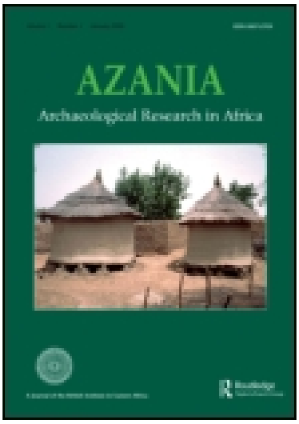

Azania: Archaeological Research in Africa
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/raza20

Exploring agriculture, interaction and trade on the eastern African littoral: preliminary results from Kenya

Richard Helm [a], Alison Crowther [b], Ceri Shipton [c], Amini Tengeza [d], Dorian Fuller [e] & Nicole Boivin [b]

[a] Canterbury Archaeological Trust, 92a Broad Street, Canterbury, CT1 2LU, United Kingdom

[b] Research Laboratory for Archaeology and the History of Art, University of Oxford, South Parks Road, Oxford, OX1 3QY, United Kingdom

[c] School of Social Sciences, University of Queensland, St Lucia, 4072, Australia

[d] Coastal Forest Conservation Unit, National Museums of Kenya, PO Box 596, Kilifi, Kenya

[e] Institute of Archaeology, University College London, 31-34 Gordon Square, London, WC1H 0PY, United Kingdom

Available online: 27 Feb 2012

To cite this article: Richard Helm, Alison Crowther, Ceri Shipton, Amini Tengeza, Dorian Fuller & Nicole Boivin (2012): Exploring agriculture, interaction and trade on the eastern African littoral: preliminary results from Kenya, Azania: Archaeological Research in Africa, 47:1, 39-63

To link to this article: http://dx.doi.org/10.1080/0067270X.2011.647947

Azania: Archaeological Research in Africa
Vol. 47, No. 1, March 2012, 39–63

Exploring agriculture, interaction and trade on the eastern African littoral: preliminary results from Kenya

Richard Helm[a]*, Alison Crowther[b], Ceri Shipton[c], Amini Tengeza[d], Dorian Fuller[e] and Nicole Boivin[b]

[a]*Canterbury Archaeological Trust, 92a Broad Street, Canterbury CT1 2LU, United Kingdom;* [b]*Research Laboratory for Archaeology and the History of Art, University of Oxford, South Parks Road, Oxford OX1 3QY, United Kingdom;* [c]*School of Social Sciences, University of Queensland, St Lucia, 4072, Australia;* [d]*Coastal Forest Conservation Unit, National Museums of Kenya, PO Box 596, Kilifi, Kenya;* [e]*Institute of Archaeology, University College London, 31–34 Gordon Square, London, WC1H 0PY, United Kingdom*

There is a growing interest in transoceanic connections between prehistoric communities occupying the Indian Ocean rim. Corroborative and well-sequenced archaeological data from eastern Africa have, however, been notably lacking. Recent excavations by the Sealinks Project in the coastal region of Kenya has sought to redress this imbalance by collecting base-line data on the local communities occupying this region between *c.* 1000 BC and AD 1000. Although our analyses are still preliminary, the quality of faunal and botanical material recovered demonstrates considerable potential for exploring local interactions and transitions between early hunter-forager and food-producing communities. A key finding in this regard was the identification of a suite of African crops (*Sorghum*, *Pennisetum* and *Eleusine*) at first millennium AD farming and hunter-forager sites, providing the first significant evidence for early agriculture on the Kenyan coast and the role of crops in forager-farmer trade. Other material data, notably the transfer of marine shell and glass beads inland, and the use of ceramics, indicate a tentative correspondence between the increased intensity of such local interactions in the latter half of the first millennium AD and the emergence of wider Indian Ocean connections.

Keywords: prehistoric archaeology; African crops; Later Stone Age; Early Iron Age; Middle Iron Age; Kenya; eastern Africa; Indian Ocean

Récemment, les liaisons transocéaniques entre les communautés préhistoriques vivant autour de l'Océan Indien ont de plus en plus attiré l'attention. Il subsiste néanmoins pour l'Afrique Orientale un manque de données archéologiques solides et chronologiquement bien calées. Les fouilles récentes du projet Sealinks sur la région côtière du Kenya ont pour but de combler cette lacune, en collectant des données sur les sociétés qui occupèrent cette région entre 1000 av. J.C. et 1000 ap. J.C. Bien que nos analyses soient encore préliminaires, la qualité des éléments fauniques et botaniques prélevés démontre un potentiel considérable pour l'étude des interactions locales et des transitions entre les sociétés de chasseurs-cueilleurs et d'agriculteurs. Une des découvertes les plus importantes à cet égard fut l'identification d'une série de cultures agricoles africaines (sorgho, pennisetum et éleusine) sur des sites du premier millénaire ap. J.C.

*Email: richard.helm@canterburytrust.co.uk

ISSN 0067-270X print/ISSN 1945-5534 online

http://dx.doi.org/10.1080/0067270X.2011.647947
http://www.tandfonline.com

occupés par des chasseurs-cueilleurs et des agriculteurs, fournissant les premières données conséquentes concernant l'agriculture sur la côte kenyane et le rôle des cultures dans les échanges entre cueilleurs et agriculteurs. D'autres éléments, notamment le transport de coquillages marins et de perles de verre à l'intérieur des terres, ainsi que l'utilisation de la céramique, suggèrent peut-être une correspondance entre l'intensification de telles interactions locales dans la seconde moitié du premier millénaire ap. J.C., et l'émergence de plus larges réseaux de l'Océan Indien.

Introduction

Despite long term interest in the nature and origins of the early Swahili communities of eastern Africa, and the potential archaeological correlates of Indian Ocean trade with Azania described in Classical sources, the early archaeology of the eastern African littoral remains surprisingly under-studied (Sutton 2002; Sinclair 2007). In particular, the first century AD *Periplus of the Erythraean Sea* (Casson 1989), a navigational and commercial guide to the Indian Ocean that has proven reliable in its accounts of other parts of this wider region, describes trade between the Classical world and Azania, the stretch of coast south of the Horn of Africa as far as modern-day Tanzania. The text's account of Azania is limited, but describes trade, particularly between southwestern Arabia and Azania, featuring the import of iron implements, wine, grain and glass beads in exchange for ivory, rhinoceros horn and turtle shell. The region is said to have been subject to a southern Arabian king, and the text describes intermarriage between local communities and Arab traders, who apparently became fluent in the local language. Despite occasional claims for material links to the Classical world in archaeological assemblages in eastern Africa (Chami and Msemwa 1997; Kessy 1997; Chami 1999a, 1999b, 2005, 2006; Juma 2004; Sinclair *et al.* 2006), evidence for Classical period trade is largely lacking on the ground (Horton and Middleton 2000). The inclusion of eastern Africa in the Indian Ocean sphere of interaction only becomes archaeologically visible with the advent of early Swahili urbanised towns in the later first millennium AD.

Archaeological research on the late Holocene of eastern Africa has tended to focus on the highly visible urban coastal settlements, characterised by standing coral stone structures and long-term occupation (Fleisher and LaViolette 1999). The absence of evidence for earlier urban settlements may be indicative of trade and interaction with small-scale communities of farmers, pastoralists, and perhaps hunter-foragers in the late centuries BC and early centuries AD. In addition, the absence of early sites directly on the coast, in Kenya at least, suggests that archaeologists may also need to consider the coastal hinterland and its role. There is, furthermore, a need to understand early interactions and trade links better *within* the coastal region upon which wider Indian Ocean linkages would have drawn and probably intensified (Kusimba and Kusimba 2005; Wright 2005). Finally, there is also a need for archaeobotanical study in eastern Africa, particularly for non-urbanised sites (cf. Walshaw 2010). Not only is the *Periplus*' description of grain imports unsubstantiated, so too is the assumed arrival of crops with the Bantu agriculturalists who have been linked to early Iron Age settlements. Interestingly, the *Periplus* seems to allude to the import of grain, probably wheat and/or barley, both of which are exotic relative to local crops in eastern Africa, suggesting that the long-term history of cultivation in the region remains to be investigated through the methods of archaeological science.

To begin addressing these lacunae, excavation has been initiated by the Sealinks Project[1] at coastal and coastal hinterland non-urban localities in Kenya and Tanzania. In the 2010 Kenya season, three localities were selected for excavation: two Later Stone Age (LSA) rockshelter/caves at Panga ya Saidi and Panga ya Mwandzumari, and an Early to Middle Iron Age (EIA–MIA) open settlement at Mgombani (Figure 1). These sites were selected because they are located in a fertile zone conducive to cultivation and because previous excavation had indicated that at least one (Mgombani) had the potential to preserve botanical remains. All three localities are located in Kilifi District and situated on the Dzitsoni Uplands, a 3 km wide range of Kambe Formation limestone hills. This runs parallel to the coastal littoral approximately 15 km inland and reaches heights of 100–200 m above mean sea level (asl). This environment is characterised by scattered limestone outcrops and

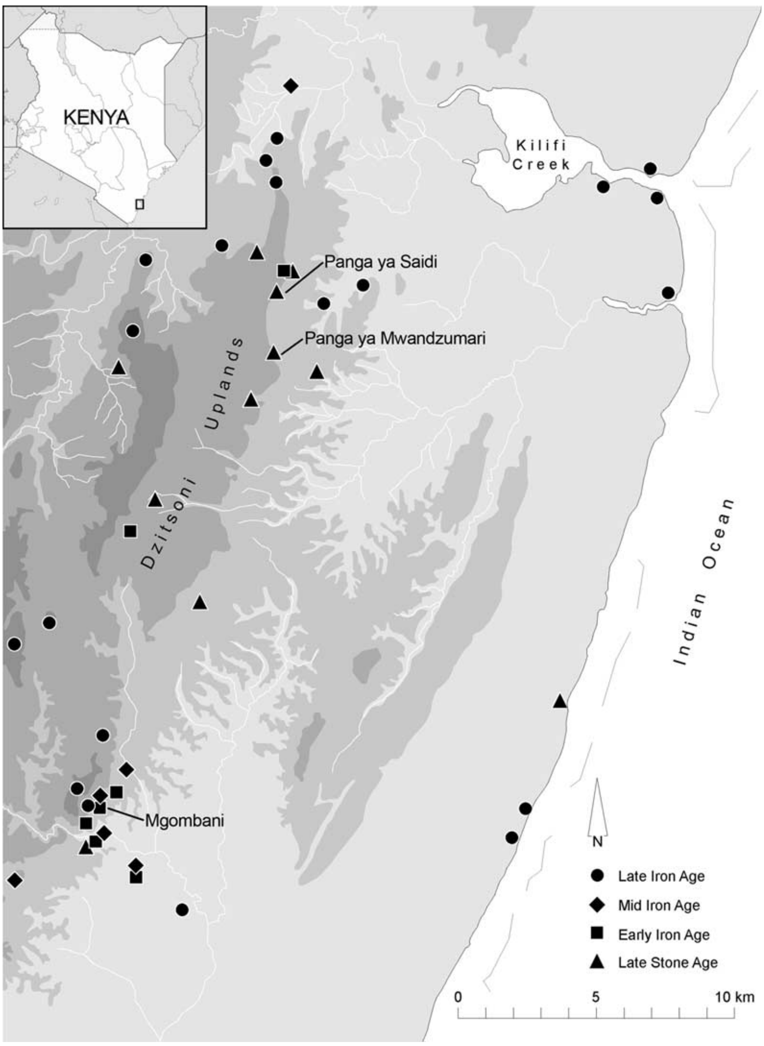

Figure 1. Map showing location of excavated localities, and the distribution of known LSA, EIA, MIA and LIA sites in the study region.

forested hilltops, both of which hold particular cultural importance to the area's present day inhabitants, the Mijikenda (Soper 1975; Spear 1978; Mutoro 1987, 1994; Robertson 1987; Robertson and Luke 1993; Willis 1996; Helm 2000a, 2000b, 2004; Githitho 2003). The relative fertility of the soils formed on this limestone has resulted in a densely populated agricultural zone, where coconut plantations are mixed with cashew, mango, citrus and banana trees, and maize, cassava and rice cultivation, the latter grown more in the valley bottoms (Waaijenberg 1987, 1994).

Populating the coast of Kenya

A preliminary understanding of the rich cultural heritage evident on the coastal hinterland of Kenya has been developed as part of an earlier study by Helm (2000a, 2000b, 2004), following the pioneering work initiated by Soper (1975) and Mutoro (1987, 1994). The emerging picture, while incomplete, is of a mosaic of continuous and increasingly complex occupation and interaction from at least the LSA onwards (cf. Kusimba and Kusimba 2005).

The Dzitsoni Uplands appear to have been a favoured location for LSA people, with a concentration of sites occupying rockshelters and caves on its once forested eastern edge, overlooking what would have been a lowland savanna environment (Moomaw 1960; Boxem *et al.* 1987). The distribution of known EIA settlement during the first half of the first millennium AD suggests that EIA communities were attracted by the same locational parameters as the LSA groups. It is likely that this choice was influenced by the high resource variability and soil fertility that characterises this region today (Helm 2000a, 83–86). As such, the Dzitsoni Uplands provide an excellent study region in which to explore both the processes underlying transformations between the LSA, EIA and MIA periods and the potential role played by both regional and wider Indian Ocean connections in eastern Africa.

In contrast to the settlement pattern now evident from Tanzania (Chami 1999b, 2006; Pollard 2008) and Mozambique (Sinclair *et al.* 2003; Sinclair 2007), no Iron Age settlement earlier than the eighth century AD has yet been identified on the coastal littoral of Kenya. This later occupation appears to correspond with an expansion of MIA settlement from the coastal hinterland to the coastal littoral. With this expansion, an increasing differentiation of settlement size has been noted, including the growth of large 'multi-component' sites in the coastal hinterland. Such sites are comparable to, and were probably linked with, the contemporary growth of early 'urbanised' settlements on the coastal littoral (Helm 2000b, 185).

The 2010 fieldwork results

Our initial field season in 2010 sought to identify the archaeological potential of selected localities. Particular emphasis was placed on recovering a controlled stratified sequence of datable materials. All trenches were excavated by single-context. Where the thickness of individual contexts was sufficient, further stratigraphic control was maintained through subdivision into spits. Bulk soil samples for flotation were collected from every spit to recover environmental and subsistence data, with the remainder of the excavated deposit dry-sieved to recover other material culture items (Figure 2).

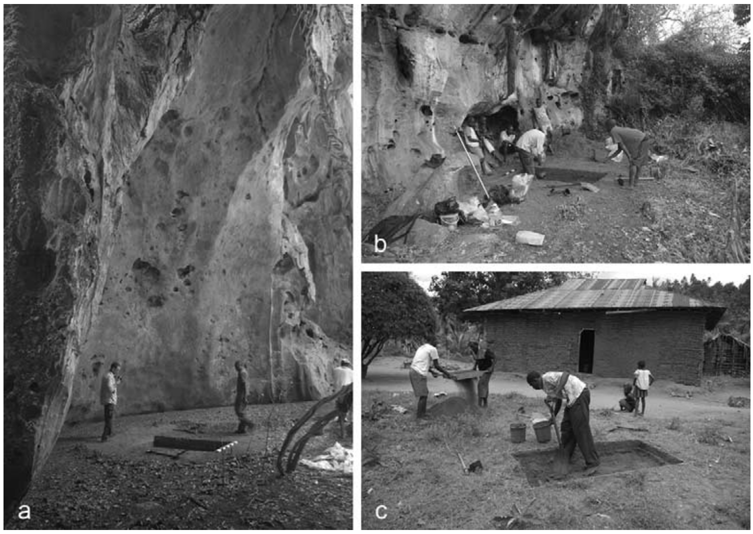

Figure 2. General view of the excavation localities: (a) Panga ya Saidi Trench 1, looking west; (b) Panga ya Mwandzumari Trench 3, looking northwest; (c) Mgombani Trench 2, looking northwest.

In addition, the project sought to collect information concerning local knowledge and perceptions of the cultural role of each locality as part of a cultural and environmental heritage assessment. This initiative was supported by the Coastal Forest Conservation Unit (CFCU), National Museums of Kenya, which has been working with local Mijikenda communities since 1994, particularly in the management and protection of the Kaya forests and other sacred groves. As part of this work, existing community protection strategies for each locality were identified and future harnessing measures suggested. Our fieldwork also sought to begin developing local community awareness and appreciation of archaeological resources within each locality. A core finding of this research was the formal recognition of the central role local community and tradition play in maintaining and protecting both the buried archaeology and the surrounding flora and fauna.

Panga ya Saidi

Panga ya Saidi (03°40′42″S, 39°44′10″E) is a large cave complex formed on an east-facing limestone escarpment, situated at 120 m asl. The complex comprises three interlinked open-chambers, each with a number of smaller adjoining secondary caves. The caves are of considerable cultural importance to the local community, members of which regularly visit them for traditional religious ceremonies. They also provide protection for a diverse range of rare and endangered plant and animal species. Although previously noted as a site with high archaeological potential (Soper 1975; Helm 2000a), this was the first time that the caves had been investigated archaeologically.

During 2010, two trenches were excavated at Panga ya Saidi, each 1 m wide by 2 m long, to a depth of 1.5 m, with neither trench reaching bedrock (Figures 3–4).

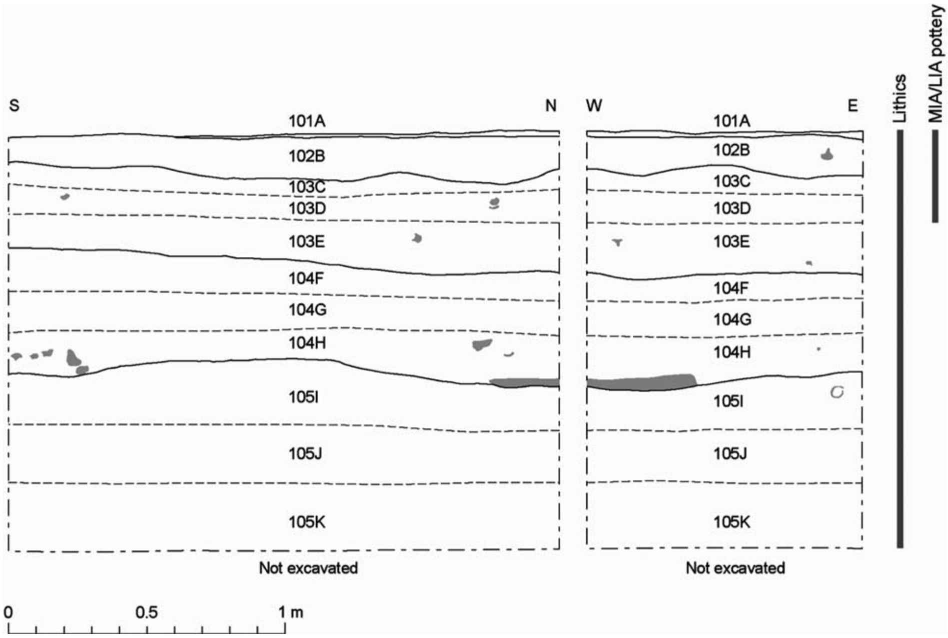

Figure 3. Panga ya Saidi: Trench 1 sections showing diagnostic artefact distributions.

Trench 1 was excavated in a large, open chamber, close to the main entrance, while Trench 2 was located in a side chamber, deeper within the cave interior. Both trenches had a depositional sequence of weathered sandy clay and silts. In Trench 1, these formed well-defined horizontal layers, within which potential occupation surfaces

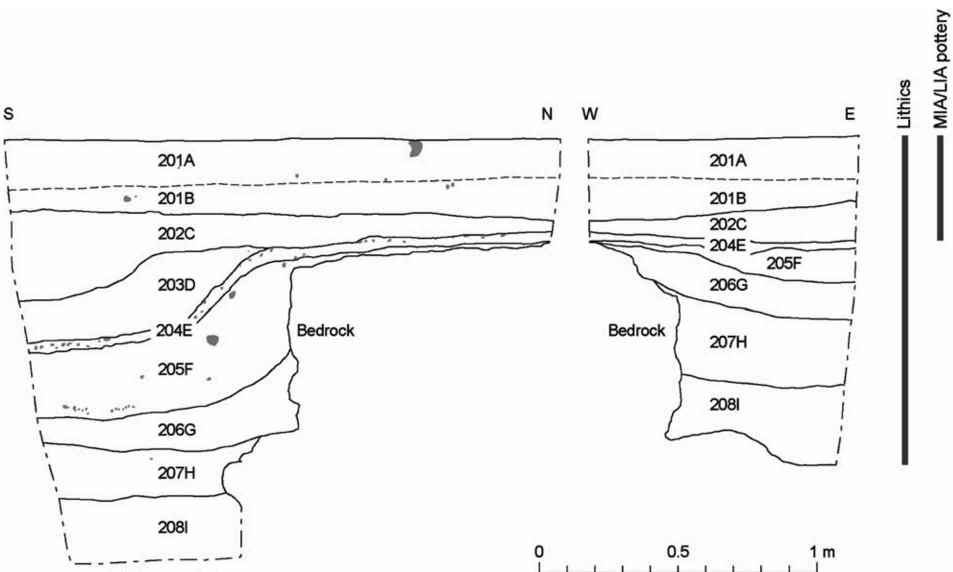

Figure 4. Panga ya Saidi: Trench 2 sections showing diagnostic artefact distributions.

comprising concentrations of carbon and ash were also evident, particularly in contexts 104H and 102B. In contrast, the layers in Trench 2 tip southwards, towards the centre of the side chamber, with the interfaces between deposits also less well defined.

Finds from both trenches were dominated by a large assemblage of stone artefacts (over 15 kg), including cores and numerous débitage pieces that indicate knapping took place within the immediate locality. The stone artefacts are mostly made in limestone, with some quartz, with a marked bimodal distribution in raw material exploitation (Figure 5) and artefact density (Figure 6). The lowest context in Trench 1 (105I–K) also lacked backed artefacts and, given that other retouched artefacts were present in a total assemblage of 682 artefacts, this is unlikely to be due to inadequate sampling. Instead, we argue that there is a distinct behavioural difference between the assemblages from earlier and later deposits, with different trends in raw material exploitation, artefact density and tool types. It is interesting to note that in the Great Lakes region of Kenya, the LSA Kiteko industry dating to between 15,000 and 13,000 years ago has been differentiated from the succeeding Eburran industry on the basis of the absence of backed artefacts (Ambrose 2002). As neither trench at Panga ya Saidi was bottomed, future deep excavations may clarify the long-term technological trends at this site and across the coastal region in general.

Pottery (638 sherds, 8.634 kg) was recovered from the upper three contexts in both trenches, in association with the later lithic assemblage (Figure 7). In Trench 2 these ceramic layers were clearly demarcated from earlier contexts by a layer of degraded limestone (context 204E). Preliminary analysis indicates that in both

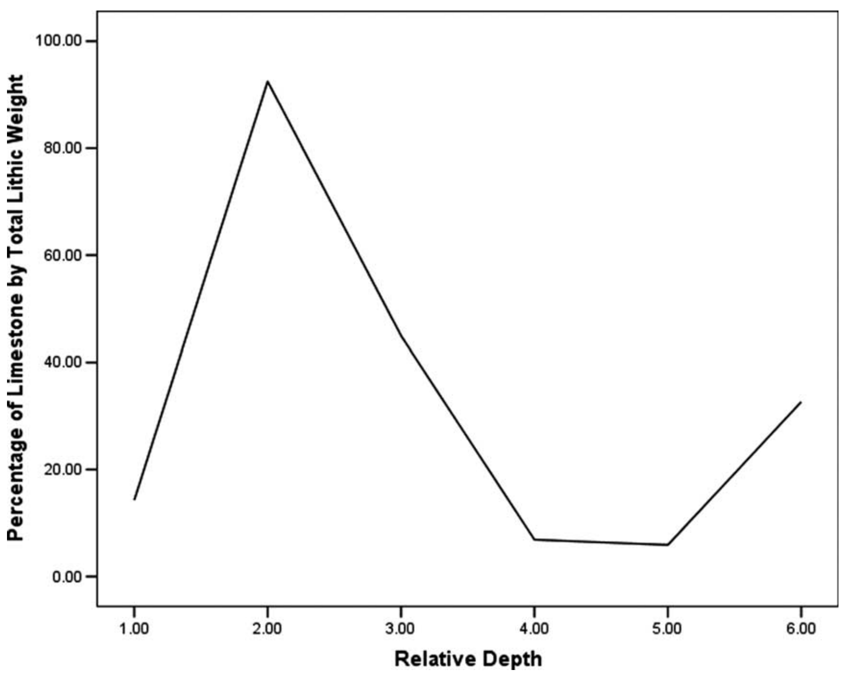

Figure 5. Panga ya Saidi Trench 1: percentage of limestone artefacts by relative depth.

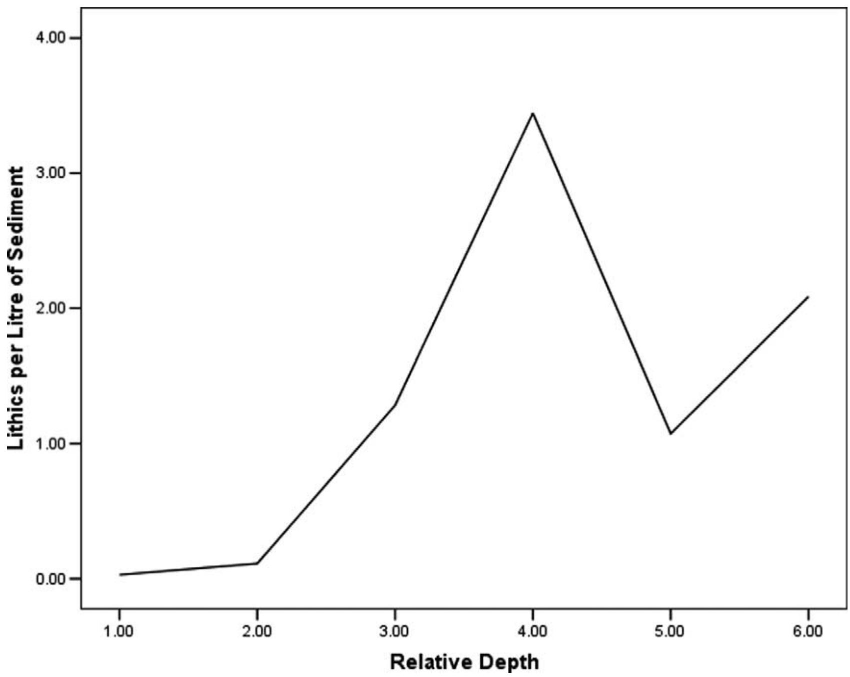

Figure 6. Panga ya Saidi Trench 1: stone artefact density by relative depth.

trenches the assemblage comprised largely MIA early Tana or Triangular Incised Ware (TIW) pottery (75.3% of diagnostic sherds by weight). The remainder of the assemblage is of late Tana/TIW affiliation, indicating that the latest phase of occupation potentially dates to around the late first or early second millennia AD (Figure 8, e–f).

Other finds included large assemblages of animal bone (12.228 kg), and both marine and terrestrial shell (8.038 kg), all of which are still to be analysed. Trench 1 also contained some 27 decorative shell, bone and limestone beads, distributed through all of the excavated contexts, including a number of perforated marine shells

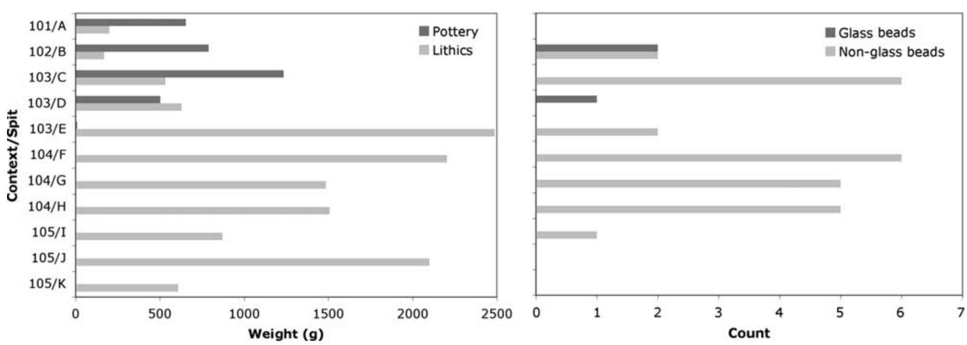

Figure 7. Artefact density per spit at Panga ya Saidi, Trench 1. Note that stone artefacts from contexts 103C, 103E, 104F, 104H and 105J have not yet been analysed. These data may therefore include a proportion of non-artefactual material.

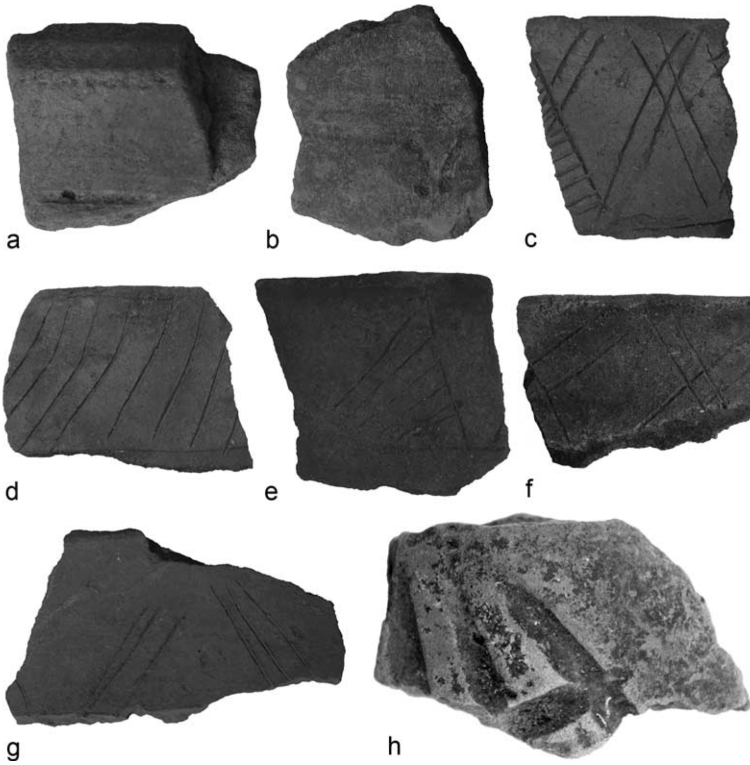

Figure 8. Mgombani, Panga ya Mwandzumari and Panga ya Saidi selected pottery sherds: (a–b) Kwale Ware; (c–g) Tana/TIW, (h) bead grinder. Proveniences: (a) Mgombani Trench 1, 101C; (b) Mgombani Trench 1, 101E; (c) Mgombani Trench 1, 101E; (d) Mgombani Trench 1, 104H; (e) Panga ya Saidi Trench 2, 200; (f) Panga ya Saidi Trench 2, 201A; (g) Panga ya Mwandzumari Trench 3, 302A; (h) Mgombani Trench 2, 206E. NB Not to scale.

(cowrie and possible *Conus*), the latter concentrated in the lower aceramic contexts (Figure 9, a and c–h). Three light green glass beads (Figure 9, j) collected from the upper contexts 102B and 103D provide further direct indicators of ongoing coastal connections, as well as the acquisition by hunter-forager groups of exotic goods entering eastern Africa through Indian Ocean trade during the site's later occupation phases.

Panga ya Mwandzumari

The locality at Panga ya Mwandzumari (03°41′48″S, 39°44′18″E) referred to as Sinseme Cave by Soper (1975) encompasses a shallow rockshelter at the foot of an east-facing limestone outcrop, approximately 110 m asl, with two open-chambered caves to the south and a smaller cave to the north. The caves have been an important community shrine for several generations, something that has provided protection for the rich natural habitat from the impact of surrounding cultivation. Previous archaeological work at Panga ya Mwandzumari was carried out by Robert Soper in 1966, during which an area of approximately 4.25 m^2 was excavated within the

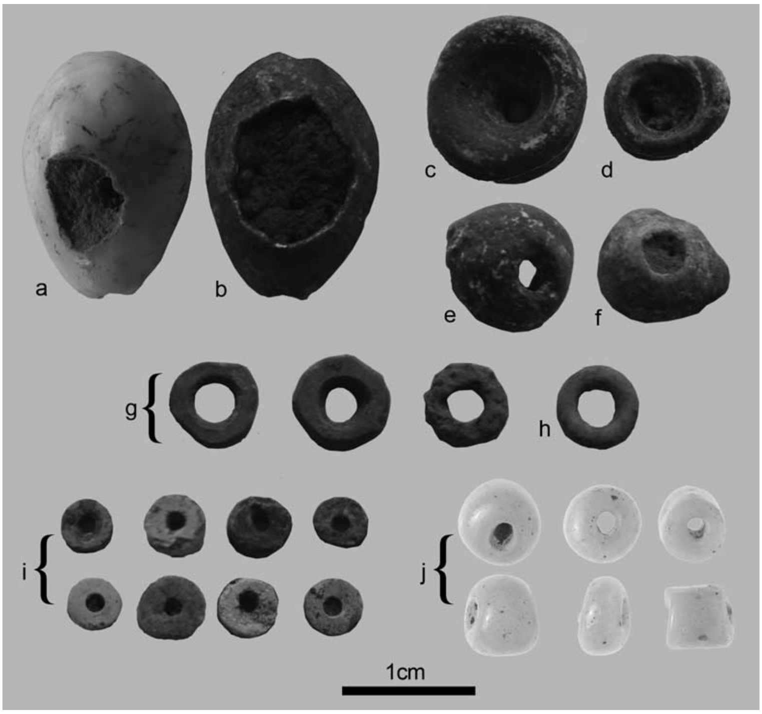

Figure 9. Mgombani, Panga ya Mwandzumari and Panga ya Saidi beads: (a–b) perforated cowrie shells; (c–f) perforated cf. *Conus* shells, showing internal (c–d) and external (e–f) views; g) limestone; h) bone; i) shell; and j) glass beads. Proveniences: (a) Panga ya Saidi Trench 1, 103C; (b) Panga ya Mwandzumari Trench 2, 203A; (c–d) Panga ya Saidi Trench 1, 104G; (e–f) Panga ya Saidi Trench 1, 104H; (g–h) Panga ya Saidi Trench 1, 104F; (i) Mgombani Trench 1, 104H; (j) Panga ya Saidi Trench 1, 102B and 103D.

entrance to the larger open-chambered cave, with three deposits recorded to a depth of 0.95 m. Soper (1975) recovered LSA stone artefacts and pottery of possible MIA to LIA date, animal bone, marine shellfish and carbonised material, along with other artefacts, including a polished stone axe, a fragment of iron blade and a worked bone/ivory ‘spatula-like’ tool.

During 2010, three trenches, each measuring 1 m wide by 2 m long were excavated. Trench 1, situated inside the smaller of the two open-chambered caves to the south, turned out to be virtually sterile of cultural materials and was abandoned at a depth of 1 m. In contrast, Trench 2, situated outside the entrance to the smaller open-chambered cave, and Trench 3, situated within the shallow rockshelter, were both excavated to a depth of approximately 1.2 m to the limestone bedrock and proved to have artefactually rich sequences of sand and silt deposits (Figures 10 and 11). No clear occupation surfaces were encountered in either trench, with sediment formation probably a result of mixed weathering and aeolian deposition. Evidence for at least one significant rockfall event, comprising large angular limestone blocks concentrated in contexts 203A–D and 302A–G respectively, was recorded in both trenches. In addition, the earliest deposit in Trench 3 (context 303A–F) was seen to have a high concentration of calcrete nodules.

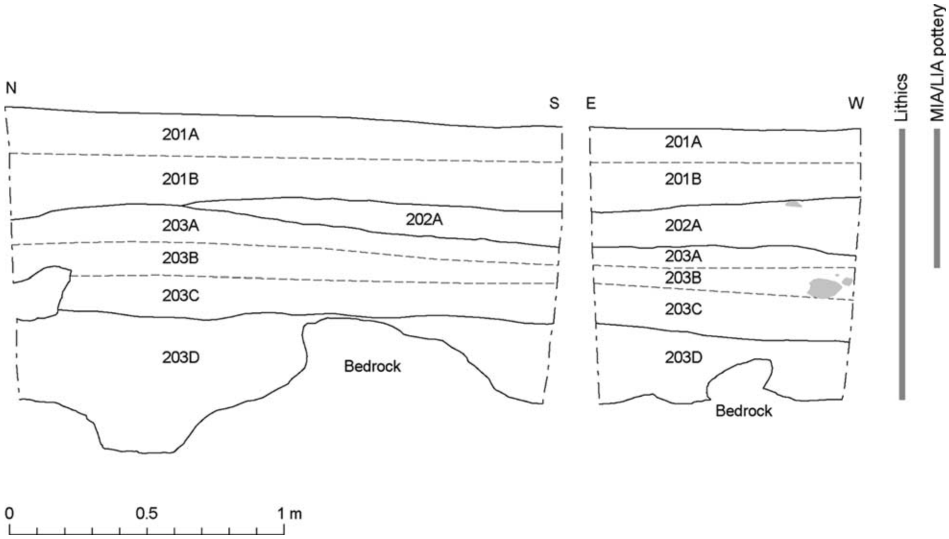

Figure 10. Panga ya Mwandzumari: Trench 2 sections showing diagnostic artefact distributions.

Artefacts from Panga ya Mwandzumari included a large assemblage of stone artefacts (over 28 kg), with both cores and numerous débitage pieces confirming on-site tool production (Figure 12). In addition, a small assemblage of pottery (80 sherds; 0.696 kg) was recovered from Trench 2, where sherds were distributed through most of the upper half of the sequence (contexts 201A–203A) (Figure 13). In contrast, Trench 3 produced only two sherds (0.073 kg), both recovered from the latest contexts (302A–B). All the pottery found was comparable to the assemblage from Panga ya Saidi in that it was largely composed of MIA early Tana/TIW (71.0% of diagnostic sherds by weight), with some LIA later Tana sherds present, indicating

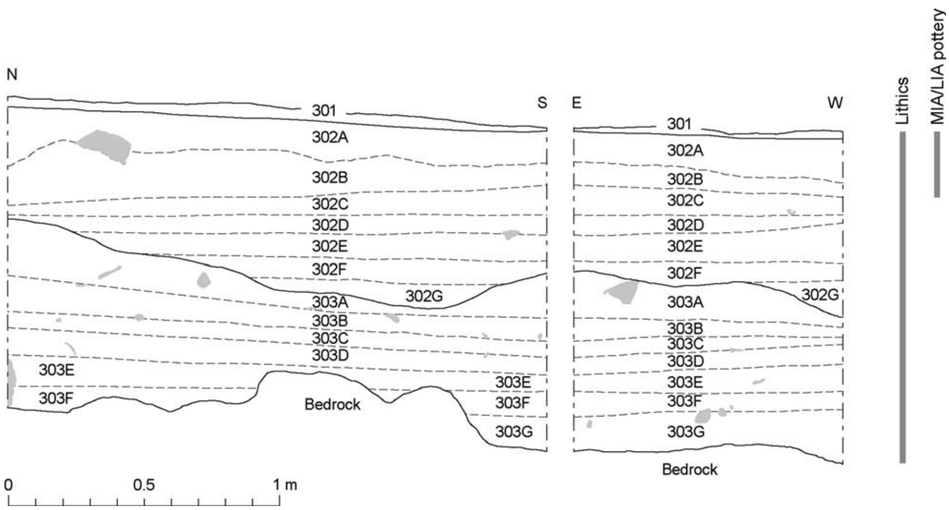

Figure 11. Panga ya Mwandzumari: Trench 3 sections showing diagnostic artefact distributions.

Figure 12. Panga ya Mwandzumari, Trench 2, context 203A: selected limestone and quartz lithic artefacts.

a roughly contemporary date between the later first and early second millennia AD (Figure 8, g). Both trenches had large assemblages of animal bone (17.466 kg), and marine and terrestrial shells (5.999 kg). Other finds included three perforated cowrie shell beads from context 203A (Figure 9, b) and one bone bead from context 203D in Trench 2.

Interestingly, the two trenches produced contrasting lithic assemblages, with the proportion of limestone relative to quartz artefacts decreasing with depth in Trench 2, while in Trench 3 the proportion of limestone increased (Figure 14). Contrasting patterns in artefact density were also noted, with the density remaining largely constant in Trench 2, but increasing dramatically with depth in Trench 3 (Figure 15) along with the mean weight of quartz flakes (Figure 16). We suggest that the sequences represented in the two trenches do not reflect simultaneous occupation, but that Trench 3 excavated a largely preceramic sequence where quartz exploitation increased over time, while the overall intensity of lithic production decreased. There may have been a period of overlap when both areas were used, but sometime during the MIA the Trench 3 area of the rockshelter was abandoned and

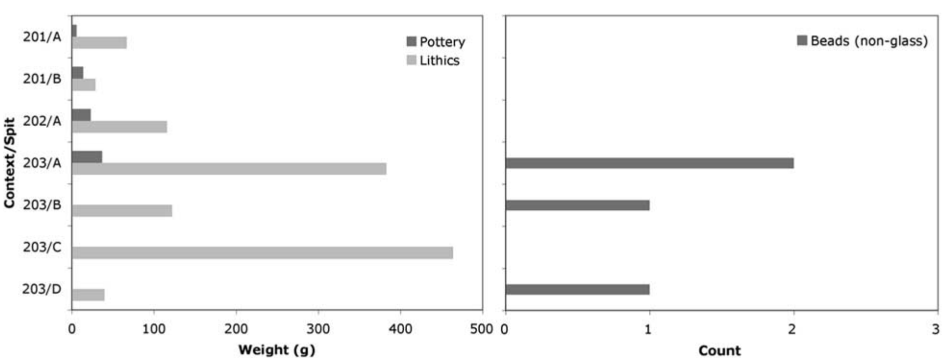

Figure 13. Panga ya Mwandzumari, Trench 2: artefact density per spit.

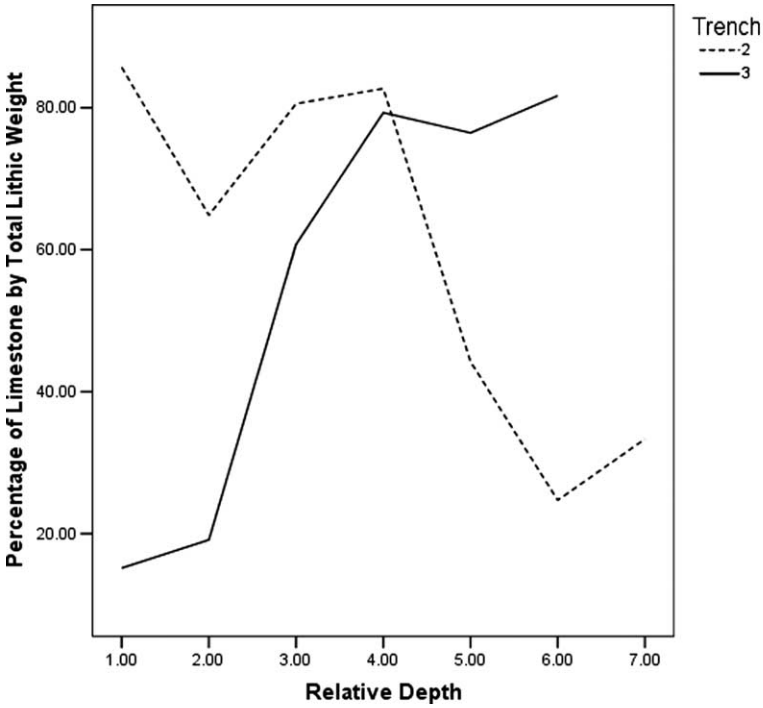

Figure 14. Panga ya Mwandzumari: percentage of limestone raw material by relative depth.

occupation shifted to the Trench 2 locality. Use of limestone as a raw material appears to have increased through time in Trench 2, perhaps reflecting changing land-use patterns. Alternatively, the differing patterns in the two trenches may represent different activity areas of contemporaneous occupation, although if this were so there must have been a strong spatial division between the activities performed in order to account for all of the differing patterns in ceramics, lithic raw materials, lithic densities and flake sizes.

Mgombani

Mgombani (03°50′27″S, 39°40′43″E) is situated on a gently sloping ridge, below the forested slopes of Kaya Jibana, a UNESCO-designated World Heritage Site. A freshwater spring located at the foot of Kaya Jibana continues to provide an important source of drinking water for the surrounding area, which is now intensively occupied by modern settlement. Previous archaeological excavations at Mgombani, comprising three trenches totalling 27 m^2 in area, demonstrated that this locality had been occupied during the transitional EIA to MIA period (Helm 2000a, 146–158). A single uncalibrated radiocarbon date from wood charcoal of 1300 ± 50 BP (Pta-7957, corrected for isotopic fractionation), gave a calibrated date range of 666–890 cal. AD (2-sigma range calibrated for the southern hemisphere using ShCal04, McCormac *et al.* 2004), though the typology of the ceramics recovered indicates that occupation may have started several centuries earlier than this.

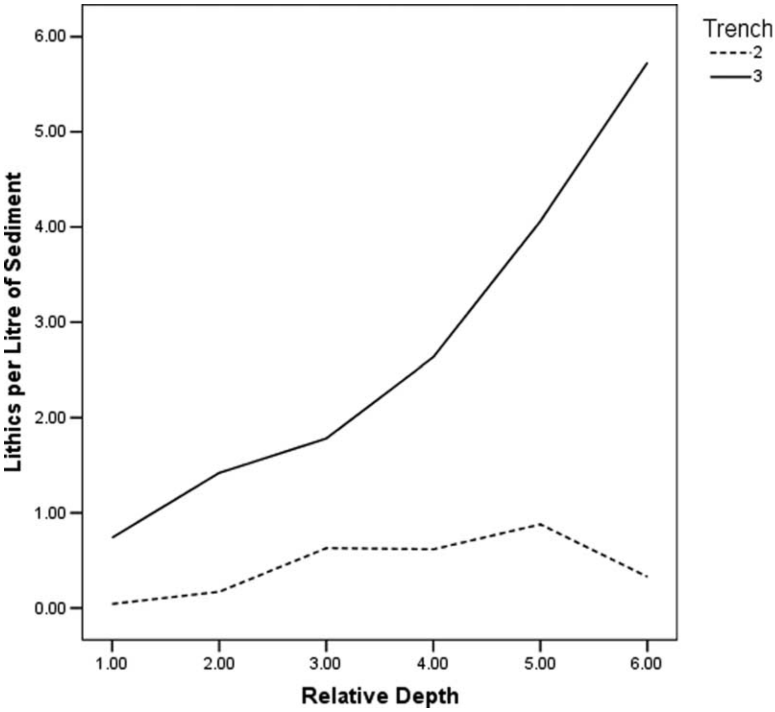

Figure 15. Panga ya Mwandzumari: lithic density by relative depth.

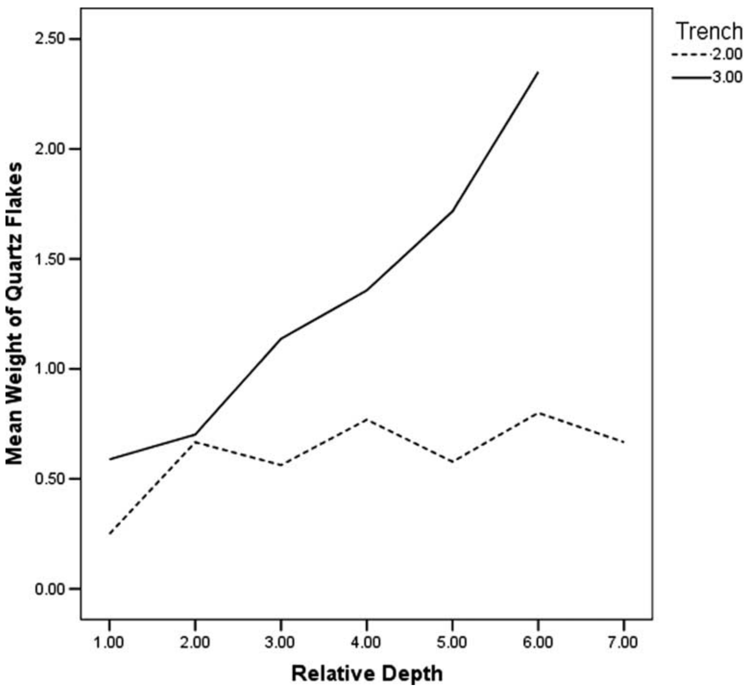

Figure 16. Panga ya Mwandzumari: quartz flake weight by relative depth.

Two trenches, each 1 m wide by 2 m long, were excavated in 2010 to a depth of between 1 m and 1.3 m to the natural red sandy clay subsoil (contexts 105I–L and 213J respectively; Figures 17–18). Above this subsoil, a series of occupation layers, characterised by variable quantities of carbon and ash, as well as flecks of daub, were recorded in both trenches. In Trench 1, a post-hole (cut 107) measuring 0.16 m in diameter by 0.46 m deep was seen to cut through the earliest occupation layer 104H and presumably formed part of a larger timber superstructure extending beyond the trench. A comparable sequence was recorded in Trench 2, where a large pit (cut 209), 0.69 m in diameter by 0.75 m deep, and a post-hole (cut 211), 0.24 m in diameter by 0.07 m deep, also cut through the earliest occupation layer 212I. Similar pit and post-hole features identified during the previous excavations indicate the presence of a relatively sedentary settlement, perhaps extending along the ridgeline below Kaya Jibana.

A large assemblage of pottery was retrieved from the excavated trenches at Mgombani (5,936 sherds, 69.695 kg), indicating a relatively high occupation intensity. Animal bone (6.269 kg) and marine and terrestrial shell (1.220 kg) were also recovered. Other finds included a ceramic 'bead grinder' (Figure 8, h), decorative glass, shell and bone beads (Figure 9, i), and three grindstones recovered from Trench 2, one of which was from the lower fill of pit 209. The glass beads were all recovered from the surface layer and appear to be of relatively modern date.

The pottery assemblage is broadly characterised as MIA early Tana/TIW (93.8% of diagnostic sherds by weight), dateable to the later first millennium AD, with a small proportion of EIA Kwale Ware (3.2%) and LIA late Tana/TIW (3.0%). In Trench 1, Kwale Ware was identified in small quantities throughout the excavated sequence, mixed with Tana/TIW. In contrast, Kwale Ware was limited to the earliest deposits in Trench 2 (contexts 212I, 206D–E, and the fills of pit 209), while Tana/TIW was only present in the fills of pit 209 and later layers. Preliminary analysis of the assemblage has indicated that the EIA Kwale Ware sherds exhibit a higher degree of surface abrasion than the MIA and LIA ceramics, confirming a greater exposure to movement and weathering typical of residuality (Figure 8, a–d). However, previous ceramic studies also indicate that the EIA Kwale Ware and

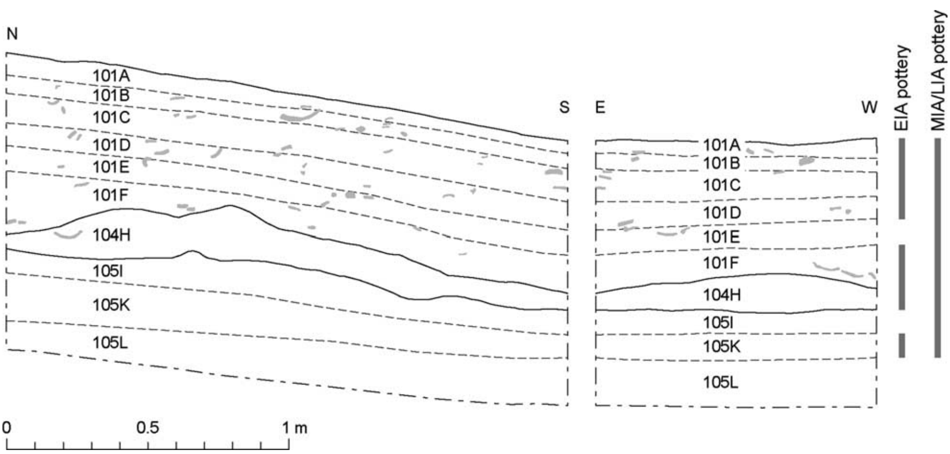

Figure 17. Mgombani Trench 1: sections showing diagnostic artefact distributions.

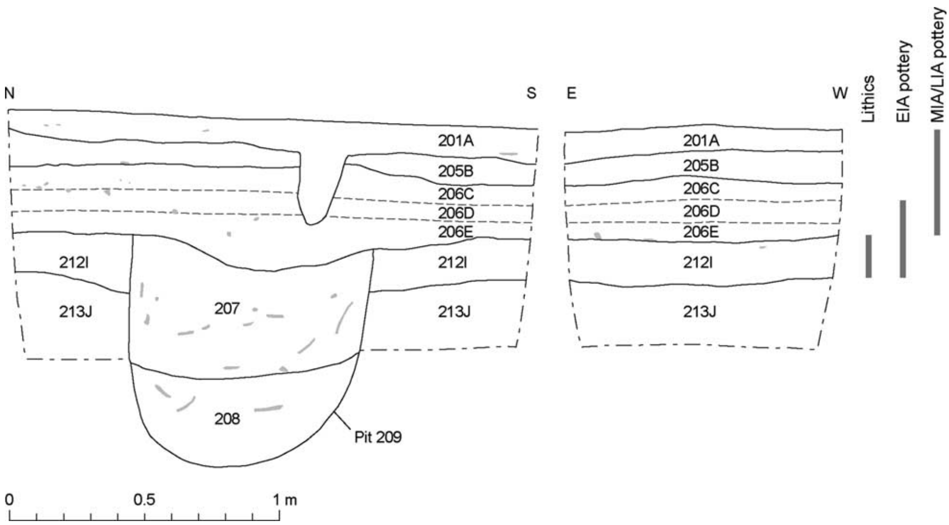

Figure 18. Mgombani Trench 2: sections showing diagnostic artefact distributions.

MIA early Tana/TIW represent a continuous and evolving EIA to LIA ceramic tradition (Chami 1994; Kusimba 1999; Haaland and Msuya 2000; Helm 2000a; Msuya 2004). Further work will probably confirm the presence of an earlier EIA phase within the locality, with continuity and intensification of this occupation into the MIA period.

The only lithic material recovered from Mgombani during the 2010 season was a single radial quartz core (0.018 kg) from Trench 2 (context 212I). A small collection of stone artefacts recovered from below the main occupation horizons during Helm's (2000a) previous excavations was therefore re-examined for comparison with the assemblages from Panga ya Saidi and Panga ya Mwandzumari. This collection included one quartz and ten limestone flakes, two of which were blades, a limestone endscraper, a sandstone multiplatform core, and a shale bifacial core-chopper. The extremely low density of stone artefacts at Mgombani suggests that they were not manufactured on site, at least not in the excavated areas, and contrasts with the patterns observed at the rockshelter/cave sites where stone artefacts were interspersed throughout the later ceramic-bearing occupation layers. This pattern is all the more interesting because Mgombani has the earliest ceramics of all three localities, so it would have been expected that the two technologies would be most likely to overlap there. Raw materials in the Mgombani trenches are also very different from those found at the cave sites, with the only example so far of sandstone and shale artefacts. Coupled with the site's low lithic density, this suggests that occupation at Mgombani prior to the EIA was sporadic, with different people equipped with different materials using the site temporarily. During the EIA occupation, lithic use appears to have been minimal or absent.

Preliminary analysis of plant remains

During all three excavations, bulk soil samples were collected from every context for flotation to recover archaeobotanical remains. In total, some 61 samples were collected, amounting to approximately 1800 litres of soil and resulting in a total flot of just under 10 kg. Samples of stone artefacts, pottery, grindstones and sediments were also collected for starch and phytolith analysis. Processing of this material is ongoing, but it is expected that it will provide valuable data on both wild and domestic plant exploitation, and possibly also ancient Indian Ocean crop transfers.

Preliminary analysis of a selection of archaeobotanical samples from both Mgombani and Panga ya Saidi (Table 1) indicates that all three of the major native pan-African cereals were being consumed, and presumably cultivated locally, by the ceramic era, probably during the EIA and certainly by the MIA. These include grains of sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*) and finger millet (*Eleusine coracana*). Grain morphology for all of these is consistent with domesticated forms. Pulse seeds of *Vigna* sp. may be attributable to one of the Asiatic *Vigna* crops, although further comparative study is needed. Seeds of the baobab tree (*Adansonia digitata*) have also been noted.

Together, these findings represent a significant contribution to the sparse archaeobotanical record from eastern Africa, where evidence for crops and the development and change of agricultural systems is very limited (cf. Walshaw 2005, 2010). Indeed, most accounts for the origins of agriculture in this region rely on inferences from historical linguistics and/or assumptions that certain archaeological culture complexes can be correlated with the spread of agropastoralist groups (e.g. Philippson and Bahuchet 1996; Phillipson 2005). For example, it has been inferred that Bantu-speaking agriculturalists obtained sorghum and pearl millet from Central Sudanian (Nilo-Saharan)-speaking groups somewhere around the northern area of the Great Lakes region of Africa and then dispersed southwards and eastwards towards the Indian Ocean coast (e.g. Schoenbrun 1993; Ehret 1998). Likewise, it has been suggested that finger millet, which is often attributed to an origin in Ethiopia, was spread southwards by Cushitic-speaking groups (Ehret 1998). However, hard archaeological evidence has been lacking for the presence of these crops in particular regions and periods and whether these crops co-occur, or correlate with particular material culture traditions remains unconfirmed. The present study therefore adds additional geographical and chronological evidence for early crops in Africa and the first such evidence from the coast of Kenya.

Although all the cereal crops recovered so far are indigenous to Africa, they were undoubtedly introduced to the east coast region of Kenya from differing centres of origin. Sorghum is generally thought to have been domesticated on the northeastern savannas of Africa (Snowden 1936; Stemler *et al.* 1975; Fuller 2003), perhaps before 2000 cal. BC, while pearl millet comes from the Sahel zone of western Africa (Fuller 2003), with confirmed archaeobotanical evidence from the second half of the third millennium cal. BC in northeast Mali (Manning *et al.* 2011). Both species are well established in the Indian sub-continent by the start of the second millennium cal. BC (Fuller and Boivin 2009). It is also clear that both species reached southern African by the second half of the first millennium AD (Mitchell 2002; Manning *et al.* 2011, online supplement). Finger millet was probably brought into cultivation somewhere between the uplands of Ethiopia and the Great Lakes region of eastern Africa. Evidence for its arrival in the Indian sub-continent remains disputed and may be later than that of sorghum and pearl millet, but it was certainly present there by *c.* 1000 cal. BC and much earlier than current evidence in Africa (Fuller 2003; Fuller and Boivin 2009).

Table 1. Preliminary results of selected macrobotanical samples from Mgombani and Panga ya Saidi (X = taxon present).

Site	Trench	Context/ Spit	Sample volume (litres)	*Sorghum bicolor*	cf. *Sorghum bicolor*	*Pennisetum glaucum*	cf. *Pennisetum glaucum*	*Eleusine coracana*	cf. *Eleusine coracana*	*Vigna sp.*	cf. *Vigna sp.*	*Adansonia digitata*	cf. *Adansonia digitata*
		101/C	30	X	X	X	X	X		X	X		
		101/F	30	X	X	X		X					X
Mgombani	1	104/H	30	X	X	X							X
		105/L	30		X	X			X				
		106/J	3			X							
		103/D	30	X	X	X						X	
		103/E	30	X									X
Panga ya Saidi	1	103/F	30		X								X
		104/G	30						X				X
		104/H	30										X

The earliest finds of finger millet in Africa come from the first/second centuries cal. AD in Ethiopia (at Ona Nagast: D'Andrea 2008) and in Nigeria (at Kursakata: Klee *et al.* 2000), while a single grain of wild finger millet (*Eleusine africana*), of uncertain date was reported from the lowest level at Gogo Falls, Kenya (Lange 1991). Recent sampling at cave sites in Rwanda indicates that finger millet was a widespread crop there from at least the eighth century cal. AD (Giblin and Fuller 2011). Elsewhere in eastern Africa, a single grain of domesticated finger millet has been reported from Deloraine in Kenya from cal. AD 800 (Ambrose *et al.* 1984), when it was also present on Pemba Island, Tanzania, (Walshaw 2005, 2010). Other finds of comparable date are also known from eastern South Africa (see reviews in Mitchell 2002; Giblin and Fuller 2011).

In addition to the evidence for crops, seeds of baobab (*Adansonia digitata*) were recovered. The baobab tree is of major economic and cultural importance across most of the savanna regions of Africa, owing in part to its edible seeds and fruits, the latter of which can also be dried for storage and used to produce nutritious drinks (Wickens 1982). Baobab pods may be regarded as an easily transportable food resource of mobile pastoralists (Blench 2007). A role for human dispersal of this species across Africa is clear. While one hypothesis suggests that this started from southeastern Africa, and ultimately Madagascar (Blench 2007), an alternative postulates a spread from western Africa. Archaeobotanical records, such as wood charcoal, come from late Holocene stone tool-using contexts in western Africa (i.e. by 1000 cal. BC) at sites such as Ti-n-Akof, Oursi and Corcoba (all in Burkina Faso) (Kahlheber and Neumann 2007), while seed evidence puts this species in the far west of Africa (Senegal) in the mid-first millennium cal. AD (Murray 2008). Recent genetic research on modern baobabs indicates that their centre of genetic diversity and the species' most primitive genetic groups are restricted to western Africa, while only two more derived genetic lineages are found through eastern Africa, Madagascar, the Indian Ocean islands and Yemen (Pocktsy *et al.* 2009). This would suggest that baobabs are indigenous to western Africa and dispersed to eastern Africa by human agency, followed by a further dispersal, probably by medieval traders, to southern India (Burton-Page 1969). The dispersal of baobab is therefore an additional component in the pattern of translocation via seafaring of plant species from the broader eastern African coast. The present evidence would indicate its presence in coastal regions by at least the middle of the first millennium cal. AD, while numerous seed fragments that are most likely from baobab have been reported from Pemba Island throughout the sequence at Tumbe from the seventh to tenth centuries cal. AD (Walshaw 2005, 2010). Further archaeobotanical evidence is needed to refine the past distribution of this species and its cultural contexts of consumption and offshore dispersal, as well as the extent to which this tree was co-dispersed with cereal agriculture.

Conclusions

While preliminary, the results from the first season of fieldwork in Kenya by the Sealinks Project have demonstrated the high potential of sites in this region for providing insights into the relationship amongst LSA, EIA and MIA communities, as well as the emergence of local and wider trade networks. While not of the urbanised site type that has hitherto attracted the majority of archaeological attention in the region, the sites discussed here retain evidence for key transformations and also provide the conditions for excellent preservation of botanical remains. Indeed, the quality of the faunal and botanical remains recovered during excavation brings into question previous predictions of poor survivability (Young and Thompson 1999). Rather than being an absence of data, there has simply been an absence of systematic recovery.

While further archaeobotanical laboratory work and direct AMS dates are needed to amplify and confirm the botanical results obtained thus far, emerging patterns are nevertheless highly significant. These finds constitute the most substantial archaeobotanical evidence for cereal cultivation yet recovered in Kenya and are likely amongst the earliest plant finds on the eastern African coast. Comparable evidence from flotation carried out on Pemba Island at the site of Tumbe also indicated that these three African cereals, and probably baobab as well, were present from the earliest levels, dating back to the seventh century cal. AD (Walshaw 2010, 141–142). These findings suggested that this mainland savanna subsistence package was well established by the MIA on the mainland and was introduced with the initial agricultural settlement of the islands of eastern Africa (Walshaw 2010). How much earlier this package was brought together remains to be determined through further archaeobotanical research.

It is also of interest that the finds from Kilifi occur outside the range of modern cultivation, especially in the case of finger millet (as mapped by Hilu and De Wet 1976), which is today restricted to more interior and upland zones of Africa. Like recent finds of pearl millet from the wet tropics of southern Cameroon (Eggert *et al.* 2006), finds such as our finger millet indicate that the prehistoric distribution of crops and cropping systems may sometimes lack modern analogues. In part, this is probably due to the impact of colonial economic regimes and introduced species like maize, but it also testifies to the importance of obtaining direct archaeobotanical evidence for the reconstruction of changes in the distribution of African agricultural systems.

Of equal importance are the insights provided into patterns of trade and exchange in the coastal region and the recognition of intersections between what have been often treated as separate entities: coast and interior, urban and rural, forager and farmer (cf. Kusimba and Kusimba 2005). Three main categories of evidence appear to indicate trade between different locales and groups. One is marine shell, which reached all three inland sites in the form of beads. At Panga ya Saidi it is present from the earliest levels, possibly indicating that coastal connections predate the Holocene, though radiocarbon dates are, of course, required to confirm this. Also arriving ultimately from the coast, though just how directly is unclear, are glass beads, which feature in the upper levels at Panga ya Saidi. Glass beads were increasingly imported into (and perhaps reworked at) eastern African sites from the late first millennium AD. While most numerous at coastal urban sites, their presence at inland hunter-forager sites is also of interest and provides insights into wider trade connections. Finally, it is also clear from the present study that plant crops also featured as trade items, leading to their consumption on what appear quite clearly to have been hunter-forager sites. This finding sheds light on the movement of 'invisible' trade items proposed previously by Abungu and Mutoro (1993, 703) and others, but not confirmed through scientific studies. As Abungu and Mutoro suggest, the paucity of trade goods in the coastal hinterland and interior probably has less to do with an independent development of coastal communities (often linked to notions of a non-African impetus to coastal settlement evolution) than to a lack of evidence for perishable trade goods, such as salt, leather and cloth (Abungu and Mutoro 1993) and, we would also add, crops. Many hunter-forager trade goods, including organic forest products and a number of the African exports mentioned in the *Periplus*, are also likely to be archaeologically invisible. As a result, the role of hunter-foragers in wider Indian Ocean trade networks is likely to be underplayed by archaeologists working entirely from the material record, particularly one to which more detailed archaeological scientific studies have not yet been applied.

In addition to evidence for a range of trade connections between different groups we detect evidence for an increasing orbit and intensity of trade through time. While shell beads of coastal origin feature as trade items from probably a very early period, other key trade items, such as crops and glass beads, do not appear at hinterland cave sites until the introduction of pottery. Indeed, it is interesting that these three classes of evidence appear largely simultaneously at Panga ya Saidi, although a smaller number of tentative preceramic crop finds may also indicate that trade in crops preceded trade in the other two categories of artefact (this remains, however, to be confirmed through radiocarbon dating). Of note is the absence of EIA ceramics from the cave sites at Panga ya Saidi and Panga ya Mwandzumari and the absence of stone artefacts in the ceramic layers from the EIA to MIA site at Mgombani. Despite a number of apparently contemporary LSA and EIA occupation sites being known in the area, there remains little direct evidence for interaction until the MIA period. The fullest realisation of regional trade networks may have awaited the emergence of the more intensive Indian Ocean interactions of the Swahili period.

Acknowledgements

Our research was carried out under Research Clearance Permit No NCT/RRI/12/1/SS/541 through research affiliation with the National Museums of Kenya, and Exploration/Excavation License No NMK/GVT/2. Funding was provided by the Sealinks Project under a European Research Council Grant Agreement No 206148 awarded to Nicole Boivin. The season would not have been possible without the support and guidance of Purity Kiura (Director, Department of Archaeology, NMK), Herman Kiriama (Head, Department of Coastal Archaeology, Fort Jesus, NMK), Anthony Githitho (Head, Coastal Forest Conservation Unit, NMK), and Matthew Davies (former Assistant Director, BIEA). We should particularly like to thank Johnpius Mpangarusya (Graduate Scholar, BIEA) for his excellent work in the field. Finally, thanks are extended to the two anonymous reviewers whose comments helped to improve our paper.

Note

1. The Sealinks Project (http://sealinks.arch.ox.ac.uk/) seeks to investigate the emergence of early long-distance connections between prehistoric communities occupying the Indian Ocean rim. The project intends to incorporate multiregional and multidisciplinary data, with fieldwork also presently being undertaken in southern India and Sri Lanka.

Notes on contributors

Richard Helm is a Project Manager at the Canterbury Archaeological Trust. His research interests include the later prehistoric archaeology of eastern and northern Africa, landscape histories, GIS and cultural resource management.

Alison Crowther is a British Academy Postdoctoral Research Fellow at the Research Laboratory for Archaeology and the History of Art, University of Oxford. Her research interests include archaeobotany, ancient food processing, starch analysis and microscopic use-wear and residue analyses.

Ceri Shipton is a Postdoctoral Research Fellow in the School of Social Sciences at the University of Queensland, Australia. His research interests include lithic technology and the prehistory of eastern Africa, Arabia and India.

Amini Tengeza is a Field Officer at the Coastal Forest Conservation Unit, Kilifi, National Museums of Kenya. His research interests include the later prehistoric archaeology and ethnobiology of the coastal region of eastern Africa.

Dorian Fuller is Reader in Archaeobotany at University College London. He has carried out fieldwork and archaeobotanical research in Africa, India, Pakistan, Sri Lanka, China and Thailand and has published extensively on plant domestication and early agricultural systems.

Nicole Boivin is a Senior Research Fellow in the School of Archaeology, University of Oxford. She is a Fellow of Jesus College, Oxford, and a Senior Research Fellow in the Oxford Centre for Asian Archaeology, Art and Culture. Dr Boivin is Principal Investigator of the Sealinks Project, author of *Material Cultures, Material Minds* (Cambridge University Press, 2008) and co-editor of *Soils, Stones and Symbols* (UCL Press, 2004).

References

Abungu, G.H.O. and H.W. Mutoro. 1993. Coast-interior settlements and social relations in the Kenya coastal hinterland. In *The archaeology of Africa: foods, metals and towns*, ed. T. Shaw, P.J.J. Sinclair, B. Andah and A. Okpoko, 694–704. London: Routledge.

Ambrose, S.H. 2002. Small things remembered: origins of early microlithic industries in sub-Saharan Africa. *Archaeological Papers of the American Anthropological Association* 12: 9–30.

Ambrose, S.H., D. Collett and M.F. Modida. 1984. Excavations at Deloraine, Rongai, 1978. *Azania* 19: 79–104.

Blench, R. 2007. The intertwined history of the silk-cotton and baobab in West Africa. In *Fields of change: progress in African Archaeobotany*, ed. R.T.J. Cappers, 1–20. Groningen: Barkhuis and Groningen University Press.

Boxem, H.W., T. de Meester and E.M.A. Smaling, eds. 1987. *Soils of the Kilifi Area, Kenya. Reconnaissance soil survey report R11*. Nairobi: Kenya Soil Survey.

Burton-Page, J. 1969. The problem of the introduction of *Adansonia digitata* into India. In *The domestication and exploitation of plants and animals*, ed. P.J. Ucko and G.W. Dimbleby, 331–336. London: Duckworth.

Casson, L. 1989. *The Periplus Maris Erythraei: text with introduction, translation and commentary.* Princeton: Princeton University Press.

Chami, F. 1994. *The Tanzanian coast in the first millennium AD: an archaeology of the iron-working, farming communities.* Uppsala: Societas Archaeologica Upsaliensis.

Chami, F. 1999a. Roman beads from the Rufiji Delta, Tanzania: first incontrovertible archaeological link with *Periplus. Current Anthropology* 40: 237–241.

Chami, F. 1999b. The early Iron Age on Mafia Island and its relationship with the hinterland. *Azania* 34: 1–10.

Chami, F. 2005. The ancient western Indian Ocean world market. *Indian Ocean Archaeology* 2: 1–7.

Chami, F. 2006. *The unity of ancient African history 3000 BC to AD 500*. Mauritius: E&D Ltd.

Chami, F. and A. Kwekason. 2003. Neolithic pottery traditions and the islands, the coast and interior of East Africa. *African Archaeological Review* 20: 65–80.

Chami, F. and P. Msemwa. 1997. A new look at culture and trade on the Azanian coast. *Current Anthropology* 38: 673–677.

D'Andrea, A.C. 2008. T'ef (*Eragrostis tef*) in ancient agricultural systems of highland Ethiopia. *Economic Botany* 62: 547–566.

Eggert, M.K.H., A. Höhn, S. Kahlheber, C. Meister, K. Neumann and A. Schweizer. 2006. Pits, graves and grains: archaeological and archaeobotanical research in southern Cameroun. *Journal of African Archaeology* 4: 273–298.

Ehret, C. 1998. *An African classical age: eastern and southern Africa in world history, 1000 BC to AD 400*. Charlottesville: University Press of Virginia.

Fleisher, J. and A. LaViolette. 1999. Elusive wattle-and-daub: finding the hidden majority in the archaeology of the Swahili. *Azania* 34: 87–108.

Fuller, D.Q. 2003. African crops in prehistoric South Asia: a critical review. In *Food, fuel and fields: progress in African Archaeobotany*, ed. K. Neumann, A. Butler and S. Kahlheber, 239–271. Köln: Heinrich-Barth-Institut.

Fuller, D.Q. and N. Boivin. 2009. Crops, cattle and commensals across the Indian Ocean: current and potential archaeobiological evidence. *Etudes Ocean Indien* 42/43: 13–46.

Giblin, J. and D.Q. Fuller. 2011. First and second millennium AD agriculture in Rwanda: archaeobotanical finds and radiocarbon dates from seven sites. *Vegetation History and Archaeobotany* 20: 253–265.

Githitho, A. 2003. The sacred Mijikenda Kaya forests of coastal Kenya and biodiversity conservation. In *Proceedings of an international workshop on the importance of sacred natural sites for biodiversity conservation. Kunming and Xishuangbanna Biosphere Reserve, People's Republic of China, 17–20 February 2003*, ed. C. Lee and T. Schaaf, 27–35. Paris: UNESCO.

Haaland, R. and C.S. Msuya. 2000. Pottery production, iron-working, and trade in the EIA: the case of Dakawa, east-central Tanzania. *Azania* 35: 75–106.

Hilu, K.W. and J.M.J. De Wet. 1976. Racial evolution in *Eleusine coracana* ssp. *coracana* (finger millet). *American Journal of Botany* 63: 1311–1318.

Hilu, K.W., J.M.J. De Wet and J.R. Harlan. 1979. Archaeobotanical studies of *Eleusine coracana* ssp. *coracana* (finger millet). *American Journal of Botany* 66: 330–333.

Helm, R. 2000a. Conflicting histories: the archaeology of the iron-working, farming communities in the central and southern coast region of Kenya. PhD diss., University of Bristol.

Helm, R. 2000b. Recent archaeological research on the iron-working, farming communities of coastal Kenya. *Azania* 35: 184–189.

Helm, R. 2004. Re-evaluating traditional histories in coastal East Africa: an archaeological perspective. In *African historical archaeologies*, ed. P.J. Lane and A. Reid, 59–90. New York: Kluwer Academic/Plenum Publishers.

Horton, M. and J. Middleton. 2000. *The Swahili. The social landscape of a mercantile society.* Oxford: Blackwells.

Hulse, J.H., E.M. Laing and O.E. Pearson. 1980. *Sorghum and the millets: their composition and nutritive value*. London: Academic Press.

Juma, A. 2004. *Unguja Ukuu on Zanzibar. An archaeological study of early urbanism*. Uppsala: Department of Archaeology and Ancient History.

Kahlheber, S. and K. Neumann. 2007. The development of plant cultivation in semi-arid West Africa. In *Rethinking agriculture: archaeological and ethnoarchaeological perspectives*, ed. T.P. Denham, J. Iriarte and L. Vrydaghs, 320–346. Walnut Creek: Left Coast Press.

Kessy, E. 1997. Archaeological site survey from Kisiji to Dar-es-Salaam. *Nyame Akuma* 48: 57–69.

Klee, M., B. Zach and K. Neumann. 2000. Four thousand years of plant exploitation in the Chad Basin of northeast Nigeria: the archaeobotany of Kursakata. *Vegetation History and Archaeobotany* 9: 223–237.

Kusimba, C.M. 1999. *The Swahili coast. The rise and fall of Swahili states.* Walnut Creek: AltaMira Press.

Kusimba, C.M. and S.B. Kusimba. 2005. Mosaics and interactions: East Africa, 2000 bp to the present. In *African archaeology: a critical introduction*, ed. A.B. Stahl, 392–419. Oxford: Blackwell Press.

Lane, P.J., C. Ashley, O. Seitsonen, P. Harvey, S. Mire and F. Odede. 2007. The transition to farming in eastern Africa: new faunal and dating evidence from Wadh Lang'o and Usenge, Kenya. *Antiquity* 81: 62–81.

Lange, G. 1991. Appendix V, a seed of wild finger millet from Gogo Falls. *Azania* 26: 191–192.

Manning, K., R. Pelling, T. Higham, J.-L. Schwenninger and D.Q. Fuller. 2011. 4500-year old domesticated pearl millet (*Pennisetum glaucum*) from the Tilemsi Valley, Mali: new insights into an alternative cereal domestication pathway. *Journal of Archaeological Science* 38: 312–322.

McCormac, F.G., A.G. Hogg, P.G. Blackwell, C.E. Buck, T.F.G. Higham and P.J. Reimer. 2004. SHCal04 Southern Hemisphere calibration, 0–11.0 cal kyr BP. *Radiocarbon* 46: 1087–1092.

Mitchell, P.J. 2002. *The archaeology of southern Africa*. Cambridge: Cambridge University Press.

Moomaw, J.C. 1960. *Plant ecology of the coast region of Kenya Colony, British East Africa*. Nairobi: Department of Agriculture.

Msuya, C.S. 2004. Discussion on the relationship between early Iron Age pottery tradition of Kwale Ware and later pottery tradition of Tana Ware: the Dakawa pottery assemblage. In *Combining the past and the present: archaeological perspectives on society*, ed. T. Oestigaard, N. Anfinset and T. Saetersdal, 161–170. Oxford: Archaeopress.

Murray, S.S. 2008. A report on the charred botanical remains from Sincu Bara, a mid-first millennium AS Middle Senegal Valley site. *Nyame Akuma* 69: 56–63.

Mutoro, H.W. 1987. An archaeological study of the Mijikenda Kaya settlement. PhD diss., University of California, Los Angeles.

Mutoro, H.W. 1994. The Mijikenda Kaya as a sacred site. In *Sacred sites, sacred places*, ed. D.L. Carmichael, J. Hubert, B. Reeves and A. Schanche, 132–139. London: Routledge.

Pocktsy, J.-M.L., R. Lumaret, D. Mayne, A.M. Vall, Y.I.M. Abutaba, M. Sagna, S.O.R. Raoseta and P. Danthu. 2009. Chloroplast DNA phylogeography suggests a West African centre of origin for the baobab, *Adansonia digitata* L. (Bombacoideae, Malvaceae). *Molecular Ecology* 18: 1707–1715.

Pollard, E. 2008. *The archaeology of Tanzanian coastal landscapes in the sixth to fifteenth centuries AD*. Oxford: Archaeopress.

Philippson, G. and S. Bahuchet. 1996. Cultivated crops and Bantu migrations in central and eastern Africa: a linguistic approach. *Azania* 29: 103–120.

Phillipson, D.W. 2005. *African archaeology*. Cambridge: Cambridge University Press.

Robertson, S.A. 1987. *Preliminary floristic survey of Kaya forests of coastal Kenya. A report to the Director, National Museums of Kenya*. Nairobi: National Museums of Kenya.

Robertson, S.A. and W.R.Q. Luke. 1993. *Kenya coastal forests: the report of the NMK/WWF coastal forest survey. Kenya coast forest status, conservation and management*. Nairobi: National Museums of Kenya.

Schoenbrun, D.L. 1993. We are what we eat: ancient agriculture between the Great Lakes. *Journal of African History* 34: 1–31.

Seitsonen, O. 2004. Lithics after the Stone Age in eastern Africa: Wadh Lang'o case study. MA diss., University of Helsinki.

Sinclair, P. 2007. What is the archaeological evidence for external trading contacts on the East African coast in the first millennium BC? In *Natural resources and cultural connections of the Red Sea*, ed. J. Starkey, P. Starkey and T. Wilkinson, 1–8. Oxford: Archaeopress.

Sinclair, P., A. Juma and F. Chami. 2006. Excavations at Kuumbi Cave on Zanzibar in 2005. *Studies in the African Past* 5: 95–106.

Sinclair, P., J. Morais, L. Adamowicz and R. Duarte. 1993. A perspective on archaeological research in Mozambique. In *The archaeology of Africa: food, metals and towns*, ed. T. Shaw, P.J.J. Sinclair, B. Andah and A. Okpoko, 409–431. London: Routledge.

Snowden, J.D. 1936. *The cultivated races of sorghum*. London: Adlard and Son Ltd.

Soper, R. 1975. *Notes on some caves in Kilifi District*. Nairobi: Caves Exploration Group of the East African Society.

Spear, T. 1978. *The Kaya complex: a history of the Mijikenda peoples of the Kenya coast to 1900*. Nairobi: Kenya Literature Bureau.

Stemler, A.B., J.R. Harlan and J.M.J. De Wet. 1975. Evolutionary history of cultivated sorghums (*Sorghum bicolour* [Linn.] Moench) of Ethiopia. *Bulletin of the Torrey Botanical Club* 102: 325–333.
Sutton, J.E.G. 2002. A review of People, Contacts and the Environment in the African Past. *Journal of African History* 43: 503–505.
Waaijenberg, H. 1987. Agriculture in the Kilifi area. In *Soils of the Kilifi Area, Kenya. Reconnaissance soil survey report R11*, ed. H.W.T. Boxem, T. de Meester and E.M.A. Smaling, 195–247. Nairobi: Kenya Soil Survey.
Waaijenberg, H. 1994. *Mijikenda agriculture in Coast Province of Kenya: peasants in between tradition, ecology and policy.* Amsterdam: Royal Tropical Institute.
Walshaw, S.C. 2005. Swahili urbanization, trade, and food production: botanical perspectives from Pemba Island, Tanzania, AD 700–1500. PhD diss., Washington University in St. Louis.
Walshaw, S.C. 2010. Converting to rice: urbanization, Islamization and crops on Pemba Island, Tanzania, AD 700–1500. *World Archaeology* 42: 137–154.
Wickens, G.E. 1982. The baobab: Africa's upside-down tree. *Kew Bulletin* 37: 173–209.
Willis, J. 1996. The northern Kayas of the Mijikenda: a gazetteer and an historical reassessment. *Azania* 31: 75–98.
Wright, D.K. 2005. New perspectives on early regional interaction networks of East African trade: a view from Tsavo National Park, Kenya. *African Archaeological Review* 22: 111–140.
Young, R. and G. Thompson. 1999. Missing plant foods? Where is the archaeobotanical evidence for sorghum and finger millet in East Africa? In *The exploitation of plant resources in ancient Africa*, ed. M. Van der Veen, 63–72. New York: Kluwer Academic/Plenum Publishers.