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Shipwreck Evidence from Kilwa, Tanzania

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This article reports on the artefacts and environment of marine ballast and pottery sites identified through inter-tidal and underwater survey around Kilwa, Tanzania, one of the most important medieval sultanates along the east African coast. An inter-tidal site on the limestone fringing reef on the approaches to Kilwa Kisiwani Harbour and an underwater site within the harbour have been dated from associated pottery to *c.*8th–10th century and the 13th–16th century respectively. The presence of exotic basalt ballast is discussed as an indicator of wreck-sites.

Key words: Kilwa, Tanzania, medieval, shipwrecks, basalt ballast.

The east African coast, popularly known as the Swahili coast, extends 3000 km from Somalia in the north through Kenya and Tanzania to Mozambique in the south (Fig. 1). This coast has played an important role in the transoceanic Indian Ocean maritime commerce in which mangroves, gold, ivory and slaves were exported, and cloth, glass, beads and incense imported. It also includes the islands of Comoro and northern Madagascar. Sailing between these lands and their settlements has been, and is still, based on regular and predictable monsoon winds linking Arabia, the Indian subcontinent and Africa. Historical coastal settlements of Mogadishu, Lamu, Zanzibar, Kilwa and Sofala were important ports of call for merchant shipping, strategically sited along busy sea lanes. The underwater environment along the coast is therefore the likely repository of shipwrecks, abandoned boats, goods lost overboard, anchors and other maritime debris. Information from shipwrecks, however, has been lacking, limiting our understanding of the trade, marine subsistence and seafaring technology of the east African coast (Breen and Lane, 2003; Lane, 2005). Although this coast is dotted with historic settlements at close proximity to the sea, archaeological research has provided minimal insight into the specifically maritime aspects of these communities. The dangers of shipping in ancient times are known and many western shipwrecks are reported lost in these waters (Guinote *et al.*, 1998; Patience, 2006; Ichumbaki, 2015), but integrated surveys using marine geophysics, ethnography and cultural landscape studies to record the medieval maritime archaeology of this coast are sparse (for example Forsythe *et al.*, 2003; Jeffery and Parthesius, 2013).

This paper reports on evidence of two sites discovered from inter-tidal and underwater survey around Kilwa, one of the most important sultanates along the east African coast. This work is key to fusing archaeological evidence with information from historical documents, ship engravings and ethnographic data on vernacular boats that has been gathered along the coasts of Oman, India and east Africa. This process has been severely hampered by the low number of known non-European shipwrecks in the Indian Ocean. The sites discussed here by the investigators at Kilwa are therefore timely.

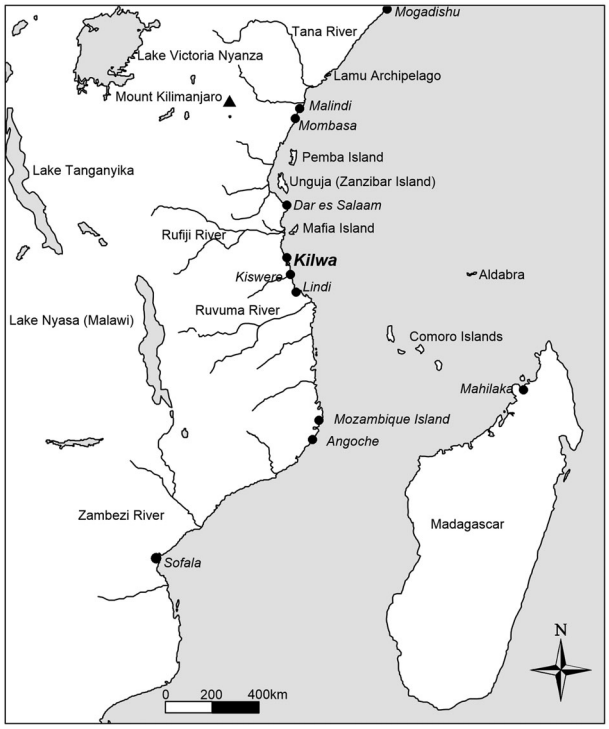

Figure 1. Location of Kilwa along the east African coast. (E. Pollard)

Medieval Indian Ocean trading vessels

Evidence for early Indian Ocean trading vessels comes in the form of historical documents, ship engravings, anchors and shipwrecks. Ibn-Jabyr, writing in the 8th–9th-century, recorded vessels at the Red Sea port of Aydhab that were carvel-built with planks stitched with coconut fibre through holes bored at intervals near the edges of adjacent planks (Hourani, 1995: 91–3). Investigations at Lamu, Kilepwe, Gede and Mtwapa in Kenya, and Kilwa and Ras Mikumbi in Tanzania have yielded boat illustrations and graffiti (Kirkman, 1964; Garlake and Garlake, 1964; Gilbert, 1998). Ship engravings are typically found on the outer walls, outer windows and door jambs of mosques, or near the main entrances of domestic buildings. Garlake and Garlake believed them to be charms or votive offerings for the safety of the vessel depicted. A 15th-century engraving from the Barrel Vaulted House at Songo Mnara near Kilwa shows the swan-necked bow typical of the *mtepe*, an east African sewn-plank ocean-going cargo vessel, with a pennant flying from its mast. Three 15th-century Kilwa engravings from the Great Mosque have similar curved, flared bows but with *oculi* and tasselled and bobbled amulets hanging from them. They appear to have yards supporting square sails and, at the foot of the sail, a spreader yard (Chittick, 1974: 265–6).

The remains of medieval ships and maritime equipment are very limited with, perhaps, the exception of anchors. Underwater surveys at the channel entrance to the ancient port of Mombasa recovered three stone anchors; of these, one is an Indo-Arabian type while the other two are composite types, that is wooden anchors weighted with stones (Bita and Wanyama, 2011; Bita and Tripati, 2015). The shape and size of the three stone anchors resemble others found along the Indian and Sri Lankan coasts, at Qalhat, Oman and Mogadishu, and the Mediterranean region (Chittick, 1974: 414; Souter, 1988: 331–42; Tripati *et al.*, 1998: 1–8; Vosmer, 1999: 248–63; Tripati, 2003: 93–106; Gaur *et al.*, 2008: 24–57). An Indo-Arabian type stone anchor shank (1.2 m long and 0.35 m wide) was recorded at Kilwa by Chittick (1974: 414) near the top of a steeply sloping bank to the west of the main town, though by 2004 it was on the foreshore below the cliff (Pollard, 2008a). This type of anchor consists of a long, flat-sided shaft, slightly thicker at one end in which two rectangular holes were set at right-angles to each other. Similar anchors have been dated to the 11th century AD at Siraf in the Gulf (Whitehouse, 1970: 14–15).

Categorical archaeological evidence for medieval ships and associated maritime trade would come from a shipwreck, but finds are exceptionally rare in the western Indian Ocean. Ships were wrecked, however, as the 10th-century Arab historian and geographer Al-Masudi recorded a Persian shipwreck returning from Qanbalu (an unidentified entrepôt on the east African coast) (Sprenger, 1841: 260–3).

Shipwreck remains have been found in the Red Sea at Black Assarca Island, Eritrea, where Pedersen (2008) recorded amphoras and wood on the seabed among sand, silt and coral from a shipwreck dating to the 5th–7th century AD. Other artefacts included one ballast stone, greenish-blue glass probably from a wineglass or goblet, and a lead globular counterweight for a steelyard. No evidence was found of the ship's structure, though Pedersen considered further excavation may reveal hull remains under the amphoras that could give insights into the seafaring technology and origin of the ship. The ship was probably involved in the trade of bulk items, along with perhaps some luxury goods as indicated by the glass piece (Pedersen, 2008: 90–1).

The Kadakkarappally boat excavated on land at Kerala, SW India, has been described by Tomalin *et al.* (2004). It is a 13th–15th-century double-masted flat-bottomed boat, 18.7 m in length and 4.05 m in width. It has a double-planked hull and the bow rises to a point. The stern end had been destroyed, but loose timbers suggested it had a transom. Longitudinal strength comes from two chine strakes. Ten frames divide the boat into 11 compartments and provide transverse strength. Iron nails and wooden pegs were used in the construction with the outer planking secured to the inner planking by square-sectioned iron nails clenched over roves. At the chines the two layers have been additionally secured with square wooden pegs. Nails in the bottom planking of the boat are without roves and in places look like they have been driven through a rectangular lap-joint between adjacent bottom planks.

Iron spikes and square-sectioned wooden pegs were employed to fasten the frames to the planking. Several transverse rows of cleats carved into the inner planks of the boat suggest that the planks may have been held together through compression by lashings. A few rope fragments remained within the cleats. Both masts had been destroyed but the mast-steps remain. One mast-step is in the centre of the boat with the other in the bow portion. The sockets for inserting the masts are only 50 mm deep, suggesting further support for the mast was needed. A stone (of beach rock or kankar stone) found in the 4th compartment from the bow narrowed at one end and could be an anchor, although it has no hole to fasten the rope, and could also be ballast (Tomalin *et al.,* 2004: 256). Tomalin *et al.* considered that the lack of cargo or significant ballast suggested the vessel was deliberately abandoned. The flat bottom and strong double planking indicates suitability for shallow backwater channels.

Although sewn-plank ships are presumed to have been common in the Indian Ocean during the Medieval period, iron-fastened Chinese junks also visited Kerala from the 6th century AD, and, under the Tang dynasty (7th–10th centuries), Malabar became the westernmost destination for Chinese ships (Tomalin *et al.*, 2004: 259). The use of lashings through cleats or 'lugs' is a fastening technique characteristic of Southeast Asian boatbuilding and these vessels also sailed off the Malabar coast during the Medieval period.

There is some evidence for western Indian Ocean seafaring technology in the eastern Indian Ocean from the 9th-century Belitung shipwreck in Indonesia. Flecker (2001) described the ship as shallow-draughted, designed to travel lightly over the water, with a keel length of 15.3 m, up to 5.1 m width, and possessing a sharp bow with little rake. Hull planks were stitched together with cross-stitched seams, wadded inside and out, but without use of dowels in edge joints. Frames and through-beams were lashed to the hull. The anchor was of grapnel type with wooden shank and iron arms. The origin of the voyage is unknown, but cargo finds included ten tonnes of lead ingots, thought to be paying ballast, and Chinese ceramics mostly from 9th-century Changsha kilns. Non-ceramic cargo included gilt silverware, bowls, spoons, a flask, Chinese mirrors, cast-iron cauldrons, copper-alloy bowls, grindstones and a blue glass Middle Eastern bottle, copper-alloy scale weights, a scale bar, cut black coral, dice carved from bone or horn, an ink-stone with two short legs and a carved butterfly design, and iron-tipped arrows (Flecker, 2001: 339–42).

The few marine surveys undertaken on the Swahili coast have documented a number of sites of potential interest on the seabed. A geophysical survey of Mombasa Island revealed numerous underwater sites, some of which may be shipwrecks (Forsythe *et al.*, 2003; Quinn *et al.*, 2007; McConkey and McErlean, 2007). In Lamu, surveys have recovered anchors, wooden features and Chinese porcelain on the seabed along Pate Bay, including a pot with dragon emblems typical of Chinese motifs of the 14th century AD (Bita and Wanyama, 2007; Bita, 2013; 2015). Dragon motifs are emblems of the Chinese Ming Dynasty Emperors. During the Ming dynasty, the Chinese are said to have launched various missions to the African continent and one of the junks is said to have sunk near Pate Island (Inghams, 1962: 5; Kirkman, 1964: 86–9).

Maritime surveys in Malindi have documented several potential sites, but most are yet to be confirmed as shipwrecks or other features. In Ungwana Bay, sailors have commented on unusual structures on the seafloor around the 'Mambrui Lump', a feature that rises some 30 m from the seafloor, but these await investigation. However, a wooden shipwreck containing 14th–15th-century Chinese and Indian pottery off Leopard Bay reef has been identified (Patience, 2006: 131; Bita, 2013). Further, a 16th-century shipwreck in Ngomeni, 30 km north of Malindi Town, has produced huge amounts of Islamic and Far East wares dating to the 13th–15th centuries (Bita, 2014). In this case, the timbers are fastened together with iron nails suggesting a different tradition of boat construction to that of the western Indian Ocean. Moreover, the presence of copper ingots with a visible trident seal similar to the Fugger family crest suggests this may be a Portuguese rather than an Arabic vessel. The Fuggers were a prominent 16th-century family of merchants and bankers from Germany who, together with others, such as the Welser family, supplied merchandise that formed part of the commercial artery of the Portuguese crown (Chalmin, 1987).

Kilwa background

The Kilwa ria or bay, situated about 250 km south of Dar es Salaam City, is founded on coral limestone along the ocean margins with sandstones and conglomerates landward (Fig. 2). A number of islands are situated in the ria, of which Kilwa Kisiwani and Songo Mnara are the largest. Kilwa Kisiwani is separated from the mainland to the north by a deep channel 1–2 km wide: this whole area is referred to as Kilwa Kisiwani Harbour. Songo Mnara is about 2 km south of Kilwa Kisiwani and this sheltered area is known as Sangarungu Harbour. Within the Kilwa ria dense mangrove-lined waterways are widespread and separate the islands from the mainland and each other. Geomorphology has thus been kind to Kilwa providing an extensive complex of accessible and sheltered anchorages as well as varied natural resources. On the ocean side the exposed coast exhibits limestone cliffs with a wave-cut platform, and a lagoon with fringing reef to the south.

Pollard (2008a) and Chittick (1974) have recorded trading evidence from Kilwa dating from the *c.*7th century. It was part of the western Indian Ocean trading system that extended at least as far south as Chibuene, Madagascar and the Comoros Islands in the latter part

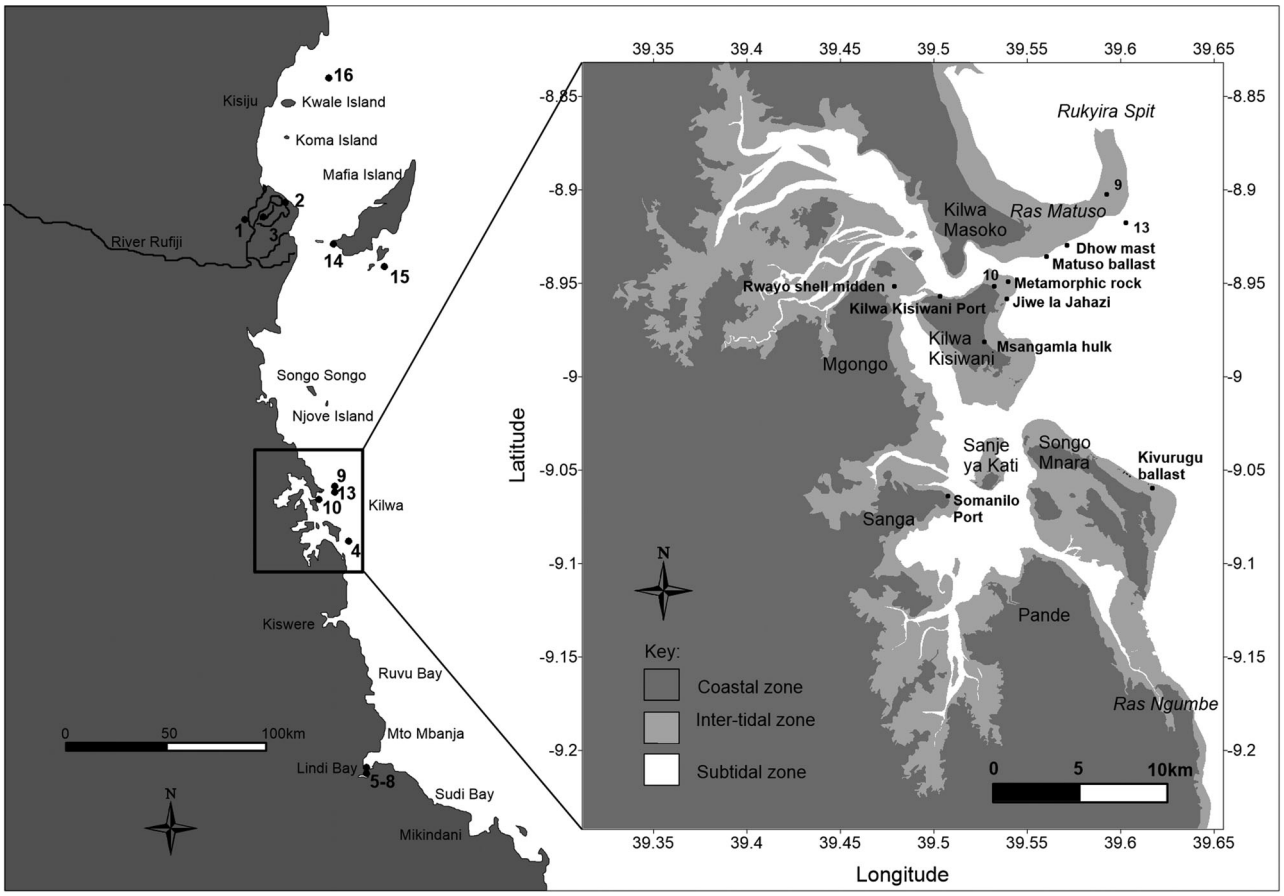

Figure 2. Recorded shipwrecks, hulks, obstructions, anchors, fouls and anomalies surrounding Kilwa where co-ordinates are known, Numbers refer to Table 1; inset: sites recorded in survey around Kilwa ria. (E. Pollard)

of the first millennium (Fig. 1) (Sinclair *et al.*, 2012). By the 12th–13th centuries, Kilwa was considered an important port-of-call when Ibn al-Mujawir, writing in 1232/1233, described it as a staging point on the route from Aden to al-Qumr (Madagascar) (Trimingham, 1975: 127–8). Excavations by Chittick (1974: 237–8) identified an increase in wealth in the port at that time, with the appearance of stone buildings and industrial activity. It was identified as an intermediate port *en route* between Aden and the Sofala region, through which gold from the Zimbabwe plateau was channelled into the world maritime trading system (Sutton, 1989: 113; Horton and Middleton, 2000: 101). Kilwa took over the gold trade from Mogadishu in the 12th century, according to the Kilwa Chronicle, but it was not until the late 13th–14th century that it secured a virtual monopoly, and with it imposing commercial and religious buildings (Freeman-Grenville, 1962: 91–2).

Much land-based archaeological research has been carried out on Kilwa and its hinterland, which has helped to define the city-state, its physical structure and political economy during the second millennium. The maritime foundation of Kilwa's importance, however, suggests that a broader view of its setting and trading operations might be obtained by extending archaeological work into the inter-tidal and subtidal zones. In the former respect, coastal and inter-tidal surveys have been conducted by Pollard (2008a; 2008b; 2011; Pollard *et al.*, 2012), which defined maritime features such as causeways, harbour structures and industrial activity. The subtidal zone remains to be explored from an archaeological perspective, although there are some known wrecks and underwater anomalies, such as fishermen's fasteners/fouls or obstructions. Most of the recorded wrecks are of 20th-century date, and have been discovered by amateur sports divers, professional salvage companies, or are listed by the United Kingdom Hydrographic Office (UKHO) (Table 1). Only one of these, at Kisimani Mafia some 60 km north of Kilwa, potentially relates to the Medieval period (Jeffery and Parthesius, 2012). The distribution of the sites (Fig. 2) reflects the main ports on this stretch of the Swahili coast, namely Kwale-Kisiju, Mafia-Rufiji Delta, Kilwa, and Lindi Bay. This may merely reflect the current high level of activity in these areas that has brought wrecks and other

Table 1. *Recorded and reported wreck-sites in the area surrounding Kilwa*

No. on Fig. 2	Site name	Location	Coordinates	Date	Description	Reference
1	*SMS Königsberg*	Rufiji Delta	7º52.133′S 39º14.500′E	6 July 1915	German cruiser built in 1907. The ship was scuttled and the guns salvaged.	Patience, 2006: 157–8
2	*Newbridge*	Simba Uranga channel, Rufiji Delta	7º47.167′S 39º22.500′E	10 November 1914	Built in England in 1906 and known as a turret ship. Chartered to the Admiralty with a consignment of coal. Scuttled across the Rufiji mouth as a blockade against *Königsberg*.	Patience, 2006: 169–70
3	*Somali*	Rufiji Delta	7º51.334′S 39º18.900′E	November 1914	Built in Germany in 1889, it supplied *Königsberg* with coal. The cruiser *HMS Chatham* shelled *Somali*, which caught fire and burnt for four days and was lost.	Patience (2006: 184–5)
4	Wreck No. 79842	SE of Songo Mnara	9°06.840′ S 39°38.700′ E	–	Water Depth 690 m, originally detected 2012, recorded as ten containers filled with concrete.	UKHO
5	Wreck No. 42549	Lukila, Kilwa	8°54.110′ S 39°35.540′ E	Probably 20th century	Water depth 2 m on coral substrate. Originally detected 1964. Wreck of a schooner on windward side of coral island near Kilwa Masoko.	UKHO; Patience, 2006: 231
6	Wreck No. 42548	Lindi Bay	9°59.625′ S 39°43.190′ E	Probably 20th century	Stranded wreck identified from aerial photo. Water depth 1 m on coral substrate.	UKHO
7	Wreck No. 42547	Lindi Bay	9°59.842′ S 39°43.157′ E	Probably 20th century	Stranded wreck identified from aerial photo. Water depth 0 m on coral substrate	UKHO
8	Wreck No. 42471.	Lindi Bay	10°00.784′ S 39°42.850′ E	Probably 20th century	Stranded wreck identified from aerial photo. Water depth 0 m on coral substrate. Detected 1964.	UKHO
9	Wreck No. 42471.	Lindi Bay	10°00.784′ S 39°42.850′ E	Probably 20th century	Stranded wreck identified from aerial photo. Water depth 0 m on coral substrate. Detected 1964.	UKHO
10	Unknown	Ras Kipakone	8°57′ 4.8″ S 39°31′ 55.12″ E	Late 18th century	A wreck marked as '*La Carcasse*' on the inter-tidal zone of *Isle de Quiloa* chart, 1775. It is *c.*80 x 16 m in size.	Bibliothèque Nationale de France, Department Cartes et Plans, GE C-2308, gallica.bnf.fr
11	Unknown	Between Kilwa and Mafia	–	1777	Abdalla of Kilwa loaded two vessels and sent them to Kilwa from Mafia in January 1777. Both ran onto the rocks between Kilwa and Mafia, and were lost with their cargoes.	Ross and Holtzappel, 1986, in Jeffery and Parthesius, 2013: 162

(*Continued*)

Table 1. *Continued*

No. on Fig. 2	Site name	Location	Coordinates	Date	Description	Reference
12	Unknown	North from Kilwa Kisiwani	–	Portuguese period	Three Portuguese ships wrecked heading north from Kilwa Kisiwani. One ship struck a reef after leaving the harbour, the second was lost after leaving Kilwa Kisiwani, while the third struck the 'bar' and was lost.	Theal, 1898, 1901, in Jeffery and Parthesius, 2013: 162
13	Unknown	Lukila, Kilwa	–	Portuguese period	An iron anchor with a shaft length of 2.4 m and measuring 1.9 m from fluke to fluke. It lies flat on the seabed in *c.* 5 m of water at low tide on a bed of hard limestone.	Jeffery and Parthesius, 2013: 162
14	Unknown	Kisimani Mafia	–	Medieval	On the seabed was a large timber which local villagers reported as the keel of a dhow. The area also contained six large stones carved in distinguishable shapes, with a large central hole that passes through each stone.	Jeffery and Parthesius, 2013: 166–8
15	Unknown	Juani Island, Mafia	–	19th century	Ten brass cannons, three anchors, fragments of shot and a bronze bell were located by divers in shallow water close to the southern shore off Juani Island, Mafia, in 1977. The bell was recovered and bore the following inscription: 'H … &B H Co. 180_' (the last figure might be 9).	ARDA, 1980: 9
16	Wreck No. 42523.	NE of Kwale Island	7°21.732′ S 39°32.538′ E	–	In 30 m water depth on mud substrate. Foul reported originally in 1916	UKHO
17	Unknown	Off Kilwa	–	1519	Portuguese ship grounded on a sandbank off Kilwa. The 10 crew were, all but one youth, killed by people from Kilwa, Mafia and Zanzibar.	Strandes, 1989: 99
18	Unknown	Mafia	–	–	A wooden shipwreck	Patience, 2006: 231

obstructions to the notice of seamen. However, the concentration of past traffic would also raise the chance of shipwreck on the approaches to harbours, and particularly so for vessels under sail on coral limestone coasts with offshore fringing reefs when wind strength and direction cannot always be relied upon. In this study attention is concentrated on Kilwa in the two environs that potentially offer the greatest danger to shipping: the reefs that mark the harbour approach, and the port itself.

Jiwe la Jahazi site

In the first of these contexts, in 2004, Pollard recorded an area of black basalt, an exotic rock on the limestone coast, on the inter-tidal zone on the east coast of Kilwa Kisiwani in the area of Mvinje near a 'dhow-shaped' coral limestone islet called the Jiwe la Jahazi (Fig. 2) (Pollard, 2008b: 110). This site lies on the fringing reef a little over 1 km south of the entrance to Kilwa Kisiwani Harbour, between two reef-coral causeways.

Figure 3. Recording artefacts on the reef crest with the Jiwe la Jahazi islet in the background. (E. Pollard)

Figure 5. Stones from the Jiwe la Jahazi site. Top row from left: sandstone, basalt, granite and quartzite; bottom row quartz, scale 0.5 m. (E. Pollard)

Local fishermen have a legend about the islet being a ship attacking Kilwa that was turned to stone, while the basalt on the foreshore marks the weapons of the invaders. In practice, the basalt would appear to be the ballast of a ship that had run aground on the reef. In 2015, the distribution of artefacts visible on the surface of the site was recorded by Trimble Geoexplorer GPS (Figs 3–5).

The basalt at Jiwe la Jahazi consists of subangular to subrounded small boulders and cobbles concentrated on the seaward edge of the sharp limestone bedrock that forms rock pools up to 0.5 m deep in which the black stones lie. The basalt is dispersed among the rock pools but is concentrated in an area 60 m NW-SE by 30 m NE-SW. Some of the basalt shows white quartz veins and other parts the quartz has weathered green; furthermore, there is red oxidation. Measurement of the longest dimension of the basalt blocks gives a range in size from 0.16 to 0.35 m. Wave transportation has resulted in some sorting of the basalt; stones becoming smaller landward presumably with distance from the point of deposition.

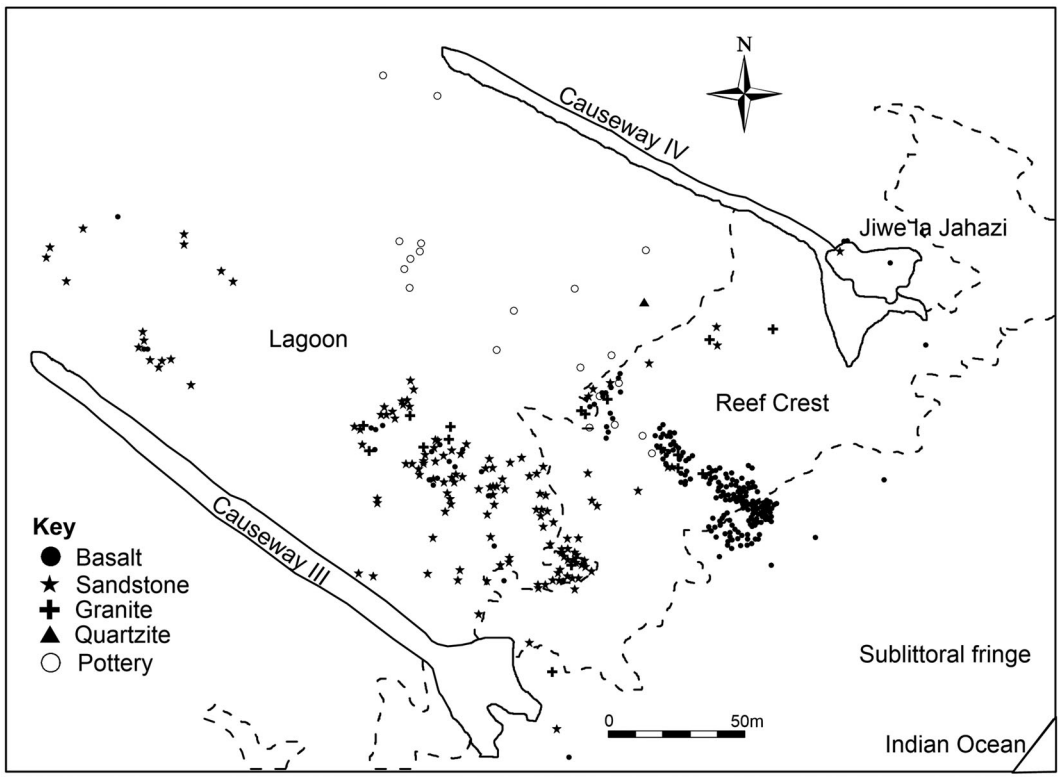

Figure 4. Distribution of materials at Jiwe la Jahazi shipwreck site. (E. Pollard)

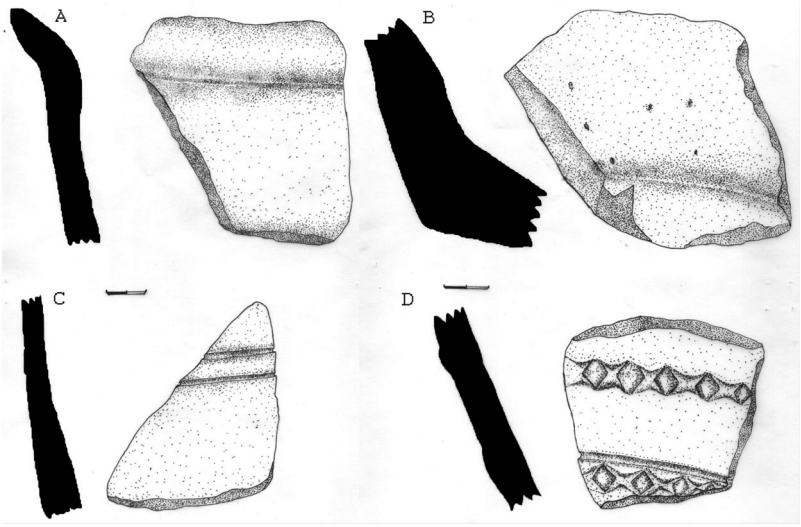

Figure 6. Imported pottery from the Jiwe la Jahazi site. (E. B. Ichumbaki and S. Kilindo)

Further search of the inter-tidal zone revealed an area of coarse-grained very hard orange sandstone that weathers to a yellow brown. It lies 50 m to the south-west of the basalt and extends from the landward edge of the spikey reef crest into the lagoon (Figs 4–5). It is concentrated in an area 90 m NW-SE by 30 m NE-SW. The dispersion suggests carriage of lower density sandstone further inland than the basalt or that the original point of deposition was more towards the landward edge of the reef crest. The large cobble sandstone boulders vary in size from 0.36 × 0.29 × 0.33 m to 0.16 × 0.11 × 0.90 m, and are angular to subangular, probably reflecting breaking along their bedding.

There were four basalt stones and one sandstone around the Jiwe la Jahazi that could not have been moved from the site by wave action due to the landward direction of dispersal of the artefacts across the reef. Therefore, they were probably brought there by fishermen to weigh down fish-trap baskets, left at low water and retrieved during the following low tide. Other exotic rocks found around the site were intrusive igneous, probably granite, and metamorphic, probably quartzite (Fig. 5). The granite is very hard, dense, with crystals 1–2 mm of pink, black and light-grey colours. Other loose rock at the site is white quartz, flattish on the two widest sides, so probably from a vein. Quartz is also found in occasional nodules in the limestone, and is probably local with fishermen using them as hammer stones for opening shellfish.

The distribution of the pottery clearly conforms to the landward edge of the basalt reflecting its lighter density and hence its carriage further landward, including well into the lagoon (Fig. 4). Although rounded by being in the wave zone, the relatively thick (up to 30 mm) and coarse red pottery includes flat bases and thickened rim, incised and moulded bands and one has possible traces of a clear slip on the inner surface (Fig. 6). Similar pot described as a storage jar from southern Iran has been recorded at Manda in Lamu Archipelago, Unguja Ukuu on Zanzibar, Sohar in Oman, and Siraf in the Gulf dated to the late 8th–10th century (Chittick, 1984: 84–91; Juma, 2004: 113–7; Priestman, 2013: 474–6).

Discussion

The dispersion of basalt ballast indicates that either the hull split open and the ballast fell out signifying a shipwreck, or the ballast was thrown overboard to allow the ship to float off the reef producing a material dump. The pottery is clearly related to the basalt as opposed to the nearby sandstone ballast due to it being directly landward of the basalt where wave energy over the reef would have carried and deposited in the lagoon. The distribution of the sandstone suggests a second shipwreck or grounding event, as most stones seem to have been carried directly landward longitudinally to the low water mark and reef crest independently of the basalt dispersion. The concentration of sandstone suggests that this vessel appears to have lost its ballast on the landward side of the reef crest, perhaps due to a higher tide allowing it to reach further landward, or because it was leaving the lagoon for the open sea when it got into trouble, or because it was a lighter vessel that was carried further by waves before breaking apart. However, it cannot be ruled out that the dispersion represents carriage of lower density sandstone further inland from a single wreck-site, the ship having been ballasted with both basalt and sandstone, the basalt having been lost first before the boat was carried a further 50 m and finally torn apart losing the rest of its ballast. The combination of different ballast types is possible if a vessel trades in diverse locations, as a tramp ship would, loading basalt in one area of trade and

sandstone in another (McGrail, 1989: 353). Assuming the sandstone signifies a separate deposition event to the basalt and pottery, the present evidence does not support an ocean-going vessel due to sandstone being found naturally within the harbour and may have been a local vessel gathering produce from the east coast such as reef coral, lime and fish for market at Kilwa Kisiwani Port.

In the case of the exotic basalt, the presence of pottery, in part intermixed with the basalt but largely present as a landward tail as might be expected from a density perspective, adds credence to the interpretation of the basalt site as a shipwreck—although it is possible that broken pottery, especially heavy pottery, was reused as ballast. Furthermore, the ballast does not lie in an expected location for an ocean-going trading vessel, which would be expected to have sailed to the commercial port within Kilwa Kisiwani Harbour. Therefore, it is likely that it accidently struck the reef approaching the harbour. An ocean-going vessel approaching Kilwa would not deliberately sail over the sharp limestone reef, so the basalt distribution defines a ship striking the reef. Although, without any hull structure, it is not certain that the vessel(s) were not refloated following discarding ballast, this is considered very unlikely due to the sharpness of the limestone enclosing the rock pools on a reef crest 60 m wide, and the large amount of ballast stone on the reef. The sewn hulls of the late 8th–10th-century vessels in the western Indian Ocean were designed to flex going over shallow reefs and sand bars but the sharpness of the coral limestone at the Jiwe la Jahazi would have caused catastrophic damage to the vessel as it would have been carried across the reef by waves, as seen by the dispersal of the basalt in Fig. 5. Finally, there is the oral tradition told on Kilwa Kisiwani of the shipwreck at Jiwe la Jahazi, supporting a wrecking event.

The broad conclusion that can be drawn from the oral tradition of a shipwreck, the location in a sharp limestone reef crest environment, late 8th–10th-century AD pottery, and basalt ballast is that of a wreck of a vessel carrying imported goods from the Gulf. The pottery, also found at Siraf and Sohar, correlates with the description by Al-Masudi of Persian and Omani merchants sailing the east African coast *c.* 10th-century. The ballast deposition of sandstone is probably an indication of a separate shipwreck or a grounding event due to the homogeneity of the area, distinct from the basalt and pottery area, again indicating that the Jiwe la Jahazi was a dangerous zone for ships approaching Kilwa Kisiwani Harbour.

Geophysical and diving surveys

In an effort to investigate further the archaeology of the Jiwe la Jahazi site, other sections of the east coast including Msangamla, and Kilwa Kisiwani Port, surveys of the subtidal zone were carried out in February 2014. A geophysical survey was conducted using a SwathPlus 468kHz sidescan sonar attached to a motor boat hired from the Tanzania Antiquities offices in Kilwa Masoko, in conjunction with a TSS DMS205 motion reference unit, sound velocity probe, Vector Hemisphere GPS, and Topcon RTK dGPS. SCUBA diving surveys then took place, largely in 2015, to ground-truth and investigate in detail the possible cultural material highlighted. Diving was restricted to anomalies at less than 20 m depth for safety reasons. A selection of anomalies was investigated from outside the harbour and within the harbour to gather a wide variety of environments to examine preservation and distinguish natural from cultural features. A circular search pattern with two divers was used for anomalies. Other areas of potential interest were investigated with a swim line search using three to four divers.

The search along the ocean edge off the fringing reef between Causeways III and IV (Fig. 4) was undertaken to check on the possible presence of other material related to the Jiwe la Jahazi site. Nothing of significance was found, however, which is not unexpected due to coral-reef growth compared with the limestone bedrock of the reef crest and lagoon.

The majority of dives were performed within the harbour environment. While a haven from wind and waves might appear less dangerous to shipping, in practice, the high density of traffic, the possibility of collisions, the occurrence of squalls, misloading of ships, and the abandonment of boats that were no longer seaworthy, all increase the likelihood of wrecks within the broad harbour and its principal port areas. One anomaly off Kilwa Kisiwani Port revealed an artefact dispersion on the seabed around 100 m from the low water mark that included a medieval stone anchor, local pottery, and imported pottery from South-west Asia (Fig. 7). The site is gently dipping about 1–1.5 m over the 1 ha area. In 2015, a Tritech Starfish 990F sidescan sonar at a frequency of 900kHz and a sonar range of 20 m was used over this site to get a clearer picture of the environment and anomalies. The dive site at Kilwa Kisiwani Port is up to 10 m deep and presented some challenges in that underwater visibility was often no more than 1 m. At low tide a strong current developed and the water appeared more saline making the divers more buoyant.

Kilwa Kisiwani Port anchorage

There is considerable evidence to show that Kilwa Kisiwani Port was important commercially by the 11th century AD. That is particularly displayed in the midden cliff face and eroded materials on the beach below, which reveals large amounts of local and imported pottery, slag, spindle whorls, coins, beads, and bone, indicating industrial and maritime activity in the first half of the second millennium (Pollard, 2008a: 93–4). Major stone-building periods occurred from around the 14th–15th centuries, including a mosque, sea-walls and wells (Pollard, 2008a: 100–1).

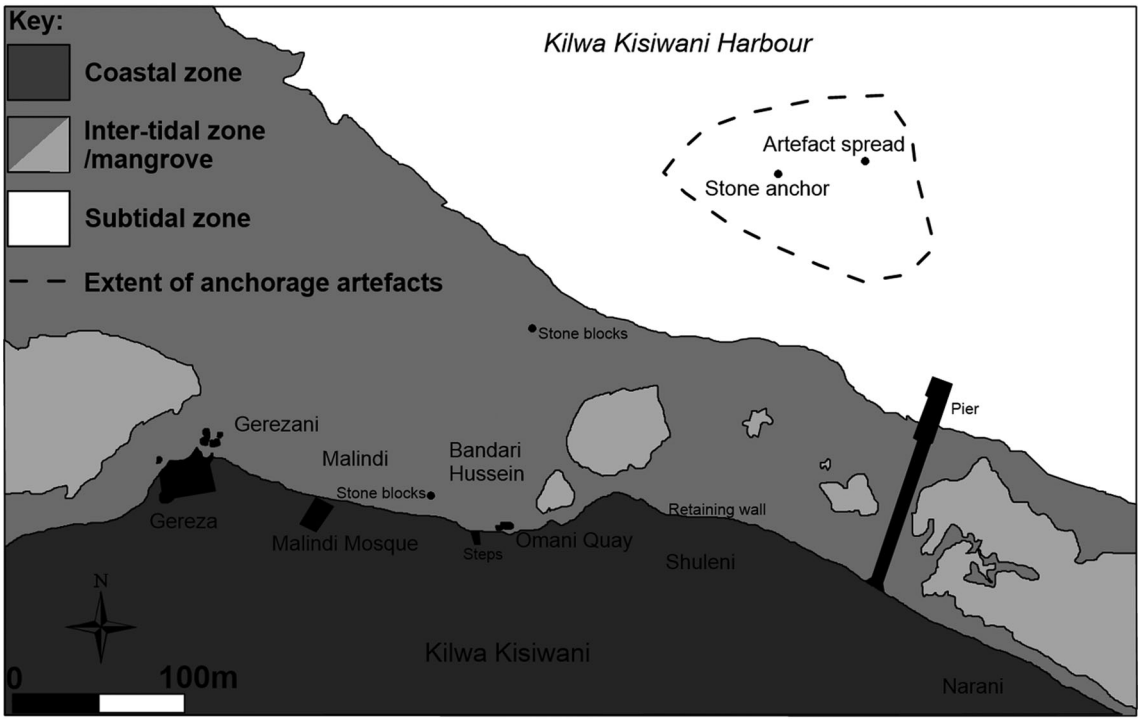

Figure 7. Kilwa Kisiwani Port showing the approximate extent of material recorded in 2015. (E. Pollard)

Presently, Kilwa Kisiwani Port remains the main landing area for the modern village. The shortest inter-tidal zone is at Bandari Hussein (port of Hussein) at the 14th–15th-century Omani Quay. Bandari Hussein was the most heavily used area of the port when larger vessels visited. This is supported by the presence of the Omani Quay and the depth of the midden cliff, which is at its maximum in this area, indicating both a greater and longer period of activity. To the west of Bandari Hussein is the Malindi area named after the 15th-century mosque, which overlooks this landing area. West of Malindi is Gerezani, named after the Portuguese and Omani Fort (Gereza) that dominates Kilwa Kisiwani Harbour. Local boats usually anchor on either side of Malindi. Gerezani is the industrial area of the port, being the location for boatbuilding and repair and the storage of fishing equipment. Bandari Hussein is the most popular area for awaiting and boarding boats today as it has the shortest inter-tidal zone and the substrate is much firmer at low tide than at Gerezani. To the west of the Omani Quay are stone steps leading up the midden cliff. These have recently been modified, along with sea-wall protection for the eroding cliff, but are probably formerly associated with boarding vessels at this location. Bandari Hussein is the more commercial part of the port: dhows regularly transport people and goods from here to Kikone Landing Place at Kilwa Masoko (Pollard, 2008a: 218). Locals consider that 'Fundi' Hussein was a blacksmith, though it was unclear when he lived as no one in the village knew him.

To the east of Bandari Hussein the land rises to Shuleni, named after the modern school. At the high water mark here is a sea-wall. The foreshore is bedrock with mangrove patches: the rockiness of the foreshore makes it unsuitable for landing boats. The pier is modern and built for use by tourists. East of the pier is the Narani area, named after a navigation tower that used to be sited on the cliff-edge. Here was once the stone anchor, known locally as 'the Sultan's bedpost', recorded by Chittick (1974: 414), but which unfortunately had been moved landward by locals wanting to ornament their tourist café, breaking the anchor in the process.

Survey

The positions of pottery artefacts on the seabed were plotted on the sidescan sonar survey of the underwater site undertaken in 2015 (Fig. 8, Table 2). An Indo-Arabian type of stone anchor, 1.88 m in length, was found within the dispersion (Fig. 9). The anchor has an orientation of 030/210 (SW/NE) tapering to the SW. Its SW end is more buried in the silty-sand substrate. It is of similar shape to that recorded by Chittick at Narani (Chittick, 1974: 414), but the newly discovered underwater anchor is about 0.65 m longer. It is damaged at the round hole, which may indicate how the anchor was lost. Chittick's anchor has two rectangular holes piercing the shank crossing each other orthogonally. In the underwater anchor one of the holes for the flukes is semi-circular and open on one side (as can be seen in the side view in Fig. 9).

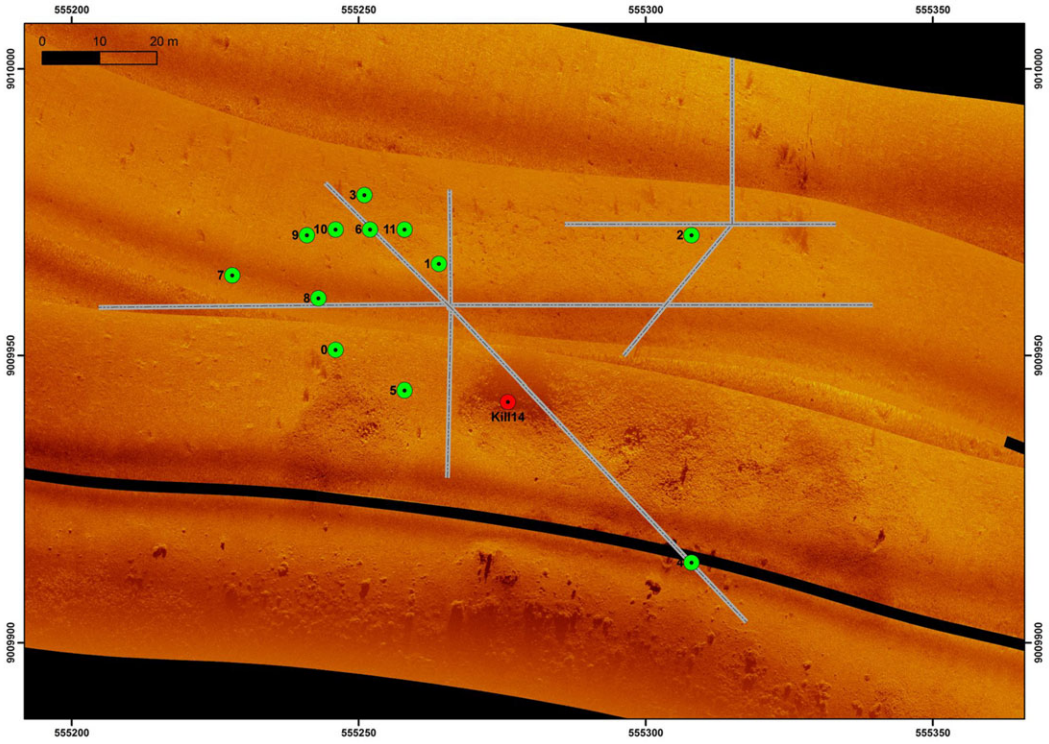

Figure 8. Sidescan sonar image of the Kilwa Kisiwani Port anchorage site showing the target, dive directions and extent of material recorded. (R. Bates)

The stone anchor was used as the main reference point for diving to determine the extent of the pottery dispersion and the following is a description of what was recorded on the seabed following cardinal and intermediate directions (Fig. 8). The pottery dispersion continues for 20 m to the anchor's north until the silty-sand substrate becomes mud where either the dispersion disappears under the mud or peters out. A denser dispersion of artefacts has been deposited to the east of the anchor where a combination of angular and rounded cobbles/small boulders, pottery and bones lies on the seabed (Fig. 10). The maximum dimension of these boulders is 200–300 mm. The stones are heavy basalt, similar to those recorded at the Jiwe la Jahazi site. This denser dispersion peters out at around 60 m east where there were only two more blocks of basalt and a pot sherd. Beyond 75 m there was mud with no sign of artefacts. To the south-east the artefacts peter out as a loose rounded coral substrate appears after 30 m, and at 60 m only a single pot sherd was recorded. To the south there is a concentration of pot sherds among mud and pebbles for 30 m, while the sediment becomes sandier with marine life increasing as the substrate gradually rises towards Bandari Hussein. To the north-west there is pottery on the seabed for 30 m, after which the substrate becomes mud. The pot dispersion is dense to the west for up to 30 m, but decreases in frequency for the next 30 m: it may continue further west.

Further investigation of the denser dispersion of artefacts to the east led to the discovery of an artefact spread starting around 25 m (centred around 40 m) north-east of the anchor covering *c.* 700 m² (Fig. 7). This artefact spread is less than 0.5 m high on a stony seabed consisting of large amounts of pot, bone, shells, angular limestone, quartz, sandstone and basalt.

The seabed material included local and imported ceramics (Figs. 11 and 12, Table 2). Due to the potential damage that taking an artefact out of water generates, only a sample of the pottery on the seabed was removed to identify use, origin and dating. Almost all the artefacts were covered by corals and worm casts, probably the shell worm *Dendropoma corallinaceus*. The ceramics were repeatedly soaked in fresh water, and cleaned between each water change, for a period of four months. Most materials observed were left *in situ* at the underwater site for better conservation and a future expedition with more conservation facilities.

Some sandy limestone slabs on the seabed stand out as different to the substrate, but their function is not immediately determined. They included, 14 m from the anchor, a rectangular slab, 0.44 × 0.38 ×0.11 m, (No. 0 on Fig. 8), an oblong block, 0.70 ×0.30 × 0.18 m, partly covered in the sandy substrate (No. 3 on Fig. 8), and a triangular block, with sides 0.38 × 0.25 × 0.20 m and a thickness varying from 0.10–0.20m, standing upright on the seabed. It is possible these blocks are ballast, but some appear to be dressed, and thus

Table 2. *Recorded artefacts from Kilwa Kisiwani Port anchorage site*

No. on Fig. 8	Description	Interpretation	Date
2	(Artefact spread) This fine-grained red matrix vessel has two handles on the two sides but one is partly broken. Between the handles are circular indentions the size of which decreases towards the base. Similar circular indentions are placed on the neck area.	A similar but closed-on-one-side vessel reported by Wynne-Jones (pers. comm.) from Vumba Kuu on the Kenyan coast is interpreted as an incense burner.	14th–15th century
2	(Artefact spread) Bowl with inturned rim.	Local pottery, Red burnished ware type 9 or 11 (Chittick, 1974: 323–4)	Late 12th–13th century
2	(Artefact spread) A nearly complete Islamic monochrome bowl with red matrix and dark green glaze.	Standard monochrome (Chittick, 1974: 304).	Mid 15th–16th century
2	(Artefact spread) Enclosed bowl earthenware fragment. Fine-grained matrix.	Type 20 of ceramic phase C: Late Tana Tradition, has single or double row of horizontal fingernail impressions along rim or carination, Horton (1996: 262).	13th–14th century
5	(dGPS potter1) Local incised-ware vessel decorated between neck and shoulder.	Type 25a globular cooking-pots with incised decoration mostly hatched on the shoulder (Chittick, 1974: 328).	16th century
6	An unglazed pottery base found near GPS365, 48mm diameter, with a high stand (foot).	Possibly an incense burner. Chittick interprets a similar artefact from Manda (1984: 100) as a leg of stand or table.	Mid 9th–early 11th century
6	(GPS365) Local pottery bowl.	Burnished food bowls. Types 16 and 17 (Chittick, 1974: 325)	15th–17th century
7	(GPS370) Complete local pottery bowl.	Early burnished ware. Type 11 (Chittick, 1974: 324)	Late 12th–13th century
8	(GPS367) Half of a local pottery bowl.	Possibly Horton's Type 12 (1994: 258).	10th–mid 11th century
9	(GPS368) Storage vessel neck.	Type 33 large globular water-pots have near vertical necks, Chittick (1974: 329)	Late 12th–15th century
10	(GPS371) Base of pot, dark-green glaze Islamic monochrome with red matrix.	Standard monochrome (Chittick, 1974: 304).	Mid 15th–16th century
11	(GPS366) Jug top with incised cross-hatched decoration on the shoulder with a thickness of 4–5 mm.	Possibly similar to handled vessels in buff fabric from Manda (Chittick, 1984: 94). Horton (1996: 297–8) has fine creamwares (3–5 mm thick) from Siraf in early Islamic occupation at layers at Shanga.	Mid 9th–early 11th century

could be building stone or parts of composite anchors. Three similar blocks of stone were recorded near the low water mark and a further two were recorded landward nearer the midden cliff of Bandari Hussein reinforcing the possibility of their use as anchors (Pollard, 2008a: 107) (Fig. 7). It is possible they are stones from ruined buildings, reused as anchor weights but they may also have been brought by the vessels anchored in the harbour as they are similar to those recorded under water. A distinctive cone-shaped block 1.5 m in diameter and up to 1 m high was around 75 m SE of the anchor. It may be a natural fossil coral but needs further investigation (No. 4 on Fig. 8).

Discussion

The artefact dispersion surrounding the stone anchor includes local and imported pottery varying in date from the 9th–17th century. This reflects a long period of use of the space off Kilwa Kisiwani Port as an anchorage. Pottery finds from the artefact spread north-east of the anchor range from the 13th to the 16th century. The presence of sandstone and basalt on the seabed is not natural in this silty-sand environment and,

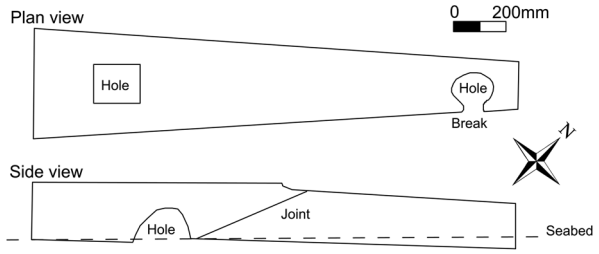

Figure 9. The stone anchor shank drawn from measurements taken under water. (E. Pollard)

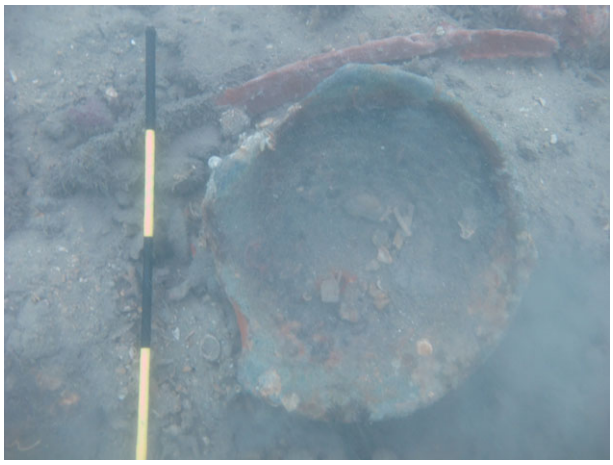

Figure 10. An Islamic monochrome vessel and large animal bone in the artefact spread on the seabed. Scale shows 0.1m segments. (R. Bates)

similarly to the Jiwe la Jahazi site, is expected to be ship's ballast. The stone anchor marks an anchorage off Kilwa Kisiwani Port, but, starting at 25 m distance from the ballast concentration, it cannot be definitely linked to the artefact spread. However, the 13th–16th-century pottery and bones in this location are probably associated with the basalt and sandstone, though it cannot be discounted that later artefacts have been dropped in this area or moved by currents within the harbour environment. In the case of Kilwa Kisiwani Port artefact spread, ballast and other stone artefacts are unlikely to have been deliberately dumped close inshore in a principal navigation and administered harbour area, especially when ballast stone is often reusable as building stone (Chittick, 1984: 45, 198). The combination of the artefacts and ballast within a concentrated area is likely to be indicative of a shipwreck especially as the assemblage consists of 'light' incense burners, bones and complete bowls that would not have been normal ballast choices. Therefore, the sinking of a ship in Kilwa Kisiwani Port anchorage is the preferred explanation. Confirmation of a shipwreck would, however, be dependent upon further investigation at the site especially through test excavation of the silt substrate to search for further artefacts or, indeed, ship-structure remains.

Indian Ocean medieval trade

On the assumption that these are indeed shipwrecks, they are the first to be found in the Kilwa area compatible with a medieval dating, and add to the emerging evidence of non-European shipwrecks coming from around the Indian Ocean. Their finding confirms expectations of wreck-sites in particularly vulnerable positions for shipping, that on a reef-lined coast in the vicinity of a harbour entrance, and within the harbour itself. Unfortunately, the environments in which they are found display significant post-depositional transformation processes over the subsequent centuries. The inter-tidal wreck(s) of Jiwe la Jahazi would have experienced salvage from inhabitants of Kilwa Kisiwani, marine and biological degradation, and gradual landward progradation of any surviving artefacts. The subtidal harbour wreck is subjected to a strong current particularly at low tide as well as siltation and organic decay processes.

The widespread presence of igneous basalt is of considerable interest as it has to have been imported to this sedimentary coast. Apart from the Jiwe la Jahazi site, there are two further areas of basalt recorded on the reef crest around Kilwa, both in the vicinity of causeway features: one is at Kivurugu near the westernmost point of Songo Mnara, and the other at Matuso at the northern entrance to Kilwa Kisiwani Harbour (Fig. 2). The Matuso basalt extends for *c.*50 m, but neither the Kivurugu nor Matuso basalt distribution has been investigated to see if they are associated with other artefacts that could be dated. Pollard (2008b: 109–10) has argued that the inevitable shipwrecks might have precipitated the need to mark the reef edge by building the reef-coral causeways that themselves support the growth of mangroves marking the reef edge and the way into the harbours of Kilwa Kisiwani and Sangarungu.

Finds of basalt are not confined to Kilwa. The same stone has been recorded further south on the limestone foreshore at Mtamba in the Kiswere area, and Patumla in Ruvu Bay (Fig. 2). Both locations are again landing places in areas of reef-coral causeways. However, the fragments are too few to be ascribed to a shipwreck and may have been deliberately unloaded ballast.

Further south again, on Mozambique Island, a large basalt block lies in the inter-tidal zone the base of the cliff below the 16th-century Portuguese Fort São Sebastiã. The block is about 1m long and, as it is dressed, it could have been cargo from a shipwreck (Fig. 13). Other smaller basalt boulders can be seen in the walls below the Chapel of Nossa Senhora de Baluarte, built in 1522. As this area of the island has no landing place and is backed by a steep cliff, the blocks probably came from a wreck and were reused for the wall. Black basalt is also found in a pier on the landward side of the island.

Other writers have noted basalt far from its geological sources: for example, boulders of olivine

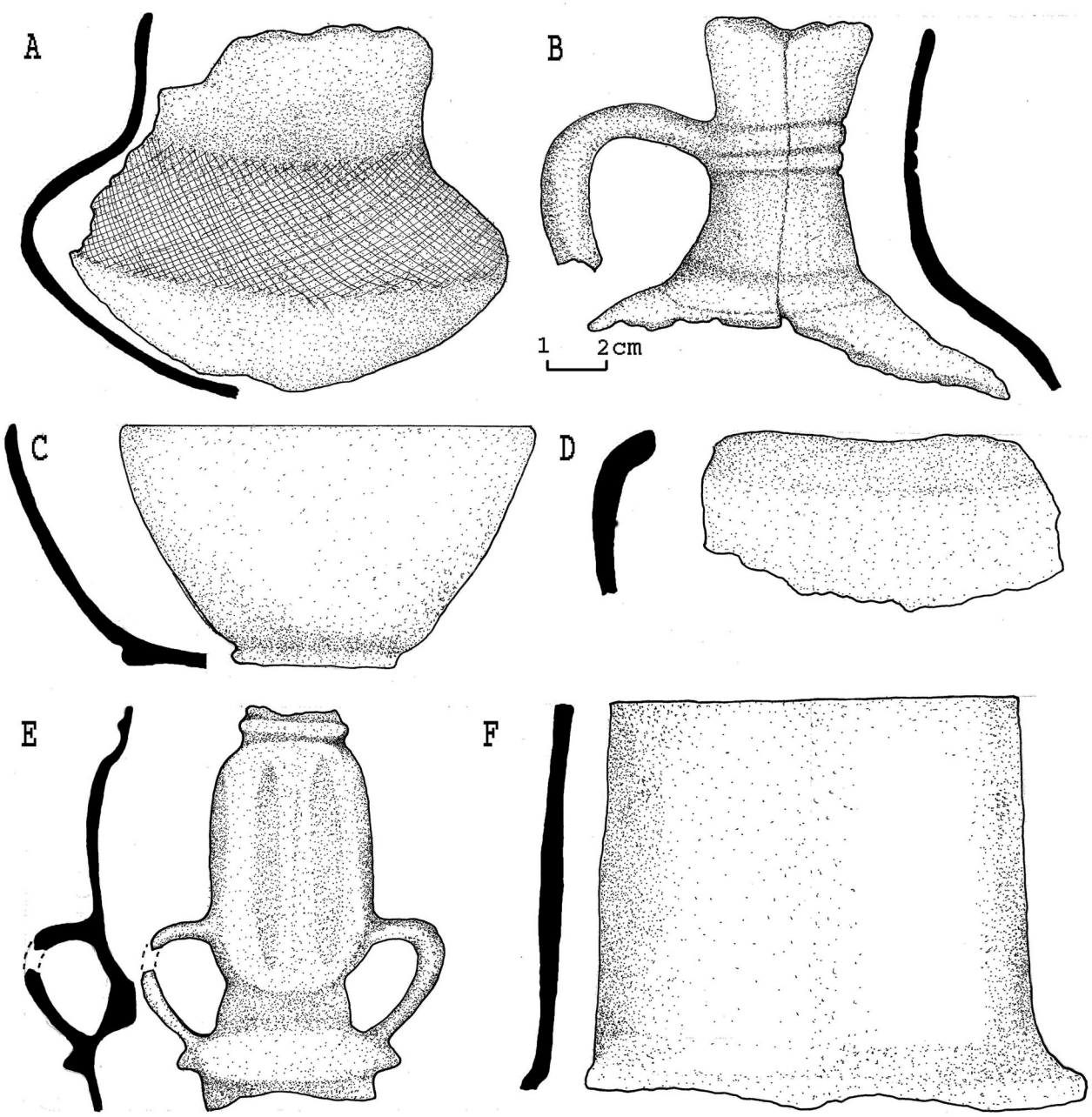

Figure 11. Artefacts from the anchorage site at Kilwa Kisiwani Port. A: No.5 incised ware, B: No.11 imported jug top, C: No.6 food bowl, D: No. 2 (artefact spread) bowl with inturned rim, E: No.2 (artefact spread) incense burner, F: No.9 storage vessel neck. (E. B. Ichumbaki and S. Kilindo)

basalt were also incorporated in a wall dated to *c.* 1025–1050 AD at Manda in the Lamu Archipelago (Chittick, 1984: 45, 198). Radimilahy (1998: 180, 194) recorded a triangular piece of basalt, perhaps used as a net weight, from the *c.* 9th–10th century AD at Mahilaka on Madagascar. It would seem that the tradition of basalt as ballast must go back to the Classical period in the western Indian Ocean as it was found on the Red Sea Indian Ocean coast ports of Myos Hormos and Berenike (Tomber, 2012: 205).

Other rocks, exotic to Kilwa, have been recorded along the reef including granite, quartzite and gneiss, but all in very small quantities. The sandstone at Jiwe la Jahazi may derive from beyond the region, but that rock is not entirely foreign to the Swahili coast of southern Tanzania, although the principal petrology of the wreck-site is limestone (coral rag). Basalt is most predominant, and indicates that ships trading with Kilwa visited areas of basalt geology. However, the possibilities are widely dispersed and include the

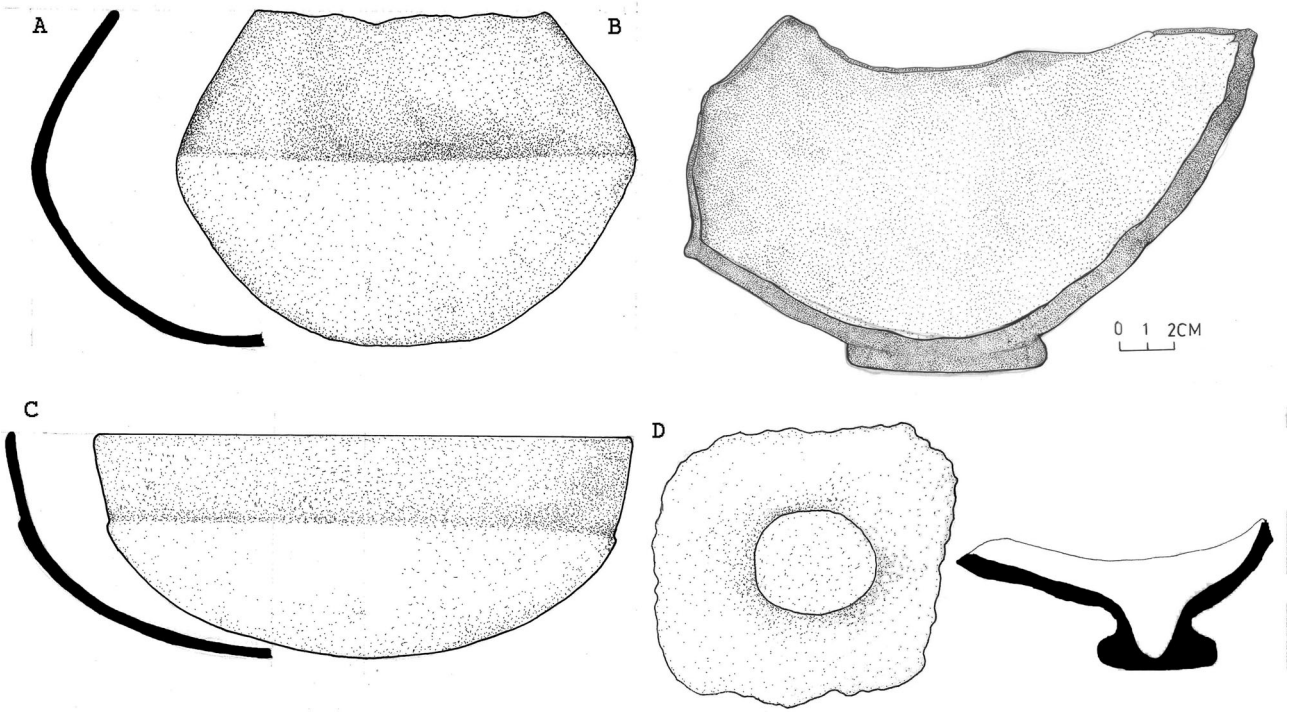

Figure 12. Artefacts from the anchorage site at Kilwa Kisiwani Port. A: No.7 local pottery bowl, B: No.10 Islamic monochrome base, C: No.8 local pottery bowl, D: No.6 foot of pot (plan view of base and cross-section). (E. B. Ichumbaki and S. Kilindo)

Comoro Islands to the south-east, the Deccan Plateau of India to the east, and the Arabian Peninsula to the north. Basalt in Red Sea ports has been interpreted as coming from the Hadramawt. Chittick (1974: 415; 1984: 45, 198) also attributed the finds of basalt at Manda and Kilwa to ballast from Arabia. As far as is known, however, there is no scientific attribution to this claim. In contrast, some preliminary chemical analysis of the Jiwe la Jahazi basalt indicates a close similarity with Comoros basalt, but no analysis has been done to exclude other sources.

As previously noted, we must be cautious when interpreting the underlying cause of the basalt finds. In particular, deposits will not always equate to wreck-sites. While a shipwreck, or a grounding event, would be the logical explanation for ballast found on offshore reefs, such as Jiwe la Jahazi, and rocky or cliff coastlines, its original function needs to be considered in more detail for other contexts. The purpose of basalt is to trim the ship in the absence of sufficient cargo weight. Thus, when taking on heavy cargo, such as mangrove wood, salt or iron goods, a lightly loaded incoming vessel would discharge excess ballast at the landing site. Ballast found at ports would be compatible with trade in a high-value, low-weight commodities, such as frankincense, beads and jewellery, or textiles and garments. Any vessel that was not fully loaded would also require some ballasting, so that imported pottery could be found in combination with ballast, as appears to be the case with the Kilwa sites. Thus, context is all-important in the explanation of basalt and other exotic ballasting materials.

It is possible to speculate on the content and direction of Kilwa's trade insofar as ships wrecked on the reef are more likely to be inward-bound as vessels leaving the harbour would be expected to await favourable sailing conditions, while those arriving must accept whatever conditions prevailed. Prestholdt (1998) has attested to the levels of adornment and material consumption of the wealthy populations of the Swahili city-states, much of which would involve imports of lighter weight commodities, such as clothing materials, beads and other jewellery, precious metals, porcelain, incense and beauty products. Such would probably require ballast, as might luxury foodstuffs such as dates, oils and spices. In contrast, the likely exports of mangrove wood, salt, lime, worked iron and ivory are much less likely to have needed ballasting. As for gold from Sofala, little is known of arrangements for its transfer via Kilwa on its journey north, although, given its value, the physical quantities shipped in any vessel would not be expected to be large.

Ballast material can clearly help identify landing sites for ships around Kilwa. For instance, Rwayo on the mainland in the Mgongo area exhibits a mangrove whelk midden on a sand spit that can be dated from the pottery from the 14th–16th century (Fig. 2). The midden contains some basalt on the surface along with iron dhow nails, and suggests a vessel landed here, possibly to collect salt or mangroves as these are

Figure 13. A large basalt block, probably ballast, on the inter-tidal zone at the base of the cliff below the 16th-century Portuguese Fort São Sebastiã, Mozambique Island. (E. Pollard)

nearby resources, and perhaps degraded at the site. Furthermore, the mainland to the south at Somanilo in the Sanga area was an important 15th–16th-century port: it, too, displays basalt in a 14th–16th-century context on the cliff overlooking the port. Chittick (1974: 415) also recorded a large (70 × 50 × 35 mm) piece of basalt on Kilwa Kisiwani, a stone that appeared to have been used for grinding. Unfortunately his description is unclear as to where or whether this was found in a stratified deposit.

No wood has been recorded at any of the ballast sites. It may be presumed that wood might have been salvaged: otherwise, the tidal and wave energy along the exposed inter-tidal zone would be expected to wash away such low-density material or, if fixed *in situ*, it is likely to have succumbed to worm or other biological attack over the centuries. Very little wood from ships was recorded during the survey of Kilwa: the most significant was a recent dhow mast that lay on the reef 1.5 km north-west of the Matuso ballast. The Kilwa Kisiwani Port shipwreck holds the prospect of physical remains of a vessel, with the possibility of preservation of wood beneath the surface of the mud and other substrate. The surface finds reported here provide encouragement to investigate this site more intensively by excavating below the surface. It is also intended to extend geophysical and diving searches over the whole Kilwa area and the southern approaches to Songo Mnara with the goal of discovering medieval shipwreck sites that might shed light on boat construction and sailing techniques and the inventories carried on the trading ships of the Swahili coast.

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