first modern pilot texts for East Africa, Findlay's *Directory for the Navigation of the Indian Ocean* (1866), describes Menai Bay as "a beautiful bay and a seemingly excellent port" (Findlay 1866:507). Unfortunately the same text misidentifies several islands and features of Menai Bay, complicating comparisons to even contemporary charts. In the text Sumi, Miwi and Niamembe islands are identified as Miwi, Gomany and Boony respectively, Pamunda is renamed Kiseewa Ngoowy, and Kwale and Pungume islands appear to have been agglomerated into one, since the description of the terrain fits Kwale, but all directions as to its position can only fit Pungume. It is possible that Kwale itself has been mistaken in this instance for one of the two 'rocky islets' north-west of the 'Kwaly Island' (actually Pungume) in the text (Figure

9.1). This has the potential to create an unfortunate situation for users of the guide, since in spite of the initial description of Menai Bay, 'Kwaly Island' is the anchorage actually noted in the text.

Subsequent texts refer frequently to Admiralty charts in order to emphasise the importance of their use in shallow coastal passages, and to ensure consistency in the naming of islands and reefs. Good holding ground for anchoring is noted at around 22-28m depth anywhere inside the chain of islands on the edge of Menai Bay, but the Africa Pilot also emphasises that during the SW monsoon the only sheltered anchorage is north of Pungume Island or between Niamembe and Miwi Islets (De Horsey 1897: 427; NGIA 2015: 84). The waters north of Sumi are noted as being shallow, and pilots of small vessels are advised to trust to the visibility of the reefs at low water. The clear water and visibility of the reefs at mid-tide is a constant feature of all the East African pilots, including recent volumes such as that produced by the National Geospatial-Intelligence Agency (NGIA 2015). The India Directory goes so far as to state optimistically that "the reefs are discernible all the way, and with a good look-out, it is impossible to run into danger" (Taylor 1874: 100).

In spite of this reassurance, the only feature of the east coast of Menai Bay which is noted consistently in all the texts is the hazardous nature of the broad reef which dries to around half a mile from the shoreline, and the coral cliffs which make landing impractical (De Horsey 1897: 426) (Figure 9.2). The NGIA's recent pilot summarises with a simple statement that the east coast of the bay is "fronted by numerous islands and dangers" (NGIA 2015: 83), whilst Rosser and Imray's *Seaman's Guide* (1867) calls attention to the prevailing northern currents which may also push a vessel towards this shoreline, especially during the SW monsoon. Findlay briefly notes the shelter of the long channel now known as Peet/Pete Inlet Bay to the east of Uzi Island, but also cautions its shallowness and narrow opening due to the reef at Bweni Point (Findlay 1866:508). De Horsey's *Africa Pilot* (1897), by comparison, describes the same inlet in some detail, and also the existence of the shallow channel through the mangroves at the northern end of the inlet which rounds Uzi Island and connects with the creek to the east of Unguka Ukuu between Uzi Island and Mikame peninsula. De Horsey's guide is therefore almost unique in describing the contemporary use of these waters by indigenous vessels, rather than just dispensing advice for European ships and sailors.

It would seem on balance that whilst Menai Bay is generally agreed in European pilot manuals to be beautiful, it is admired as a passage to Port Zanzibar, rather than for its anchorages or as a harbour in its own right. The reefs which edge the main island and the prevailing current pushing towards these reefs deter the passage of vessels close to this coast, and the lack of deep-water bays means that there are no natural harbours to shelter large European ships. The waters between the two islands of Kwale and Pungume appear to be the only consistently referenced sheltered anchorage for such vessels in the bay, although less sheltered night anchorages are also noted in the shallows of the Pungume Patches just south of the entrance to Menai Bay. Since there have been no major

port settlements in the bay for the past 400 years though, there has been little reason for European vessels to utilise these offshore anchorages for anything other than overnight shelters.

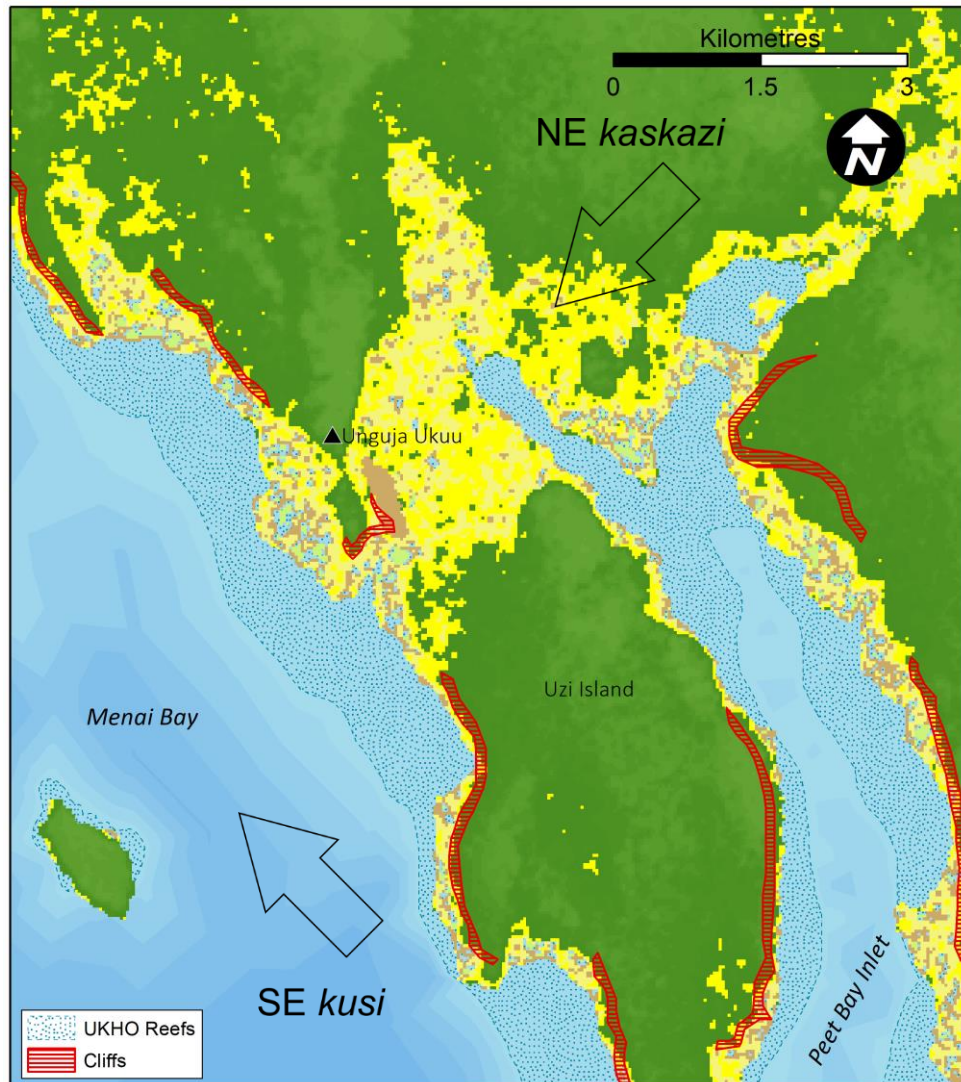


Figure 8.2: Coastline around Makime Peninsula at estimated position of low tide. Note cliffs and shallow depth of mangrove creek north of Uzi Island. Note general direction of monsoon winds, and narrow shelter therefore offered by headlands of Uzi Island and Makime Peninsula

The wealth of the archaeological settlement at Unguja Ukuu, as well as the comments of De Horsey and the modern exploitation of the harbour demonstrate of course that smaller vessels can certainly make use of this coastline, and have been doing so with great success since at least the sixth century CE. De Horsey's noting of the use of the mangroves between Makime and Peet Bay Inlet for the passage of small craft is particularly interesting, raising the question of what types of activity might prompt this. As noted above, the high tidal range means that at full water the mangrove estuary to the east of Makime peninsula is quite deep enough for small vessels today to sail up to the village at

the northern point of Uzi Island (Figure 9.2). At least some of the craft which use the channel today appear to originate from the village at the northern point of Uzi Island. Given the size of Uzi Island De Horsey suggests that the channel serves as a shortcut between Peet Bay Inlet and Menai Bay (1897: 426). At least 4 villages marked close to the shores of the inlet on nineteenth century Admiralty charts may have had cause to use this passage, both for access to the bay and to maintain lines of communication with each other and Unguja Ukuu.

It is also possible that passage in the opposite direction, both into the mangroves and through to the Inlet, may have been useful to the inhabitants of Unguja Ukuu for subsistence fishing and resource exploitation. Whilst Juma's work at Unguja Ukuu did not include a detailed analysis of fish species from the faunal remains, he did report large quantities of molluscs in faunal assemblages, three shell middens, and 'significant' quantities of inshore and pelagic fish species, particularly in his Period Ia (500-700 CE) and Ib (750-900 CE) (Juma 2004: 148). Mudida's analysis of Horton and Clark's fish remains assemblage, along with two fish hooks from the site were also used to suggest a reliance on inshore fishing of fringing reefs, lagoons and creeks (Horton and Mudida 1993 and forthcoming). Comparisons were drawn to broad similarities with the Shanga assemblage, although Quintana Morales offers a slight caution that differences in the assemblages indicate that different types of coastal habitat were exploited to different degrees, and probably using different tools and methods (Quintana Morales 2013: 137). Her own detailed thesis analysis demonstrated that as well as the exploitation of intertidal zones for molluscs and invertebrates, the majority of fish species found in any Swahili site appear to come from coral reefs or habitats associated with reef systems. This is of course to be expected given the abundance of these environments on the coast, but differences in site assemblages indicate a practical exploitation of local environments for subsistence purposes, and with techniques adapted for that environment, rather than journeying to exploit a particular species from specific environments (Quintana Morales 2013: 230). A possible explanation for this this is related by analogy in Quintana Morales thesis to research by Jarvenpa and Brumbach (2006: 145) showing that Khanty fishers are likely to limit their subsistence fishing to within one hour of travel from settlements. Whilst there is no suggestion that the same figure is applicable to Swahili fishers either past or present, the point is made that regular subsistence activity, particularly in the late first millennium, may have been limited for practical reasons to the local marine environment.

The wide beach might also offer a two-part strategic advantage to the settlement as a port of trade. As the view from the beach at Unguja Ukuu (Figure 9.4) and viewshed analysis (Figure 9.3) demonstrates, the site has an excellent field-of-view across Menai Bay and south west towards the mainland coast. This view allows approaching ships to be seen and prepared for, but by the same token must also have enabled the settlement to be seen from a considerable distance by merchant vessels looking to trade, especially given the presence of the coral mosques on the beachfront, and the maritime traffic which might be assumed of a busy settlement (Figure 9.3). In this context it is possible that the coastal shelf and shallow harbour might actually have provided Unguja Ukuu with a

measure of protection from, or limited control over the approach of visiting craft. As recommended in the *Africa Pilot* (1897) and observed during the course of project fieldwork, small fishing vessels such as the *mashua* and the *ngalawa* (discussed in Chapter Four) tend to approach the harbour from Menai Bay on the early flood tide whilst the reefs are still clearly visible. Visiting merchant craft though, especially large vessels, may have been deterred from attempting to sail in as far as the beach without a local pilot to guide them to safe harbour, enabling the commodification of local knowledge or services in bringing in goods by tender from vessels anchored further out in the bay or in the lee of the islands.

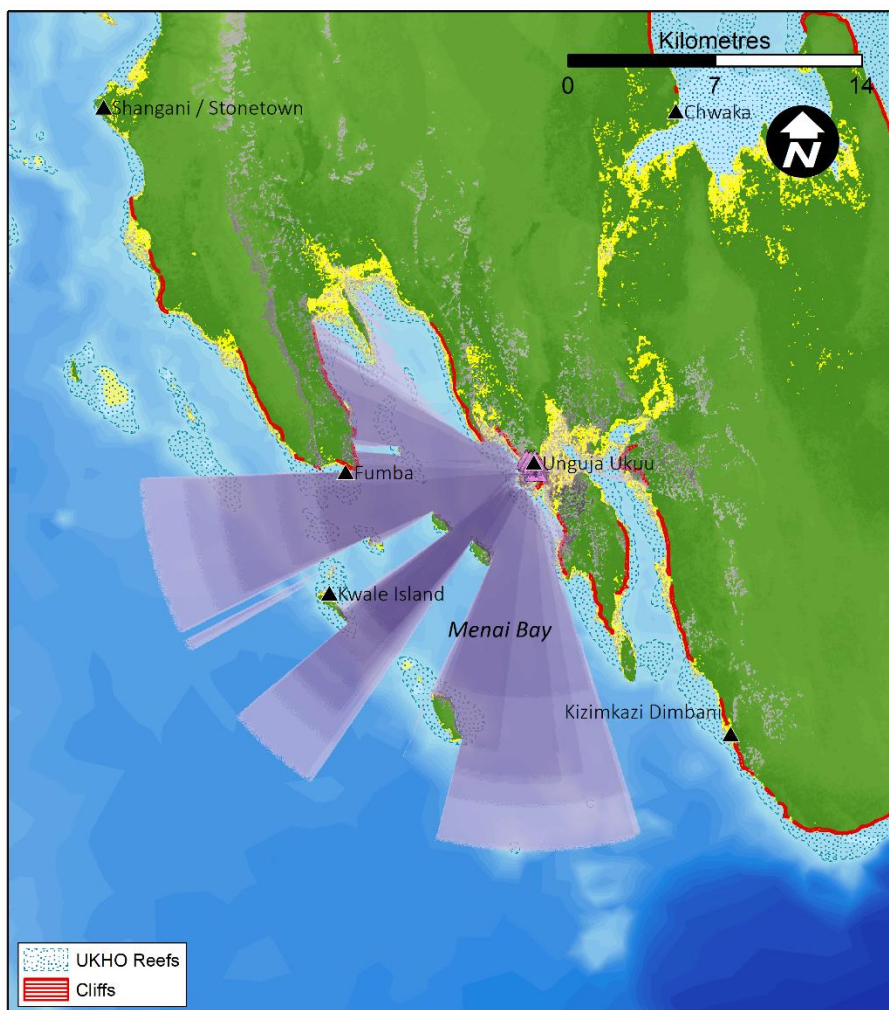


Figure 8.3: Viewshed analysis from key areas of archaeological site at Unguja Ukuu



Figure 8.4: View of Menai Bay at low-tide from shoreline of Unguja Ukuu facing south west. Niamembe island is visible on the left, and Miwi island on the right. Pungume and Kwale Islands are partially hidden from sight behind these islands, respectively

8.4.1 Site Summary

As noted in Chapter Five, Pearce (1920: 416), on the strength of his visit to the site, described the potential difficulty of approaching this coastline even by small ‘native’ vessels, because of the shallow intertidal zone in front of the beach at Unguja Ukuu. It is argued here however that this view is likely to have been shaped and unfairly biased by European attitudes, and that whilst the harbour can in fact offer sufficient depth and shelter for local vessels, its location and even its shallowness may have offered a number of advantages to the archaeological settlement at Unguja Ukuu.

The beach at Unguja Ukuu offers easy access between the land and sea. The settlement had a wide, shallow, and intertidal harbour basin, with a marginally deeper, albeit still drying channel between open water and the sandy beach. As seen today, the harbour is clearly suitable for *ngalawa* outriggers and *mashua* fishing vessels to sail into between mid- and high-tide, and allows for intertidal anchorage, whilst the shallow slope of the sandy beach means that both dugouts and sewn-plank craft might be drawn up onto the shore when necessary. The channel in the intertidal basin leads up to the narrow bridge of the peninsula and the area of industry and middens highlighted by both Horton in 1984, and the geophysical survey in Chapter Five. It is possible

therefore that this locus of activity was chosen or developed because of its convenience as a point of least-effort contact between the open beach and the mangrove peninsula, both for processing, exchange, and portage.



Figure 8.5 Menai Bay from Unguja Ukuu, facing south west towards Niamembe Island shortly before high tide. *Mashua* in foreground is anchored approximately 5m from beach. White cap wave crests can be seen to increase in frequency further from shore, and away from shelter of the harbour area.

Given the coral cliffs that front the east coast of Menai Bay, noted in many of the pilot texts and visible in the digitised hydrographic charts of the area (Figure 9.1), the combination of both bay and shallow, sandy beach at Unguja Ukuu provides one of the few access routes between the water and the interior of the island in this region. It therefore offers a natural harbour, if not a deep-water anchorage. During the course of fieldwork over several seasons it was noted that the harbour appears to be relatively well sheltered by the ridge of elevated ground behind the site, and by Makime peninsula itself, from both seasons of the monsoon winds. This was especially apparent in high winds in comparison to the open water of Menai Bay, when white caps could be observed on wave crests in open water, but not within the sheltered bay between Ras Kigomani and Makime Peninsula (Figure 9.5). Some of this shelter may be due to the current tree cover close to the shore, which is likely to be more prominent today, in the absence of a modern settlement on the shoreline. As well as being sheltered from both seasons of the monsoon winds and currents, the curve of the beach also means that different areas can be utilised in different seasons as conditions and activities necessitate. The shift in the position and clustering of boats, noted between the survey seasons

described in Chapter Five, suggests that the size of the beach and bay enables the local fishermen to adapt their seasonal, and even daily choice of mooring spot according to changing weather conditions.

The subsistence evidence from the site indicates a reliance on the exploitation of shallow-water and coastal fish and shellfish species, and the range of near-shore and intertidal environments available within a short distance and travel time, both on foot and by boat, demonstrates that the inhabitants of Unguja Ukuu knew of and made use of good access to a wide variety of resource areas. The undated well at the site, as well as multiple wells in the modern village, demonstrates that good water is available and can be tapped to supply a settlement. The intertidal zone of the harbour and estuary offer opportunities for mollusc collection, crab catching, and fish-traps, and the mangroves provide an important resource for construction and wattle-and-daub architecture, fuel, and for trade. The faunal assemblage of Unguja Ukuu indicates that alongside hunting, fishing and marine exploitation were an important part of subsistence strategies at the site, especially in the seventh – tenth centuries (Crowther *et al* 2013a, 2013b; Prendergast *et al* 2013; Quintana-Morales and Horton 2014). The waters of Menai Bay and its islands provide an environment suitable for pelagic line fishing, even from dugouts and without venturing far from shore, whilst the passage through the mangroves enables easy access using near-shore craft to the sheltered waters of Peet Bay Inlet and, given the high tidal range, further associated opportunities for inshore net, basket and trap fishing. All of these activities would have been feasible and productive given the predicted use of dugouts and sewn-plank vessels in the proto-Swahili period. Following this model it is hypothesised that the intertidal reefs and sandbanks around Unguja Ukuu itself could easily have been exploited on foot from the settlement; that dugouts could have been used to access and fish in the mangroves, inlets, and shallow waters along the coast; and that larger sewn-plank craft are likely to have formed the principle means of sailing the deeper coastal waters of Menai Bay and of maintaining networks of communication and exchange around the archipelago and across the Zanzibar Channel.

One potential limitation of this harbour is that there are no conveniently accessible areas of sheltered deep-water which could provide safe and secure anchorage for pegged or nailed vessels with a deep draught. It is possible however that this limitation might have contributed to the declining use of the site throughout the second millennium, and the need for hypothetical access routes through the mangroves to other sites and resource areas supports the idea, raised in Chapter Four, that the slow local adoption of pegged-hulls may have been related to the flexibility and adaptability of sewn-plank hulls to the regional environment.

Finally, with regards to the maritime activity and connections of the site, viewshed analysis indicates that the town would have been clearly visible from the open waters of Menai Bay and its islands, and may have been visible from predicted coastal sailing routes along the continental coast. This factor may have contributed to the settlement's success as a trading port, even as comparison to the

other case studies sites and lack of a clear pattern of visibility indicates that this is unlikely to have been a primary factor in the choice of location for the early settlements of the archipelago.

One potential limitation of this harbour is that there are no conveniently accessible areas of sheltered deep-water which could provide safe and secure anchorage for pegged or nailed vessels with a deep draught. It is possible however that this limitation might help to explain the declining use of the site into and throughout the second millennium.

8.5 Fukuchani

Previous excavations at Fukuchani have demonstrated two archaeological phases of occupation in the raised embayment, dating to around the sixth-eighth centuries, and the thirteenth-fifteenth centuries. Rather than the open waters of Menai Bay, the beach at Fukuchani faces west into the narrower Mkokotoni Harbour and across to the island of Tumbatu. As described in Chapter Six, the site lies in the base of a relict embayment, and the gently curved shoreline and intertidal zone are for the most part exposed coral carbonate, with a depression in the middle of the bay acting as a trap for sand and muds. The beach itself is broad, extending around half a kilometre, but the coral reefs of the intertidal zone mean that although the potential area of anchorage in this bay is well sheltered from the currents of Mkokotoni Harbour, it is only 200m across at its widest point. The relatively slow growth of coral carbonate means that the topography of the bay is unlikely to have changed significantly since the late first millennium, although it is possible that sand may once have covered a greater extent of the intertidal coral. A deeper channel of water enables access by boat between Mkokotoni Harbour and the sandy beach in front of the site even at low tide, and the majority of the villages' boats today beach along this narrow strip of sand. Although a small number of craft choose to anchor in the intertidal zone south of this point, the exposed coral make this a potentially dangerous prospect.

Considering the maritime technology of the first millennium hypothesised in Chapter Four, and the increased threat that sharp coral is likely to pose to the stitches of sewn-plank craft compared even to the more rigid pegged or nailed hulls, it is probable that the same central area of the shoreline would have been utilised for the harbour during the initial sixth - eighth century period of occupation. This analysis supports the hypothesis developed in Chapter Six that the early settlement at Fukuchani may have had a relatively small area of harbour activity above the beach adjacent to this depression. An Islamic graveyard and a pre-Islamic burial overlooking the water just south of this harbour may represent continuity of a ritualised area or relationship between settlement and maritime activity. Horton's (forthcoming) report of iron-working activity in trenches around the new school then appears to be arrayed in a region just inland of this harbour area. It was also

hypothesised in Chapter Six that traces of multiple daub structures to the south identified in the gradiometry represent the main area of occupation, between the sandy deposits where wells are dug today, and the exposed coral and possible springs south of the main site.

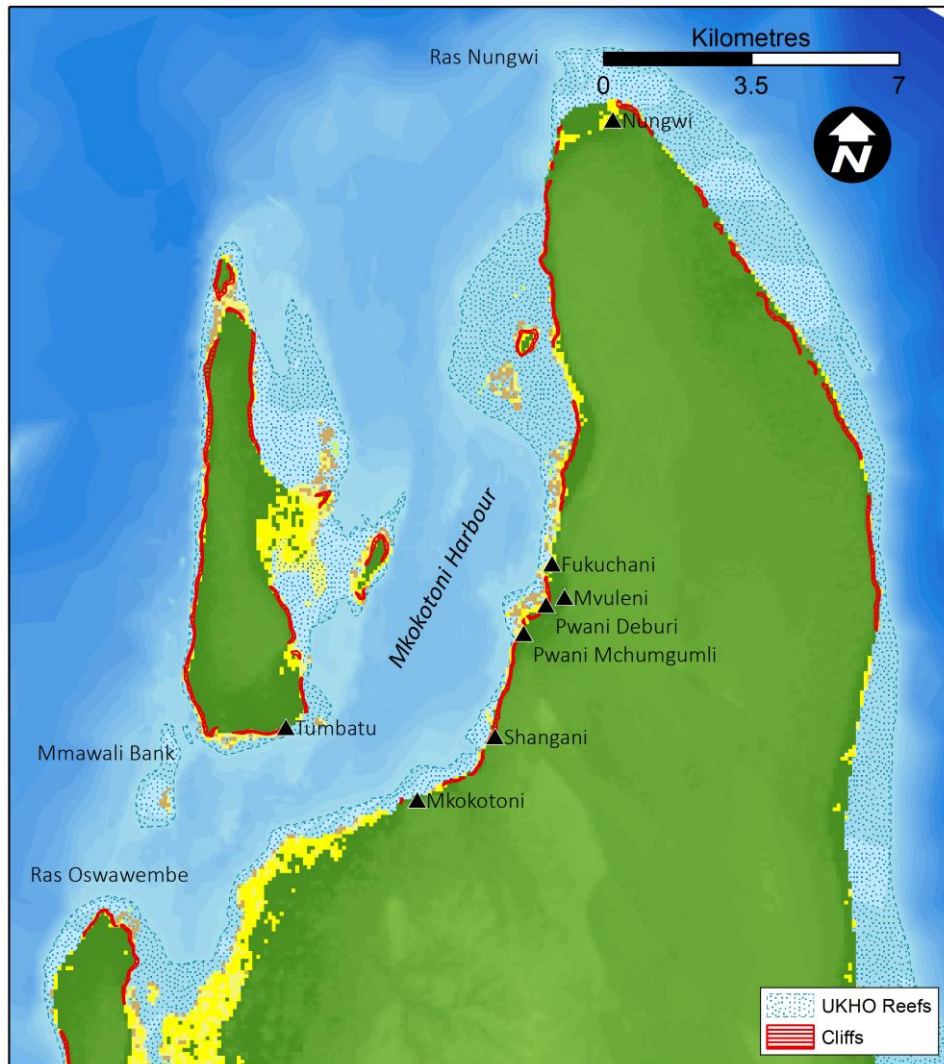


Figure 8.6: Digitised Admiralty hydrographic charts showing area of Mkokotoni Harbour and coastline around Fukuchani

It is also noted here that as with Unguja Ukuu, the cliffs lining almost the entire coastline of Mkokotoni Harbour mean that this beach site offers a rare and convenient access route between land and deep water. Mkokotoni Harbour appears to be another drowned valley on the north-west shoulder of Zanzibar, enclosed by the curve of the islands coastline to the east and south, and by the 10km long island of Tumbatu to the west (Figure 9.9). North of Fukuchani the coast consists of an increasingly wide intertidal coral shelf with outcropping rocks, and a line of cliffs which run all the way to the northern tip of the island, where they flatten into the long curving beaches of Ras

Nungwi. Behind the cliffs meanwhile the landscape climbs into the wooded hillslopes of northern Zanzibar. South of Fukuchani the land is again fronted by coral cliffs, broken within the first 2km by the beach at Pwani Debuli, and a second, more exposed beach around a fractured headland. Thereafter to the south the cliffs run unbroken down to the turn of the bay at Shangani, where there is a mangrove creek, and then west past the beach at Mkokotoni. West of Mkokotoni the coast curves into the mangroves of Makoba Bay and then juts north again as the wide, flat headland of Ras Oswawembe, opposite the southern tip of Tumbatu. As well as the dense mangroves and associated river around Makoba Bay, the interior of this part of the coast consists of broad wooded valleys and isolated hills.

All of the pilot texts warn against approaching the headlands of Ras Nungwi, Mwana or Ras Oswawembe too closely because of the coral shelves which extend almost a kilometre and half from the shore at their points (Findlay 1866: 503; Rosser and Imray 1867: 342) (Figure 9.9). The western cliffs of Tumbatu and Zanzibar though have deep water and good grounds for anchorage close to the shore (Findlay 1866: 503; Rosser and Imray 1867: 342). The eastern side of Tumbatu Island, on the other hand, slopes down to the water and has fewer cliffs, but does feature an extensive intertidal coral shelf along its entire length, which extends up to 2km from the island's coast as far as the smaller island of Puopo. De Horsey notes that at low tide this reef narrows the passage of Mkokotoni considerably, especially in its northern and western entrances (1897: 442).

Apart from the issue of the coral shelves flanking its shorelines, Mkokotoni harbour is described as a sheltered anchorage with deep water of up to 16m. Good berths and holding grounds can be found in the middle of the harbour from a little way south east of Puopo down to just north of the sandy shelf off Mkokotoni (De Horsey 1897: 445). The northern entrance to the harbour is a bottleneck framed by Tumbatu Island to the west and the broad coral shelf which extends up to 2.5km from the shoreline to the east (Figure 9.9). Between the reefs the channel is wide and deep, and apparently safe for maritime traffic. The digitisation of Admiralty hydrographic charts shows however that the southern entrance to the harbour between Tumbatu and Ras Oswawembe is shallow, connected below the waterline by reefs, and with an extensive intertidal sandbank known as Mmawali which dries to around 3.3m above MLWS (Figure 9.9) (De Horsey 1897: 444). De Horsey warns that the deepest point of the entrance is at most 5m, and that this entrance to the harbour is only suitable for vessels of less than 3m draught, since it has a strong current, and the mud and silt from sandbanks and out of Makoba Bay reduce water visibility (1897: 445). The spring tidal range is 4.5m, and the neap range is 3m, and the currents generally run south with the rising tide and north with the ebb, except in the south-western monsoon when, as in Menai Bay, the current runs continuously northward. The headland of Ras Nungwi apparently protects the harbour from the ocean swells, which pass visibly across the northern entrance. Whilst this environment is deep enough for both the first millennium sewn-plank vessels and second millennium pegged-hulls described in Chapter

Four, it is again noted that the sewn-plank hulls are likely to have been the more resilient and reliable in dealing with the risk of scraping and grinding against these submerged sandbanks.

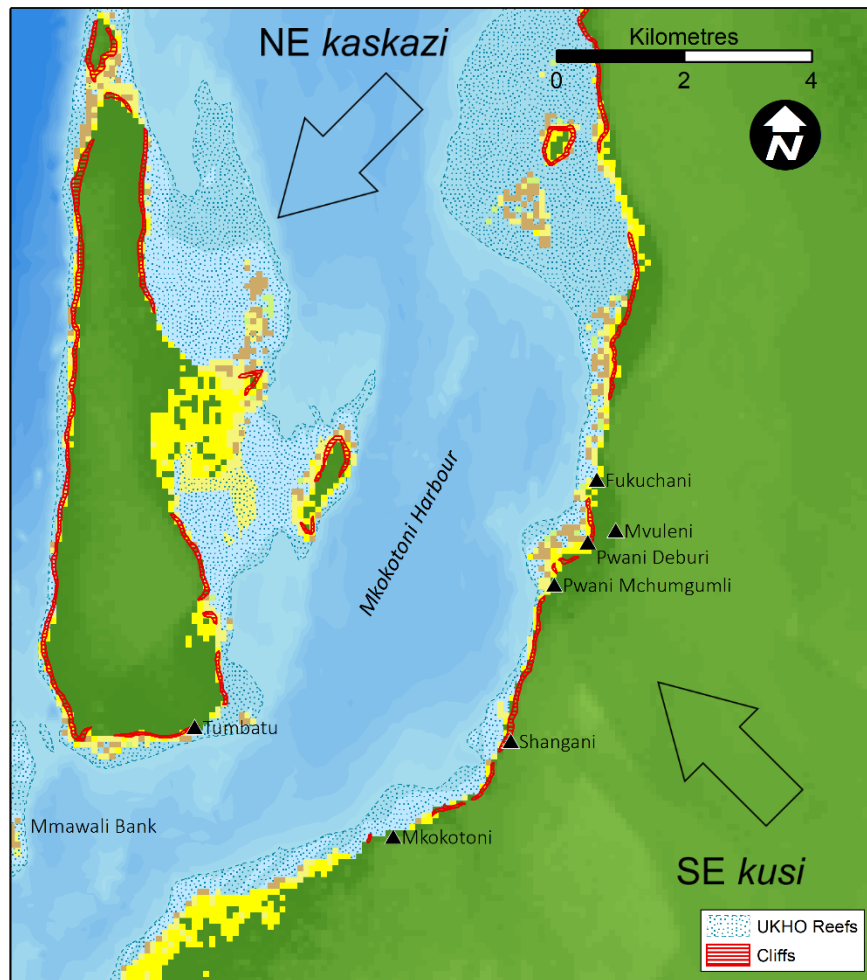


Figure 8.7: Comparison of known proto-Swahili and Swahili period sites around Mkokotoni Harbour, showing proto-Swahili sites aligning with breaks in cliffs, and greater variety amongst Swahili sites referenced in text. Also note that the Nungwi headland just north of the map helps shelter Mkokotoni harbour during the NE *kaskazi* monsoon, whilst the hills inland provide some shelter to Fukuchani harbour from the SE *kusi* winds

Numerous villages with which ships may trade are noted in the *Africa Pilot*, and contemporary charts show villages at Mkokotoni, under Pale Hill, and at Potea (now Potowa) (De Horsey 1897: 444). A number of archaeological settlements are also known in the area, including Mkokotoni, Shangani, Tumbatu, and Pwani Deburi (Figure 9.10). Like Fukuchani, the earliest known phases of the village site at Mkokotoni date to around the eighth-tenth centuries. The beach at Mkokotoni is sandy, backed by steep earth cliffs, and the intertidal zone is broad and shallow with sands apparently overlying a continuation of the coral shelf. The position of the early settlement at Mkokotoni, as

plotted by Horton and Clark (1985), demonstrates that the harbour of this site is likely to have been the broad, sandy intertidal beach, and perhaps the creek below Shangani, rather than the modern harbour in a sheltered bay to the west of the site, again demonstrating the value of flexible, sewn-plank hulls. Pwani Deburi, a beach site just 700m south of Fukuchani, has some ceramics dated to around the eighth century¹³, but little to indicate more than temporary or ephemeral settlement in this period (Horton pers. comm; Norman and LaViolette 2016). The beach at Pwani Deburi is similar to Fukuchani, in that the intertidal zone of exposed coral and the bay is flanked by coral cliffs, but the beach and relict raised portion of the embayment appear to have deeper sand deposits which are being eroded by the sea. Behind the beach is another area of exposed coral and small caves in a depression in the ground, with springs and at least one well (Figure 9.11). It is suggested here that this site may have served as a temporary or seasonal camp because of its water supply, but may not have been permanently settled in the first millennium. Tumbatu, also known today as Makutani (place of the ruins) or Jongowe Makutani, was settled on the southern coast of Tumbatu Island around the eleventh century, and until the fourteenth century was the capital and wealthiest trading town of Zanzibar (Figure 9.10). The site stands on a coral bluff overlooking the harbour and, as noted above, the broad intertidal coral shelf which extends from the eastern coast of Tumbatu. By the tenth century Mkokotoni had fallen into either severe decline or abandonment, but by the thirteenth century the rise of Tumbatu seems to have revitalised the village. It is likely that Mkokotoni served a vital role as a supply point for Tumbatu, since there are few wells on the island and no natural springs, whereas Mkokotoni has good water and a great number of wells along or behind the beach, as well as far better soils for cultivation than the island (Horton forthcoming). Shangani appears to have been an extension of Mkokotoni to the east, on a headland above the mangrove creek, and ceramics and a number of Chinese coins found at this site date the occupation to the thirteenth-fifteenth centuries (Horton forthcoming). Again, this site is likely to have grown in relation to the rise and success of Tumbatu, and perhaps in response to the need to supply the town on the island.

The resettlement of Fukuchani in the late thirteenth century therefore fits into a wider pattern of revitalisation and resettlement around the coastline of Mkokotoni Harbour. Evidence of thirteenth century settlement activity at Mkokotoni, Shangani, and Fukuchani corresponds with evidence of a widespread phase of construction and redevelopment work in Tumbatu, which Horton (forthcoming) hypothesises may have been linked to an influx of outsiders, perhaps Ibadi merchants from Kilwa, and the transfer of power to the island reported by Yaqut (Trimingham 1975). It is suggested here that each of the smaller sites around the bay may have served as satellite sites for the resupply of Tumbatu. With few subsistence resources of its own on the island, it is likely that without such contact Tumbatu would otherwise have struggled to be self-sufficient, especially in the

¹³ Some nineteenth century ceramics and a possible 'Arab' structure have also been identified at Pwani Deburi, but these are beyond the scope of this thesis (Horton 1984:11; Norman and LaViolette pers. comm.)

face of an influx of occupants in the thirteenth century and the associated growth and redevelopment of the town.

On the issue of subsistence, comparisons to Unguja Ukuu raise some interesting points of difference. Like Menai Bay, the region around Mkokotoni Harbour, with its reefs, the mangroves of Makoba Bay to the south, and deep water down the west coast, apparently offers a variety of good fishing grounds. Unlike Unguja Ukuu though, Fukuchani is not situated near any stands of mangroves, and the only such areas in Mkokotoni Harbour are found in the creek between Mkokotoni and Shangani, and in Makoba Bay. The intertidal muds and coral shelf of Fukuchani harbour are used today, as at Unguja Ukuu, for the harvesting of molluscs, but these do not appear to have been identified in large quantities in previous excavations at the site. Furthermore, based on Horton's excavations at Fukuchani in the 1980s, Horton and Mudida's analysis indicated a surprisingly low proportion of fish, around 1.6% after correction for estimated NISP, compared to around 13% at Unguja Ukuu (Horton and Mudida forthcoming). The authors note a far greater emphasis on hunting compared to fishing at Fukuchani, with a ratio of approximately 6:1, whereas at Unguja Ukuu the same activities were estimated at around 2:3 (Horton and Mudida forthcoming). Excavations by the Sealinks Project at the same sites however produced different proportions, with estimates of faunal assemblages dominated by more than 75% fish remains (Boivin *et al* 2014: ; Crowther *et al* 2016).

One of the reasons for this discrepancy is almost certainly the relatively small quantities of all faunal remains at Fukuchani, as noted by Horton and Mudida, and this may be due in turn to the necessarily limited size of the original excavations (Horton and Clark 1985; Horton and Mudida forthcoming). Another reason though might be the location of Horton's original trenches. As noted in Chapter Six, these trenches cut into the known middens in the centre and southern end of the site. Based on her own ethnographic observations, Quintana Morales argued in her thesis for differentiation in the types of fish processing and consumption activity occurring in particular social spaces, depending on the type or size of settlement:

"The most notable difference between the larger (Vanga) and smaller (Jimbo) settlement types was the use of space. In Jimbo, the area around the shoreline was occupied by fishers mending their sails, making traps, and exchanging fish with dealers. In Vanga, this area had been limited by a town wall that borders the shoreline. New buildings had been erected along the wall, pushing fishing activities to the margins. In Vanga I observed fishers working on their traps near their homes rather than in a communal space" (Quintana Morales 2013: 115).

This observation is compared here to the hypothesis put forward in this thesis of distinctions between harbour-activity areas, processing and industrial zones, and occupation spaces. If the middens excavated by Horton and Clark (1985) and by the Sealinks Project (Crowther *et al* 2013a) were located in an area of industry, rather than in either the harbour or the occupation area of the

site, this might help to account for both the low numbers of faunal remains in general and the low percentage of fish and shell remains in particular. The purpose of the original survey at Fukuchani and the focus of the Sealinks Project on interregional trade connections across the Indian Ocean, rather than on individual settlement plans, means however that this faunal data was amalgamated for general site interest, and was not available in published tables for each trench at the time of writing. It would be of interest in future however to examine the faunal data from individual areas of this site in order to identify potential variation in faunal assemblages across the site. On the same basis, just as Wynne-Jones and Fleisher's research at the fourteenth-sixteenth century site of Songo Mnara has demonstrated distinct areas of specialised activity within the stone houses (Wynne-Jones and Fleisher 2010; Wynne Jones 2013), and geophysical and geochemical survey across the site has indicated further distinctions in the types of activity taking place in different 'open' areas of the town (Sulas *et al* 2016), Quintana Morales has demonstrated that people in different types of structures in the town were consuming different types of fish. The inhabitants of the wattle-and-daub structures in the 'open area' between the harbour and the stone houses generally ate smaller coral fish averaging less than 5kg, and a higher proportion of fish than domesticated animals, whilst the inhabitants of the stone houses ate larger fish, with higher numbers of deep water species such as ray and shark, and a higher proportion of cattle, sheep/goat, and chicken. These variations appear to have been related to social status, which corresponds to both type of house and location within the town, and may also correspond with access to or ownership of fishing boats (Fleisher and Wynne-Jones 2012; Quintana Morales 2013; 226). Further survey and excavation at Fukuchani, at least in those areas not covered or disturbed by modern occupation, might establish whether similar patterns of consumption and social status could be identified at this earliest known Swahili settlement on Zanzibar.

For the purpose of this thesis though, focusing on harbours as an integral part of settlements, one of the most interesting features of the early sites of Fukuchani, Mkokotoni and Pwani Deburi is the nature of their coastal setting in comparison to later sites. Analysis of the digitised Admiralty charts, such as Irving's 1951 survey of northern Zanzibar, shows that the coastline around Mkokotoni Harbour is almost entirely edged by coral cliffs (Figure 9.9). The three early settlements are sited on the only significant breaks in these cliffs, at beach sites which enable easy access between the shoreline and the interior of Zanzibar. Moreover, as relict embayments both Fukuchani and Pwani Deburi have natural depressions in their intertidal zones which provide natural anchorages close in to the shore, and therefore sheltered by the surrounding cliffs from the prevailing winds. This is in apparent contrast with the later settlements of Tumbatu and Shangani which are situated on bluffs above the water, and which do not have convenient areas for beaching. Anchorage for these sites is, as described, available in deep water in the middle of the bay, but not close in to the shoreline. Although the locations of the earlier settlements were all reoccupied in the thirteenth century, it is hypothesised here that the movement of settlements such as Shangani, Tumbatu and Jongowe to

more varied topographic and hydrographic settings in the second millennium may have been related to at least two factors. First, the increase in interregional trade from the eighth century onwards is likely to have brought greater numbers of ships requiring anchorages, as noted in Chapter Four. It may be that the trade and settlement discontinuities of the tenth century and increasing urbanisation of the countryside after this date (Fleisher 2003) prompted the increasingly market-trade reliant coastal communities to seek settlement locations with greater access to anchorages in order to cater to traders, and therefore to compete with other urban towns in their maritime small world. Secondly, improvements in the variety and capabilities of ships available to the Swahili are likely to have enabled the exploitation of a greater range of marine environments, as predicted in the conclusions of Chapter Four, and therefore supported the occupation of more varied landscapes, since access to key resource areas could still be guaranteed. These hypotheses will be discussed in detail in the concluding chapter of this thesis.

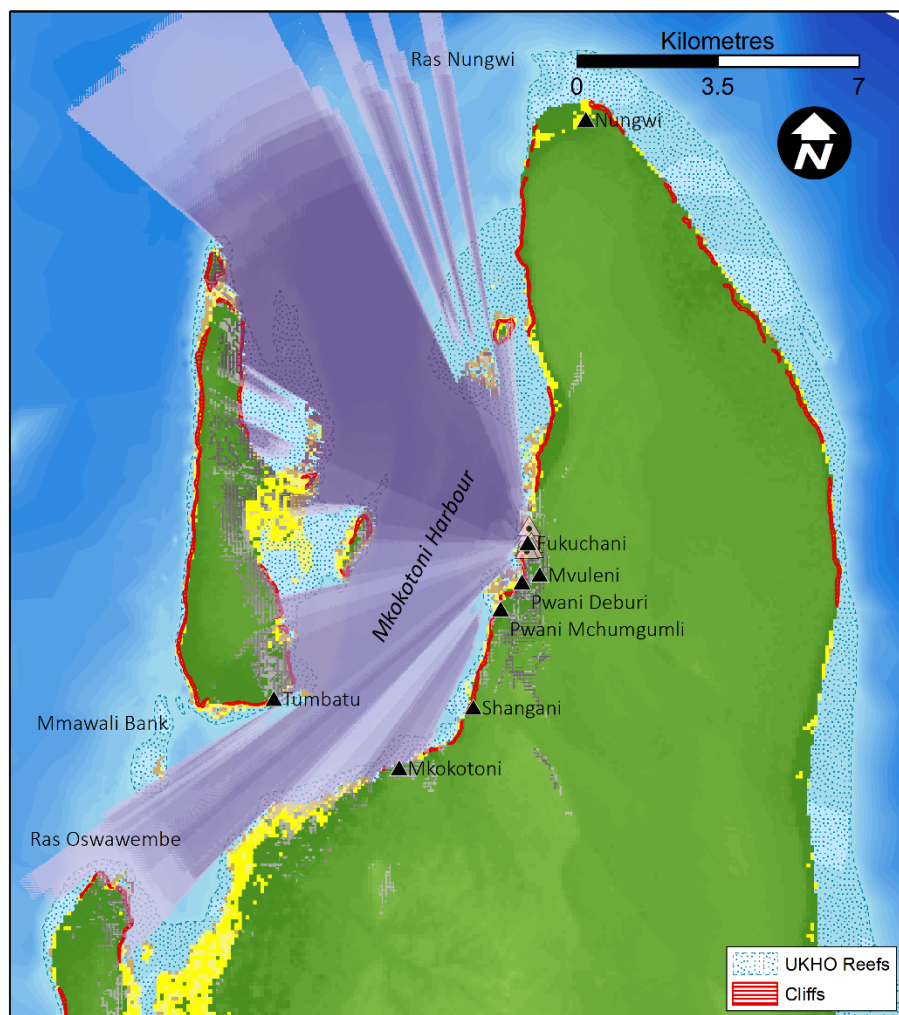


Figure 8.8: Viewshed analysis from key areas of archaeological site at Fukuchani

It is also noted that whilst viewshed analysis of Fukuchani suggests that the site is less clearly visible from open water than Unguja Ukuu, the settlements of Mkokotoni Harbour are likely to have had a degree of intervisibility with each other. The predictions made in Chapter Four about the types of ship technology available to the proto-Swahili settlements, as well as the availability of resources in Mkokotoni Harbour described above, also suggests that by necessity these settlements were exploiting the same local marine resource areas using the same forms of maritime technology. This overlapping within the maritime cultural landscape is worth investigating further, in order to explore whether the sites operated in competition, or collaboration with their neighbours.

8.5.1 Site Summary

Fukuchani is, along with Unguja Ukuu, the earliest known Swahili settlement on Zanzibar, and the two sites show many similarities. In terms of their maritime spaces, the coast at Fukuchani has a similarly wide coral intertidal zone, but the central depression in the coral shelf in front of the beach at Fukuchani creates a natural anchorage, and one clearly sheltered from the currents of Mkokotoni Harbour. The cliffs and hills around the relict embayment of the site also shelter the anchorage from the prevailing winds. The regular position of the boats moored and beached in the harbour today indicates a clear preference for the central section of the beach, where boats are left resting on the mud and sand deposits in the depression, but craft may also be seen securely anchored fore and aft on the coral carbonate shelf at the southern end of the beach. Interestingly, since the coral carbonate of the beach is actively growing, many artefacts dating to the early occupation of the site can be seen embedded in the matrix along the shoreline, and particularly in the central and southern area of the beach. Whilst this deposition may be due to an unidentified current within the small bay washing artefacts along this beach, it seems likely that the density of artefacts, which can be seen eroding out of the sand and earth section at the top of this stretch of the beach, may represent the remains of shoreline harbour activity.

With reference to the wider region of Mkokotoni Harbour, the known locations of at least three sites dating to the first millennium at Mkokotoni, Fukuchani itself, and a potentially seasonal site at Pwani Deburi indicates the co-existence, and presumably networked connections between contemporary settlements. Whilst it is not clear what form this connection may have taken, the short distance, the sheltered waters of the bay, and the intervisibility between Fukuchani and Mkokotoni suggests the likelihood of regular contact. The resettlement of Fukuchani and Mkokotoni and the growth of a new site at Shangani in relation to the rise and success of the town Tumbatu again indicates network connections in the early second millennium. In this case however the rapid urban growth of Tumbatu and its population, together with the scarcity of water and relatively poor soils on the island, and the necessity of maritime traffic to and from the larger island of Zanzibar suggests that Mkokotoni, Fukuchani, and Shangani may have been more closely linked to the urban site as economic satellite harbours, trading food and goods to the site.

Once again the dominance of faunal remains at Fukuchani indicates a reliance on shallow-water fish, albeit with less variety than at Unguja Ukuu. This difference might be related to the less varied marine landscape available in the vicinity of Fukuchani, which lacks the immediate mangrove resources of Unguja Ukuu. The nearest mangrove creek is around 4.5 kilometres to the south of the site, between Shangani and Mkokotoni, and without a suitable lagoon, creek, or sufficient deposits covering the coral shelf it seems unlikely that this situation has changed significantly over time. The mangrove resource area at Shangani though could easily have been exploited by boat from Fukuchani using either the near-shore or coastal vessels predicted in Chapter Four. The site does appear to have good access to fresh water by digging through the sands behind the beach, and the faunal and fish assemblage indicates a range of available inland and marine subsistence resources. Whilst the faunal assemblage indicates that the inhabitants of both Unguja Ukuu and Fukuchani were exploiting and consuming similar types of reef fish, the variety of species appears to have been greater at Unguja Ukuu, and the settlement at Fukuchani appears to have relied on a slightly higher proportion of hunting to fishing. Deep-water fishing grounds lie outside the southern entrance of Mkokotoni Harbour, and although access to these areas is theoretically possible using the same type of maritime technology, it is possible that this access is dependent on a greater degree of confidence, investment in time, and maritime ability than at Unguja Ukuu, where access to fishing grounds was, as noted above, available through sheltered mangrove creeks.

It may be then that in spite of broad similarities between the two sites, the inhabitants of Fukuchani had less success in developing the site as a port of trade than those at Unguja Ukuu, or perhaps less interest in attempting to do so. Whilst the viewshed analysis from various points in the settlement demonstrates the intervisibility of the sites in Mkokotoni harbour, the harbour appears to be less visible from the sea than Unguja Ukuu, tucked as it is behind Tumbatu Island (Figure 9.10). A clear line of sight out of the northern entrance into the Pemba Channel may have been convenient for regional traffic between the two islands though, suggesting again the likelihood of regular network connections within and beyond Mkokotoni Harbour. It is hypothesised therefore that the location of the settlement at Fukuchani was rooted in the convenience of its sheltered harbour and its access between land and sea on a coastline with so many cliffs, and sustained by local connections for both subsistence and trade, rather than the emphasis on long-distance interregional trade and increasingly maritime, cosmopolitan, and Islamic identity of Unguja Ukuu. Given the position of other sites in Mkokotoni Harbour in relation to Fukuchani, it is also possible that there was greater competition for resources in this region compared to Unguja Ukuu, and that some degree of negotiation may have been necessary in order to access and exploit such resources.

8.6 Tumbe

Previous investigations of the archaeological site at Tumbe have demonstrated the spread of the wattle-and-daub settlement across a peninsula overlooking Sisini Creek. It was hypothesised in Chapter Seven that the main harbour at Tumbe is likely to have been located in the silted and prograded bay on the north eastern edge of the settlement, facing out across the channel of Sisini Creek towards Micheweni Peninsula. As well as indications of craft activity and processing taking place on the slopes behind the beach, the bay is well-sheltered by the surrounding hillslopes, and has access to the shoreline from both the peninsula and the water. This bay and shoreline, at the bottom of a shallow, sandy slope, also has the widest potential area for shoreline activity along the narrow and steep shore of the peninsula, and its position is more or less central relative to the expanse of the settlement, enabling easy access for inhabitants and visitors to the site.



Figure 8.9 KAP view of Harbour (i) at low tide, facing north from intertidal mud flats. The headland extending towards the right of the photo shelters the harbour from the north-east monsoon.

The present view of the harbour shows a broad intertidal zone of sands and mud, with some underlying areas of coral reef, and an area of deep water even at low tide, sheltered from the currents of the bay by the reef and from the prevailing winds by the surrounding hills. This channel of deep-water extends from the central channel of Sisini Creek into the turn of the bay even at low tide, and the location is sheltered from both seasons of the monsoon by the surrounding ridgelines of the coast and peninsula, and from the currents of Sisini Creek by longshore sandbanks and underlying reefs. The areas of underlying reef noted during the pedestrian survey of the harbour, described in Chapter Seven, means that the area of sheltered deep water is unlikely to have

extended much further in towards the shore than at present, but it is likely that silting and progradation of the shoreline in the second millennium has buried an earlier intertidal harbour area. Although the narrow central channel, high tidal range, and strong currents of Sisini Creek may present issues for large vessels both in the approach and in anchoring, this harbour would be easily accessible for the sewn-plank vessels hypothesised in Chapter Four. Regardless of subsequent issues of silting and therefore the uncertain size of the first millennium intertidal zone, the small bay offers the opportunity of either beaching on sands or good anchorage in sheltered water.

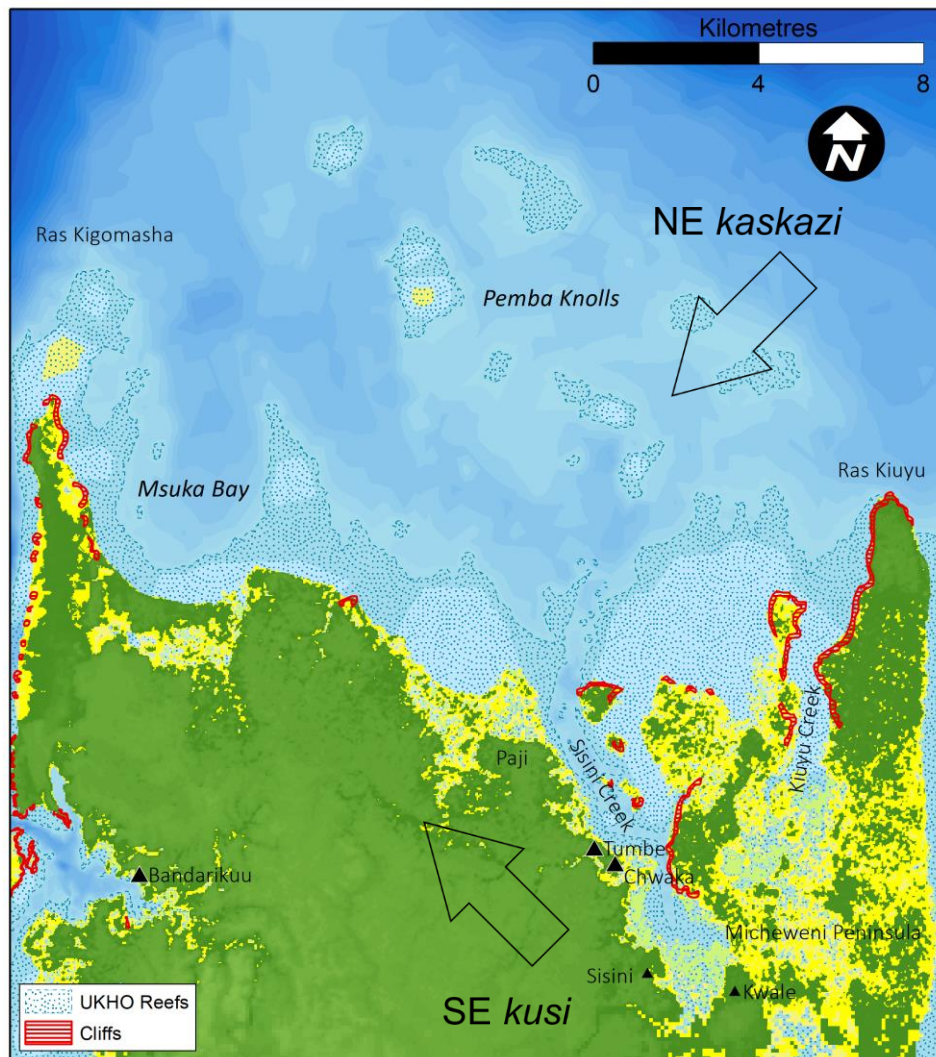


Figure 8.10: Digitised Admiralty hydrographic charts showing area of Sisini Creek and Pemba Knolls with local placenames. The Pemba Knolls and Micheweni Peninsula provide limited shelter during both monsoon seasons

It was also noted in Chapter Seven though that several areas along the eastern shoreline of the archaeological settlement at Tumbe could have hosted harbour-related activity areas, and indeed

that the massive concentrations of bead-grinders identified by Flexner *et al* (2008) along this eastern shoreline supported the idea of multiple crafting and processing activities. Whilst alternative areas of shoreline activity may well have existed, further south along the peninsula the curve of the shoreline means that potential beaching areas are increasingly exposed to the winds which blow up and down the creek, and to the influence of the strong currents in the central channel. This southerly shoreline also consists of deep soft muds, with little underlying firm ground, and the area is treated relatively cautiously by locals today, who will load from the mudflats but anchor in rocky bays on the eastern side of the creek, presumably for fear of vessels becoming stuck in the soft muds and subsequently swamped by the rising tide. Whilst the shoreline of Sisini Creek around Tumbe has few cliffs to actively obstruct access, the mud flats, the thick mangroves at the mouth of the river behind the peninsula, and the steep hillslopes all around again mean that the potential harbour identified at the north-eastern edge of the site offers the best access between land and sea on this western side of Sisini Creek.

The long tidal inlet of Sisini Creek beyond the harbour of Tumbe is enclosed to the east by Micheweni Peninsula, and terminates to the south in the dense mangrove forests of Msitu Kuu and the land bridge to the peninsula. The mouth of Sisini Creek opens onto a wide, shallow bay between Ras Kiuyu and Ras Kigomasha, respectively the north-eastern and north-western 'horns' of Pemba (Figure 9.11). The shallow waters of this bay extend around 14 kilometres north of the island and contain many reefs, known collectively as the Pemba Knolls. The low cliffs and reefs fronting this coastline form several natural sheltered bays and inlets. Just south-east of Ras Kigomasha, for example, is the reef-enclosed Msuka Bay; whilst south-west of Ras Kiuyu is another tidal inlet, Kiuyu Creek, which extends south through mangroves towards the modern villages of Kiuyu and Kwale, the latter of which also borders Sisini Creek.

Within Sisini Creek itself the western coastline, where the inland hills slope down to the water, is broken by a number of small river mouths, but these and the rest of the shoreline are almost entirely hidden from the water by mangroves (Figure 9.12). The cautious dashes on Admiralty charts denoting the nominal edge of these mangroves indicates both the density of the vegetation and the shallowness of the creek fringes which make accurate charting extremely difficult. The eastern coastline has a shallower inland slope than the west, and has a number of small sandy bays with low coral cliffs around 1-2m in height. A maximum spring tidal range of 4.11m has been recorded on the coast near Konde, close to the mouth of Sisini Creek. Admiralty charts show intertidal reefs along the length of both coastlines, which are particularly wide along the eastern coast, and the sands and muds which cover the reefs dry at low tide to around 1m above MLWS, leaving a narrow channel of deep water. Soundings in this central channel in Sisini Creek indicate varying depths of between 3-8m, with a maximum depth of almost 13m (7 fathoms) MLWS just east of the modern village of Tumbe (north of the archaeological settlement). By comparison the dotted line marking the centre of neighbouring Kiuyu Creek indicates the near total drying of the inlet at low tide.



Figure 8.11: View south from end of the Peninsula at Chwaka, showing mouth of mangrove channel

The only mention of Sisini Creek in any of the available pilot texts appears in the *Africa Pilot*, which names and briefly describes the inlet as shallow, containing several islands, and providing good shelter for dhows (De Horsey 1897: 465). Most of the low islands in Sisini Creek stand along the eastern reef, but as these are generally wooded, they are easily visible. Admiralty charts also mark a number of small, submerged dangers and obstructions in mid-channel though, presumably reefs, which do not dry and may therefore pose a significant hazard to shipping. The approach to the creek is also made complex by the ‘labyrinth’ of drying and submerged reefs of the Pemba Knolls described by Captain Owen whilst charting for the Admiralty (Rosser and Imray 1867: 346). Furthermore, whilst Rosser and Imray (1867: 346) state that there is little current felt amongst the Pemba Knolls, the high tidal range means the current in Sisini Creek flows fast and strong, especially in the narrow central channel. Referring back therefore to the personal observation described in Chapter Seven that the busiest period of daily boat traffic occurs between mid-ebb up until the early flood tide, it is hypothesised that this must be due to the increasing exposure and visibility of the sandbanks in the channel. A comparison of Sisini Creek in this text to descriptions of the west-coast ports indicates that the depths in this channel are more variable and unpredictable than the harbours of the west-coast, creating a number of potential hazards for sailors unfamiliar with these waters, and potentially disadvantaging the use of this area as a harbour compared to the channels of the west coast. On the other hand the *Africa Pilot* notes the issue of “inconveniently deep water”

(De Horsey 1897: 459) in Port Cockburn, for example, which makes secure anchorages hard to find and confirm.

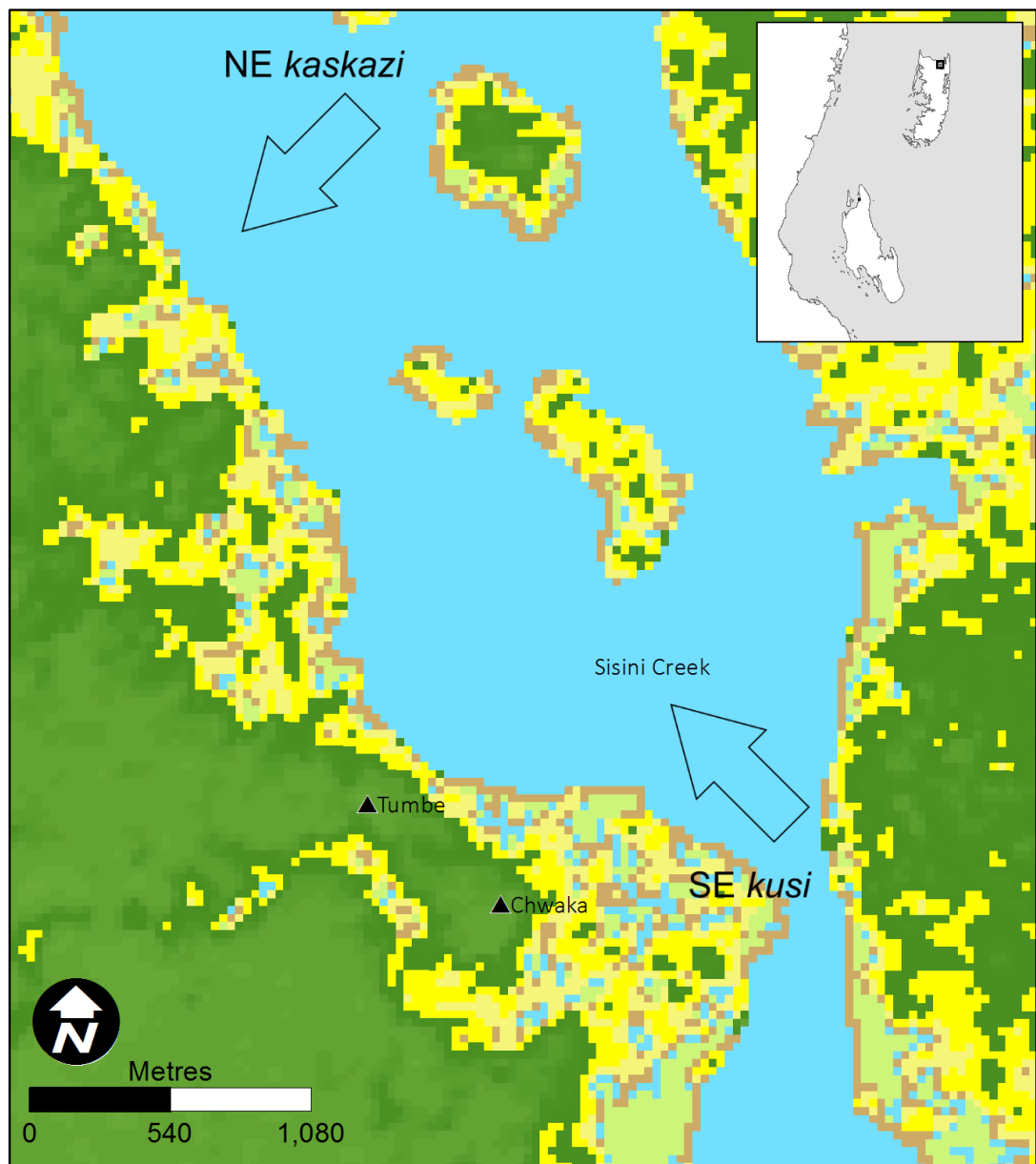


Figure 8.12 Direction of monsoon winds marked in Sisini Creek. Whilst the Tumbe/Chwaka peninsula provides shelter in the *SE kusi*, observation during fieldwork suggests that the intertidal reefs may help to help disrupt NE wind-driven surface currents in the theorised Harbour (i)

In spite of these issues, the *Africa Pilot* mentions several villages around the rim of Sisini Creek apart from Sisini village itself, noting in particular the availability of good anchorage at Paji, on the mouth of the inlet (De Horsey 1897: 465). The wide bay outside the inlet *also* has a number of potential anchorages, and references to these in the pilot texts are of particular interest because they

describe the varying quality of shelter in different monsoon seasons. Msuka Bay is a broad embayment which is noted as a good anchorage sheltered by reefs to east and west, but during the north-eastern monsoon the ocean swell washes into the shore, which can make the passage through the reef 'troublesome' (De Horsey 1897: 465; NGIA 2015: 93). A small anchorage around 13m (7 fathoms) in depth known as Port Wanyeeeka¹⁴ is noted between Ras Kiuyu and the northern line of the Pemba Knolls, but receives no protection from wind or swell in any season (Findlay, 1866: 513; Taylor 1874: 102). The reefs of the Pemba Knolls, on the other hand, were apparently utilised by Arab vessels for anchorage during the south-west monsoon (Findlay, 1866: 513; Taylor 1874: 102). Kiuyu Creek is not mentioned in any of the pilot texts, and Admiralty charts indicate that this is due to its shallowness and drying at low tide. It is noted here however because given that it is a tidal creek with extensive mangroves and a pool at the southern head though, it seems as likely to be navigable by small local craft and canoes as the mangrove creek between Unguja Ukuu and Uzi Island, and may therefore have provided an access route and resource area for settlements with suitable vessels in the region.

The position of Tumbe inside Sisini Creek may seem at first to create issues for the maritime connections of the site beyond the immediate area of the creek itself. The trade wealth of both Tumbe and Chwaka though clearly demonstrates that merchants either knew of or had reason to come across the creek and sites. Viewshed analysis of this site is slightly complicated by this greater variation in landform and elevation than compared to Unguja Ukuu and Fukuchani. It would appear that the harbour area and archaeological settlement had good visibility to the east and south across Sisini Creek. In spite of the curve of the headland north of the site, the settlement on the ridgeline has relatively good visibility to the north-east, through the mouth of the inlet into the Pemba Knolls. It may be hypothesised therefore that since ships bound on southerly voyages from Malindi and points in Kenya and Somalia were presented with a relatively clear view of the northern coast of Pemba during their approach towards the Pemba Channel, the passage of local vessels around the bay may have provided a reason to venture into the area. Vessels thus sailing through the Pemba Knolls are then likely to have a relatively good chance of sighting either Tumbe or one of the other settlements in the creek through the mouth of the channel.

¹⁴ The etymology of the name Port Wanyeeeka is not clear; the term is generally applied to a scrub landscape, but it is also possible that it refers to the Kiswahili-speaking Wanyika group who occupy the coastal hinterlands of Kenya (see Eliot 1966: 123).

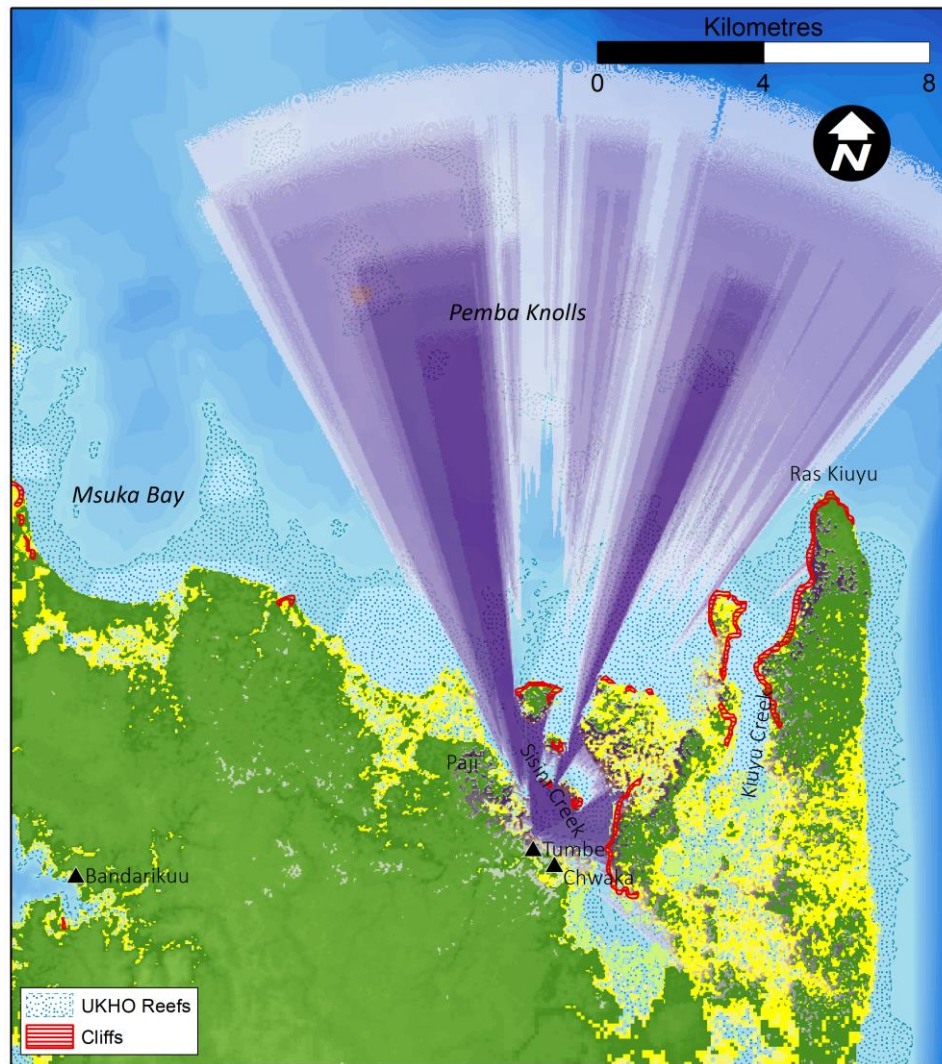


Figure 8.13: Viewshed analysis from key areas of archaeological site at Tumbé

Although the sandbanks, reefs and islands, the high tidal range, and the fast current of Sisini Creek do not appear to offer excellent prospects for a sailing harbour, the environment of the creek may have offered alternative advantages to the inhabitants of Tumbé. It will be recalled that Pemba itself was described in Arabic sources as ‘The Green Island’ for the fertility of its soils and bountiful agricultural produce. In discussing the northern coastline, the *Africa Pilot* (De Horsey 1897) lays particular emphasis on the village of Paji at the mouth of Sisini Creek for its food supplies. Archaeological and ethnographic data demonstrates that Sisini creek offered, and constitutes today, a wide array of resources within an enclosed and sheltered bay. Sarah Walshaw’s analysis of subsistence strategies on northern Pemba between the seventh-sixteenth centuries indicates a widespread reliance by independent settlements on similar types of local terrestrial and especially shallow-marine resources for daily subsistence. Her identification of archaeobotanical remains at Tumbé in particular indicates household cultivation of pearl millet, and access to imported Asian

plants such as coconuts, in contrast to lower quantities and percentages of such crops at smaller village sites in the region (Walshaw 2005; 2010). The depopulation of the countryside around the tenth century was accompanied by changes in cultivation and consumption, so that by the eleventh and twelfth centuries the stone towns were instead reliant on the cultivation of Asian rice, probably in the small river valleys such as the one behind the peninsula at Tumbe/Chwaka and which empties into Sisini Creek, where rice is also grown today. The second millennium also heralds increases in the quantities and percentages of domesticated meat consumption, particularly cattle, at urban sites such as Chwaka (Cain 2005, cited in Walshaw 2005: 218). By the sixteenth century, Pemba was known as an exporter of subsistence goods, particularly of rice, cattle, and fruit, and of other resources such as mangrove poles. Walshaw suggests that the absence of pre-storage processing and cleaning of grains in either the late first or early second-millennium occupations of Tumbe and Chwaka indicates household-level cultivation rather than settlement-level economic organisation (Walshaw 2005: 210). She also suggests that variations in the quantities and percentages of botanical remains at different sites, and the absence of variation for botanical processing or faunal butchery at different sites indicates settlement independence rather than networked production for the specific benefit of urban sites resulting in homogenous classes of subsistence evidence.



Figure 8.14: View facing north-east from Tumbe, of northern end of Sisini Creek

Whilst the final report on Fleisher and LaViolette's excavations is yet to be published, and the variety of fish species found at the site in comparison to Unguja Ukuu and Fukuchani is therefore unknown,

the faunal remains from the site indicate a particular reliance on shellfish and coastal fish, with potentially a slightly greater emphasis on the former. Of the faunal assemblage recovered from Fleisher and LaViolette's excavations at Tumbe, fish bone apparently made up around 10% of the total assemblage by weight, with far greater evidence of shellfish collection than fishing (Fleisher and LaViolette 2013: 1163). This was attributed in part to possible taphonomic issues, but the authors note the high frequency of shallow-water and mangrove shell species appearing in the shell-middens of northern Pemban coastal sites, and highlight the probable expedience and low-investment requirements of exploiting such commonly available shoreline areas (Walshaw 2005: 214; Fleisher and LaViolette 2013: 1164). Together, the archaeobotanical and faunal evidence indicates an emphasis on the cultivation of both naturally-occurring and cultivated resources in the immediate vicinity of settlements in northern Pemba in the first and second millennia. Based on this emphasis on local area exploitation, and quite apart from any advantages the creek might hold for local sailors or the anchorage of visiting vessels, the mangroves, sandbanks, and shallow waters of Sisini Creek must therefore have represented a key resource area which enabled the inhabitants of Tumbe to meet their daily subsistence and fuel requirements, and provided essential materials for craft activity, trade, and export. Furthermore, as well as providing a source of timber and fuel (albeit not a high-temperature one), the known harvesting and trade of mangroves as a construction material is likely to have created the secondary benefit of providing a convenient means of clearing waterfront areas for maritime access and shoreline activity.

8.6.1 Site summary

Gray complains in his *History of Zanzibar* that "[Pemba] suffers from the disadvantage that it has few satisfactory deep-water anchorages. Most of the creeks are extremely shallow and dry to considerable distances off shore at low water" (Gray 1962: 4). As well as being erroneous, overlooking the multiple deep-water colonial harbours of the west coast at Port Cockburn, Port George, and Mkoani, Gray's static interpretation misses the potential benefits of shallow-water environments to archaeological, historical, and even modern populations living on the coast.

Although not an ideal sailing harbour, with fast currents, drying sandbanks and a difficult approach through submarine hazards, the number of settlements around its fringes and the wealth of successive towns at Tumbe and Chwaka clearly demonstrate that the creek offered material advantages for its inhabitants. The variety of environments available in and around Sisini Creek, including dense mangroves, intertidal coral, sand, and mud flats, and the extensive reefs of the Pemba Knolls, is comparable to Unguja Ukuu, and the clear archaeological exploitation of all of these demonstrates the value of the marine environment to the life of the settlement. The emphasis in both towns and periods of occupation on the exploitation of local resources, as well as the mass of

evidence for reliance on mangrove-based shellfish and shallow-water fish species suggests that the sites benefitted from the extensive availability of these environments in the area. The extent of the mangrove stands around the bay and in neighbouring Kiuyu Creek also provided a near-limitless supply of fuel and construction materials, and the ubiquity of wood charcoal (albeit of unidentified species) reported by Walshaw in every sample from Tumbe demonstrates the importance of this fact (Walshaw 2005: 99). Similarly, the botanical remains from this site indicate exploitation and household processing of local, rather than network-exchange resources, providing further evidence of the agricultural, and consequently political independence of the site as a result of its setting.

The waters of Sisini Creek are sheltered in most seasons by the surrounding hills and wooded environments of Pemba and Michweni Peninsula, unlike some of the more seasonal anchorages along the northern coastline of the island and amongst the Pemba Knolls.

Finally, whilst it is clear that the harbours of the west coast are deeper and generally easier to approach than Sisini Creek, the soundings in the middle of some those bays are apparently so deep as to create potential problems for boats in finding secure anchorages. Moreover, it should again be emphasised that the discussion of deep-water anchorages in the pilot texts and through Admiralty charts is based upon an assumption of the necessity of such anchorages particularly for European vessels from the eighteenth century onwards. Based on the predicted development of ship technology and use and requirements of East African watercraft described in Chapter Four, if we consider the possibility of beaching rather than anchoring as a means of harbouring vessels, the sandbanks and mudflats around the shorelines of Sisini Creek, and particularly around Tumbe and Chwaka, may have been far more useful, indeed important, than a reading of European pilot texts and charts might suggest.

8.7 Summary

The analysis of the coastscapes and marine environments around each of the three case study sites indicates a possible pattern of landscape features, maritime activity, and subsistence and harbour use amongst the proto-Swahili settlements of the first millennium in the Zanzibar Archipelago. As described above, Unguja Ukuu faces south-west into the open deep waters of Menai Bay; Fukuchani faces directly west across Mkokotoni Harbour towards the island of Tumbatu; and Tumbe faces east across the mangrove fringes of a tidal inlet to Micheweni Peninsula. Although the three sites have different orientations, different topographic features and face different types of enclosed or open water bodies, all three have shallow intertidal beaches which allow for easy access between land and sea, in contrast to their surrounding coastlines; all three appear to be relatively well-sheltered from both north-east and south-west monsoon winds, swells, and currents; they all have access to a

similar range of marine resources given a certain basic level of maritime technology, which can be assumed from the initial settlement of the islands and given the similar dates of occupation; and the faunal and botanical evidence suggests archaeological reliance on the exploitation of shellfish and shallow-water fish in the first millennium, although Fukuchani appears to show less variety in species exploitation and has fewer nearby resources areas than Unguja Ukuu or Tumbe.

Juma has previously suggested that the rocky coral shorelines of the western coast were a barrier to anchorages and hence to settlement, but that this factor was outweighed by the advantage of proximity to the mainland coast of Tanzania, noting that "most economically prosperous early sites on Zanzibar Islands were located on the western or northern coastlines" (Juma 2004: 51-52). It is suggested here however that the initial selection of each of these sites for permanent settlement in the first millennium may have been related to the pattern of sheltered harbours with intertidal flats and beach access described above, rather than access to predicted maritime trade routes in this period.

Some of the patterns identified here also appear to be applicable to contemporary sites such as Mtambwe Mkuu and Ras Mkumbuu on Pemba. The later occupations of sites such as Tumbatu, Shangani, and Stonetown, with their previously noted changes and wider variations in accessibility and resources, as well as the shift in settlement locations at Ras Mkumbuu, and from Tumbe to Chwaka around the tenth century, may therefore indicate the predicted change in settlement patterns and priorities noted above, and potential reasons for these changes will be discussed further in Chapter Nine.

Chapter Nine

Discussion and Conclusions

“But ships are but boards, sailors but men: there be land-rats and water-rats, water-thieves and land-thieves, I mean pirates, and then there is the peril of waters, winds and rocks.”

Shakespeare, ‘The Merchant of Venice’ I:iii, 20-22.

9.1 Introduction

As stated in Chapter One, the aim of this PhD was to identify maritime activity and patterns of spatial organisation through archaeological survey at first millennium coastal settlements in the Zanzibar Archipelago, in order to explore the nature of proto-Swahili harbours and evaluate the role of maritime activity as a component of proto-Swahili settlement in the region. In pursuit of this aim, this thesis has presented a range of new data relevant to maritime activity areas in first millennium settlements of the Zanzibar Archipelago.

Following an introduction to the archaeology of the Swahili Coast in Chapter One it was noted that the traditional archaeological focus on the urban centres of Swahili settlements has led to an unfortunate, and perhaps unintentional disregard for shoreline and harbour spaces in coastal settlements, and that this was especially noticeable in the limited investigations of first millennium proto-Swahili sites.

The literature review of Chapter Two explored the extent of archaeological investigation in first millennium maritime contexts in East Africa; introduced key themes of maritime archaeological theory and network analysis and discussed the reasons why such methods have not, or cannot yet be applied to the sites Swahili Coast; and described the previous investigations at the port of trade stonetowns of Kilwa Kisiwani, Manda, and Shanga. In spite of the general lack of maritime architecture such as wharves or jetties in the coastal settlements of the first and early second millennia (apart from the land-reclamation walls of Manda), the review demonstrated that an array of features and archaeological evidence related to the maritime cultural landscape have been identified at Swahili port sites. This evidence included iron-working and ballast from trade vessels buried on the beaches beneath later structures at Kilwa and Manda; shipwreck remains in the foreshore and intertidal zones of Kilwa; and the predominance of molluscs, fish and shellfish in faunal assemblages, particularly visible in the analysis of Shanga. The review demonstrated that the absence of sailors and ships in current archaeological discussions of the Swahili Coast and western Indian Ocean trade has more to do with the focus on urban investigation at Swahili sites, than an actual absence of maritime evidence in the archaeological record. The review then introduced the

study region of the Zanzibar Archipelago, and the three contemporary proto-Swahili sites selected for survey and analysis.

Chapter Three described the aim and inductive methodology of the project, drawing for reference on previous archaeological surveys of port sites around the Indian Ocean, including Myos Hormos in the Red Sea (Peacock and Blue 2006, 2007), Siraf in the Persian Gulf (Whitehouse *et al* 2009) and terrestrial geophysical surveys of second-millennium Swahili settlements such as the Northern Pemba survey (Fleisher 2003; LaViolette and Fleisher 1999), Vumba Kuu (Wynne-Jones 2012) and the Songo Mnara Project (Fleisher *et al* 2012). On the basis of these examples, three proto-Swahili sites in the Zanzibar Archipelago were chosen as examples of well-sequenced and previously investigated contemporary sites dating to the relevant first-millennium period of study, each with relatively well-defined archaeological boundaries, and readily-available published sources of archaeological data to use as comparative data for new archaeological surveys.

Five objectives for research were then outlined and described:

Objective One. To analyse the archaeological use and predicted evolution of ship technology in the western Indian Ocean as evidence of potential co-dependent development of maritime activity and harbour spaces in the Zanzibar Archipelago.

Objective Two. To conduct geophysical surveys and ground-truthing excavations at three case study proto-Swahili sites in the Zanzibar Archipelago, in order to identify archaeological features related to maritime activity and settlement plans

Objective Three. To identify harbour spaces, related activity areas, and evidence of spatial organisation at each site based on a GIS analysis of collated geophysical survey and archaeological excavation results, and topographic and hydrographic datasets.

Objective Four. To identify patterns and variations in maritime activity, harbour spaces, and settlement organisation across the archipelago.

Objective Five. To evaluate and characterise the role and importance of harbour spaces and maritime activity to proto-Swahili settlements of the Zanzibar Archipelago between the sixth and eleventh centuries CE

Chapter Four presented the analysis of ship technology in East Africa and the western Indian Ocean, which was carried out in fulfilment of Objective One, and in order to account for the totality of the maritime cultural landscape emphasised by Westerdahl (1992), the entangled development of maritime technology advocated by Karmon (1985) and Dhoop (2014), and the absence of East

African sailors in scholarly discussion highlighted by Vernet (2015). This analysis noted that the rarity of ship remains predating the fifteenth century on the East African coast may be due in part to the lack of underwater and intertidal surveys until the recent work of Pollard (2007, 2008a, 2016) in the Kilwa Archipelago, Breen *et al* (2001) in Mombasa, and the growth of the maritime archaeological programme of the National Museums of Kenya (Bitu 2011, 2014; Bitu and Tripathi 2015). Drawing on a combination of historic references, archaeological remains from around the Indian Ocean and South East Asia, and ethnographic accounts of later second millennium western Indian Ocean sailing craft, this analysis suggested that dugouts canoes and sewn-plank vessels with square-rigged sails are likely to have formed the backbone of ship technology in East Africa until the early second millennium. It was emphasised however that the continued use of such craft should not be considered indicative of a lack of alternatives, or that the use of such craft restricted the maritime activities of the proto-Swahili settlements. Instead, the continued use of dugouts and sewn-plank vessels through the first millennium represents the deliberate selection, by a knowledgeable and skilled sailing society, of a versatile form of ship technology, and one eminently well-suited to the maritime activities of contemporary settlements on the East African coast. This choice, indicative of the agency of proto-Swahili sailors, is reflected in the successful and clearly profitable permanent settlement of the offshore islands of the coast, and the Zanzibar, Mafia, and Comoro Archipelagos by the seventh century CE, as well as the range of maritime activities seen at all three case study sites and those reviewed in Chapter Two.

Objective Two of the thesis, the survey of three selected coastal settlements of the Zanzibar Archipelago to identify evidence of maritime activity, was accomplished in four seasons of fieldwork between November 2013 and August 2015. Chapters Five, Six, and Seven presented the results of each of these surveys in individual case studies of Unguja Ukuu, Fukuchani, and Tumbe respectively, along with detailed re-evaluations of previous investigations of each site. The results of each of these individual surveys indicated concentrations areas of iron-working or crafting activity on or near the beaches. In fulfilment of Objective Three of the thesis, these surveys and re-evaluations were used to build hypothetical models of settlement organisation and maritime activity areas at each of the sites. These individual models indicate that the earliest use of Unguja Ukuu may have been as a seasonal site, and that the spread of the site over time indicates a growth from the main harbour area of the beach. Furthermore, relatively large areas next to the shoreline at all three sites appear to have been preserved in spite of urban growth as multi-purpose crafting and iron-working areas, presumably related to the maritime activity occurring of the shoreline.

Chapter Eight offered a comparative examination of all three case study sites in order to identify patterns and variations in maritime activity, harbour spaces, and settlement organisation across the archipelago, in fulfilment of Objective Four. Building on the results of the surveys presented in Chapters Five, Six, and Seven, this inter-site analysis indicates that all three settlements were served by shallow intertidal harbours with sandy beaches. Although this in itself is not unusual for Swahili

harbours, the analysis of Admiralty hydrographic charts demonstrated that these beach sites offer some of the best land-sea access routes on the otherwise cliff-lined and rocky coral shelves of Zanzibar's coastline, and that whilst the orientations of each site varied, the harbours of all three settlements appear to offer relatively good shelter from both monsoon winds and swell. Finally, it was also noted that all three sites appear to have relied on marine fauna such as molluscs, shellfish, and coastal fish as the basis of their diet, and on marine resources such shells for bead-making and craft activity, and mangroves for construction materials and fuel. The pattern of the three sites therefore demonstrates not only a clear reliance on the marine resources of the coastal environment for subsistence, but a knowledgeable exploitation of the topography of the coast for the benefit of sailors, their vessels, and the maritime connections of a sailing society.

Building on these results and analyses, and linking back to the issue of the maritime agency of the settlers of the coast, the final chapter of this thesis will address Objective Five, the evaluation of the role and importance of harbour spaces and maritime activity to the proto-Swahili settlements of the Zanzibar Archipelago between the sixth and eleventh centuries CE.

9.2 Site Summaries

This section summarises the results of the surveys of each of the three case study sites and the analysis of Chapter Eight as a prelude to the thematic discussion arising from this summary in the following section.

9.2.1 Unguja Ukuu

Previous surveys of Unguja Ukuu have demonstrated that the sixth-eleventh century phases of this settlement stood just inland of the base of the Makime Peninsula, between the open beach of Menai Bay and the mangrove creek running north of Uzi Island. The geophysical survey and excavations conducted as part of this thesis project and presented in Chapter Five indicate that the settlement appears to have hosted some level of trade and industry along the shoreline, on the narrowest point of land between the beach and mangrove creek. At least some of this activity area was then buried by a phase of urban expansion dating to around the ninth century, evidenced by stone structures excavated by Juma, and a shoreline mosque replacing an earlier wattle-and-daub structure identified and excavated as part of this thesis project in 2014.

The analysis presented in Chapters Five and Eight has shown that this coastal and port settlement had a wide, shallow, and intertidal harbour basin, with a marginally deeper, albeit still drying channel between open water and the sandy beach. This channel leads up to the narrow bridge of the peninsula and the area of industry and middens highlighted by both Horton in 1984, and the

geophysical survey in Chapter Five. It is possible therefore that this locus of activity was chosen or developed because of its convenience as a point of least-effort contact between the open beach and the mangrove peninsula, both for processing, exchange, and portorage. This hypothesis ties into the issue of access raised in Chapter Eight. In contrast with the low cliffs which constitute much of the north-eastern coastline of Menai Bay, the beach at Unguja Ukuu offers easy access between the land and sea. The harbour is deep enough for boats to sail into between mid- and high-tide, and allows for intertidal anchorage, whilst the shallow slope of the sandy beach means that both dugouts and sewn-plank craft might be drawn up onto the shore when necessary. The harbour is relatively well sheltered from both seasons of the monsoon winds and currents, and the curve of the beach also means that different areas can be utilised in different seasons as conditions and activities necessitate. The subsistence evidence from the site indicates a reliance on the exploitation of shallow-water and coastal fish and shellfish species, and given the predicted level of maritime technology available in the late first millennium, the sites position on the peninsula offers quick access to a wide variety of marine environments. Following this model it is hypothesised that the intertidal reefs and sandbanks around Unguja Ukuu itself could easily have been exploited on foot from the settlement; that dugouts could have been used to access and fish in the mangroves, inlets, and shallow waters along the coast; and that larger sewn-plank craft are likely to have formed the principle means of sailing the deeper coastal waters of Menai Bay and of maintaining networks of communication and exchange around the archipelago and across the Zanzibar Channel.

One potential limitation of this harbour is that there are no conveniently accessible areas of sheltered deep-water which could provide safe and secure anchorage for pegged or nailed vessels with a deep draught. It is possible however that this limitation might help to explain the declining use of the site into and throughout the second millennium.

9.2.2 Fukuchani

Previous excavations at Fukuchani have demonstrated two archaeological phases of occupation in the raised embayment, dating to around the sixth-eighth centuries, and the thirteenth-fifteenth centuries. The layout of the site at Fukuchani is harder to establish than at Unguja Ukuu, due to both the location of the modern village and construction of the school, and the necessarily limited nature of previous excavations at the site. In spite of this, useful traces of settlement activity have been recorded or remain identifiable using geophysical survey. It is suggested here that the central area of middens excavated by Horton in 1984 and by the Sealinks Project in 2012, which were found to contain iron slag, shells, and fish remains, may indicate a possible concentration of industry and processing activities between the shoreline and up 50m inland. A pre-Islamic burial above the beach, identified by the Sealinks Project in 2011, and the later Islamic cemetery just south of this burial, indicate a ritualised concept of this shoreline overlooking the harbour. This may have some parallels

to the shoreline mosques at Unguja Ukuu and elsewhere in the archipelago (Horton and Middleton 2001). The geophysical survey conducted as part of this thesis project and presented in Chapter Six also indicates an area of early occupation on the south-eastern side of the settlement, inland of the hypothesised processing and industrial area.

As described in Chapters Six and Eight, the harbour at Fukuchani lies in a shallow bay sheltered from the north-eastern monsoon winds by the hills north of the site, and from the south-eastern winds by the coral cliffs to the south. The beach itself is broad, extending around half a kilometre, but the coral reefs of the intertidal zone mean that although the potential area of anchorage in this bay is well sheltered from the currents of Mkokotoni Harbour, it is only 200m across at its widest point. Although a small number of craft choose to anchor today in the intertidal zone south of this point, the exposed coral make this a potentially dangerous prospect. Considering the maritime technology of the first millennium hypothesised in Chapter Four, and the increased threat that sharp coral is likely to pose to the stitches of sewn-plank craft compared even to the more rigid pegged or nailed hulls, it is probable that the same central area of the shoreline would have been utilised for the harbour during the initial sixth-eighth century period of occupation. Once again, the cliffs lining almost the entire coastline of Mkokotoni Harbour mean that this beach site offers a rare and convenient access route between land and deep water. Similar beaches at Mkokotoni and Pwani Deburi also suggest that this may be a pattern for the early occupation sites of the area. Although these locations were all reoccupied in the thirteenth century, it is hypothesised here that the more varied topographic and hydrographic settings of exclusively second millennium settlements such as Shangani, Tumbatu and Jongowe indicates a change in settlement priorities, organisation, or technology between the late first and early second millennium phases of occupation.

Once again the dominance of faunal remains at Fukuchani indicates a reliance on shallow-water fish, albeit with less variety than at Unguja Ukuu. This difference might be related to the less varied marine landscape available in the vicinity of Fukuchani, since the site lacks the immediate mangrove creek and nearby lagoon environments around Unguja Ukuu. The nearest mangrove creek is around 4.5 kilometres to the south of the site, between Shangani and Mkokotoni, and deep-water fishing grounds lie outside the southern entrance of Mkokotoni Harbour. Although access to both types of environment from Fukuchani without an overland journey is therefore possible using the same type of maritime technology, it is possible that this access is dependent on a greater degree of confidence, investment in time, and maritime ability than at Unguja Ukuu. Given the position of Mkokotoni in relation to these areas, it is also possible that there was greater competition for resources in this region compared to Unguja Ukuu, and that some degree of negotiation may have been necessary in order to access and exploit such resources.

9.2.3 Tumbe

Previous investigations of the archaeological site at Tumbe have demonstrated the spread of the wattle-and-daub settlement across a peninsula overlooking Sisini Creek. The geophysical survey described in Chapter Seven showed two types of thermoremanent magnetic anomalies, and comparison to Fleisher and LaViolette's survey maps suggests that whilst the smaller represent mofa ovens or household iron-working, the larger anomalies are the result of burned and collapsed daub structures. The spread of these anomalies and decline in their occurrence down the sides of the peninsula towards the shore indicates that the main area of occupation lay across the top of the ridgeline. A particular cluster of thermoremanent and ferrous anomalies at the top of the slope suggests a locus of industrial or iron-working activity, although the eighteenth century disturbance of the ground in this area and the construction of the Mazrui fort means that it is difficult to date this activity without careful excavation. No evidence of first millennium iron-working areas were identified on the beach, but evidence of crafting within every excavated household indicates that the majority of iron-working activities may have taken place in the home (a theory which might also explain the number of burned daub structures).

Concentrations of bead-grinders indicate established middens as a result of processing activities along the shoreline though, and it is likely that this zone provided an informal location for communal activities and trade. The newly-identified burned daub structure and possible compound overlooking the harbour from the north-eastern slope of the peninsula also suggests that this shoreline held some significance for the settlement. Excavation of this structure may reveal whether this significance was ritual or economic in nature, or a combination of the two.

Assuming the location of the main harbour at Tumbe in the subsequently silted bay to the north-east of the site, as discussed in Chapters Seven and Eight, the harbour here is likely to have been relatively shallow with extensive intertidal flats along the shoreline to the south. A channel of deep-water extends from the central channel of Sisini Creek into the turn of the bay even at low tide, and the location is sheltered from both seasons of the monsoon by the surrounding ridgelines of the coast and peninsula, and from the currents of Sisini Creek by longshore sandbanks and underlying reefs. This harbour would be easily accessible for the sewn-plank vessels hypothesised in Chapter Four. Regardless of subsequent issues of silting and therefore the uncertain size of the first millennium intertidal zone, the small bay offers the opportunity of either beaching on sands or good anchorage in sheltered water. Further south along the peninsula the curve of the shoreline means that potential beaching areas are increasingly exposed to the winds which blow up and down the creek, and to the influence of the strong currents in the central channel. This southerly shoreline also consists of deep soft muds, with little underlying firm ground, and the area is treated relatively cautiously by locals today, who will load from the mudflats but anchor in rocky bays on the eastern side of the creek, presumably for fear of vessels becoming stuck in the soft muds and subsequently

swamped by the rising tide. Whilst the shoreline of Sisini Creek around Tumbe has few cliffs to actively obstruct access, the mud flats, the thick mangroves at the mouth of the river behind the peninsula, and the steep hillslopes all around again mean that the potential harbour identified at the north-eastern edge of the site offers the best access between land and sea on this side of the creek.

Whilst the final report on Fleisher and LaViolette's excavations is yet to be published, and the variety of fish species found at the site in comparison to Unguja Ukuu and Fukuchani is therefore unknown, the faunal remains from the site indicate a particular reliance on shellfish and coastal fish, with potentially a slightly greater emphasis on the former. The variety of environments available in and around Sisini Creek, including dense mangroves, intertidal coral, sand, and mud flats, and the extensive reefs of the Pemba Knolls, is comparable to Unguja Ukuu, and the clear archaeological exploitation of all of these demonstrates the value of the marine environment to the life of the settlement. Similarly, the botanical remains from this site indicate exploitation and household processing of local, rather than network-exchange resources, providing further evidence of the agricultural, and consequently political independence of the site as a result of its setting.

9.3 Discussion

The pattern described in this thesis of similar coastal environments, harbour topography, and archaeological evidence of maritime activity suggests that the choice of location for all three sites may have been dependent upon a combination of advantageous features, rather than a single determining factor such as 'shallow or deep water harbours'. It was suggested in Chapter Eight that the initial selection of each of these sites for permanent settlement in the first millennium may have been related to a pattern of sheltered harbours with intertidal flats and beach access. That is, these sites and their coastscapes may have been chosen as reliable locations for year-round subsistence exploitation of the marine environment, and sheltered near-shore maritime transport. In light of this, the current section presents a discussion of the spatial organisation of each site, the position and interaction of the sites with the maritime landscape, and the role of maritime activity as a core component of proto-Swahili settlements.

9.3.1 Harbour Locations and Maritime Activity

It has now been established that Unguja Ukuu, Fukuchani and Tumbe were all located on the fringes of shallow harbours, sheltered from monsoon winds, with easy access to deep water. The pattern of features described in Chapter Eight indicates that this is not simply due to the common environment of the East African Coast, but the result of the deliberate selection of sites with shallow, sheltered, intertidal harbours and sandy beaches. The location of the three case study sites and their

contemporaries also suggests a pattern of either preference for the western coastlines, or avoidance of the eastern coasts of the archipelago. As noted in Chapter Eight, Juma (2004: 52) has suggested that the rocky shorelines along the western coast of Zanzibar limited the numbers of available anchorages, and that shortfalls in subsistence resources could be made up through local exchange networks. Whilst this perspective is certainly relevant to the interpretation of the eleventh-fourteenth century ports of trade, an alternative hypothesis put forward here is that the early settlements, which may have engaged in trade initially only as a by-product of existing maritime small world networks, were sited on the western and northern coasts precisely because of their shallow and rocky shorelines which enabled sheltered, year-round maritime activity and access.

One of the reasons behind this pattern of settlement may have been access to subsistence resources. The first century CE *Periplus of the Erythraean Sea* (Casson 1989) records the use of wicker fish-traps set using logboats across river mouths and estuaries on Pemba, and evidence of intertidal fences and traps, net and line fishing in the first millennium proto-Swahili settlements demonstrates the intense exploitation of near-shore subsistence resources using an array of tactics. The faunal assemblages of all three case study sites provide evidence of this exploitation, demonstrating each settlement's reliance on marine resources, with a particular emphasis on near-shore and shallow-water species of shellfish and fish. It is reasonable to suggest therefore that the extensive intertidal zones, offered a distinct advantage in that they are large and potentially rich subsistence resource areas within the immediate proximity of the settlements. The mangroves creeks in the vicinity of Unguja Ukuu and Tumbe similarly offer resource-rich environments providing subsistence in the form of shellfish and small fish, terrestrial fauna for hunting, and abundant, fast growing, and rot-proof timber for construction and fuel. The creeks in both locations may also have been used as routeways linking settlements along the coasts, creek fringes, and some way into the interior. By contrast, the eastern coast has fewer creeks or mangrove stands for exploitation.

It was also noted in Chapter Eight that whilst the orientations of each site varied, the harbours of all three settlements appear to offer relatively good shelter from both seasons of monsoon winds, and related swells. The eastern coast of Zanzibar however is fully exposed to the monsoon winds pushing into this coast, as well as the heavy swells washing in from the Indian Ocean. Given the limited upwind sailing capabilities of square-rigged craft, and hence the potential seasonal limitations related particularly to the changeable south-east monsoon winds, the selection of harbours on the western coast which are sheltered from both monsoon seasons by rocky cliffs, and which are less troubled by ocean swells seems far more pragmatic. This decision might also have enabled the continued exploitation of the shallow-water marine zone through the unsettled *kusi* monsoon, perhaps using logboats or sewn-plank craft propelled by oars and poles rather than by sails. The exploitation of rocky marine environments may therefore have encouraged the continued use of shallow-draught sewn-plank craft, capable of beaching, and the beaches of these proto-Swahili sites

in turn offer some of the best land-sea access routes on the otherwise cliff-lined and rocky coral shelves of Zanzibar's western coastline, or of Pemba's steep-sided coasts and deep-water bays.

9.3.2 Settlement Layout and Occupation Areas

As well as similarities in their marine environments and maritime activities, the comparison of the sites themselves indicates certain patterns of spatial organisation amongst the coastal settlements of Zanzibar in the first millennium. Like the plans of Shanga, Kilwa, and Songo Mnara described in Chapter Two, the main occupation areas of all three case-study sites appear to have been located between 50 – 250m inland of the shoreline. These areas were identified in different ways at each of the three sites. At Unguja Ukuu, local knowledge of archaeological remains and an antique stone-lined well led to the excavation of an Abbasid coin hoard in 1865, and Horton's mapping survey of middens and sherd scatters in 1984 indicated that the core of the settlement lay approximately 100m north of the beach and peninsula (Chittick 1966; Horton and Clark 1985: 11). Juma's geophysical auger and resistance surveys supported this interpretation, and coring and excavations revealed robbed-out stone remains dating to around the ninth century, as well as earlier clay surfaces, around 30m north of the beach (Horton and Clark 1985: 12; Juma 2004: 76). The magnetic gradiometry surveys carried out as part of this thesis have demonstrated a further area of occupation just south of the narrow land bridge on the western shoreline of the peninsula. Analysis and excavation of this project's Trench 1 has revealed a probable mosque built of porites coral, potentially dating to around the ninth-tenth centuries, and an earlier, partially underlying daub structure with internal deposits indicating abandonment and collapse. The lack of structural remains found in Horton's UU1 test pit, or across the neck of the peninsula in either Juma's surveys or in this project's gradiometry survey suggest that the bridge of the peninsula was relatively open and empty of structures, but the daub remains of TR1 indicate that occupation areas continued along the western shore of the peninsula for a further 100m south of the limits established by Horton and Clark (1985). The use of this open area will be discussed in Section 10.2.3.

At Fukuchani, Horton and Clark's (1985) identification and initial surveys of the early settlement revealed middens and extensive ceramic scatters radiating up to 300m south-east of the beach. This mapping showed no obvious clustering to indicate core areas of occupation, but the modern spread of the town may have obscured or destroyed the northern part of the site even before Horton's first survey in 1984, just as the recent construction of the school has apparently disturbed or destroyed a large portion of the southern end of the site. Based on the gradiometry survey of the site, it was hypothesised in Chapter Six that regular patterns of faint magnetic anomalies around 200m inland of the beach represent the main occupation area of the site. These anomalies correspond to parchmarks and lines of what appear to be degraded daub, as well as with a cluster of small middens mapped by Horton. Excavation of the area to confirm this hypothesis was not possible in the time

available, but is planned for the future to investigate whether crafting and industry occurred within households at this important early settlement on Zanzibar. The assessment of the site in its topographic setting suggests that the spread of the sixth-eighth century settlement may have been restricted to the low, sandy ground of the relict embayment by the surrounding coral cliffs and base of the hills.

Tumbe was identified in the course of the broad landscape surveys of the Northern Pemba Project. LaViolette and Fleisher's (1995) investigation of Tana Tradition ceramics revealed an extensive settlement close to, but temporally and spatially separate from the well-known stone town of Chwaka (LaViolette and Fleisher 2013). Their excavations demonstrated that the settlement extended around the curving ridgeline at the base of the peninsula, and that the dense daub deposits encountered in test-pits were the collapsed remains of burned daub houses. Concentrations of bead grinders and shell middens were identified beneath the slopes of the peninsula, and evidence of crafting and of limited iron-working was found inside the houses. As well as offering a potential explanation for the number of burned structures, these discoveries also provide an index to help analyse the gradiometry survey described in Chapter Seven, and indicate that the main occupation area of the settlement was built along the top ridge of the peninsula.

Although a range of identifiers have been used to identify and analyse these sites, the use of magnetic gradiometry has proved in each case to be one of the most efficient means of investigating the changing nature of activities across the site, provided sufficient ground-truth data is available.

9.3.3 Communal Harbourfront Activity

It was hypothesised at the start of this thesis that the shoreline areas of proto-Swahili settlements may have hosted trade and iron-working areas related to maritime activities. As noted above and in Chapters Five, Six, and Seven, this thesis has now demonstrated that all three case study sites featured areas of iron-working and craft activities in prominent locations close to the identified harbours. These areas had a relative lack of structures compared to the hypothesised occupation areas of each site, and the boundaries of these 'open spaces' appear to have been respected and maintained despite the growth of occupation areas adjacent to these at each site over time. It is argued here that these sites represent communal harbourfront areas hosting a wide range of iron-working and craft activities, related to the maritime activity of the harbours of these settlements.

Shell middens underlying sixth-ninth century remains were found in the 'open' area of Unguja Ukuu in both Horton and Clark's UU1 (1985: 67) and this project's TR2 test pit, indicating subsistence resource processing occurring at least 30m metres inland of the beach in the earliest phases of occupation. Large quantities of iron slag in the middens of Horton's UU1, and the thermoremanent and ferrous magnetic anomalies identified through gradiometry survey in the same area indicate

later iron-working in the region. Metal detection and test pitting also recovered multiple net-weights, and various glass or metal artefacts with indications of repair and reworking which were approximately dated by association with limited ceramic remains to the sixth-eleventh century period of occupation, with due regard for potential modern disturbance. This analysis suggests that the narrow bridge of the peninsula may have hosted a mixed array of industry, resource processing, and trade activities. The lack of structures and range of deposits in the middens suggests that this was an informal common area for processing activities, and the finds of net weights suggests a link to the daily activity of the nearby harbour. From the location at the bridge of the peninsula it might also be inferred that the area provided a convenient location for portage of goods between the harbours of the beach and the mangrove creek.

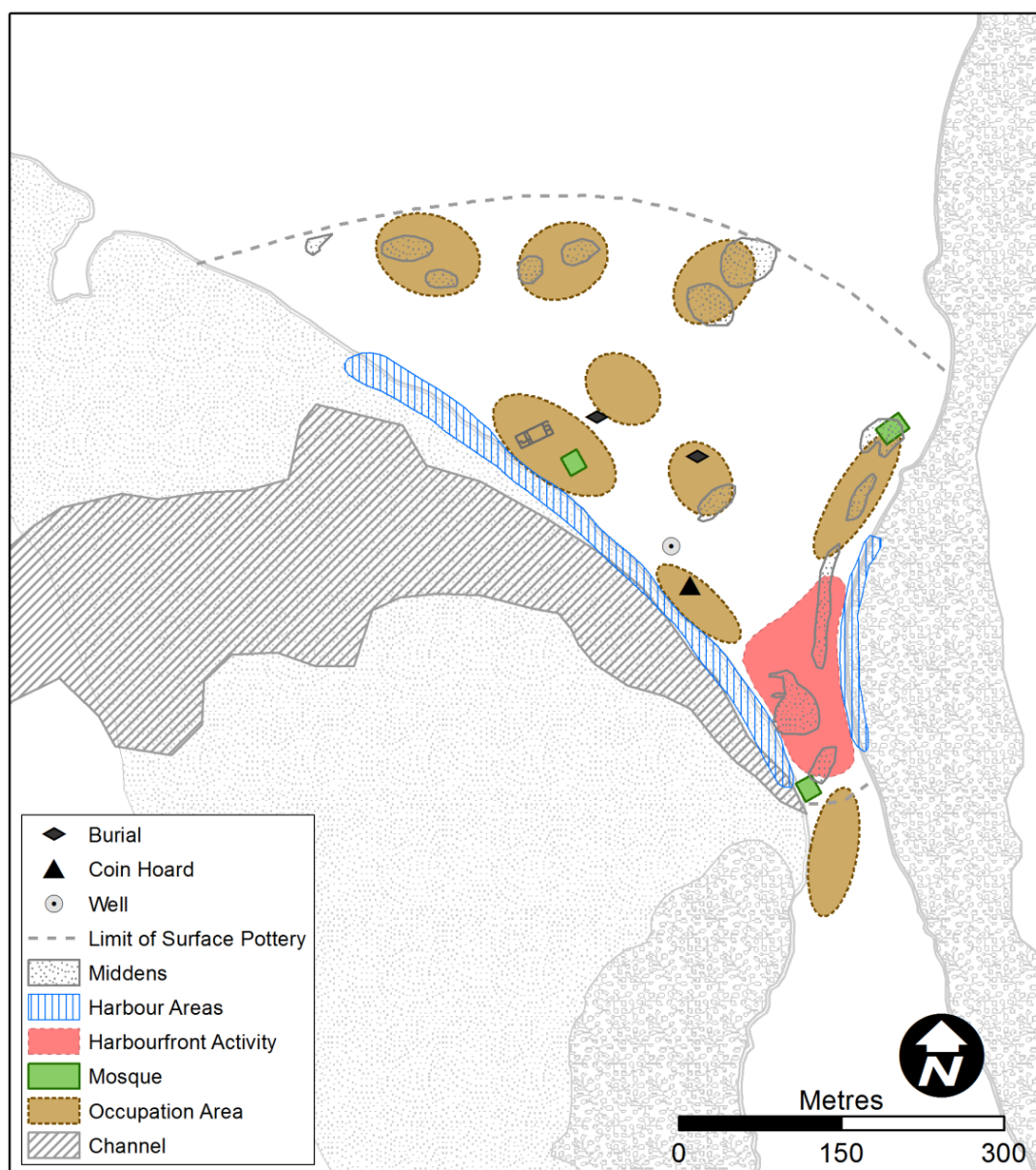


Figure 9.1 Hypothetical arrangement of harbour, communal activity area, and occupation areas at Unga Uku in the seventh – tenth centuries based on thesis analysis

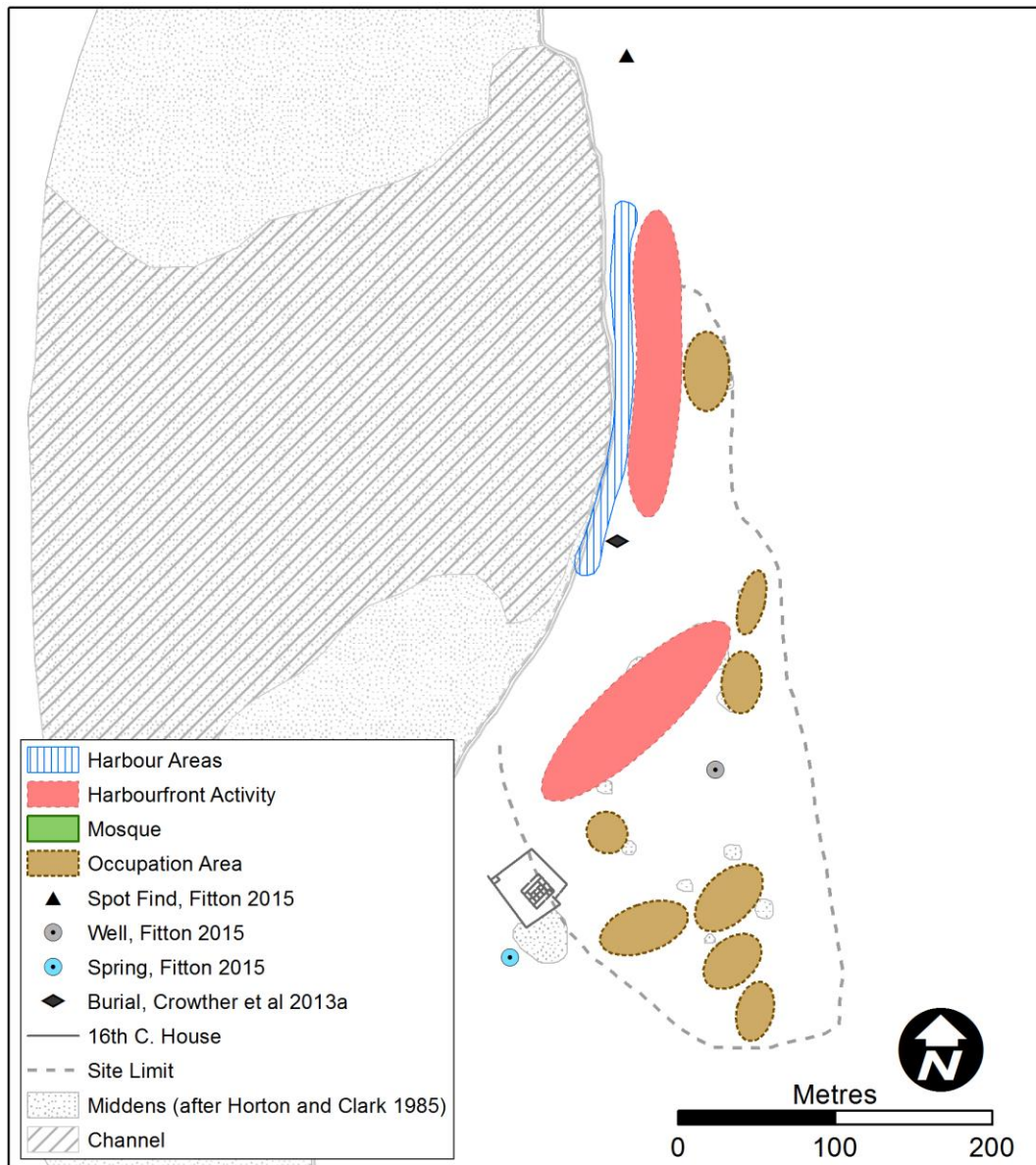


Figure 9.2 Hypothetical arrangement of harbour, communal activity area, and occupation areas at Fukuchani in the seventh – ninth centuries based on thesis analysis

At Fukuchani, Horton’s identification and initial surveys of the early settlement revealed middens and extensive ceramic scatters radiating up to 300m south-east of the beach. Some of the largest identified middens on site lie between the hypothesised occupation zone and the shoreline, around 100m east of the beach. Excavations of these middens in 1989 and by Sealinks in 2011 exposed dumps of shell, ceramics and iron-slag in the midden matrix. Small amounts of daub structural remains were found in the lower layers of the midden, although no postholes or alignment could be identified, and a large part of the midden appears to have been dug out as a ditch or pit and then refilled with further midden waste (Crowther et al 2013: 22). No other signs of structural remains were noted in this region of the site. During survey in 2013 a fragment of burnt tuyere around 15cm

long, and several Tana tradition sherds were found south of the cemetery and around 50m inland of the beach, indicating that the recent expansion of the school had disturbed an area of probable iron-working. It is hypothesised here therefore that whilst the early occupation of the site may have been close to the beach, by the eighth century the central and south-western area around 50-100m inland of the beach was the location of a range of resource processing and industrial activities, effectively separating the main occupation area further inland from the business of the harbour area. A scatter of ferrous anomalies with no obvious modern cause was also noted in the results of the gradiometry survey in Area B, just above the beach on the north side of the settlement, and lying just beyond Horton's estimated limits of the sixth-eighth century settlement. Given their proximity to the beach, these anomalies may represent the remains of harbour-related archaeological activity, but excavation to investigate and date the anomalies remains has not yet been possible.

At Tumbe, the relative lack of structures noted on the slopes of the peninsula between the occupation area and the shoreline indicates another possible region of 'open' space. Although subsistence processing, iron-working, and crafting are all known to have occurred at the level of individual households at this site, concentrations of bead grinders and shell middens on the open slopes above the shore again suggest a common area used for resource processing rather than occupation. The large, burned daub structure on the slope overlooking the harbour area, identified through gradiometry and dated to the seventh-tenth century through test-pit excavation, remains as yet unexplained. From the size and orientation of the anomaly and what appears to be an enclosing wall also identified in the gradiometry results, two hypotheses have been put forward in this thesis. The first is that on the basis of the orientation, the structure might represent an early, misaligned mosque, which would make it the only one yet found at the site and a precursor to the varying alignments of the later mosques at nearby Chwaka. The second possibility is that the enclosing wall indicates a compound surrounding either a single large house or two collapsed, neighbouring structures, and which might therefore represent an early example of a formal, dedicated merchant house. If so, the structure would represent the first example of a formalised merchant house found on the East African coast, and provide a crucial insight into the process of the formalisation of trade in Swahili society between the ninth – eleventh centuries.

The concentrations of iron-working and crafting activities in prominent harbourfront locations at all three sites indicates an archipelago-wide pattern of settlement organisation. Whilst previous investigations have indicated that limited iron-working and craft activities may have occurred within individual structures at a household level in both Swahili and proto-Swahili sites, it is suggested here that the harbourfronts of the proto-Swahili settlements may also have hosted larger communal areas for iron-working, crafting, fish-processing, boat and maritime equipment maintenance, and trade. The preservation of these communal harbourfront areas in spite of urban growth indicates that they played an important role in the economic life of the site, and it is suggested that they may have provided a neutral ground on which to meet and trade with incoming visitors and merchants.

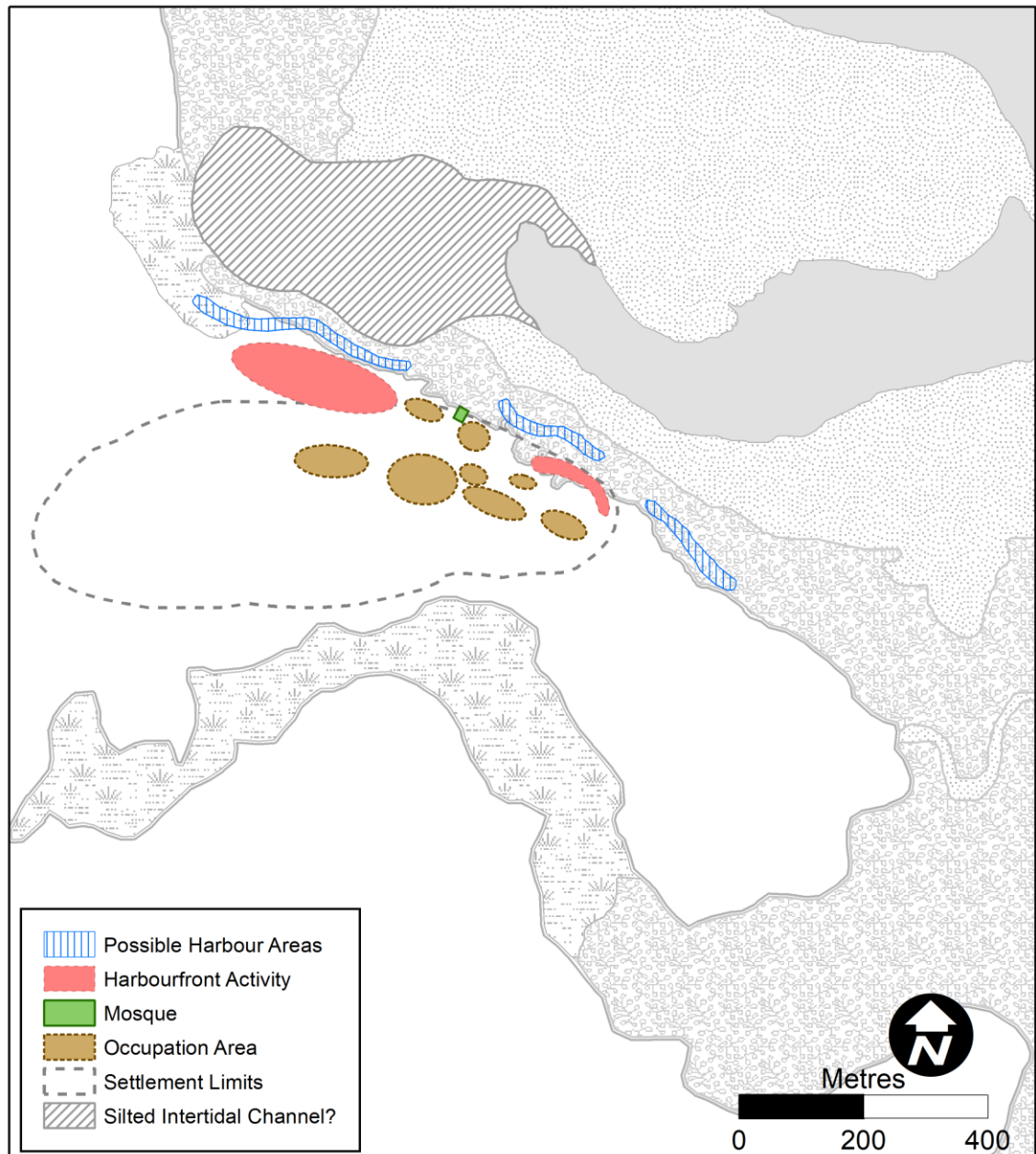


Figure 9.3 Hypothetical arrangement of harbour, communal activity area, and occupation areas at Tumbe in the seventh – tenth centuries based on thesis analysis

Evidence of surrounding shoreline late-first millennium mosques on either side of the area at Unguja Ukuu, nearby shoreline burials at Fukuchani, and a possible mosque or trading structure overlooking the harbour at Tumbe also indicates, however, that these areas were key to the expression of the social-cultural identity of the settlement and its development in this period. In this respect, the relative lack of structures in these areas bears comparison to the investigation elsewhere of open areas in Swahili settlements. Horton (1996), for example, has argued that the central space of the earliest phases of Shanga represented a restricted ritual space, and that the construction of the

earliest mosque in this area marks the start of the Islamisation of the settlement. Fleisher and LaViolette's (1999) surveys on Pemba were successful in proving the existence of a 'hidden majority' of timber structures in Swahili stonetowns, demonstrating that the concept of central open areas may in itself have been problematic. Fleisher and Wynne-Jones' (2012) subsequent surveys of Songo Mnara have now demonstrated that the whilst some 'open' spaces of the town were busy with timber structures, others served as active sites of communal memorialisation, ritual, and for the display of individual and group identity. None of these surveys has examined or considered the open shoreline areas described in Chapter Two of this thesis, although Fleisher (2010: 151) has quite separately hypothesised the existence of beach markets predating the privatisation of commerce in the second millennium, and the rise of formalised and dedicated trading spaces.

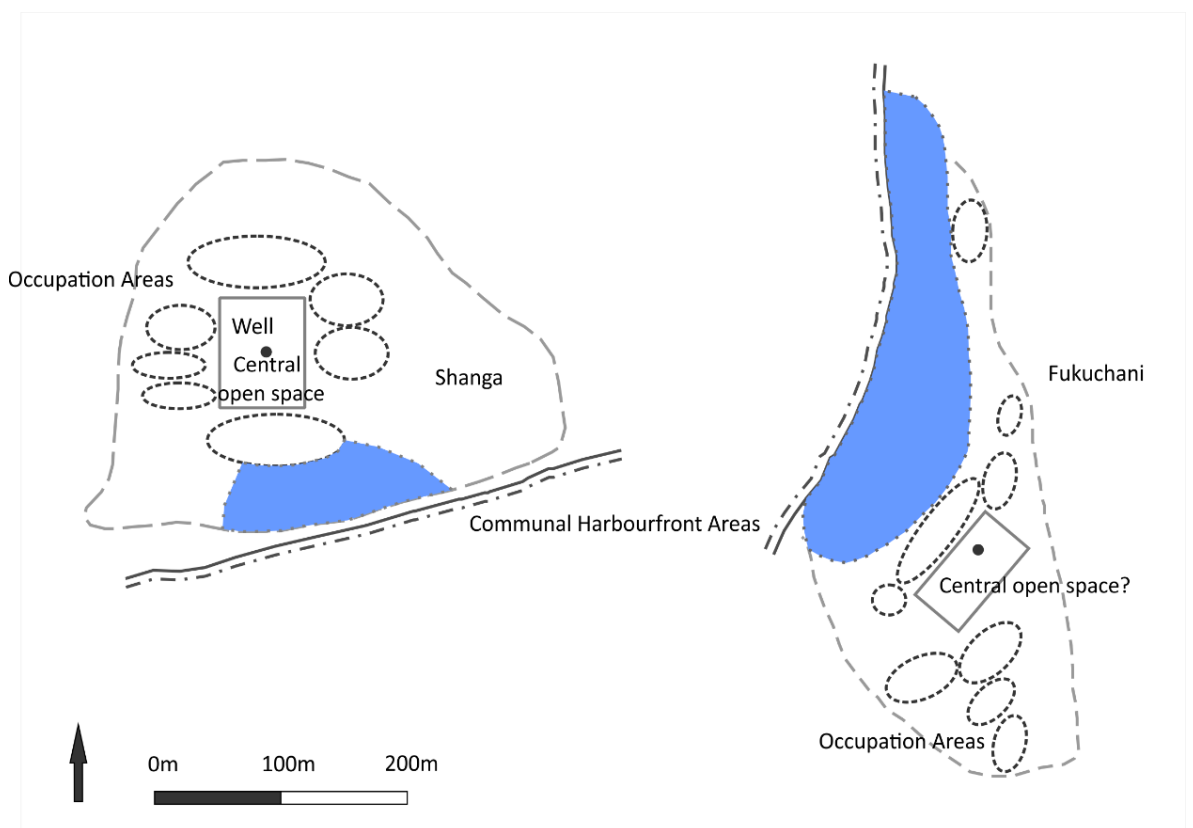


Figure 9.4: Comparisons of (left) Horton's schematic model of settlement organisation at Shanga (after Horton 1996: 420), and hypothesised settlement organisation at Fukuchani as representative of proto-Swahili sites in Zanzibar Archipelago. Communal harbourfront areas at Fukuchani, and added to Shanga model are marked in blue, with possible central space predicted between activity areas and occupation area added at Fukuchani.

What is proposed here is an extension of these arguments. It is hypothesised that as well as providing a communal area for iron-working, crafting, maintenance, and trade, these open,

maritime-related, harbourfront areas may also have provided a space for an expression of local settlement identity. In contrast with the restricted central spaces of the site however, which apparently served to bind the local community of the settlement, these shoreline open areas may have been aimed outwards, towards the maritime cultural landscape beyond the settlements. It is argued that in the context of the growth of regional and long-distance trade after the eighth century CE, the shoreline mosques which flank these open areas, and which are likely to have been constructed around the ninth - tenth centuries, were intended as an expression of identity aimed at maritime visitors to these sites, rather than for the social binding of the local community previously hypothesised for the central open spaces.

9.3.4 Encoded Spaces and Urbanisation

Whatever the contemporary reasoning behind the apparent pattern of separation between occupation and working areas, the effect from an archaeological perspective is the long-term encoding of economic and social information in the spatial layout of the town. It was suggested at the start of this thesis that having working areas available close to the shoreline is likely to have been of practical benefit both for the construction and maintenance of watercraft, and for informal trade. Although the towns do not appear to have been 'planned' in the sense that there is no evidence of streets (Fleisher 2014), the evidence presented suggested nevertheless a pattern of organisation in settlements based around specific activity areas, whether maritime, industrial, trading or occupation areas, which structured the use of space and therefore movement through the settlements. Given the nature of regional and long-distance voyaging, a predictable village or town layout might have benefitted the contemporary sailors, merchants, and craft specialists of various Indian Ocean origins seeking assistance, accommodation, and opportunities in the first millennium ports. It would also have provided a degree of control to locals by structuring the movement of visitors through the settlement, and creating built-in controls over contact between locals and visitors. The identification of working areas at multiple sites suggests at least a regional pattern of spatial structuring in this way.

Quintana Morales' (2012) thesis study of the spatial organisation of fish-processing activities at the second millennium sites of Vumba Kuu in Kenya and Songo Mnara in Tanzania provides further evidence of spatial structuring. Her thesis provided models based on ethnographic observations of modern coastal villages and towns on the Swahili coast, and demonstrated the archaeological applicability of these for the second millennium stonetowns. The model described a pragmatic arrangement whereby the initial selling of fish took place close to where the catch was landed, and secondary preparation, involving cleaning and gutting for consumption, occurred in the privacy of individual households (Quintana Morales 2012: 112). As well as Quintana Morales' own second millennium case study sites, the discovery of mixed deposits of fish remains and shellfish in shell

middens in the lowest levels of the open area at Unguja Ukuu provides support for the use of this model in the interpretation of the early phases of occupation in the first millennium settlements.

Crucially for the purpose of this thesis, Quintana Morales (2012: 115) also noted that the beach processing of fish in small modern villages tended to decline as the towns grew larger, because urban spread frequently led to construction and development on previously common open areas between the settlement and the shoreline. She observed that the continuing process of urban growth in coastal towns can cause fish-processing to move either further down towards the shoreline, with subsequent taphonomic issues for preservation of deposits, or into dedicated formal structures such as the concrete fish-markets seen at Fukuchani and Nungwi, and an unfinished equivalent seen at Unguja Ukuu. It is suggested here that in conjunction with the archaeological evidence of dedicated maritime working areas in proto-Swahili settlements, this observation offers two separate insights into the possible development of harbour spaces in the first millennium. The first is that shell-middens may offer a means of spatially and temporally plotting the growth and redevelopment of working areas and urbanisation in Swahili sites. As well as the calcium content of shell-middens supporting the preservation of various artefacts which might be carbon dated, the preservation of these working areas or their replacement by urban construction can tell us something about the relative importance of these activities in the settlement at that moment in time.

The second point is related to the symbolic role of the modern fish-markets, and the position of these structures in the encoded space of coastal settlements. These buildings, close to their respective harbours, are used by both men and women for the purpose of buying and selling fish shortly after a catch is landed, as a communal rallying point for subsequent cleaning, and for informal gatherings of almost exclusively men and boys throughout the rest of the day. One of the most important features of all of these buildings therefore, from the perspective of both fishermen and consumers, is proximity, visibility, and access to the shoreline. This enables fishermen to quickly offload their catch and obtain prime positions in the display of fish before sale occurs shortly afterwards, thereby improving their chances of turning a good profit. The recognition of this building and space also helps maximise the number of customers willing and able to travel to the market, knowing that there will be a good range of fish on offer. Fish-markets provide a multi-purpose hub of interaction in the settlement, and the presence or absence of these structures might be used as a settlement value attribute in the future development of a gravity model of network connections amongst proto-Swahili and Swahili settlements¹⁵. This may explain why fish markets are often set slightly apart from other structures in the area, in a relatively open space, the building standing as a symbol for the market even though it frequently provides little practical benefit given the brevity of the activity.

¹⁵ See Chapter Two for discussion of gravity models in network analysis (Knappett *et al* 2008) and the current limitations preventing their use on the Swahili Coast

In continuing to investigate and compare the layout of the first and second millennium sites, and the processes and effects of urbanisation therefore, the results of both this thesis and Quintana Morales' work offer some solutions to the problem of dating urban developments. It is suggested that a complementary strategy to Quintana Morales' work in exploring spatial and temporal patterns of fish consumption might be to excavate shoreline middens, communal harbourfront activity areas, and house contexts in the occupation zone, in order to investigate the types of fish being processed in different areas of the site, and the effects of site redevelopment on this activity. The early shell midden in UU1 and TR2, for example, appears to have been buried beneath a later phase of industry, trade and middens. It would be useful to determine whether fish processing continued to occur in the same communal areas, or whether high-resolution carbon dating might indicate that this type of activity moved out of sight into the enclosed spaces of houses.

9.3.5 Growth and Focus

The growth of the individual sites over time also appears to demonstrate the importance of harbour spaces to the early coastal settlements and ports of trade. Evidence of the redevelopment of harbour and processing areas to make way for urban growth has been noted above at both Unguja Ukuu and Fukuchani, and has been hypothesised in the construction of the large daub structure overlooking the harbour at Tumbe. Looking at the wider plan of the sites too, similar patterns of growth are hypothesised for all three settlements.

In spite of their amorphous final plans, Unguja Ukuu and Fukuchani both show signs of a semi-circular radiation away from the key area of the beach, albeit with different constraints imposed by their respective landscapes and surroundings. Similarly, although Tumbe appears to run parallel to the shore along the ridge of the peninsula, the postulated position of the harbour in the north-eastern bay suggests an early, central focus from which the site might quite pragmatically have radiated out along the secure and firm ground at the top of the ridge, rather than the soft and light sands around the northern slopes of the bay.

Horton's original model for the development of Shanga described the growth of the settlement from clusters of kinship-related houses centred around a ritualised open area, the whole assembly located 50-100m inland of the shoreline amongst the shelter of the dunes. This model has since become a standard for the growth of coastal Swahili towns, but can be critiqued on the basis that this 'maritime' settlement appears to have only limited physical relationship to its nearest shoreline and the sea beyond, the main source of its subsistence and foundation of the town's later trading wealth.

An alternative model is therefore proposed here as a variation on Horton's original. Whereas Horton theorised that the hub of activity throughout the life of Shanga was a central open area enclosed by

surrounding kinship clusters of houses, it is hypothesised here that the key hubs of activity at each of the three case study sites were the harbour working areas between the shoreline and the inland occupation areas (although it is entirely feasible that other 'open' areas, perhaps with alternative social roles, may have existed within the main occupation zone). The theory may be supported by the apparent growth of the sites not from a single central point within the cluster of houses, but radiating away from the beach, and the preservation (to a point) of these working areas in spite of the encroachment of both houses and the later construction of mosques. These processing, industrial, and informal trading zones were the beating economic hearts of the settlements, and the radial growth of the sites out from these working areas may be considered a spatial testament to the practical need (if not necessarily desire) for a continued connection to the beaches and harbours that helped define their early phases. The construction of mosques in the ninth-tenth centuries, as demonstrated at Unguja Ukuu, may then have been located nearby in order to attempt to engage with or influence those working in these areas.

9.3.6 Continuity and Change

Following on from the theme of settlement redevelopment, it is noted that exclusively later sites such as Tumbatu appear to have a greater variety of coastal settings than the proto-Swahili sites, and may have some leaning towards areas with deeper harbours. Whilst the reasons for the general movement of towns to such sites are beyond the proto-Swahili-related chronological remit of this thesis, it is suggested here that the trend may have been enabled and supported by the development and widespread adoption of alternative maritime technologies in the western Indian Ocean, and by shifts in settlement priorities on the East African coast. It was noted in Chapter Four that the dugouts and sewn-plank craft predicted to have been used in the late first millennium were sufficiently flexible to enable the proto-Swahili settlers to exploit shallow-water intertidal harbours and environments for various reasons, including subsistence purposes. It is suggested here that the predicted development and adoption of pegged-hulls in the second millennium, especially for long-distance voyaging, may have meant that deep-water harbours became a higher priority in Swahili society, especially within the ports of trade which had to cater to the requirements of a wide array of vessels from around the Indian Ocean.

It has been argued in the past that the establishment of stonetowns such as Tumbatu and Chwaka were part of a move towards securing the towns by settling on remote peninsulas and islands. Whilst the establishment of Tumbatu has been attributed to political refugees from Zanzibar, the site's role and rise as a port of trade and seat of power is likely to have been enhanced by its maritime connections, rather than cut off by an assumed marine isolation. It is important in this context to note that the location of the site on an island with few sources of water and little agricultural

hinterland indicates a growing emphasis, indeed reliance on trade networks for economic success, social authority, and even for subsistence.

These changes and requirements suggest a widespread shift in settlement priorities which tie into the evidence of changes in subsistence strategies highlighted particularly by Walshaw (2010). It is suggested that although Walshaw (2005), LaViolette and Fleisher (2013) have demonstrated a continued reliance on local resources in the villages and towns of the second millennium on Pemba, the competition between independent settlements noted in Chapter Seven might have enabled the rise of local trade and exchange networks, allowing sites like Tumbatu to thrive without requiring the control or domination of tributary sites. This might in turn explain the reoccupation of smaller, but apparently independent sites such as Mkokotoni, Shangani, and the reoccupation of Fukuchani in the fourteenth century. Such a network must have relied heavily though on the existence and continuing development of a highly skilled maritime culture with access to a range of vessels with overlapping maritime footprints, allowing for the exploitation of varied environments for various purposes.

As described in Chapter Eight, the island of Tumbatu has few beaches, and the western approaches through the sandbanks are dangerous. The position of the town indicates that the inhabitants could have made use of the good anchorages known just off the shoulder of the island in Mkokotoni Harbour, but a reliance on these anchorages is likely to have necessitated a shift away from the flexible, and therefore leaky sewn-plank hulls of the first millennium. Evidence of this shift can be seen in the changing patterns of fish consumption in the second millennium (Horton and Mudida 1993; Quintana Morales 2012). The dominant proportions of shellfish and shallow-water fish remains found in small or growing settlements, such as Fukuchani, Tumbe, and the early phases of Unguja Ukuu and Shanga, seem to fall in the second millennium as a result of the increasing appearance of coastal and deep-water fish species, especially in town sites such as Chwaka, and the later phases of both Unguja Ukuu and Shanga (Horton and Mudida 1993; Fleisher 2003; Walshaw 2005; Quintana Morales 2014). This seems to provide evidence, as noted in both Chapters Four and Eight, of the continued development of maritime technology, the variety of ship types, and subsequently the range of environments which could be exploited. As maritime technology improves, so too does access to off-shore maritime resources, enabling sailors and fishermen to venture further abroad and exploit with greater confidence the regional and open water, as opposed to simply the local coastal maritime environment. Graffiti found in second millennium contexts such as Kilepwa and the palace complex of Husuni Kubwa on Kilwa also indicates the increasing use of pegged and deeper-hulled craft by the thirteenth – fourteenth centuries (Pollard and Bitá 2017), which may have required deeper anchorages than were necessarily available at the earlier beach sites. The evidence indicates an entangled shift in the use of both sailing craft and harbour spaces. Whilst the increasing settlement of islands and peninsulas with different shoreline environments is likely to have encouraged or necessitated the increasing use of pegged hulls which were more

watertight, and therefore more capable of riding out extended periods at anchor than leaky sewn-plank hulls, a move away from sandy beaches may have discouraged the use of stitched hulls, which might be damaged by beaching on rocky shorelines. In the same manner, the predicted widespread adoption of pegged-hull vessels appears to have supported an increased sailing range and wider exploitation of marine environments, is likely to have allowed for greater variety in the types of cargo carried, and enabled and supported the settlement of an increasingly broad array of coastal landscapes.

In accepting the improvement of maritime technology however, it must be recognised that the settlement of islands and peninsulas in the eleventh century was not a move to more remote locations, an idea rooted firmly in terrestrial perspectives, but a cultural and economic move towards increasingly maritime locations with better maritime access and connections to the Indian Ocean world. The increasing importance of maritime networks and movement may also have encouraged the enshrining of maritimity into the increasingly Indian Ocean-facing coastal identity of Swahili culture in the early second millennium.

9.4 Conclusions

The comparison of three contemporary case-study sites in this thesis suggests a pattern of maritime activity, harbour locations, and settlement organisation based on the knowledgeable exploitation of the East African maritime cultural landscape by a skilled sailing society in the first millennium. The results of this thesis indicate that the proto-Swahili coastal settlements of the Zanzibar Archipelago were deliberately located on beaches with shallow harbours in order to exploit a range of intertidal and near-shore resources, and that this choice was enabled and supported by the deliberate use of sewn-plank craft and dugouts. These beach sites allow for easy access between land and sea, in contrast to their surrounding coastlines, and are sheltered from both seasons of monsoon winds and currents. They also have access to a similar range of marine resource areas, and the faunal and botanical evidence of all three sites suggests reliance on the exploitation of a similar range of intertidal shell-fish, and of near-shore and coastal fish for subsistence. The development of maritime technology through the first millennium, inferred from textual sources, maritime trade and connections, and subsistence practices, indicates a deliberate tradition of dugout canoes and sewn-plank, square-rig sailing craft as the most appropriate and flexible means of exploiting the regional marine environment.

The analysis of this thesis has also identified a pattern of communal harbourfront activity areas hosting iron-working, crafting, fish-processing, boat and maritime equipment maintenance, and trade. As well as serving an economic purpose, the preservation and delimitation of these areas may have been linked by the end of the first millennium to a maritime-facing expression of settlement identity. Furthermore, these coastal settlements each appear to have grown inland from the

shoreline of the harbours, demonstrating that these communal harbourfront areas were a key component of proto-Swahili settlement organisation. Maritime activity in the nested spheres of the coastscape and maritime small world, if not necessarily a maritime cultural identity, appears to have been an important facet of daily life in these communities right from the earliest phases of settlement in the sixth – seventh centuries CE.

Elements of these first millennium layouts and related social practices may also have remained encoded in the layout of the later stonetowns in open shoreline working areas, and the locations of shoreline mosques even in newly founded second millennium stonetowns. The conclusions of this research therefore offer insights into settlement locations and spatial practices in both the first millennium daub settlements and second millennium stone towns of the Swahili coast, as well as the development of maritime technology and Swahili cultural identity. It also implies that distinctions between different types of harbour and port settlements may be drawn not just on the basis of scale, but on the arrangement and use of activity spaces, contributing to current debates on the nature of urbanisation on the Swahili coast. As noted in Chapter Eight for example, the eleventh century *Book of Curiosities* refers to twenty harbours around the coast of Zanzibar, suggesting both that a number of eleventh century harbour sites have yet to be identified, and that it is likely that there is some variety in the size and role of these unknown harbour settlements.

Having noted at the start of this thesis the lack of sufficient base data to carry out effective network analysis of ports on the Swahili Coast, the work of this thesis has now provided enough data to begin a new process of evaluating the comparative roles of proto-Swahili ports and harbours in the region. The review of the development of maritime technology in East Africa contained in Chapter Four provides a range of ship types on which to base daily voyaging estimates and cargoes, and the primary field research of Chapters Five, Six and Seven and analysis of Chapter Eight provides a model for assessing the value of particular sites for the construction of a weighted gravity model of interaction. The literature review of Chapter Two has also highlighted the benefits of adopting Tartaron's (2013) nested maritime spheres as a theoretical framework for such future network analysis, and the appropriateness of such as model for discussions of the social and economic networks of the Swahili Coast in general.

Finally, this work raises new questions about the origins of the proto-Swahili societies of the sixth – seventh centuries. A recent paper by Crowther et al (2016) suggested that evidence of intense marine foraging in the early seventh century phases of settlement on Juani, Mafia, followed by a broadening of the subsistence base after the eighth century points to marine foraging as a short-term colonisation strategy driven by necessity, rather than a cultural choice. On this basis Crowther et al suggest that the settlers of Mafia should be considered a separate maritime-focused society, rather than precursors to the Swahili, and that "Swahili culture needs to be situated within a long-

term record of maritime adaptation across the region, one that is neither straightforwardly cumulative nor developmentally continuous” (Crowther et al 2016: 214).

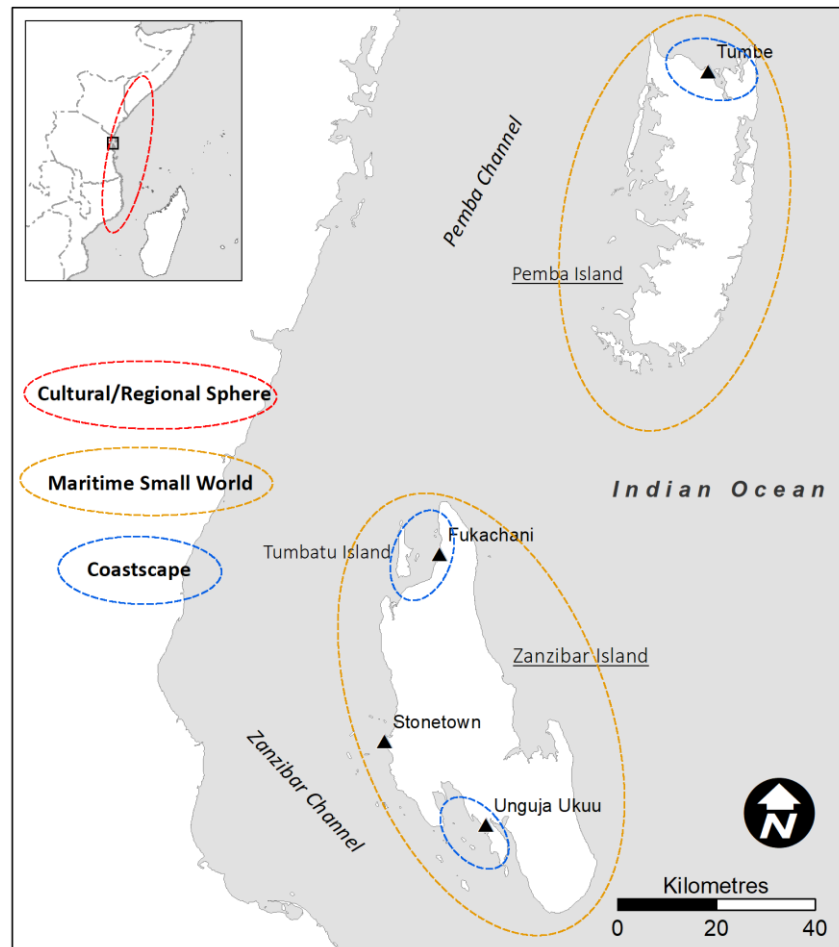


Figure 9.5 Diagram of the Zanzibar Archipelago and (inset) Swahili Coast in terms of Tartaron's (2013) overlapping spheres of maritime interaction and cultural worlds

By comparison, whilst agreeing with the characterisation of sixth - seventh century intense marine foraging as a possible colonisation strategy, the analysis of this thesis indicates that taken as part of the entire package of the proto-Swahili maritime cultural landscape, marine exploitation, maritime activities, and regional sailing networks were an increasingly important and defining feature of proto-Swahili settlements in the Zanzibar Archipelago between the sixth – eleventh centuries, in spite of the broadening of the subsistence base. It is emphasised again here though that the proto-Swahili of the archipelago were clearly an active and knowledgeable sailing society, and that maritime activity formed a key component of daily economic and social life within the coastal settlements.

As noted in Chapter Two, the lack of data from the fourth to sixth centuries CE makes it difficult to reconstruct how and when coastal communities learned to exploit the coast with such efficiency. Horton (1996) has previously theorised the merging of coastal and hinterland societies in towns such as Shanga in the seventh century, but offered little explanation of where this coastal sailing element originated. As noted in Chapter One, Chami (1999) has argued for the unity of a coastal sailing culture defined by the spread of Kwale wares, but here again there is little evidence of either permanent settlement or cultural continuity and Kwale ceramics are not consistently associated with coastal sites. As described in Chapter Five, the earliest phases of activity at Unguja Ukuu, including Juma's contested fifth-century phase of use, indicate a seasonal exploitation of the site, with layers of shell midden and abandonment deposits along much of the shoreline. It is suggested therefore that whilst the settlement of the coastal archipelagos in the sixth – seventh century did indeed represent a new phase of permanent settlement, it is possible that these islands were already being exploited on a seasonal basis by semi-nomadic sailing societies from the mainland, and therefore that the permanent settlement of the islands was based on prior experience and a working knowledge of the islands, rather than the emergence of an entirely new society. The identity and origins of this hypothesised society, and the motivation driving the permanent settlement of the islands in the mid-first millennium remains unknown, and a topic of future research.

Appendix A

Magnetic Gradiometry Results

A.1 Magnetic Gradiometry Survey

Magnetic survey (magnetometry or magnetic gradiometry) in archaeology involves measuring minute local variations in the gradient of magnetic field across a survey area, and mapping these variations in order to identify anomalous areas of potential archaeological interest. The term magnetometry technically refers to measurements collected using a single sensor in order to measure the total magnetic field at a given point. The polarity and gradient of the Earth's magnetic field means however that measurements taken in either the northern or southern hemispheres are not directly comparable. Gradiometry involves recording simultaneous measurements at two spatially separated sensors, and subtracting one measurement from the other. These sensors are usually vertically separated, so that the topmost sensor reading, representing the local atmospheric magnetic field strength, can be subtracted from the lower sensor reading, leaving a reading which is representative of the magnetic fields measured just above ground level. The difference between the two readings is the gradient of the earth's magnetic field at that location, hence the use of the term magnetic gradiometry.

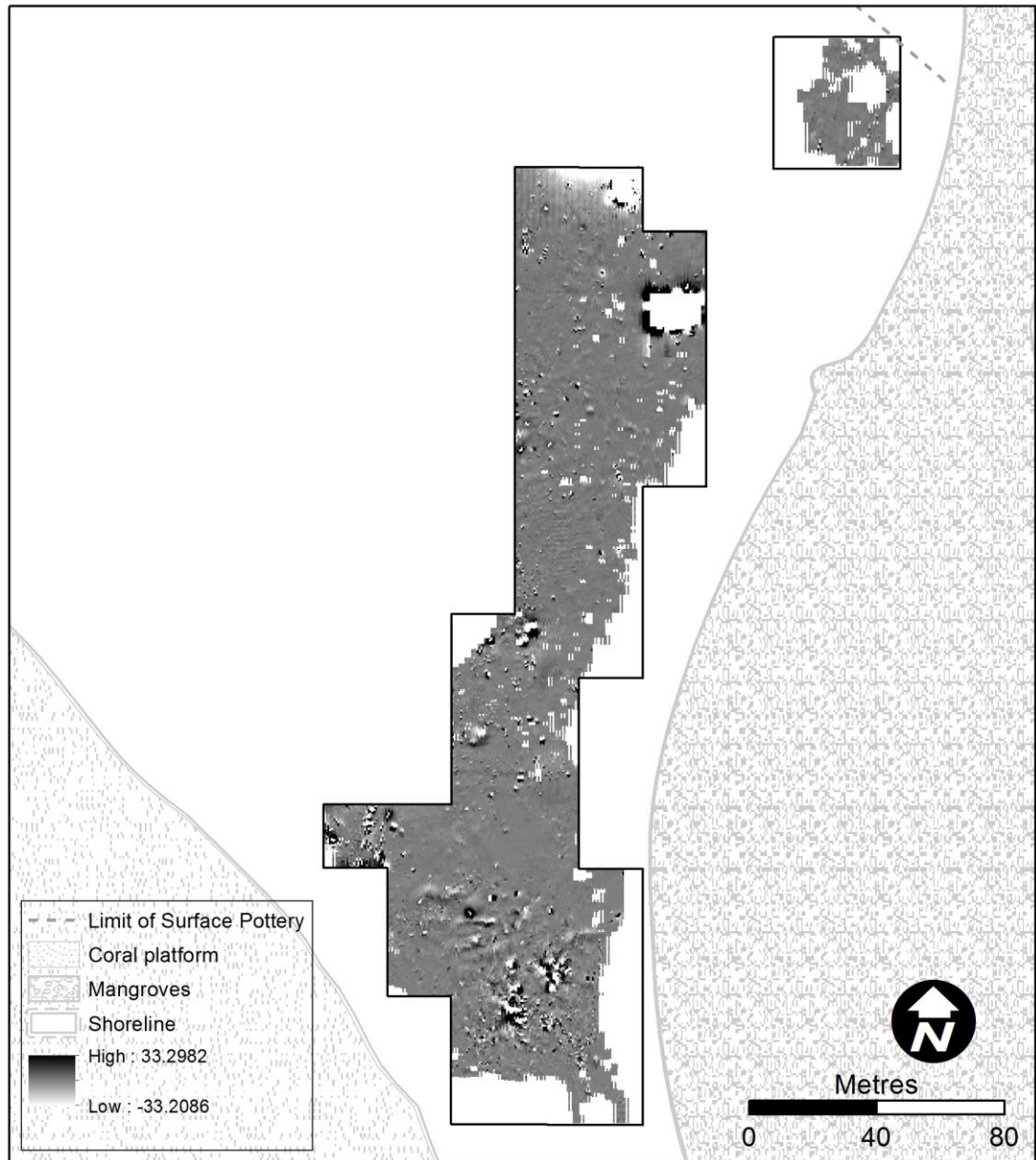
Anomalous differentiations in magnetic fields may be caused by the presence of magnetically charged or polarised objects which produce or are affected by magnetic fields, such as ferrous metals; by the polarised thermoremanent signature of materials heated beyond their Curie Point, at which any existing magnetisation of magnetically susceptible elements is lost and subsequently remagnetised upon cooling, resulting in the polarisation of affected iron oxides in alignment with the regional magnetic field of the Earth (Clark, 1996); by the disturbance of magnetically susceptible minerals in near-surface sub-soils; and potentially even by objects with a relatively unusual low magnetic signature, such as coral. Magnetic field strength is therefore extremely variable, and subject to a number of competing factors. The strength of a thermoremanent magnetic anomaly, for example, is dependent upon the concentration of iron oxides in the soil, since these must be present at the time of the heating event to be affected (Gaffney & Gater 2003). This means that although the technique is adaptable to many environments, the results are also subject to interpretation and are best understood when typical anomalies can be ground-truthed. The technique has proved immensely useful in mapping sub-surface variations and anomalies which can then be targeted by excavation, and has a wide variety of applications both within and beyond the field of archaeology.

The survey of each site will be carried out with reference to a 20 x 20 metre grid, established in advance in a GIS database and mapped out in the field using a Trimble Geo7X Differential GPS

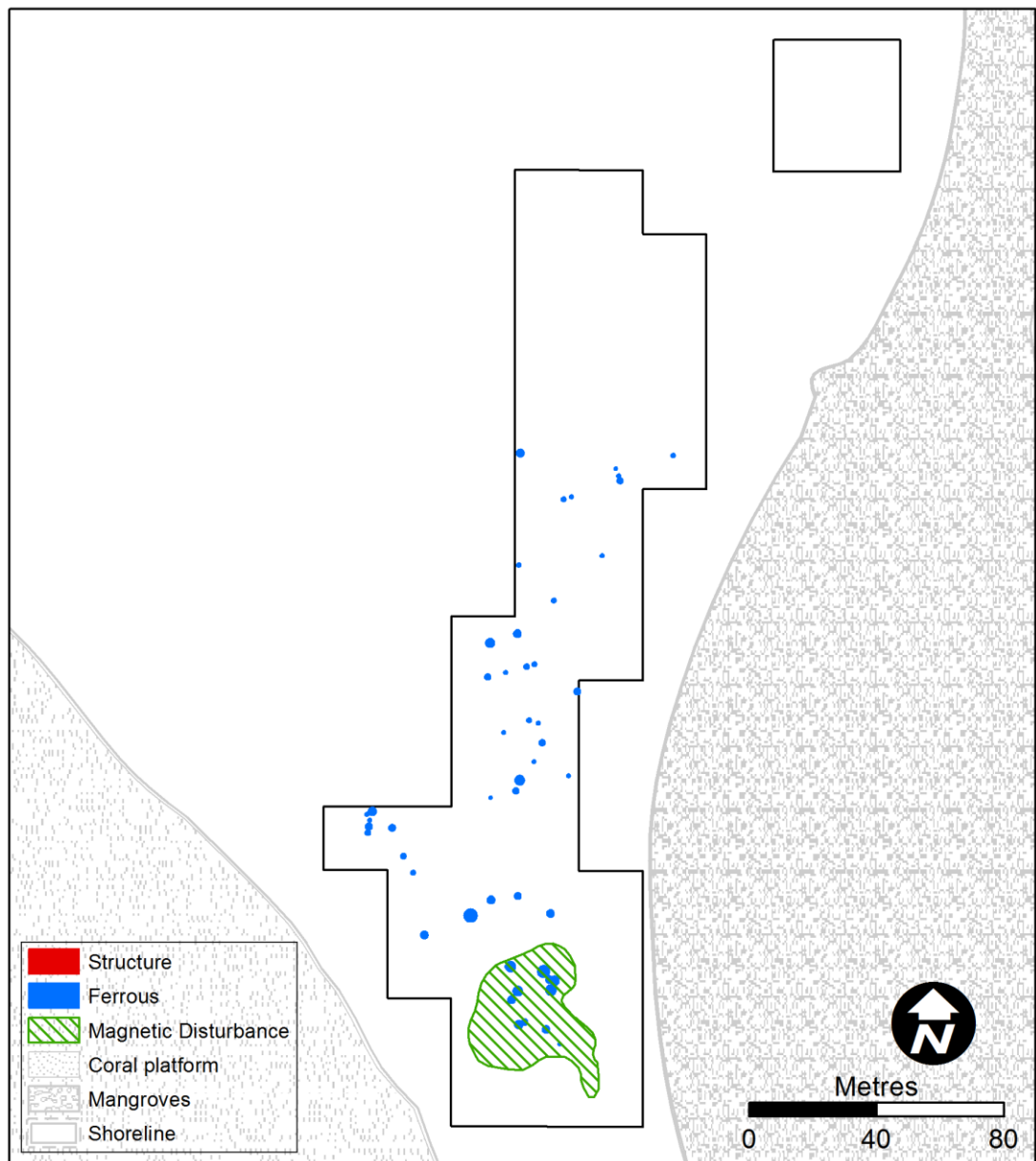
(DGPS). This grid will aid precision in data collection, and allow the accurate georectification of geophysical data in the GIS after survey, as well as the subsequent location of trenches for excavation. The geophysical survey will be conducted using a dual array Bartington Grad-601 Fluxgate Gradiometer, and survey transects will be marked in advance at appropriate intervals across the grid edges using measuring tapes and non-ferrous pegs and markers. Survey readings will be taken at 0.125 metre intervals on 1 metre-spaced transects. This strategy allows high-resolution data to be collected in spite of the possible obstacles presented by trees, high grass and scrub or thorn bushes common to the coast. The Bartington Grad-601 has an automatic sensor calibration system which alleviates the need for frequent manual recalibration to counter sensor drift under the temperature changes encountered over the course of a day in East Africa. As a further redundancy, the system will also be recalibrated on a local magnetic zero-point, an area of neutral magnetic signatures, at least once every hour. Surface features of potential interest to survey interpretation or georectification of imagery will also be planned using the Trimble DGPS and hand drawn on survey plans, to be added to the GIS in post-processing.

Data from the magnetometer was downloaded using the native Bartington Grad-601 download utility, and imported for analysis into ArchaeoFusion, a beta-test program published by CAST (Centre for Advanced Spatial Technologies), University of Arkansas, for processing. Post-processing was kept to a minimum whenever possible, including the standard agreed limit of clipping of magnetic field strength to 3 standard deviations of the mean measurement, and destaggering of individual grids to eliminate variations in surveyor's pace across uneven or difficult terrain. Survey results were exported and then georectified into the project GIS database using the DGPS data and survey grids referenced on site. Magnetic anomalies were traced and numbered in ArcGIS, and those which could be attributed to modern features mapped during the survey filtered out. Any remaining anomalies were then analysed according to shape, size, and intensity, as well as available comparative archaeological data described in the relevant chapters of this thesis.

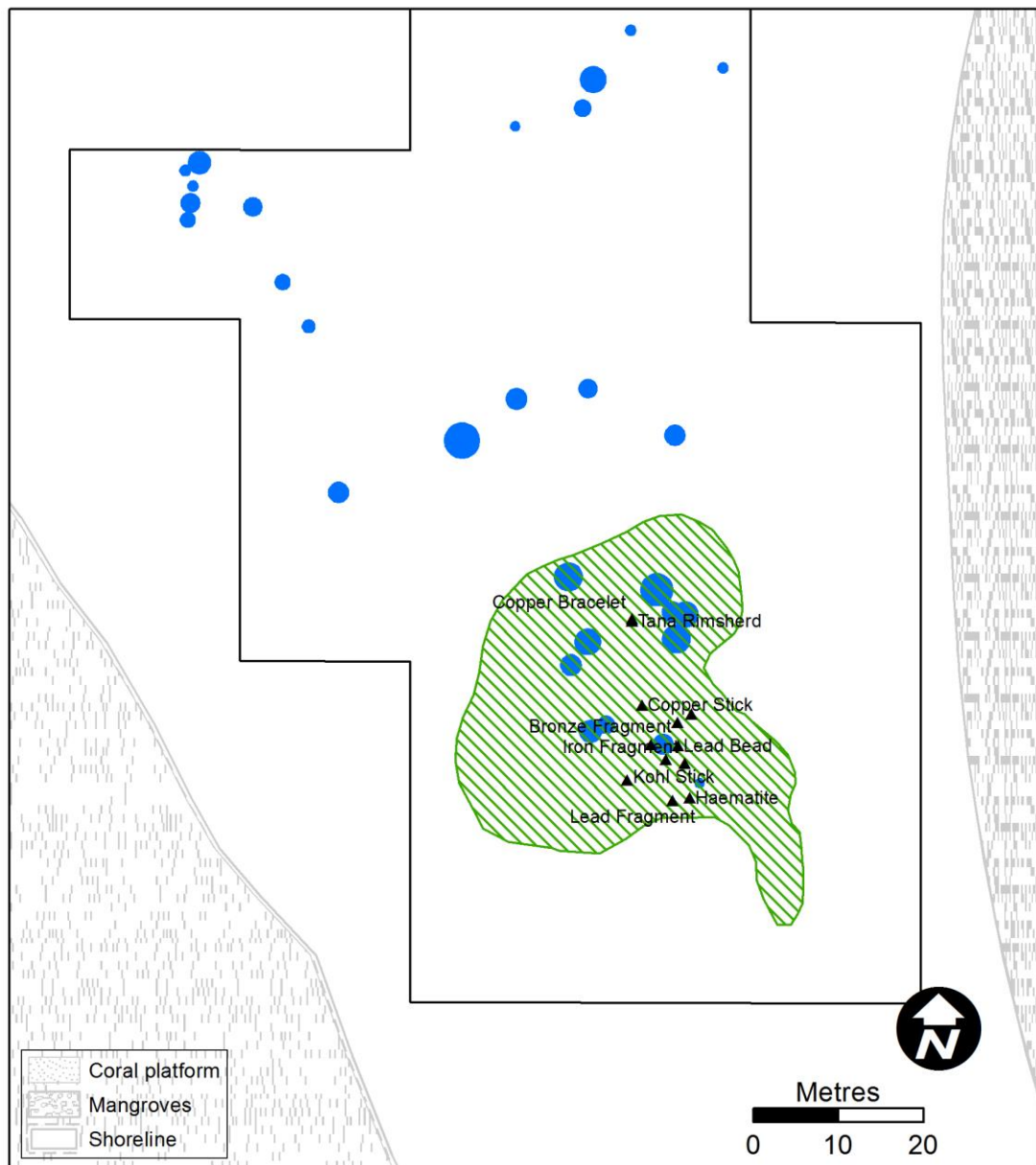
A.2 Magnetic Gradiometry results from Unguja Ukuu, Zanzibar



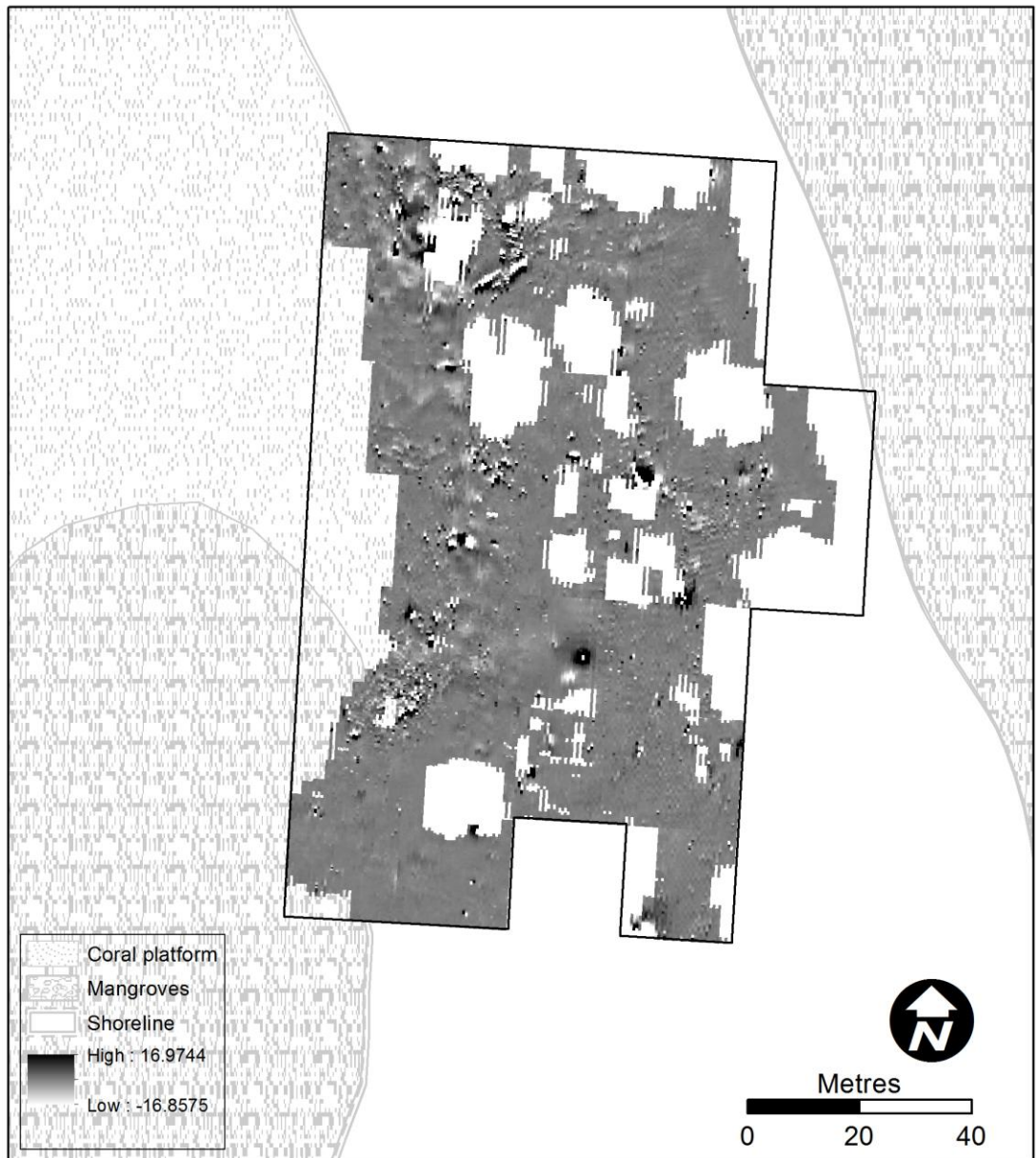
A. 1: Processed results of magnetic gradiometry survey of Area A, Unguja Ukuu



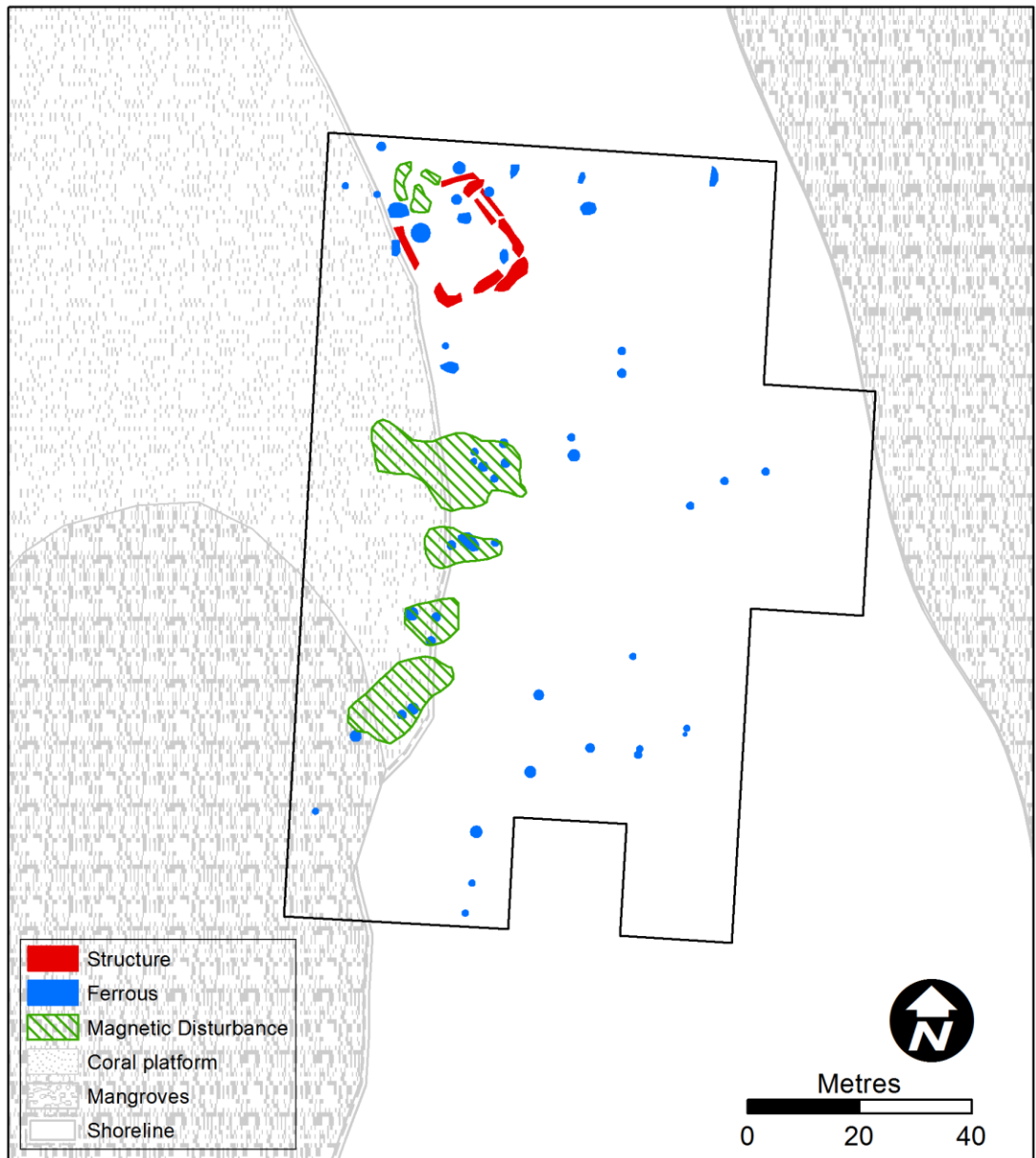
A. 2: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area A, Unguja Ukuu



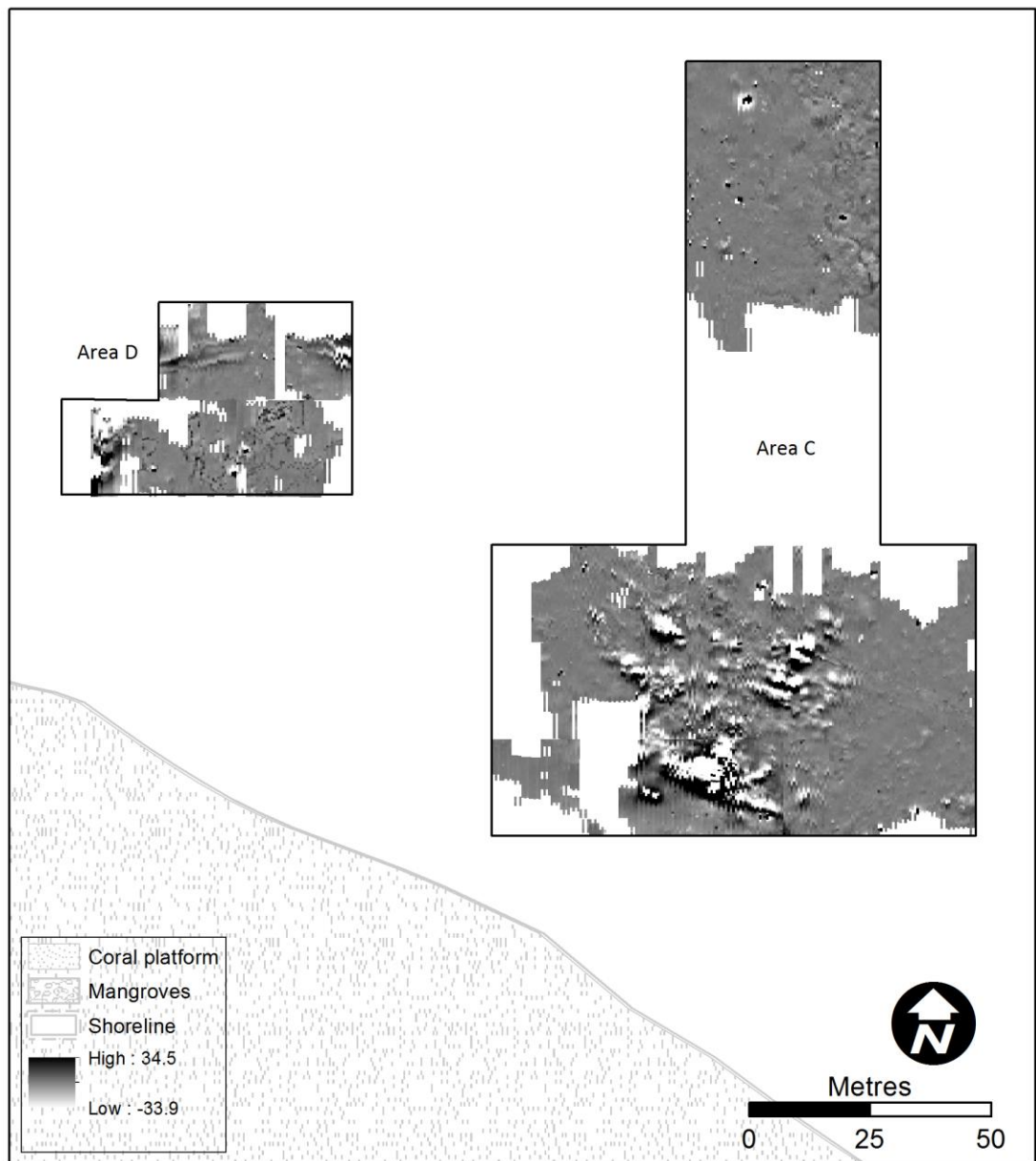
A. 3: Interpretation of archaeological anomalies from results of magnetic gradiometry and metal detection survey of Area A, Unguja Ukuu



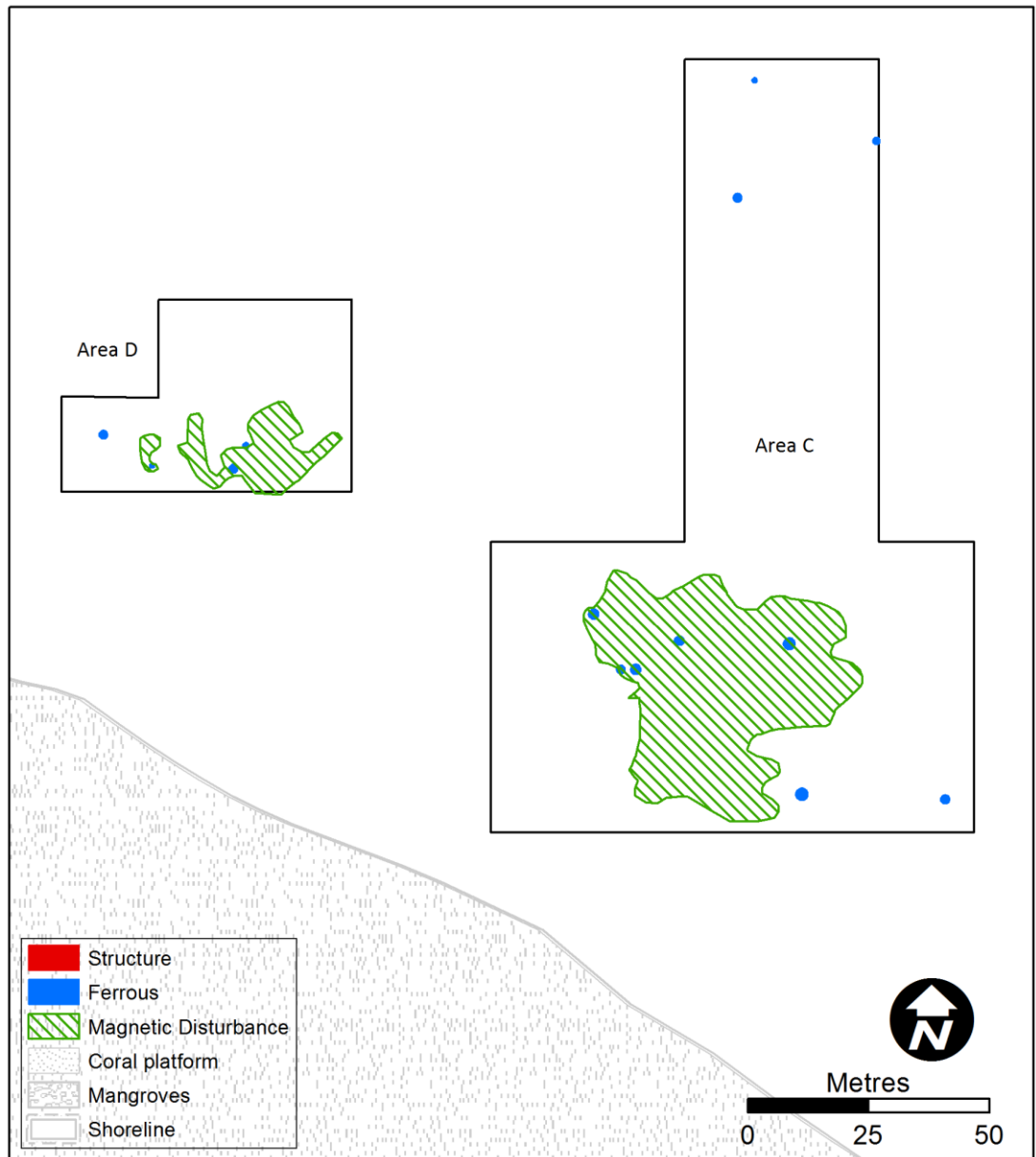
A. 4: Processed results of magnetic gradiometry survey of Area B, Unguja Ukuu



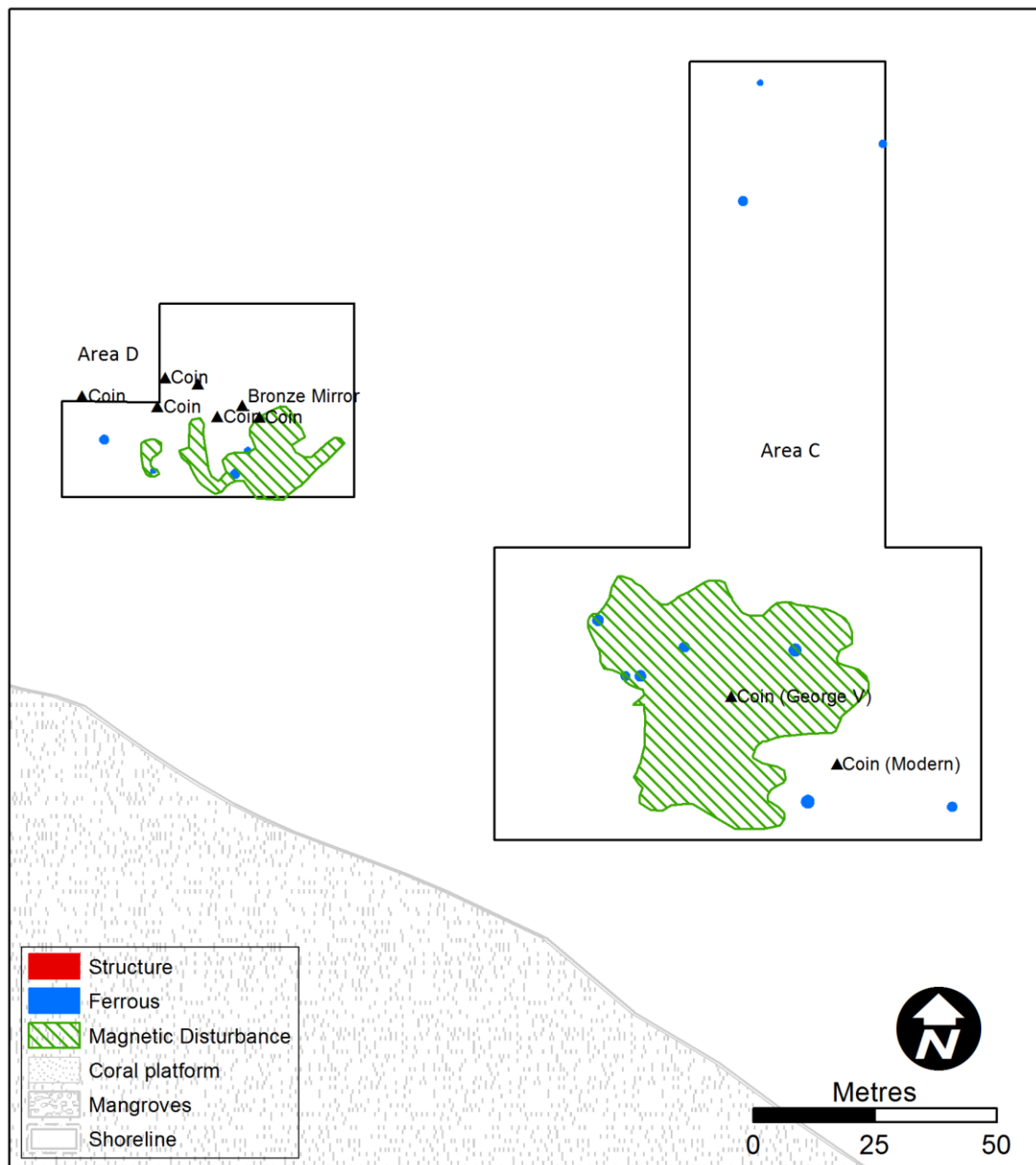
A. 5: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area B, Unguja Ukuu



A. 6: Processed results of magnetic gradiometry survey of Area C and D, Unguja Ukuu

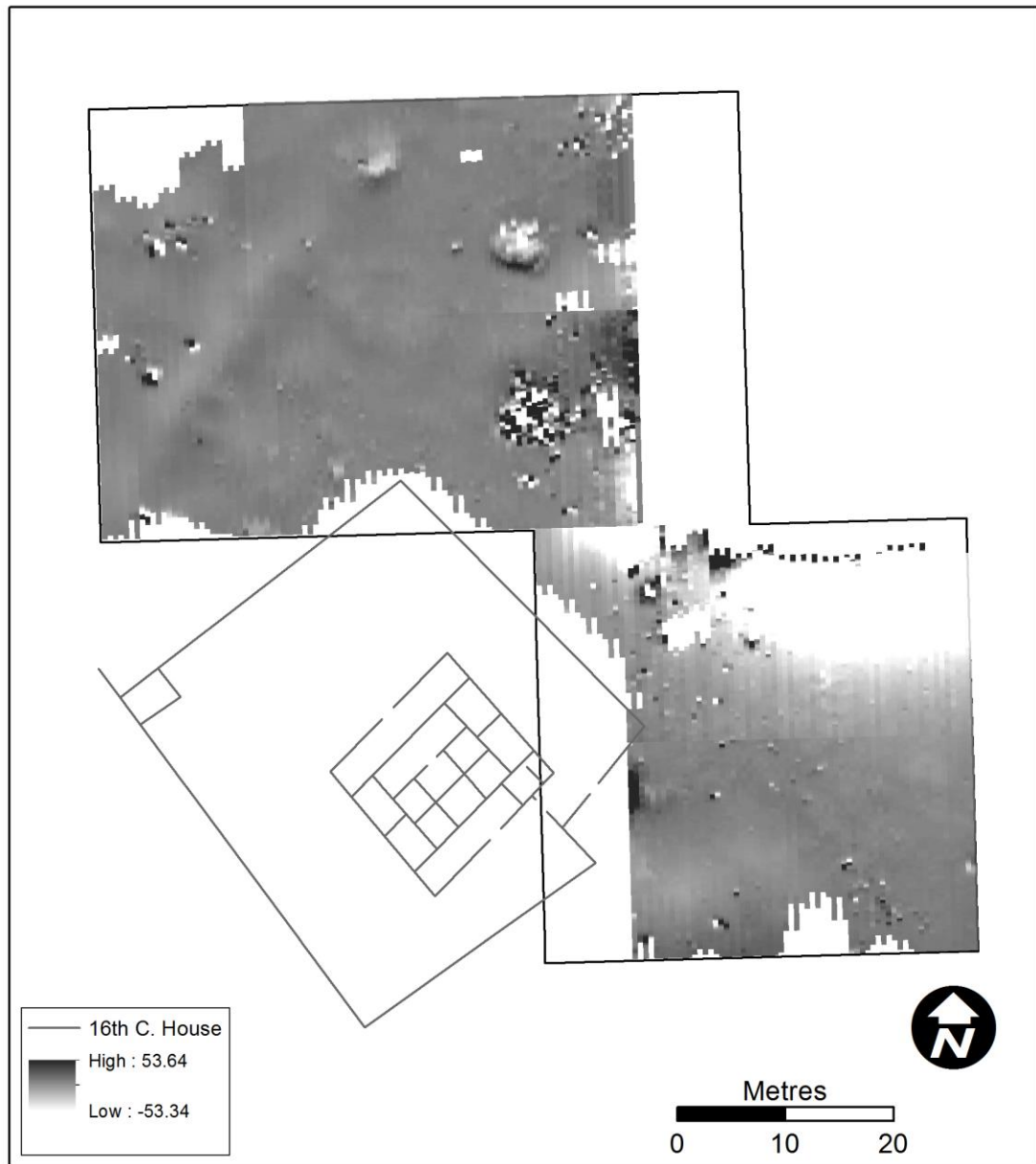


A. 7: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area C and D, Uguja Ukuu

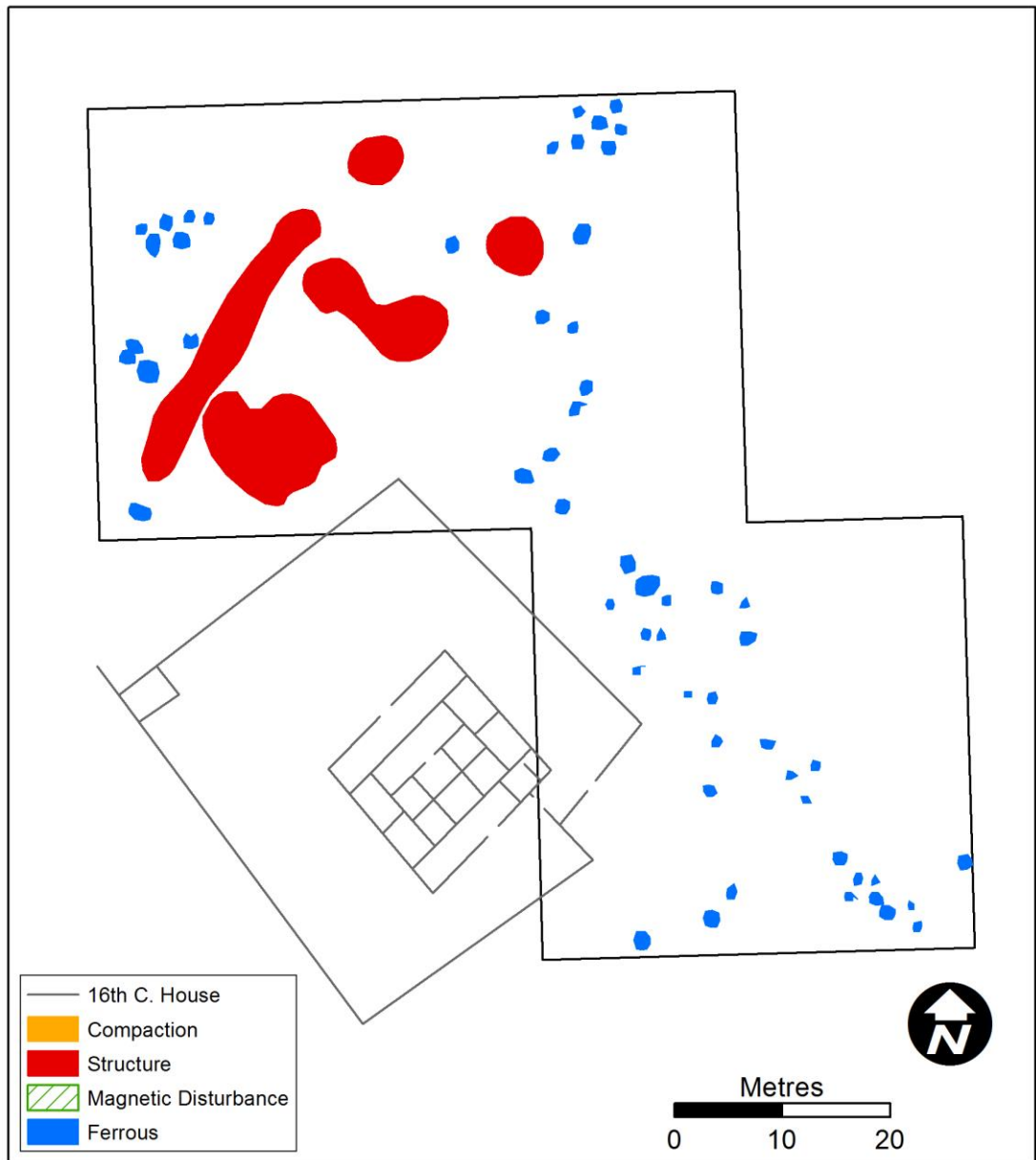


A. 8: Interpretation of archaeological anomalies from results of magnetic gradiometry and metal detection survey of Areas C and D, Unguja Ukuu

A.3 Magnetic Gradiometry results from Fukuchani, Zanzibar



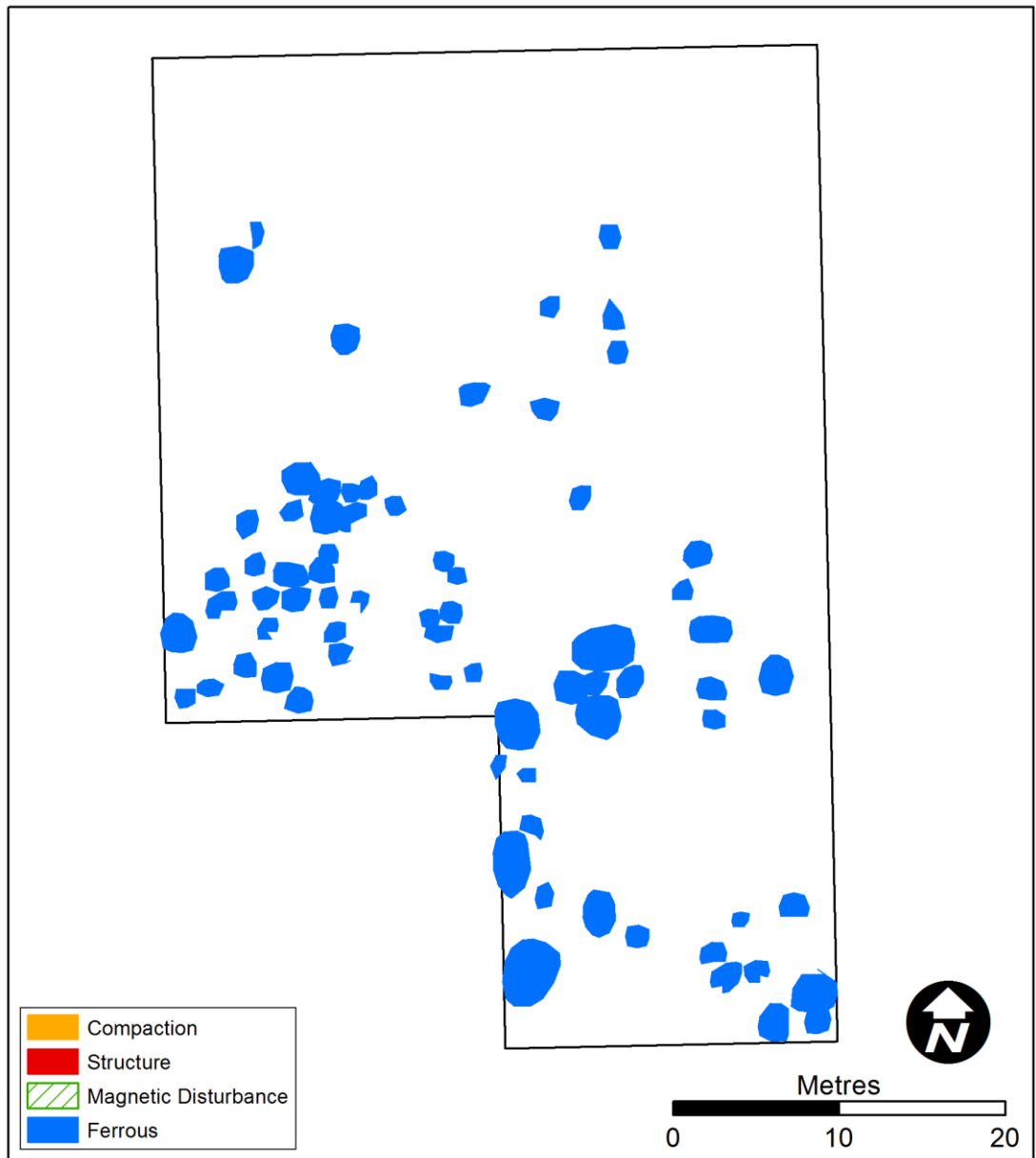
A. 9: Processed results of magnetic gradiometry survey of Area A, Fukuchani



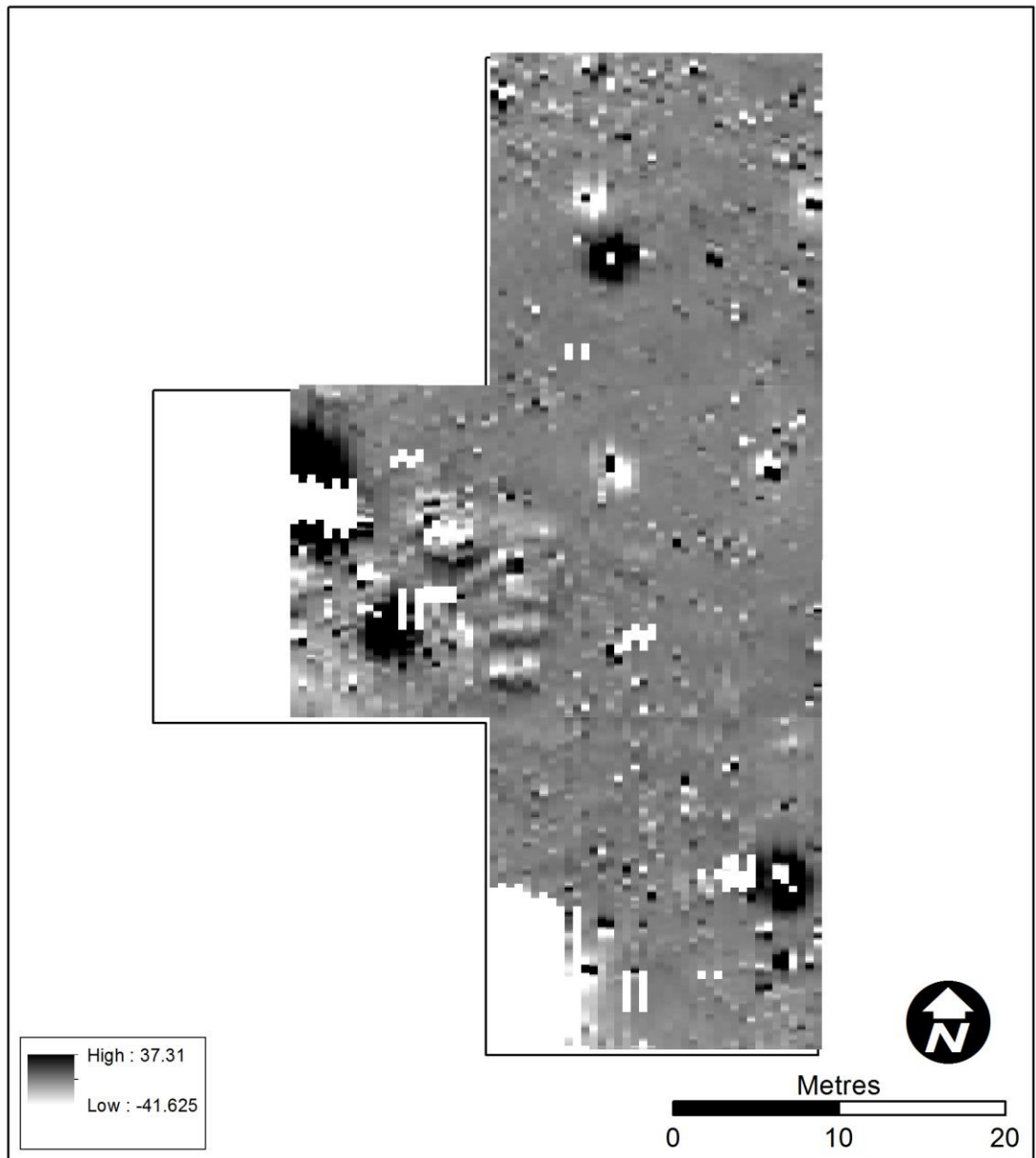
A. 10: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area A, Fukuchani



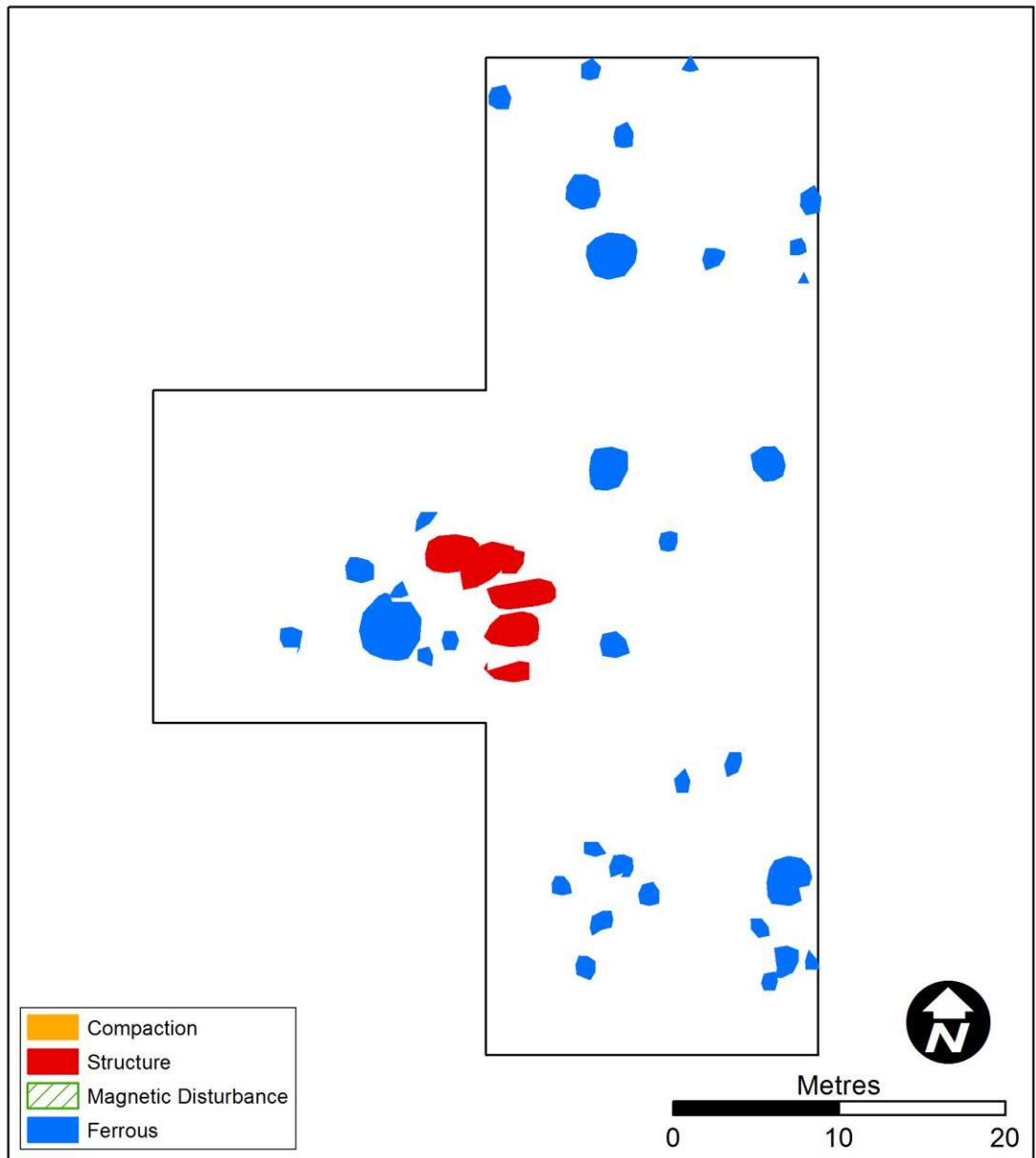
A. 11: Processed results of magnetic gradiometry survey of Area B, Fukuchani



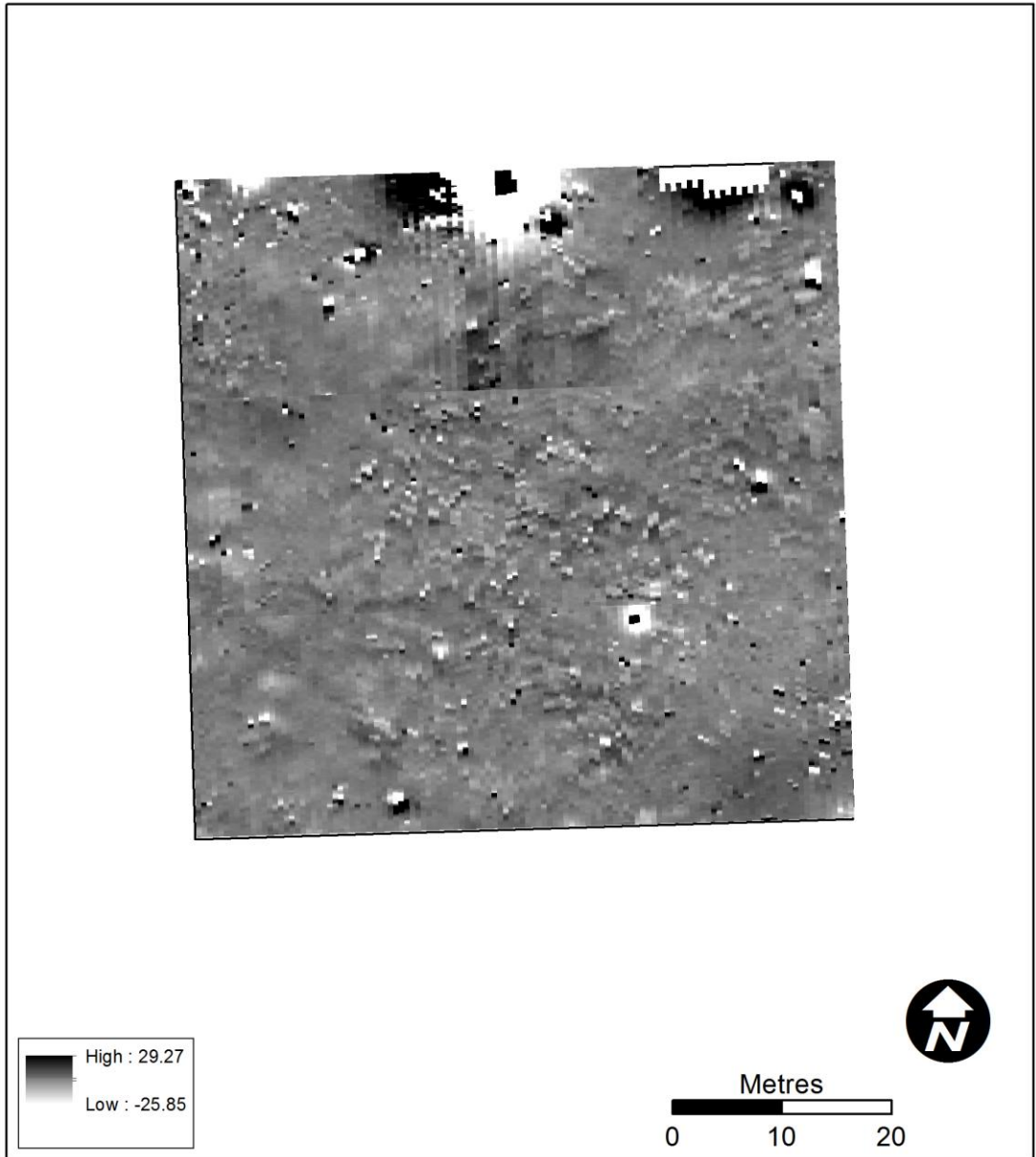
A. 12: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area B Fukuchani



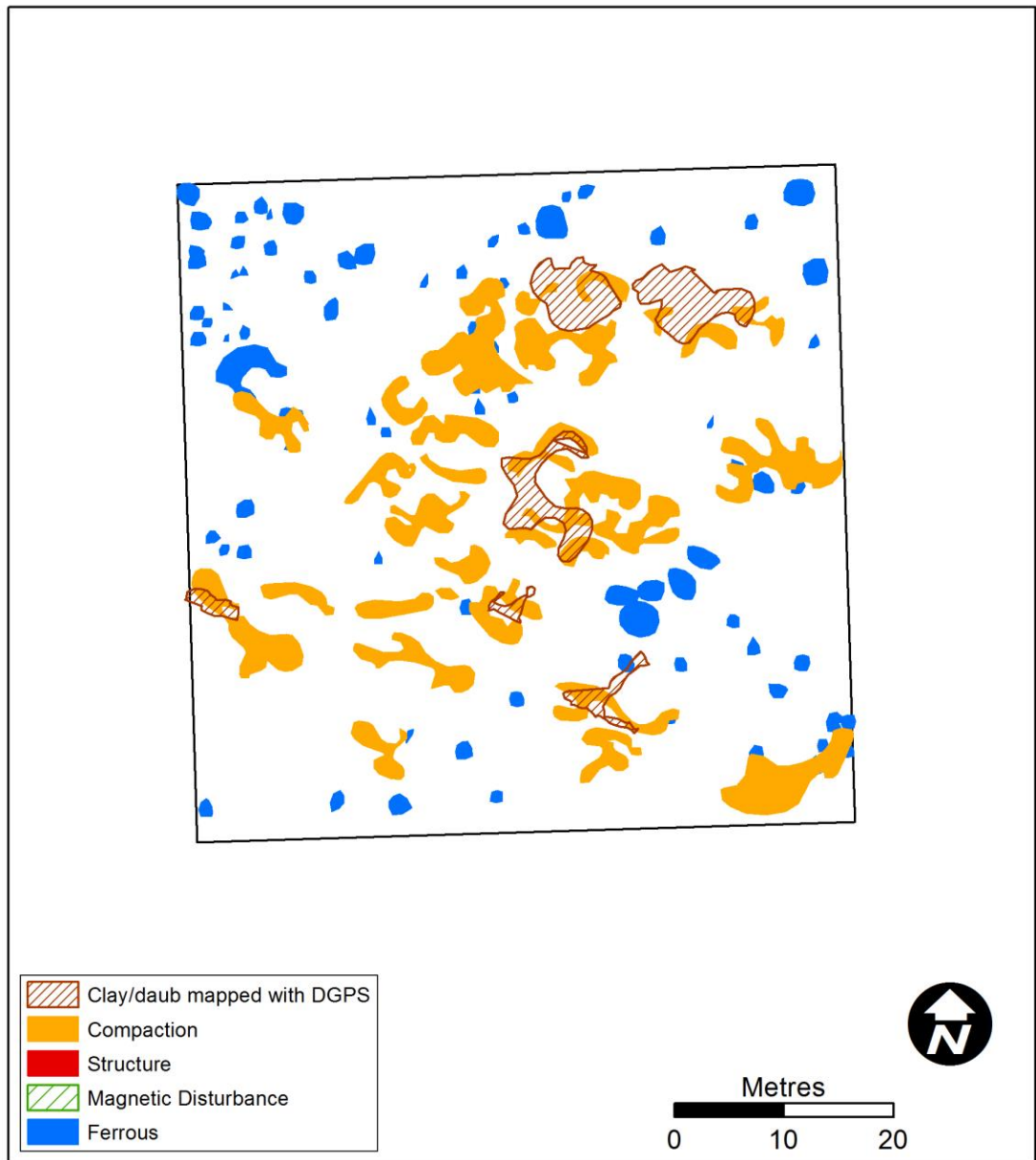
A. 13: Processed results of magnetic gradiometry survey of Area C, Fukuchani



A. 14: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area C, Fukuchani

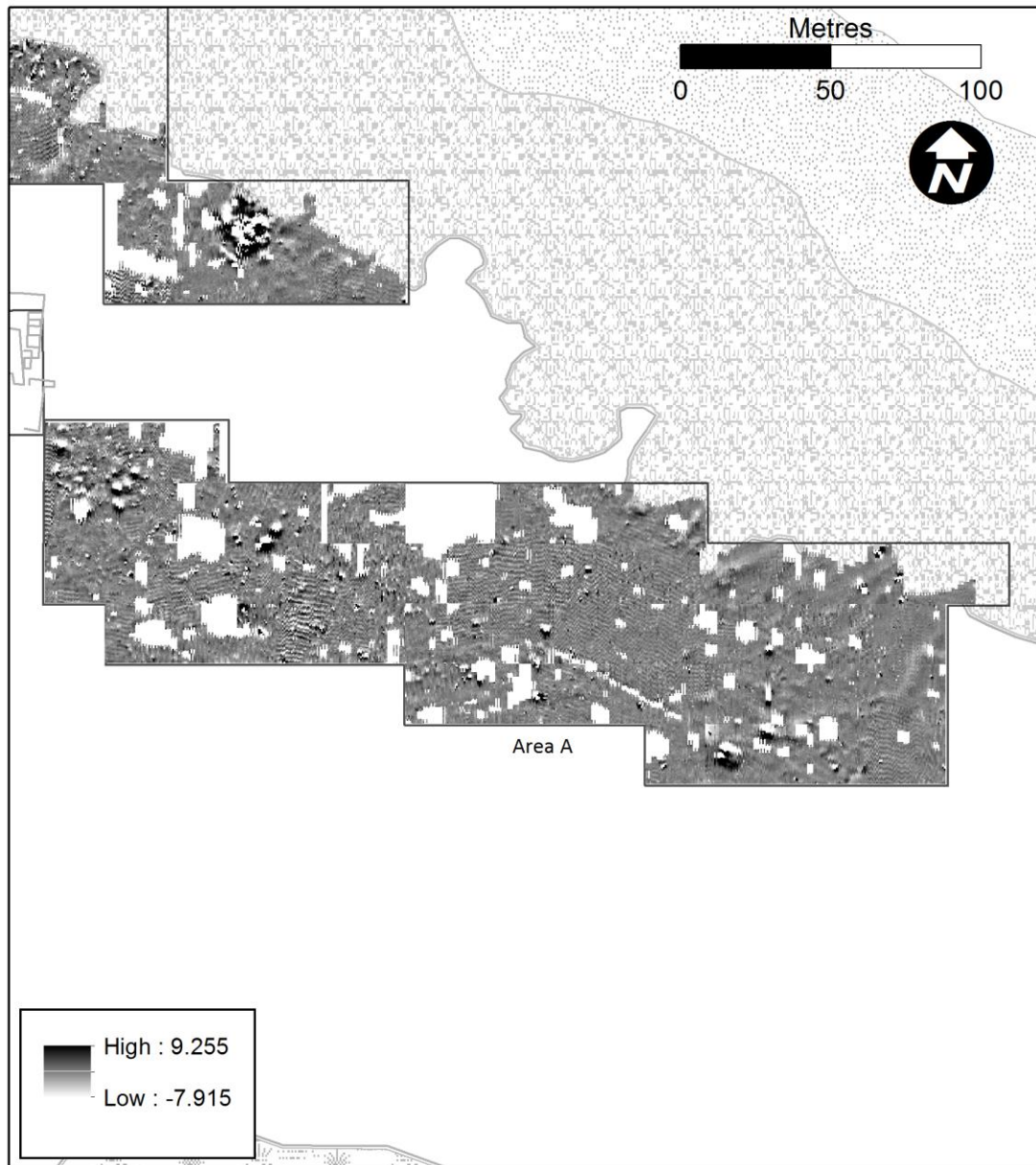


A. 15: Processed results of magnetic gradiometry survey of Area D, Fukuchani

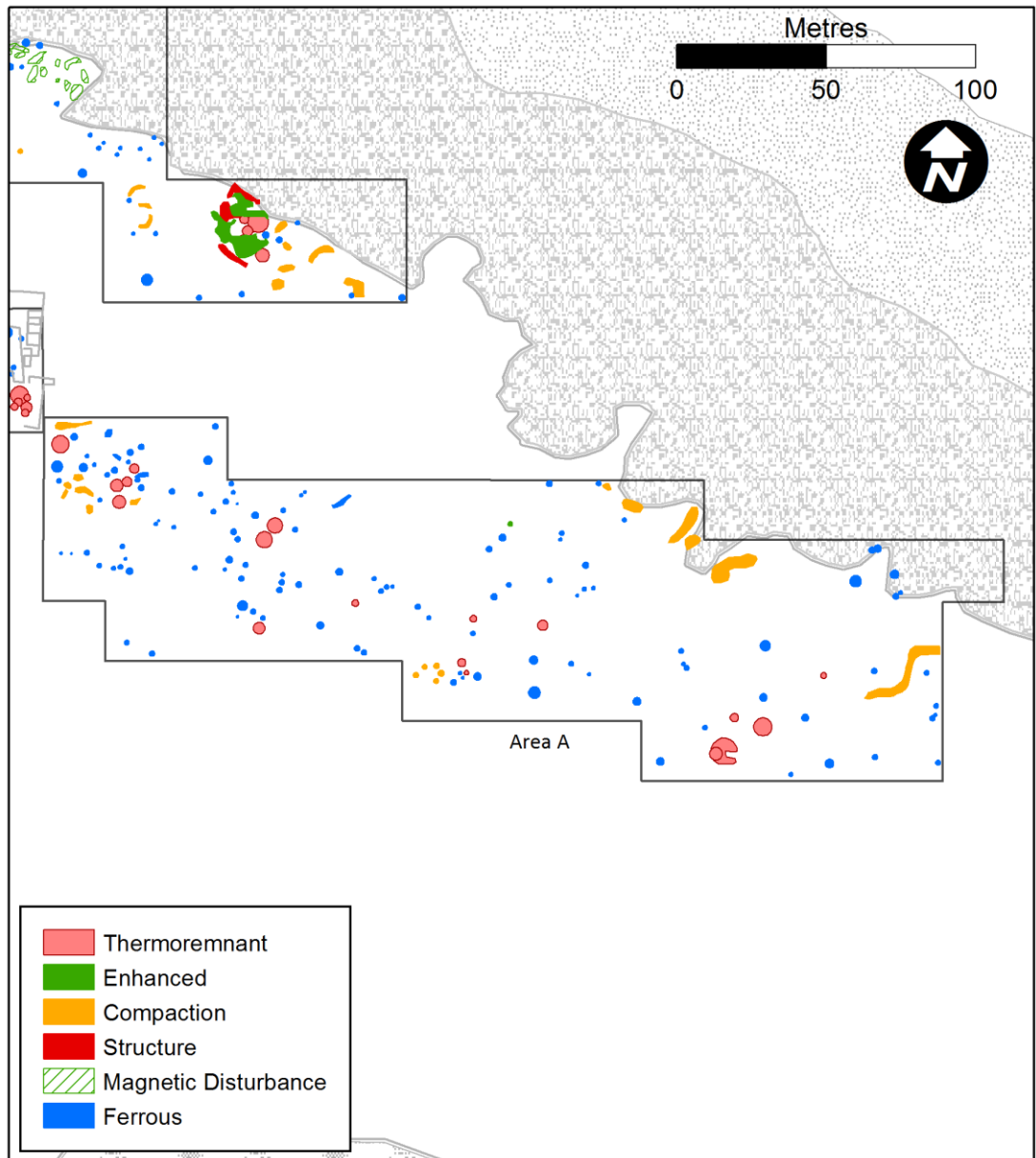


A. 16: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area D, Fukuchani

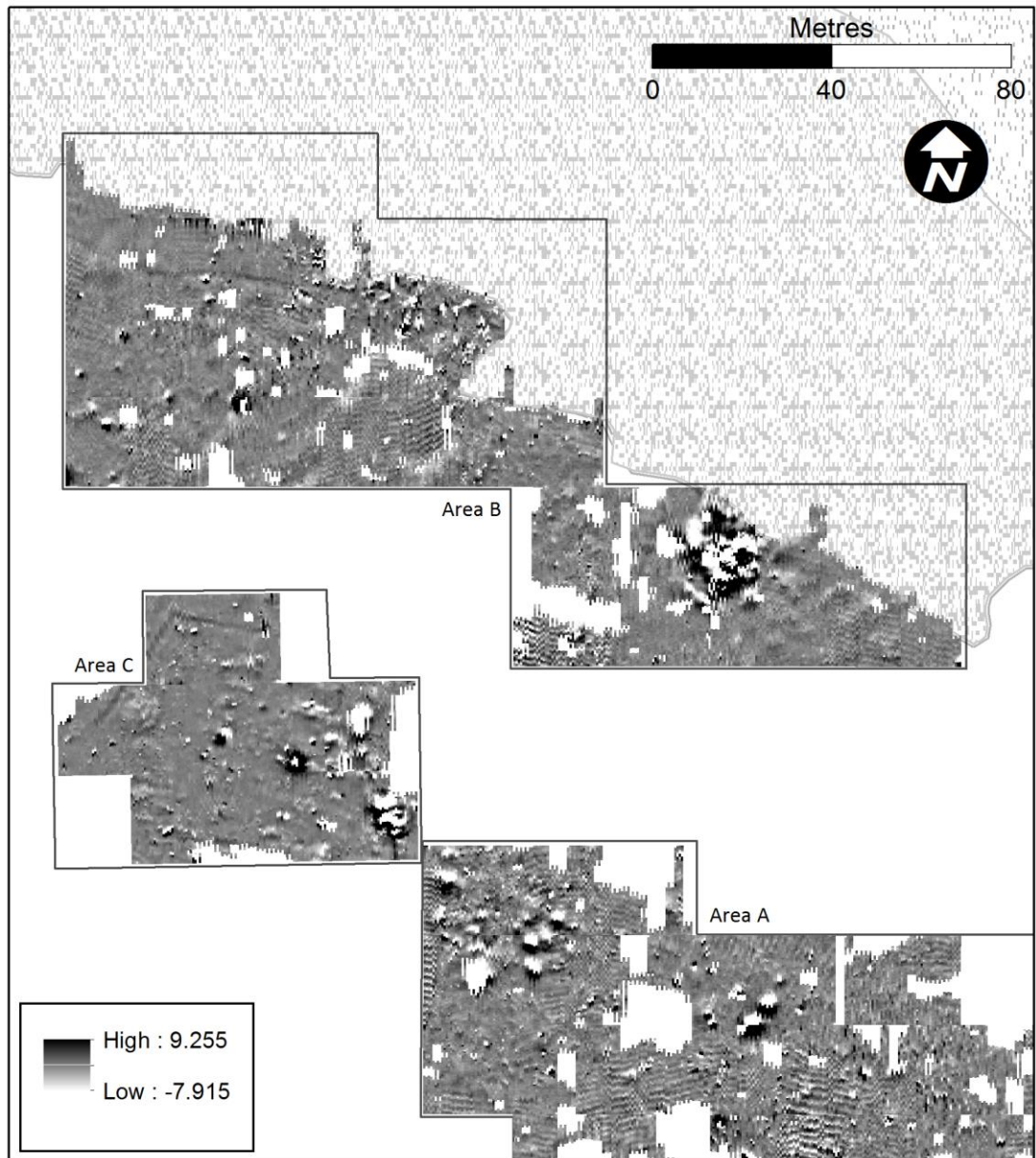
A.4 Magnetic Gradiometry results from Tumbe, Pemba



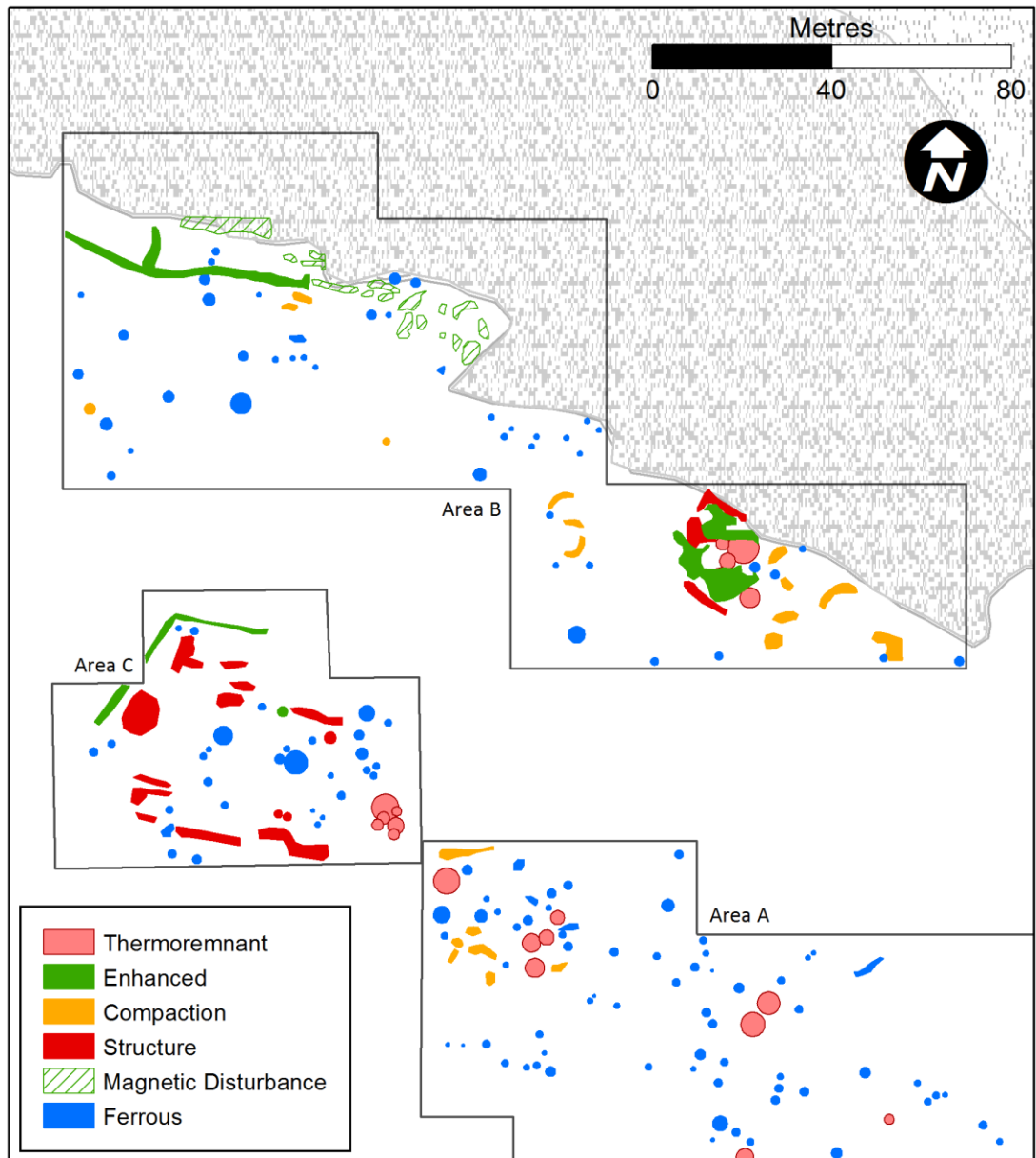
A. 17: Processed results of magnetic gradiometry survey of Area A, Tumbe



A. 18: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area A, Tumbe



A. 19: Processed results of magnetic gradiometry survey of Area B and C, Tumbe



A. 20: Interpretation of archaeological anomalies from results of magnetic gradiometry survey of Area B, Tumbe

Appendix B

The Zanzibar GIS

B.1 Introduction

Having discussed the methodology of the project in Chapter Three of this thesis, this appendix provides additional detail on the construction of the GIS database of archaeological data from Zanzibar; the various sources and limitations of data used to create the database and the ways in which data was processed for inclusion; and some of the problems encountered and solutions devised to deal with these issues. It is to be hoped that in providing useful, though extraneous technical data the methods described in this appendix might benefit other researchers and contribute to the development of field practice especially on the East African coast.

B.2 GIS in Archaeology

A Geographic Information System (GIS) is essentially a means of mapping spatial data, and displaying and analysing it according to various attributes assigned by the user. Data incorporated into a GIS can be stored as raster image files, where each pixel of the image may be assigned numerical values relating to a visible or physical attribute; or as point, line, or polygon vector shapefiles representing features, which can again be given numerical attributes such as elevations, or quantities or qualities related to the relevant area. Data can be plotted and created from scratch in a GIS, imported in a fully-processed state with coordinates and attributes already attached for ease of display, or in an unprepared digital format which can then be assigned coordinates and attributes. Such attributes can be used to display the data according to user-defined parameters, or for analysis using a broad range of mathematical tools and geoprocessing functions. For example, the coordinates of a site can be plotted as a vector shapefile in a GIS, assigned attributes based on the type of site represented, periods of occupation, or numbers and types of artefacts found, and these attributes can be used to display different attributes of the site on comparative maps, or to analyse the finds in a variety of ways. Geoprocessing options might include hydrological simulations to predict water flows and drainage areas across a landscape based on elevation and geological data; cost-time analysis of known or potential routes through a landscape based on the numeric representation of various landscape attributes; or viewshed analysis of visible areas from selected points. The flexibility of GIS means that they are a popular method of storing, analysing and displaying archaeological databases. The Zanzibar GIS constructed in the course of this research project provided a means of both storing and analysing data from a broad range of archaeological and historical sources, as well as testing the accuracy and usefulness of some of these sources against comparative datasets. The ability to plot

archaeological data at any scale enabled the direct comparison of primary survey and excavation data against digitised data from previous studies and published archaeological sources.

In order to understand the use and requirements of Swahili harbours, it is necessary to draw a series of inferences about the types of vessels that are likely to have utilised them, since the form and technology of the craft may have affected their choices about which harbours to visit, where to moor or beach, and how loading was conducted. The available evidence for boatbuilding traditions in the western Indian Ocean between the first and fifteenth centuries will be discussed in detail in Chapter Nine, but the general conclusion is that sewn-plank boats with square sailing rigs were common throughout the first and into the early second millennium (Blue *et al*, 2011; Flecker, 2001, 2008). The use of these technologies has implications for the strength and integrity of the hull, and for sailing and cargo capabilities. This in turn has an impact upon the requirements for port and harbour facilities, such as whether or not a shoreline is suitable for beaching of a given type of craft, or whether deep-water anchorage is required, which might lead to the construction of artificial mooring and loading facilities such as wharfs and jetties. Such decisions may be influenced by the topography of the shoreline, the orientation and exposure of a harbour, and the common or dominant maritime technology. One of the purposes of the GIS was therefore to examine the hydrography of the case study harbours, and compare these data to the predicted capabilities and uses of Swahili and visiting foreign vessels in the sixth - thirteenth centuries. To this end the GIS includes various sources of hydrographic data, including SRTM elevation data from USGS, digital bathymetric data from GEBCO, and scanned and digitised versions of eighteenth, nineteenth and twentieth century Admiralty hydrographic charts from the UKHO Archives in Taunton, Somerset.

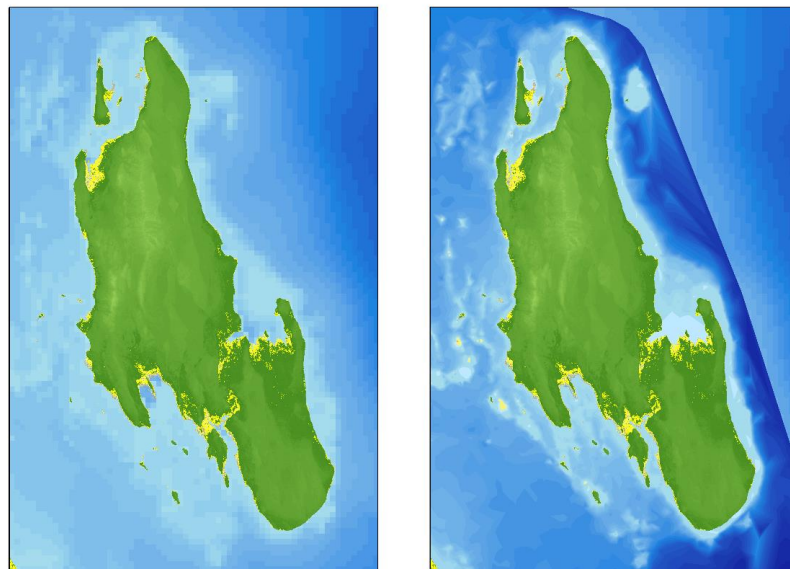


Figure B.0.1: Comparison of bathymetric data from GEBCO (left), and digitised Admiralty charts (right) demonstrating difference in resolution, particularly in shallow near-shore zones

Sean McGrail's (1997: 11) comments on the direction and focus of maritime archaeology included the maxim that the field should cover not only watercraft but also "the study of landing places, boatbuilding sites and all the other maritime structures found in the coastal zone". The methodology of the current thesis project was influenced by a number of maritime archaeological studies which adopt a similar position in the study of sailing and of port and harbour spaces. Peacock and Blue's (2007) study of Adulis, for example, draws on descriptions of other Red Sea ports in the *Periplus of the Erythraean Sea* to draw comparisons and commonalities between maritime practices, and to apply these in discussion to the reasons for the separation of harbour and town at Adulis. Due to circumstances beyond the investigators control, hinterland and palaeo-landscape survey were necessarily limited, and the emphasis of the project was on harbour facilities, with notes on the silting of lagoons and development of sandbanks at each harbour which might have affected their use. As will be discussed in the case study chapters of this thesis, such considerations may have relevance to the shallow harbours of Zanzibar and Pemba. Efforts were made to identify potential areas of sandbanks, mudflats and coral reefs at each of the case study sites through existing studies, field survey, and examination of satellite imagery, and to note the dominant features of each harbour in the GIS and in the case study chapters.

Whilst the process of urbanisation has become an increasing focus of study on the Swahili Coast since the 1980s, little has been made until now of the potential effects of urban changes on the maritime activity of the harbours. In contrast, a GIS access analysis of the connections between harbours and changing urban landscapes is the subject of Thomas Dhoop's (2014) examination of medieval European ports. This type of study could be of great use in assessing the effects of hypothesised changes in architecture, increasing urbanisation, and possible formalisation of trading spaces in Swahili settlements between the sixth and the thirteenth century, but unfortunately we do not yet have enough information on the nature and layout of early Swahili settlements. One of the intentions in constructing the GIS however was to begin pulling together as many different sources of settlement data for the early occupation period as possible, both for the discussion of the thesis and as a potential resource for future study. The GIS therefore includes georectified maps, survey data, and excavation plans from previous archaeological investigations of each of the case study sites, as well as the hydrographic sources outlined above.

Whilst wind strengths and directions have been used in the past to explain the seasonal patterns of merchants and sailing in the Red Sea (Casson, 1991; Facey, 2004) subsequent re-evaluations have indicated that such studies tend to underestimate the sailing ability or technologies of the relevant groups (Whitewright, 2007; Ward, 2007). By comparison, Thomas' (2009) analysis of Roman ports in the Red Sea notes the regular spacing of anchorages at five nautical miles apart (9.26 kilometres), and the possible system of cairns which may have been constructed as navigational aids along the

coast, as evidence of a deliberately constructed system of predictable navigational aids and reliable sailing support. The evidence may indicate some sense of a shared maritime community amongst both sailors and coastal settlers, lending further support to the concept of a continuous experiential landscape, rather than a total separation of landscapes and seascapes. Carmen Obeid has used concepts of maritime perspectives, and particularly the landscape-warping effect of coastal sailing, as the basis of a GIS analysis to try to predict the locations of 'missing' harbours in the eastern Mediterranean based on descriptions of voyages in historic texts and pilots, known archaeological sites, maritime hazards and winds, and hydrographic models. These studies helped influence the discussion in Chapter Eight of maritime approaches to harbours, which was based on the digitisation of hydrographic charts in the GIS and the use of nineteenth-century sailing pilots.

B.3 Processing of Survey Data

Whilst the GIS itself was constructed using ESRI ArcGIS 10, a commercial GIS package with a built-in suite of geoprocessing tools, various other programs were used as necessary to process certain types of data before they were imported into ArcGIS. The next two sections discuss the origin and processing of the various sources which were integrated into the project GIS. The following describes the various sources of survey data, and how they were collected and processed for inclusion.

B.3.1 GNSS Coordinate Data

As described in Chapter Three, coordinate data related to various topographic, structural, archaeological and survey features were recorded in the field using a Trimble Geo 7X GNSS system¹⁶. This data was downloaded after the completion of each season of fieldwork and post-processed for improved accuracy. Post-processing describes the method of differential correction to process out errors that might affect GNSS measurements in the field. GNSS positions are determined by comparing time-coded signals received from multiple (minimum of 4) networked satellites and triangulating a theoretical position based on the time taken between transmission and reception. Atmospheric disturbance, ground-level radio reflectance, receiver issues, and even minor errors in the orbital drift or atomic clock of a satellite can affect the accuracy of this calculation.

¹⁶ The Global Navigation Satellite System (GNSS) acronym refers to the use of any satellite navigation system. Although commonly known as a Global Positioning System (GPS), this in fact only refers to the US-owned NAVSTAR satellite network, a freely accessible, but originally restricted military system. Rival global systems are currently offered by the Russian GLONASS and European Union Galileo networks.

Post-processing involves the comparison of these time-coded signals to those received by a fixed reference station with known coordinates in the same region. Processing can be done in the field using a real-time Differential GPS signal broadcast by the reference station, or as post-processing after the fact using the recorded signal of the reference station. DGPS corrections are broadcast by various networks, but none are currently available within range of Zanzibar, the last local station having apparently ceased broadcasting in September 2013, three weeks before the first season of fieldwork at Unguja Ukuu (UNAVCO).

In order to post-process the GNSS data therefore, corrective signals relevant to each season of survey and recorded by the MAL2 International GNSS Service (IGS) reference station at Malindi were downloaded from the UNAVCO GPS Data Archive. The positions were then post-processed in comparison to this data using Trimble's dedicated Pathfinder Office software, and exported using the same software as ArcGIS compatible shapefiles. A small number of points could not be post-processed because of the in-field loss of satellite lock on the minimum four satellites whilst under partial cover from trees or structures. These were flagged by Pathfinder Office and automatically discarded from the dataset. All other points have their estimated accuracy before and after post-processing recorded in the relevant metadata and attribute tables, with an average estimated range of error <2m noted for each survey.



Figure B.0.2: Recording GNSS data on beach at Fukuchani, November 2013. Photo by J. Hawkes

B.3.2 Magnetic Gradiometry Data

As described in Chapter Three, magnetic gradiometry survey data from the three case study sites were downloaded using Bartington's proprietary Grad601 software, and processed in ArchaeoFusion, an experimental geophysics/GIS package from the Center for Advanced Spatial Technologies (CAST), University of Arkansas. Grid data was then assembled as a plot of the survey area and assigned WGS1984 coordinates for georectification based on post-processed GNSS coordinates recorded in the field. Grids were processed in batches as necessary for various corrections and filters. Processing was limited to destaggering to correct for minor differences in pace across each grid transect; zeroing of the mean per traverse to correct for minor drifts or differences between the dual arrangement of sensors; clipping of the data to optimise the image for viewing by reducing particularly high or low outlying readings to within 3 standard deviations of the mean across the survey area; and interpolation between traverses to account for the difference in survey resolution between the samples and traverse spacing, so that each pixel in the final image file represented .125 x 0.125m. The plotted results were then exported as both 'raw' unprocessed and processed geotiff image files for direct import into ArcGIS.

Once the plotted results of the gradiometry survey had been imported into the GIS database and their georectification checked against comparative sources, the data was studied to identify magnetic anomalies. Anomalous areas were marked in shapefiles created for each site, and flagged as positive, negative, bipolar, or dipolar anomalies in the attribute table of the shapefile. An assessment was then made of the possible cause of the anomalies based on their type, form, and plan or clustering across the site, and a further flag assigned in the attribute table to denote probable modern, archaeological, or unknown cause. These assessments were compared to known archaeological features in the area, modern features and contaminants noted during survey, soil marks in satellite and aerial imagery, and finally to the results of survey from the other case study sites to check for consistency and confidence in the analysis. This led in several cases to regrading of features based on this comparison, and led ultimately to a far better understanding of the nature and causes of both geological and archaeological magnetic anomalies. The results are included in the discussion of each of the relevant case study chapters as both raw and processed images, and with features highlighted. These results will also be published as individual articles to highlight the efficiency and potential usefulness of gradiometric survey in this type of context.

B.3.3 Kite Aerial Photography

Kite Aerial Photography (KAP) surveys were conducted at all three case-study sites in September 2015, with the aim of combining pedestrian surveys of the intertidal zone at low tide with the

creation of a photographic database of the harbour area. It was hoped that these aerial photographs would provide the basis for photogrammetry and a topographic model of the harbour basin. The process of KAP survey involved mounting a small, waterproof, Mobius digital action-camera on a picavet rig hung from a kite line, and capturing a long sequence of photographs at timed exposures whilst walking a systematic route across the coral shelf at low tide. More than 9000 still frames of aerial imagery were collected from each site, and observations were recorded during the walkover and flight to aid interpretation. Visual ground reference points were laid out before the flight and recorded using the Trimble GNSS to enable later georectification of imagery. These images were subsequently loaded into Agisoft PhotoScan Pro for photogrammetry.

Photogrammetry uses pattern-recognition algorithms to identify common features in multiple photographs, predict the location of the camera in each photo, and to construct a point-cloud model of theoretical spatial locations for each of the pattern-features. The point cloud can be assigned real-world coordinates using established markers in photos, edited and processed to remove outlying errors, and reprocessed in order to create a network mesh between points. This mesh can then be exported to form the basis of a DEM, along with a photomosaic composite draped over the DEM. Unfortunately, it was eventually established that the dense mangroves at Fukuchani and Tumbe, and reflections of bright sunlight from the surface of the sea and even in very small puddles in the intertidal zone at all three sites were creating an insurmountable problem for the photogrammetry software, and preventing sufficient pattern recognition to allow the creation of large point clouds. Various experiments to optimise the photos for processing and to mask sky and large reflective areas were made, but in spite of more than 2000 hours of attempted photogrammetric processing, only small areas of the beach at Fukuchani could be modelled. Whilst some attempt may still be made to control or solve the issue, it is recommended here for future reference that a dense network of ground-control points is likely to be necessary to overcome the issue of reflection on such a sandy, relatively featureless background. The issue of tidal debris and puddles also caused some problems in trying to integrate an experimental second set of photos from a second day of survey at Fukuchani, although this might be overcome by processing different days separately, and attempting to integrate and interpolate between the meshes of different areas in ArcGIS later on.



Figure B.0.3: Preparing kite for aerial photography survey with audience at Bandarikuu, Pemba.

Photo by Jennifer Tremblay-Fitton (2015)



Figure B.0.4: Aerial photo of intertidal zone at Tumbe, facing south-west towards Tumbe and Chwaka. Captured using Mobius digital actioncam on Picavet rig below kite. Photo by author (2015)

B.4 Processing of Digital and Digitised Data

The following section describes the digitisation, processing and incorporation of various spatial datasets into the project GIS, for comparison and analysis with the survey data described above.

B.4.1 Published Archaeological Data

The published results of several previous archaeological surveys and excavations of each of the three case study sites were incorporated into the GIS to provide a comparative source of archaeological data. Maps and plans were scanned at high resolution and georectified in ArcGIS based on a combination of published coordinates and recognisable permanent topographic or structural features which could be identified during field survey, or in satellite imagery and other incorporated spatial datasets.

B.4.2 Landform and Spatial Datasets

For the creation of regional maps of the archipelago, vector and raster files representing various landform types were obtained from a variety of sources. Coastal outlines of the Zanzibar Archipelago were extracted from the Global Self-consistent Hierarchical High-resolution Geography (GSHHG) dataset. This is a not-for-profit project offering a global, freely available database of vector shapefiles created through the combination of the CIA world database WDBII, and ocean-land shorelines derived from the US National Oceanic and Atmospheric Administration (NOAA) World Vector Shoreline (WVS) project. The dataset is available in 5 scales of resolution, ranging from coarse to fine, in which fine represents a horizontal resolution of approximately 100m. This resolution was good enough for maps and display at a large scale for archipelago-wide analysis, but not high enough for mapping at smaller scales focusing on regions on a single island.

For small-scale mapping of individual sites, coastlines and certain features were mapped using vector files plotted by tracing required features from high-resolution satellite imagery, and checked and georectified where necessary against survey points and features collected in the field using a Trimble Geo 7X handheld GNSS system, post-processed for sub-metre accuracy. The sources used for tracing landforms was a combination of Google Earth Pro and Landsat 8 multispectral imagery. Features were traced by eye as KML vector files in Google Earth Pro, converted to shapefiles and imported into ArcGIS. KML files contain coordinate attribute data in the same way as ESRI shapefiles, so that the landforms should be automatically displayed in the correct location in ArcGIS. The position accuracy of these vector files was verified and corrected where necessary in ArcGIS by

comparing the digitised landforms against 15m resolution Landsat 8 imagery, orthorectified and downloaded without charge from the US Geological Survey (USGS), and against the aforementioned survey data.

B.4.3 Elevation Data

A Digital Elevation Model (DEM) is a single dataset containing elevation data for a broad region, and which is usually stored in a GIS as a raster or GRID image file, or as a vector surface model such as a Triangular Irregular Network (TIN), a mesh created by drawing triangular polygons between known points of elevation. Various sources and agencies provide DEMs for download online in ready processed image formats, which are provided with coordinates related to their position on a known geographic or projected global coordinate system, and pixels are attributed values relating to their representative height above a datum. DEMs can also be user-compiled by inputting (individually or in bulk from text or spreadsheet files) X and Y coordinates and Z elevations, or by digitising and tracing contour lines with elevations from maps. These sources can then be used to create DEM image files or TIN models.

The Digital Elevation Model used for most of the analysis in this thesis was the SRTM DEM V4 released in 2014 by the NASA Jet Propulsion Laboratory (JPL) and the US National Geospatial-Intelligence Agency (NGA). This is a near-global topographic model derived from the compilation and corrective processing of shuttle-mounted, stereoscopic radar measurements taken in February 2000 as part of the NASA Shuttle Radar Topography Model (SRTM) mission (LP DAAC 2015, 3). The dataset covers almost the complete globe, from 60 degrees north to 54 degrees south, and whilst the original ground resolution of the dataset was approximately 90m (3 arc seconds) subsequent processing and refinement against multiple overlapping passes and alternative data sources means that Version 4 of the dataset now has a ground resolution of approximately 30m (1 arc second) (LP DAAC 2015). Comparison of this dataset to alternative sources, such as the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global DEM from NASA and Japan's Ministry of Economy Trade and Industry (METI), demonstrated that although the ASTER GDEM had a design resolution of 30m compared to the 90m resolution of the SRTM dataset, the Zanzibar dataset contains serious vertical errors in its elevation data. ASTER is an optical system, and anomalous elevations in the ASTER, the result of optical observations of dense cloud cover, mean that areas of lowland plain known to lie approximately 13m above sea level on the west coast of Zanzibar appear in the ASTER GDEM as mountains over 300m high, whereas the radar system of SRTM penetrated similar cloud cover without issue (LP DAAC 2015, 5). The fact that these errors have not yet been corrected in the ASTER dataset is due in part to a relative lack of corrective GPS and mapping data in East Africa, and probably in part to the low-priority status assigned to the region when processing

compared to North America, Europe, and Asia. They are likely to be corrected in a future version of the dataset, but at present, the older SRTM dataset, first released in 2004 and subsequently updated to Version 4 in 2014, is the more reliable source, having been processed more fully and frequently against comparative data sources compared to the relatively recent release of ASTER in 2009.

There are still some issues which need to be addressed in the SRTM dataset however, and one in particular which is of relevance to this project. During the NGA's early processing of the data, it was discovered that whilst sharp topographic features had caused topographic 'shadows' which left unrealistic and inaccurate 'sinkholes' in the DEM, areas with a low profile, such as deserts and large bodies of water, were scattering the radar signal and reflecting very little of the return back to the shuttle-mounted array, and creating further no-data holes in the DEM. Topographic shadows and sinkholes were processed out using a combination of existing maps and interpolation of slopes between known points of elevation (LP DAAC 2015, 4). Holes and false-positive and negative elevations in water bodies were corrected by applying a uniform measurement representative of the surface of the water up to the edges of the feature, so that areas within delineated seas and oceans in the DEM register as 0, representing mean sea level. The edges of these waterbodies were identified and delineated though using existing maps and spatial datasets in the US, or Landcover vector files derived from low-resolution, optical imagery from the Landsat 5 satellite, collected a decade earlier than SRTM (USGS 2015). Areas with good spatial datasets suffered little from this process, but the coast of Zanzibar, like much of continental Africa, has few high-resolution spatial datasets which were not derived from the automated, algorithmic selection process using low-resolution Landsat 5 imagery, and consequently the vector and raster representation of coastlines is both low-resolution and frequently inaccurate. Due to their colour and wavelength reflectance, areas of mangrove, for example, which may extend some distance from the shoreline, often register as landforms in selection algorithms, and retain positive, apparently terrestrial values, whilst low lying exposed beaches and reefs are sometimes clipped out of the dataset *altogether*, rather than appearing as an integral area of the coast. This issue means that the SRTM dataset, although currently the most accurate terrestrial DEM available for Zanzibar and marking some offshore islands, does not accurately represent the fringing reef and sandbank shorelines of the archipelago. Some of these issues have been corrected by third parties working with alternative elevation datasets, and one particular such 'hole' in the coastal SRTM data of Pemba was filled using a cross-referenced patch obtained from Viewfinder Panoramas (de Feranti 2014).

B.4.4 Hydrographic Data

In comparison to the DEM, the dangers posed to shipping by shallow coastlines, sandbanks, and reefs means that the seabed and shorelines of the Zanzibar Archipelago have been relatively well

mapped on several occasions between the mid-nineteenth and mid-twentieth centuries by the United Kingdom Hydrographic Office (UKHO) on behalf of the British Admiralty. Hydrographic charts provide navigational aids for shipping, and therefore record both the bathymetric depth of the seabed through soundings, and the positions of coastlines, hazards to shipping such as reefs and sandbanks, and prominent landmarks such as towers, lighthouses, or clearly defined topographic horizons such as hills which can be used by navigators or ships-pilots in plotting their relative positions to such features whilst under sail. Modern digital charts remain under license and copyright to the Admiralty brand, and are not openly available except through annual subscription services. However, since the last detailed and high-resolution survey of the Zanzibar Archipelago was conducted in 1961, the original hand-drawn and annotated chart, as well as previous surveys, were available for study through the UKHO archives. Between the UKHO's headquarters in Taunton, Somerset, and The National Archive at Kew, the new home of the archive, the collection contains over 600,000 surveys, books, charts, and files dating back to the establishment of the Hydrographic Office in 1795, most of which are freely available for examination by researchers by arrangement. In order to allow a meaningful archaeological analysis of both the navigation of the harbours around Zanzibar and the terrestrial access to, and occupational use of the coast, hydrographic charts of Zanzibar were examined for relevance and photographed with permission in the UKHO archive using a Canon D1000 DSLR on a tripod. A selection of these charts were digitised and integrated in the project GIS (Admiralty 1875a, 1875b, 1878a, 1878b, 1880, 1881, 1897, 1951, 1958, 1967). The digital photographs were imported into ArcGIS and georectified against Landsat 8 imagery to ensure that the landforms and hydrographic features matched, and soundings and relevant features from the charts were traced as vector shapefiles.

Prior to the introduction of metric measurements in 1967, Admiralty charts usually recorded depths in fathoms and feet, a fathom representing 6 feet (although until 1795 the definition of a fathom may have varied between 5 and 6 feet depending on the class of ship), whilst distances might have been noted in nautical miles, cables, or feet. Chart datums and systems of measurement are generally noted on individual charts however, and all of the UKHO charts used in the production of this thesis were originally plotted with soundings (spot depths) recorded as fathoms below a chart datum, or in fathoms and feet for depths of less than 11 fathoms on charts made in the 1950s. The chart datum for soundings is usually the average maximum low water mark measured during survey, or Mean Low Water Spring (MLWS). Chart E9078, for example, includes a note to the effect that tidal measurements were taken against a pair of tide-post established on the shoreline and observed over a period of 29 days in order to establish the MLWS, representative of the probable lowest ebb of the tide, and the MHWS. The tide-posts were referenced to an engraved brass plate benchmark "cemented into the upper step of the verandah of the Government Rest House Mkokotoni" (Chart ref., 1951), and all triangulated depth soundings taken during the survey were then reduced to 30 feet below the benchmark, with the result that a measurement of zero on the chart represents the

Mean Low Water Spring mark (MLWS) as measured during creation of the chart. Underlined numbers underlined along shorelines represent the average height of reefs and beaches above the low-water datum in feet. Occasionally, notable landforms further inland may also be marked with their height, taken from either triangulations from a datum point or, as noted in the annotation of Chart E9078, from stereoscopic aerial photographs. In this it is important to note that the datum benchmark for the charts elevations may or may not be the same as that used for the bathymetric survey. Chart E9078 notes that prominent landmarks are measured in feet above the MHWS, compared to the bathymetric datum of the MLWS, a vertical difference which is recorded on another chart as potentially as much as 15 feet (4.5 metres).

For the purpose of the thesis it was of interest to be able to digitise the hydrographic profile and features of the harbour, and to integrate and compare the terrestrial and marine datasets directly. At this point, the issue of the delineation and flattening of waterbodies in the SRTM dataset became a minor issue, since it was not clear whether the datum used for the SRTM dataset would match either of the MHWS or MLWS used for the UKHO topographic and bathymetric data respectively. To illustrate the comparative issues of the datasets, the clipping of the SRTM dataset means that although the cliffs above the beach are visible in the dataset, the very extensive, shallow beach that lies in front of the early Swahili settlement at Mkokotoni has been flattened by the delineation of the coastline, and appears to be a uniform sea level of 0m. By comparison, hydrographic charts of the coastline around Mkokotoni show an extensive and broad beach, numerous sandbanks and shoals, and both shoreline and underwater coral reefs, but do not record the height of the cliffs which mark the edge of the coastline on the DEM.

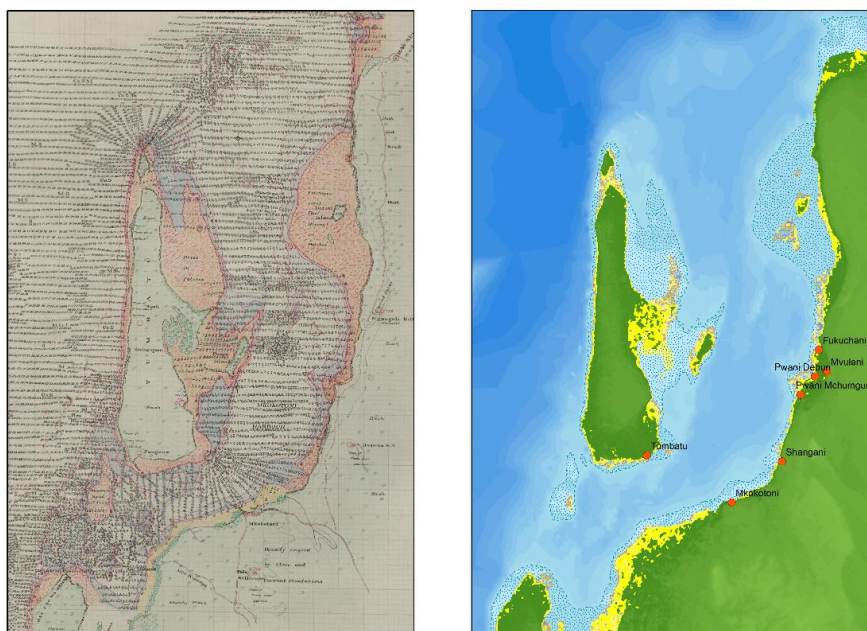


Figure B.0.5: Comparison of Admiralty chart E9078 (1951), and hydrographic DEM of Mkokotoni Harbour, based on digitisation of soundings from multiple Admiralty charts

Admiralty Chart E9078 records that a brass benchmark plaque was established during the hydrographic survey of northern Unguja by the HMS Dalrymple in 1951, and set into the steps of the verandah at the Government Rest House at Mkokotoni. Using the 30 foot reduction of the MLWS from the benchmark noted on Chart E9078, it should in theory have been possible to record both this brass benchmark and the low water tide line using a DGPS or Total Station, in order to establish common reference data between the SRTM DEM and the hydrographic charts. However, following the independence of Zanzibar in 1963 the use of the building changed, and although the building of the former Government Rest House is still standing in Mkokotoni, the brass benchmark plaque appears to have been removed. Furthermore, it is not certain which of three verandahs on the building, of various heights, was being referred to, although evidence of differential discolouration on the cement suggests that it is likely to have been the southern-most platform. The benchmark could therefore not be used as a point of reference for field measurements. As a compromise, the area in front of the verandah at the former government building was marked in the GIS, and a general height was extracted from the SRTM DEM. The structure stands a short distance from the top of the cliff above Mkokotoni beach, overlooking the harbour, and the SRTM DEM indicates a height of 13m ASL at the site of the Rest House. Elevations from the area around demonstrate that this is a measurement representative of the terrain, rather than the height of the top of the building itself. Elevations were also extracted from the SRTM DEM at prominent topographic features which had been marked and measured on the chart, such as Pale Hill, which showed that the topographic measurements of the two datasets were consistently accurate to within 1.5m of each other, a difference which is likely to have resulted from the 30m resolution of the SRTM DEM, and rounding of elevations to integers in different measurement systems; to metres in the SRTM DEM, and to feet on the hydrographic chart. A comparison of the SRTM coastline with landsat imagery and primary survey data showed that other parts of the coast had been less closely clipped. At Unguja Ukuu, for example, a 200m wide section of the broad intertidal coral platform was clearly visible, although rounding to integers of elevations has distorted the profile slightly. Unfortunately, this platform appears to have been a low priority during the hydrographic survey that covers this area, and comparative readings were not available. It was however possible to extract comparative measurements from both sources along the coastlines of Fukuchani and Tumbatu and these indicate a variation between the MLWS of the hydrographic charts and the ASL of the SRTM DEM of between 0.3 - 2m, a range which is again likely to be the result of mathematical averaging, tidal variation, and human error. On this basis, and because of the frequent gaps between the intertidal measurements of the hydrographic charts and the coastline elevations of the SRTM, the two datasets were not merged into a single DEM, but the coloured symbology representing the elevations and depths of each were altered to follow each other, so that although quantitative analysis was deemed fallible due to the range of error, continuous qualitative assessment of the profile and nature of the coastline would still be possible.

Glossary of Terms and Abbreviations

DEM: Digital Elevation Model. Usually a raster image dataset of ground-level elevation measurements. By comparison a Digital Terrain Model (DTM) may include elevations of buildings, structures, and vegetation canopies.

GEBCO: The General Bathymetric Chart of the Oceans is an international coalition of marine experts working to develop a range of authoritative, high-resolution, and publically-available bathymetric data sets. The GEBCO dataset used in this thesis was extracted from the most recent version of the global GEBCO_2014 bathymetric model.

SRTM: Shuttle RADAR Topography Mission. A NASA project to create a global elevation database, using shuttle-mounted RADAR reflectance data. The SRTM dataset used in this thesis was extracted from the most recent SRTM V4 Digital Elevation Model.

MHWS: Mean High Water Spring. The average high water mark measured during new- or full-moon spring tides in a given period. Sometimes compared to Mean High Neap tides, which are measured during half-moon phase neap tides.

MLWS: Mean Low Water Spring. The average low water mark measured during new- or full-moon spring tides in a given period. Sometimes compared to Mean Low Water Neap tides, which are measured during half-moon phase neap tides.

UKHO: The United Kingdom Hydrographic Office (UKHO) collects and supplies hydrographic and geospatial data for the Royal Navy and merchant shipping, to protect lives at sea, trading as ADMIRALTY Maritime Products & Services. The UKHO is an executive agency, sponsored by the Ministry of Defence.

USGS: United States Geological Survey. The American national science agency dedicated to the survey and study of the landscape of the United States, but which is also responsible for producing, processing and archiving a wide array of geographic datasets on a global scale.

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