

The Byzantine-Aksumite period shipwreck at Black Assarca Island, Eritrea

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Lying astride the Massawa Channel, between the mainland of Eritrea and the Dahlak archipelago, the two islands known as the Assarcas became the focus of archaeological investigation beginning in 1995 (Fig. 1). Both are ancient coral outcrops, with just enough accumulated topsoil to support euphorbia cacti, scrub grass, and the associated insects and arachnids. The southern island is known as White Assarca for its surrounding of white sand beaches. The northern island is called Black Assarca as it is encompassed on all sides but one by coral cliffs stained dark by the sea. In places, the cliffs reach approximately two metres above the sea. As the uppermost parts of the reefs surrounding Black Assarca are exposed only at low tide, and are hidden during high water, they present a danger to watercraft as they lie very close below the surface. The reefs extend outward from the island for ten to twenty metres, if not more in places, before gradually dropping off to a sandy bottom. Here, at the edge of the reefs on the northern side of Black Assarca Island a ship wrecked some 15 centuries ago and lay undiscovered until 1995.

The 1995 survey

In early 1995 a group of tourists informed the Eritrean Ministry of Marine Resources (MMR) of ceramics lying on the sea floor off Black Assarca. The Institute of Nautical Archaeology (INA), based at Texas A&M University, was contacted to investigate the site (Pedersen 2000: 4).

A small survey team consisting of the author, Yassin Aden, head of diving operations for MMR, and Dr. J.C. Hillman, a marine biologist associated with the ministry investigated the site on May 20, 1995. Visible from the surface through water 4 to 6 metres deep were several amphorae. These lay scattered over an area approximately 5 by 7 metres in area. Exploration revealed several buried amphorae as well as numerous sherds. The centre of the site was characterised by a small pile of broken amphorae lying on sand and in disarray. This grouping was dubbed 'the main pile'. Sherds belonging to what appeared to be perhaps lentoid- or globular-shaped amphorae were found



Fig. 1: Map of the central Eritrean coast. Drawing by author.

elsewhere on the site (Fig. 2). Towards the eastern edge of the site a single example of a wider conical amphora type was found.

Amphorae, all broken, were found exposed, buried, lying under coral shelves, and concreted into the reef with the shallowest visible amphora lying on the reef in four metres of water. Sherds were found down-slope of the site until a depth of thirteen metres. None of the sherds on this slope showed fresh breakage, and some were clean of marine growth on their underside. This indicates that the sherds had been lying on the slope for a long period.

The exposed materials gave little evidence as to the pattern by which the cargo of amphorae might have been stowed. The most numerous of the amphorae, those of a narrow conical shape, were dubbed 'Assarca Type I'. The lentoid/globular ones,

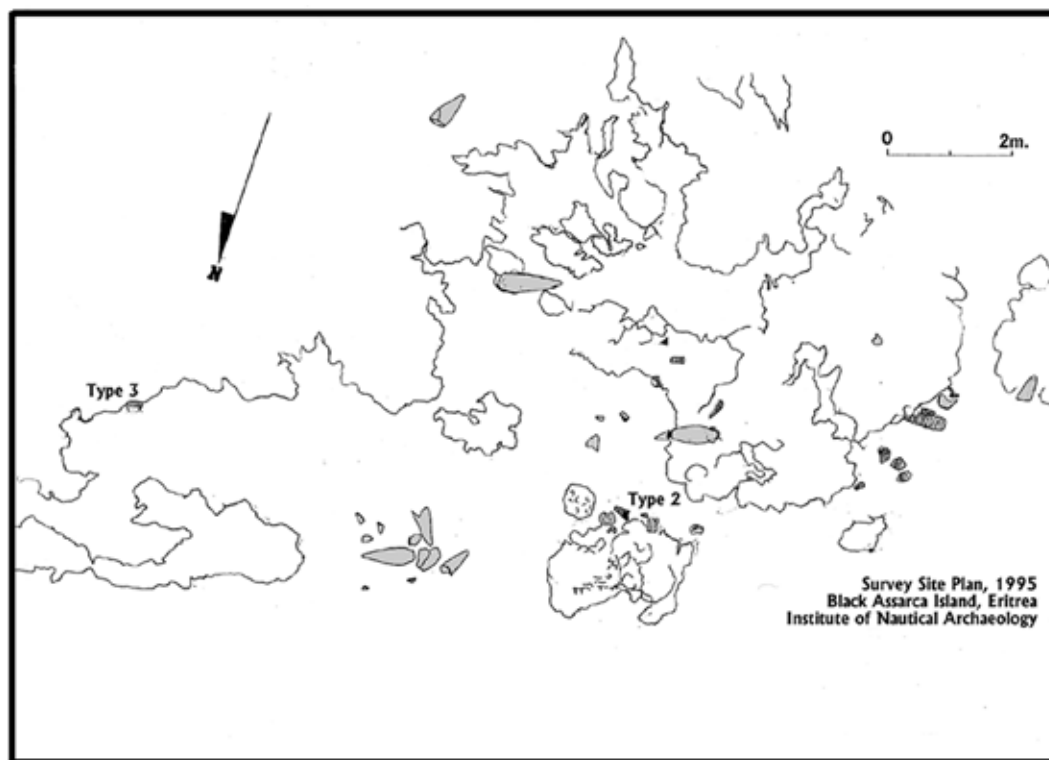


Fig. 2: The survey site plan of the central part of the wreck site. In the center are two sections of Ayla-Axum amphorae, which are pictured in figure 4. Between them and the reef is a sandy area with buried sherds of the same amphora type. Below and to the left are a number of sherds belonging to the globular amphora type. During excavation, this area would yield most of the finds of the globular type mixed in with amphorae of the Ayla-Axum type. The sandy areas also concealed many more amphora sherds. The coral head is that seen in Figure 3. Drawing by author.

as represented only by sherds, were given the title 'Assarca Type II'. The single wide conical amphora was designated 'Assarca Type III'. All the amphora sherds noted in the survey had dark red/brown fabric. All body sherds were approximately 1.5 cm thick. Corrugations or rilling spaced approximately 1.2 cm apart covered the outer surfaces, while the inner surfaces exhibited marks from shaping on a potter's wheel.

There were at least ten mostly-intact Type I examples visible on the site. While more examples were seen partially buried or concreted into the coral, it is not known whether these represented complete vessels or fragments.

Although all the free-lying Type I amphorae were broken (Fig. 3), two had intact bodies, missing only handles and neck. One of these sat atop the main pile. It was 71 cm long, with a maximum circumference of 80 cm at the shoulder, and a neck opening of 9 cm in diameter. The second intact body, 74 cm in length, sat nearby.

Type II amphorae were highly fragmentary with no intact examples seen during survey. The same style of rilling found on the Type I amphorae covered these body sherds, but here the rilling ran vertically. The wreck's discoverer raised the only apparent complete neck and handle assembly (Fig. 4), but the neck and handles visible on site

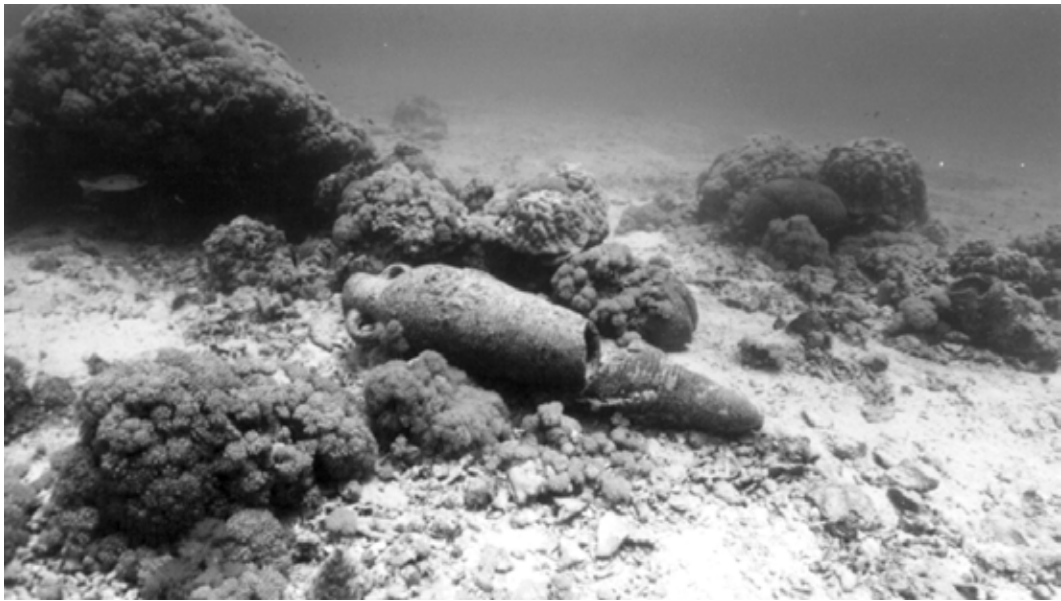


Fig. 3: Broken amphorae lay scattered around the sea floor at the base of the reef surrounding Black Assarca. Here two pieces of two different amphorae lie together fully exposed to the elements. To the right is the area where globular amphora sherds were found. Photograph by author.

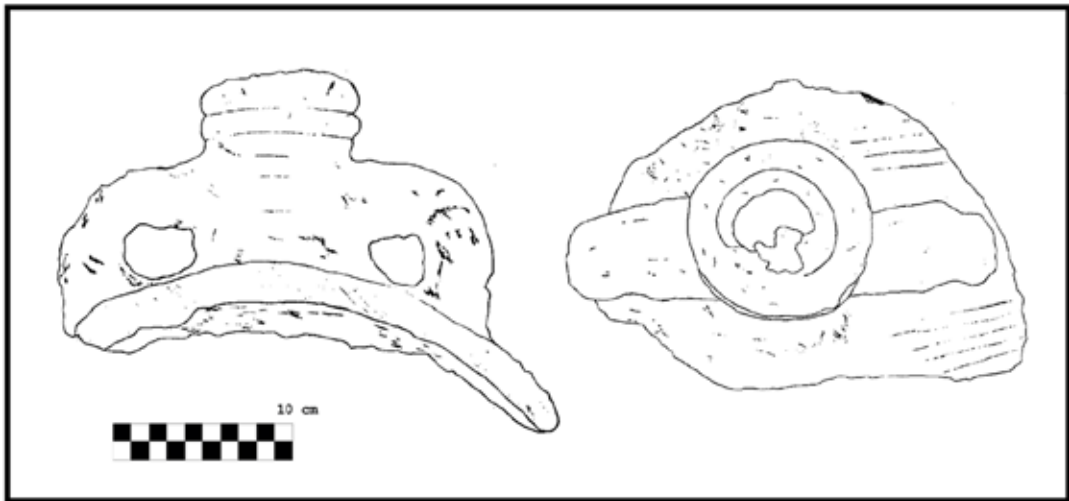


Fig. 4: The amphora fragment raised by the tourists upon discovery of the wreck site. This piece gave an initial date for the wreck to c. AD 500. Drawing by author.

were the same style as those on the raised sherd. Later these sherds would be identified as belonging to costrels (Pedersen 2000: 10).

The single example of Assarca Type III was discovered in the coral under an overhanging outgrowth. The neck, handles, and possibly shoulder appeared to be missing. The base, being buried, was not examined. The body had the same ridges as

Types I and II. This amphora was 7 cm broader than Assarca Type I at the juncture of shoulders and body.

The survey located one sherd of another type. It was approximately 10 cm long and 1 cm thick, and it had no rilling. Unlike the other amphorae, this sherd had a light brown fabric. There were no other discernible features.

Some wood was also identified, potentially associated with the amphorae scatter. Two, possibly three, small wood fragments, approximately 10 cm long and 2 cm wide, were found on the slope below the site. The fragments were hard and appeared calcified. The wood was dark in colour and without distinguishing features. No other wood was observed. It is not known whether the wood fragments were wreck material or if they were associated with wreckage of modern war material lying not far off.

On the basis of the pottery found during the survey it was determined that the site was probably that of a wrecked ship dating from the fifth to seventh centuries AD.

The 1997 excavation

Excavation of the site off Black Assarca began in early February 1997 and ran for 55 days. Frequent storms and rough seas hampered operations and reduced excavation efforts significantly. During the course of the excavation, however, further examples of conical and lentoid/globular amphorae were found, as were two small non-descript iron pieces, one glass shard, and one lead steelyard counterweight.

The excavation site was mostly confined to the area where amphorae were noted on the surface in the 1995 survey: the sandy area at the base of the reef, the sections of the reef immediately adjacent, and the area extending east as far as the Type III amphora find spot. The descending slope north of the site was also partially excavated where small sherds were found, and the lower section of one Type I amphora was discovered concreted into the coral under the sand. One ballast stone was also found in this sector. More of the ship and its cargo may have slid or spilled farther down the slope as the wreck occurred. Resources did not permit deeper exploration along this slope.

Even at the deepest levels of excavation, amphora sherds were mixed in among more intact vessels. Perturbation, responsible for two well-encrusted spark plugs found several centimetres deep in the site, could account in part for the mix of sherds. Wave action and storms may explain our finding amphorae atop the reef, as well as several sherds strewn about the shore of Black Assarca immediately landward of the wreck. While these sherds could be deposits resulting from human activity on the island in antiquity, their limited location on the shore nearest the wreck suggests otherwise.

Most artefacts were located in the sandy area at the base of the reef. This sector was excavated down to approximately one metre below the original seabed. Ceramics extended even deeper into the sea floor, but time did not permit deeper excavation. Based on one amphora found at this level, at least another sixty centimetres of archaeological deposits could be present. Indications from the area immediately down-slope of this amphora and under a large coral head in the centre of the site support this view. As the coral head sat atop the amphorae, having grown there over the centuries, the adjacent area to the north was excavated horizontally. Thus it was determined that one amphora lay piled upon another to a depth of approximately a metre and a half. As excavation began to undermine the coral head, efforts in this area were suspended.

To the west of the central part of the wreck the mix of sherds continued in much the same manner. East of the wreck's centre, however, the team encountered a different scenario in the area where the aforementioned 'main pile' lay. This yielded some intriguing data for wreck formation processes. Under the main pile, which appears to have been an area where sea-disturbed amphorae had accumulated, was a layer of sand with a number of sherds mixed in. We initially believed bedrock to be under this sand. Some amphora sherds were concreted into this and had to be chiselled out of the matrix. Further examination revealed that this layer was not rock but dead coral lying in large pieces. These were moveable with some effort. Under the coral was fine silt in which Type I amphorae lay side-by-side in a somewhat orderly fashion. All of the amphorae exhibited hairline cracks but otherwise retained their shape, held together by the overburden of silt. Unfortunately, time did not permit full excavation of this layer.

What may be seen here is a layer of artefacts lying in position since the original wrecking of the ship. Silt was deposited on the wreck site over the years and coral grew on top of that. Further deposition of sand may have killed the coral. Over centuries, storms probably ripped away at the outer edges of the wreck dislodging amphorae and throwing them onto the reef and on top of the sand, leaving them exposed and visible.

Analysis

Type I Amphorae

As was noted in the 1995 survey, the most common ceramic form was the conical amphora, found in all excavated sections of the site. Although all but one were broken, they formed a body of material cohesive in both form and style. Some amphorae were simply missing handles. Others had necks broken off as well, while many had broken bodies. Several of this type were cleanly broken at the joint where the upper body segment joined the bottom segment. The juncture, a weak spot in the vessels, was obvious on all the narrow conical amphorae.

Unlike the evenly spaced rilling elsewhere on the bodies the rilling added to the joint was irregular and roughly done. Rilling was present on all the amphorae and sherds excavated by the team, spaced approximately 1.2 cm apart and apparently done on the potter's wheel. It started immediately above the toe where there was a button 4.5 cm in diameter and 1.5 cm in height. From here it was a continuous spiral to the neck, interrupted only at the joint. Rilling was peculiar to the eastern Mediterranean in the first millennium AD and has been found on several ceramic forms in a number of sites. These include, for example, two recent underwater surveys, one which included the discovery of a sixth-century shipwreck near Marmaris, Turkey (Royal 2006: 9) and the other the finding of Late Roman pottery on the author's survey near Tell Fadous-Kfarabida in Lebanon in 2007.

Many of the broken amphorae at Black Assarca were covered in a brown wash or slip. The interior fabric on many sherds was red-brown when wet, drying to brown. However, a number of sherds revealed a fabric that was light green-grey when wet, drying to a light grey. There were no overt differences between the amphorae with brown or grey fabrics.

Only a single Type I amphora was found intact. This vessel, amphora A3-010 (Fig. 5), found near the western end of the site, was relatively free of encrustation, having been



Fig. 5: Amphora A3-010. The single intact amphora yet found on the site. Drawing by T. Erwin and S. Pulak.

covered with sherds, coral and sand. The lid was missing and silt had filled the vessel. The contents were sifted for archaeobotanical analysis but no botanical materials were found. Small chips on the grey-slipped surface of the amphora revealed it had the grey fabric. Otherwise the form and styling were the same as the brown-fabric amphorae. The amphora had a volume of approximately 11 litres.

The interior faces of many sherds and amphora bodies were coated with a resin. Mediterranean wine amphorae were sealed with a resin to prevent the liquids inside from leaching out, and evidence for use of the same method was found at Black Assarca. One sherd, comprising approximately the lower 15 cm of an amphora, was split vertically down through the button. The piece was filled with a solid mass of resin, probably excess that collected in the bottom when the interior of the vessel was being sealed. This revealed that the button was not solid but hollow. Buttons generally receive the brunt of damage in shipping amphorae as they rest on dunnage, other cargoes, hulls, and

docksides. None of the buttons examined showed wear beyond what one would expect for new vessels being transported from potter's shop to dock to ship.

The narrow conical amphorae are a type lately called 'Ayla-Axum' as they are most associated with finds in the Red Sea area. The term seems to have been introduced by the Roman Aqaba Project (see for example Parker 1996: 389). The Ayla-Axum amphora has parallels from at least three terrestrial sites in Eritrea and Ethiopia: Aksum, where amphora sherds with grey fabric were found by the Deutsche Aksum Expedition (Zahn 1913: 208); Matara, dating to the fourth through seventh centuries (Anfray 1990: 118); and Adulis (Paribeni 1907: 551) examples of which are on display in the National Museum in Asmara. Other examples have been found at Berenike in Egypt, where the amphorae date firmly to a well-stratified early fifth-century AD context (Hayes 1996: 159-61); from Aqaba in Jordan where the most examples have been found (see below); at Elephantine Island, Egypt (Gempeler 1992: 191); and in the Mediterranean such as on the late sixth-century AD shipwreck at Iskandil Burnu, Turkey¹, as well as in Spain and Carthage in strata datable from the mid-fourth to the sixth centuries AD (Keay 1986: 356, 358, 471).

¹ The shipwreck at Iskandil Burnu, Turkey yielded a single example of the Ayla-Axum type 'unique amongst the surface pottery' but that does not preclude more examples lying deeper in the wreck. This shipwreck was the focus of three surveys by the Institute of Nautical Archaeology in the early 1980s, during which 16 examples of pottery, including Gaza Ware amphorae, were raised for diagnostic purposes. The wreck is dated to the late sixth or early seventh century based on ceramic typology as the surveys found no coins. (Lloyd 1984: 6-11, 29-32, 70, ill. 8.) The amphora has red fabric and a red slip and it is theorised that the vessel was taken aboard at Gaza or Ashkelon. (Lloyd 1985: 4-5).

A number of Ayla-Axum amphorae were excavated at Aksum in the 1970s by Neville Chittick. The best-stratified examples date from the fifth to seventh centuries, although their dating is notoriously difficult. The amphorae from Aksum are similar to those from Assarca: ‘...the jar material is of the long, thin, conical corrugated surface type. The base is generally buttoned. The rim is gently inswept after its shoulders, with a straight lip with a diameter of 11-12 cm. The rim is around 10 cm long and carries a pair of opposed vertical loop handles’ (Munro-Hay 1989: 314). Some examples at Aksum had shop marks of apparently of northern Egyptian origin.

More recently at Qana, Yemen, where archaeology has revealed a number of buildings, texts and coins of the first millennium (Sedov 1992: 110), Ayla-Axum amphorae were found in the upper period BAIII corresponding to the fifth to seventh centuries (Sedov 1992: 114). The amphorae were the most common type found in these levels and had a grey fabric (Sedov 1992: 113), or as more recently reported a fabric of ‘reddish gritty clay’ with a cream or greyish wash on the exterior. As with the examples from Aksum, the amphorae from Qana had graffiti, depinti or painted designs (Sedov 2006: 87). No such markings were found on the ceramics from Black Assarca.

Type II amphorae

These amphorae were found mostly in the central part of the site. As excavation progressed, sherds of the globular type were found mixed with Ayla-Axum types in the deepest excavated sections in the centre of the site (Fig. 6). Neither extremity of the wreck yielded sherds of this type. Their concentration in the central part of the wreck indicates their stowing area, with these possibly occupying the central part of the hold with Ayla-Axum amphorae stowed fore and aft, if not to either side as well. It is also possible the globular amphorae were stacked on top of the Ayla-Axum amphorae, cushioned by dunnage as necessary.

The sherds of the Type II vessels indicated a globular shape, perhaps with the slightest vertical flattening on one axis of a type known as a costrel (Pedersen 2000: 10). The necks of these vessels often retained their handles, the style and configuration of which were the same as that of the sherd raised by the tourists in 1995 (see Fig. 7). The largest



Fig. 6: The mix of sherds of the Ayla-Axum amphorae with those of the globular type may indicate that they were loaded and stowed together, or that one type originally sat above the other on the ship. Evidence indicates that the globular type was limited to the central part of the wreck site. Photograph by author.

L3-012



Fig. 7: The largest piece of the globular amphora found during excavation revealed that the vertical rilling ended on the centre of the body at a button, just barely visible underneath the concretion. Photograph by author.

globular piece comprised neck, handles and a section of the body that included vertical rilling spiralling to a central button on the side. A reconstruction of the type, based on various data from the excavation, yields a vessel with a diameter of approximately 40 cm and with a possible volume of 27 litres, based on an idealised round shape (Fig. 8).

Other globular sherds derived from areas of the bodies without handles or neck. At least one sherd displayed a blank band covering the joint of the two hemispheres of the vessel and separating the rilling on either side of the body, just right of centre. This one, however, which was not raised to the surface but only observed during excavation, may belong to another globular type that is more ovoid than round, as indicated in the observable shape. Yet, without further excavation, it is not possible to determine the veracity of this observation.



Fig. 8: A reconstruction of the globular amphora shape based on field data and photographs. Drawing by author.

The globular vessels at Black Assarca likely originate in Aila², where a number of similar vessels have been found in association with the kilns. These vessels were noted to be particular to Aqaba, with strap handles attached to the neck and with symmetrical rilled sides and were designated as pilgrim flasks (Melkawi, Amr, and Whitcomb 1994: 456). At Aqaba the vessels occurred in two sizes: a smaller one handled version, and a giant variety. This latter kind resembles in style and in size the Ayla-Axum amphorae (Melkawi, Amr, and Whitcomb 1994: 456). There are stylistic differences in the neck and handles and perhaps in the presence at Black Assarca of the blank band between the rilled sides, details not reported at Aqaba. Otherwise they appear to be of the same corpus. The design of the amphora is vertical, that is, the rilling runs in a vertical spiral on each side, and each side was thrown separately on a wheel and then joined. This is typical of pilgrim flasks, but the Black Assarca vessels lack the lentoid shape of such flasks.

Type III amphorae

The single Assarca Type III example was the one found during the 1995 survey. The body of the amphora is similar to Type I, albeit wider, displaying the same style of rilling, toe shape, and brown fabric. No traces of this vessel's missing handles, shoulder, or neck pieces were found.

No examples of this type have been reported from the other Red Sea sites, although excavations on Elephantine Island on the Nile have revealed similar amphorae, underscoring the stylistic connection between the Byzantine ceramics of the Red Sea and Coptic Egypt. Gempeler (1992: 191) reports both the narrow conical amphora and the broader kind with a diameter up to 6 cm greater. These amphorae date to the heyday of the Egyptian-Nubian wine trade, which falls between the years AD 550 and 750. Amphorae of varying form but with a similar corrugated appearance are also found at other Egyptian sites of the sixth and seventh centuries (Sauneron 1972: 8, 10). It is not necessarily the case, however, that the wide conical amphora from Black Assarca originated in Egypt; indeed, the fabric appears identical to the brown fabric of the Ayla-Axum amphorae indicating a shared clay source.

If this type is a singular find in the wreck it would likely indicate that this contained a special item or that it was a utilitarian item on the ship- perhaps a jar kept on deck for drinking water. Its location toward an extremity of the site supports the latter suggestion of on-deck storage, which can be observed in vessels of the Bronze Age onwards. For example, this is seen in an illustration of a Syrian merchant fleet of the fourteenth century BC from the Tomb of Kenamon (Bass 1972: 22-23). Archaeological examples of these containers- *pithoi*- being used as transport containers for goods have been found on the fourteenth-century BC shipwreck at Uluburun (Bass 1989: 9-11).

Amphora lids

A small number of amphora lids along with a number of sherds of such were found throughout the site. With a single exception, all examples of lids were thin plain disks, light brown in colour and fabric. Many such lids were found in the Aqaba kilns, where they were 'flat or very slightly concave disks which rest precisely on the amphora rim' inside the mouth (Melkawi, Amr, and Whitcomb 1994: 460).

² For clarity the Nabataean/Roman/Byzantine city at Aqaba is referred to as 'Aila,' while the adjacent Early Islamic walled town is called 'Ayla' (as in Parker 1996: 232).

Two lids at Black Assarca were found in place in amphora mouths. One rested on the lip inside a globular amphora mouth and was set in a resinous substance similar to that found lining the interior of the Ayla-Axum sherds. One other lid found fixed in the mouth of a globular amphora was fashioned from a sherd recycled from some other vessel, as indicated by rilling on its exposed face. Obviously a ceramic piece from a broken vessel had been purposefully knapped into a disk-shape for this use. Such recycling of sherds for lids is known elsewhere. The seventh-century shipwreck at Yassiada, Turkey, contained 165 of these of varying diameters and thicknesses (Bass 1982: 160-61).

Other ceramics

Only two ceramic finds clearly did not come from amphorae. One thin sherd was part of a neck containing a filter. Little beyond the neck remained. The filter's three openings were apparently made by the potter poking his/her fingers three times through the clay. The fabric of this piece was light cream in colour, different from the grey of the amphorae. Vessels similar in form were found in the kilns at Aila in association with the Ayla-Axum amphorae and the globular pilgrim flasks. These were characterised by 'a trefoil pinched rim, filter neck, rilled body, and concave base; all... attributes common in Coptic ceramics...' (Melkawi, Amr, and Whitcomb 1994: 456)

One other small group of sherds indicated a vessel with a flat base. The fabric was similar to that of the brown amphorae, and rilled. Except for wheel marks on the interior of the base no other distinguishing features were noticeable and due to its fragmentary nature its size and shape could not be determined.

Glass

Only a few non-ceramic artefacts were found. One of these was a piece of glass, greenish-blue in colour with a hollow base ring, apparently the remains of a wineglass or goblet. It was found upslope of the central wreck area. A break indicates where the stem was once attached. Wine glasses found at other late Roman and Early Byzantine sites have similar rims (Sa'id 2004). These glasses were produced in abundance in the fourth and fifth centuries and later. During the Roman period, glass was a regular trade item on the Red Sea (Stern 1999: 477) and may also have been in the subsequent Byzantine era. The Byzantine stemmed goblet which is similar to modern wineglasses was 'used far beyond the borders of the empire... (and likely) originated around the middle of the fifth century, presumably in Syria or Palestine' (Stern 1999: 483). Pieces of Mediterranean glass from Arikamedu in India at the terminus of the Mediterranean-India sailing route are believed to be personal possessions and not items of trade (Stern 1999: 477). This might have been the case at Black Assarca. The proximity of the glass shard to a steelyard counterweight (see below) suggests this as the merchant would have kept his personal items and tools together on the ship as seen on the seventh-century shipwreck at Yassiada, Turkey (van Doorninck 1972: 143).

Glass shards were found in association with the Aqaba kilns (Melkawi, Amr, and Whitcomb 1994: 460). Glass at Aqaba appears to be imported from Egypt and the Syro-Palestinian coast and not created on site (Parker 1996: 252). Sidon has long been a glass-producing area (Pliny HN 36.190), and remained so in the Byzantine period (Stern 1999: 454). While recycling of glass in antiquity is a well-known phenomenon, the absence of glass in abundance currently argues against this possibility.

The counter-balance weight

Found near the glass shard was a lead globular weight, lacking cladding or other distinguishing features, with the remains of a copper-based eye for the attachment of a hook on top (Fig. 9). It weighed approximately 500 grams. This is a counterweight for a steelyard, a basic weighing instrument of the period. The weight has parallels from Byzantine sites in the Mediterranean. For example, at Sardis a similar, albeit heavier, globular weight along with a steelyard and hooks was found in fill under a floor in association with coins dated to the fourth century (Hanfmann 1963: 50; Waldbaum 1983: 81, pl. 28).

A number of steelyards have been found on other wrecks, including those at Yassiada dating to the fourth and seventh centuries (van Doorninck 1972: 139, 143). The presence of the weight on the wreck at Assarca may indicate that the steelyard and associated chains and hooks await future excavation. The weight suggests the use of Byzantine standards for weighing out goods, and that merchants in the various ports along the ship's route would have been familiar with the Mediterranean system of weights.

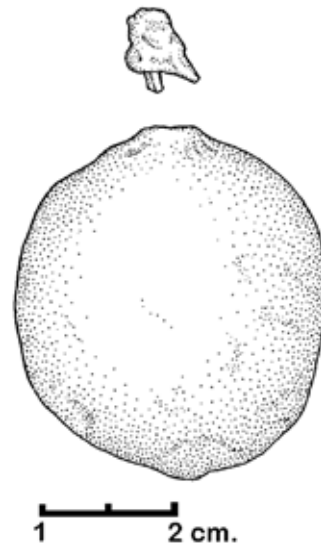


Fig. 9. The counter-balance weight for a steelyard. Drawing by T. Erwin and S. Pulak.

Cargo origins and destinations

The obvious candidate for an origin point for the ceramic cargo of transport containers is Aqaba. Excavations by the Roman Aqaba Project, under the direction of S. Thomas Parker throughout the late 1990s into the 2000s, revealed several thousand sherds of the Ayla-Axum amphora type. Parker notes that the amphora type at Aila first appears in the 'late fourth or early fifth century and is common through the seventh century,' (Parker 2002: 425) a determination of the dating supported by the early fifth century finds at Berenike already mentioned (Hayes 1996: 159-61).

Located at the head of the Gulf of Aqaba, the ancient port city Aila served as the nexus between the products of Palestine and Jordan and those of the Red Sea-Indian Ocean littoral in the Roman and Byzantine periods. During excavations in the 1980s of the early Islamic settlement, Whitcomb found that the foundations of the earliest Islamic structures were 'consistently associated with late Byzantine ceramics' (Whitcomb 1994: 9). He discovered the narrow conical amphorae were 'common at Aqaba but very rare elsewhere, raising questions as to the stylistic origin and distribution, and more importantly, the reasons for amphora productions at a site with no commercial product except for fish... and dates...' (Whitcomb 1989: 170). Whitcomb also noted that the amphorae and other ceramics at Aila exhibited stylistic similarities, not with Palestinian or Jordanian types, but with those from Coptic Egypt (Whitcomb 1989: 169-170). The lack of examples at other recorded sites in Palestine, Jordan and the Sinai implies a strong local tradition although similar styles have been found by Parker at Wadi Yitm

near Aqaba (Whitcomb 1989: 169). The amphora published at this time was waster connected with kilns not far from the find site. The ceramic assemblage consisted of red or orange ware with a darker slip, but these also occurred as cream slipped ware, and cream ware. The amphora and related ceramics date from the sixth and into the seventh centuries (Whitcomb 1989: 170).

Further excavations in 1993 revealed kilns for the production of the Ayla-Axum amphorae. The kilns contained three nearly intact Ayla-Axum amphorae, melted and vitrified, used to patch one corner on the combustion chamber (Melkawi, Amr, and Whitcomb 1994: 453). Despite the absence of primary pottery types and the presence only of wasters, these imply production of the amphorae here or nearby. Among the wasters were bowls, basins, cooking pots, various jars, and amphorae, which included not only the Ayla-Axum type but others such as a 'common amphora' ever-present in the Mediterranean in the sixth and seventh centuries (Melkawi, Amr, and Whitcomb 1994: 454-462). The Ayla-Axum amphorae are recognised by Whitcomb as being ubiquitous to Aila and are by typology 'part of a late Byzantine Palestinian corpus' (Melkawi, Amr, and Whitcomb 1994: 463). As described by Whitcomb '(t)he Aqaba amphora is carrot-shaped with heavily rilled body. The toe usually is a simple button (10m [sic]), the handles are heavy extending from just below the rim to the shoulder, there is usually a line on the exterior of the neck, vestigial of a more pronounced ridge or collar. The most distinguishing feature is the internal ledge below the rim for receiving the lid' (Melkawi, Amr, and Whitcomb 1994: 460). These are the same features found on the amphorae on the shipwreck at Black Assarca Island.

As Aila is the most probable origin for the cargo, Adulis is the likely destination. Recent survey of Adulis and the greater area by a team from the University of Southampton revealed the extensive presence of Ayla-Axum amphorae- sherds of the type are found in the Galala Hills, shoreline deposits, and in Adulis itself (Peacock 2007: 84, 95). The survey also found costrel sherds similar to those from Black Assarca (Peacock 2007: fig. 8.16, no.4). A study focusing on the contents of Ayla-Axum vessels from Aqaba was conducted which 'points firmly, but not conclusively toward wine or date products' as likely cargoes transported in these vessels (Peacock 2007: 95) with the lack of strong indicators of fatty acids ruling out animal products. Accordingly fish and olive oil were also ruled out (Peacock 2007: 104). The conclusion that wine and date products were being shipped in the containers assumes that hard firing of the clay obviated the need for a resin coating on the interior as none was found on the sherds (Peacock 2007: 104). This, as noted, was not the case with either the Ayla-Axum or costrel types from Black Assarca as many sherds and vessels of both types exhibited traces, if not large amounts, of resin coating the inside surfaces. Future study, particularly new methods of extracting DNA from the inner surfaces of amphorae from aquatic environments which have revealed olive oil, herbs, and mastics (Hanson and Foley 2008: 1175) will probably elucidate further the contents of the Black Assarca amphorae remaining to be excavated.

The ship

A cargo is only one component of a shipwreck. The vessel holding and transported the trade goods is the other. Little can be said of the ship that wrecked on the reef at Black Assarca as no evidence of it was found in the 1997 excavation. A ship of

Byzantine Aila origin could be of shell-first mortise-and-tenon construction as found on the contemporary shipwreck at Yassiada, or built frame-first with planking nailed to frame as on the sixth-century Tantura A wreck (Kahanov 2003: 49). Mediterranean style ships are known from classical sources to have sailed on the Red Sea (Procopius, *History of the Wars*, I, xix. 23-6)

Yet it is just as likely that the ship was an indigenous craft of the Red Sea. In this case the vessel would probably have been of sewn construction. In this method a shell of planking is fastened together with cordage and the internal framing lashed into it. This is the ancient and traditional method of boat construction for the Red Sea where sewn craft survived through the early decades of the twentieth century (Newberry 1942: 65; Thomas 1932: 2), as well as for the wider Indian Ocean area, where it appears to reach back from the present at least three millennia (Pedersen, 2004a). Sewn boats were mentioned in the *Periplus of the Erythraean Sea* (PME 15.4.30; Casson 1989: 73) and continued in use on the Indian littoral and its tributaries up through the twentieth century when they were mostly displaced by modern techniques, surviving in only a few places such as southern Arabia (Vosmer 1997), India (Swamy 1999; Pedersen 2004b: 4), and Sri Lanka (Kapitän 1991).

Just as the type of ship cannot be determined from the present data, determinations of the size of the vessel that ripped apart on the reef at Black Assarca are equally speculative. Carrying capacity of a ship, however, can give an indication of the size of a vessel. Judging from the extent of the wreck site, but not the number of excavated or viewed amphorae, it is suspected the ship was not as large as either of the shipwrecks at Yassiada. Both these ships had an overall length of approximately 19 metres (van Doorninck 1972: 140; Bass and van Doorninck 1971: 29), and the seventh-century ship held 900 amphorae (van Doorninck 1972: 140) while the fourth-century one carried 1,100 (Bass and van Doorninck 1971: 34). The wreck site at Black Assarca does not appear to contain this many containers. Possibly the ship was a smaller coastal trader on the scale of the Hellenistic wreck at Kyrenia which was 14 metres long and held 400 amphorae among other cargoes (Steffy 1985: 72, 100). Such a craft would have been capable of making the trip from Ayla to Aksum, if it had not actually picked up the cargo at a southern transit point like Berenike.

Without further excavation and the possibility of the discovery of hull components, the nature and size of the ship remains within the realm of conjecture. Smallish merchant vessels, however, seem to have been the norm in the Byzantine period, perhaps because the larger ships of the Roman Empire were no longer economic (Pryor 1988: 26-27). Ships tended to be in the hands of private citizens and the church rather than those of the state. Often ship captains were the owners, builders, carpenters, and even the merchants. This class, the *naukleroi*, appears in the Byzantine period to fill a gap left open by the changing conditions of empire in the Mediterranean. One such *naukteros* was Georgios, the Priest-Captain of the seventh-century wreck at Yassiada, as is known from the inscription on the large steelyard found in the site (Sams 1982: 213). Whether such social classes extended to Red Sea maritime activities is not known, but one assumes that similar societal structures existed at least on the Red Sea ships of the Byzantines. The Byzantine-style lead counterweight found at Black Assarca points to some sort of Byzantine influence if not an actual Byzantine physical presence on board.

The ship that wrecked at Black Assarca was undoubtedly involved in the trade of bulk items, the mainstay of Mediterranean sea-borne commerce in this period along

with perhaps some luxury goods as indicated in the glass piece (Wickham 2004: 163). It seems unlikely that this was *cabotage* trade – hopping from port to port trading along the way – as with the Kyrenia ship (Katzev 1980: 45); the Black Assarca wreck was more likely involved in direct trade between two centres. There were few settlement sites along the Red Sea's African and Arabian coasts available for *cabotage*, and trade may have been direct from Berenike to Adulis with few opportunities or little desire to stop anywhere except as needed at night or to replenish water supplies.

Summation and conclusions

The shipwreck at Black Assarca remains unique as an excavated site in the Red Sea. Other underwater sites are known, including at least two in Eritrea. One, at a small island on the far side beyond Dahlak Kebir (the large island of the archipelago) consists of pottery but could be just a dump site of apparently third or fourth century AD ceramics. The other is a reported wreck in deep but dive-able water between Black Assarca and Massawa. Neither of these has been archaeologically investigated.

The Black Assarca wreck therefore gives us our only surveyed and excavated physical evidence from a shipwreck of the ancient trade that existed between Byzantium, Aksum, Arabia, and India. The corpus of material indicates an origin for the ceramics in Byzantine Aila. The dating can only be estimated to the fifth or sixth centuries based on the other finds of similar ceramics at Red Sea, Indian Ocean, and Mediterranean sites. It is possible that the wreck could rather date to the early seventh century.

The presence of ceramics related to Aila does not necessarily mean the ship itself was from there or that it was a Byzantine ship. The craft may have been Indian, Arabian, or Aksumite in origin. The cargo may have possibly been assembled for shipment down to the southern Red Sea at a port such as Berenike, although there is nothing to preclude the ship sailing from Aila before coming to grief at Black Assarca. The ship obviously had come from northern realms, as it is hardly likely that it would be carrying these ceramics back to their origin point. Whether the ship had stopped at nearby Adulis before wrecking cannot be determined based on the excavated material. It is not considered likely, however, as one would expect the amphorae to be offloaded at Adulis given the number of similar finds there and at the sites further inland. It is possible the ship was making for Adulis when it may have run into trouble in a storm and been blown off course, missing the entrance to Zula Bay and running into Black Assarca. The twin Assarcas stand in the middle of the Massawa Channel and are a hazard to shipping to this day. There have been two lighthouses built on the island in recent times, the first being wrecked in a storm (materials from which provided for the construction of our artefact tank and for anchors for our diving barge *Unsinkable II*), and the second being a modern solar-powered one, inoperable during our stay on the island.

It is also possible the ship was intending to stop at Black Assarca. Remains of ancient settlements on the island include round foundations, a shallow clay-lined reservoir for rain catchment, a few small rough-hewn stelae, and obsidian flakes from tool production. The settlement brings to mind the islands of the Alalaei of the Periplus:

Before the harbor of that market-town (Adulis), out at sea on the right hand, there lie a great many little sandy islands called Alalaei, yielding tortoise-shell, which is brought to market there by the Fish-Eaters (Schoff 1912: 23).

The Assarcas are two of many sandy islands, and they are positioned to the right, out at sea, just beyond the mouth of Zula Bay in which Adulis sits. Whether the Assarca settlements, which were likely seasonal camps for fishing, were occupied at the time of the wreck, or even if they were at all contemporaneous with the ship, is not known. The settlements have yet to be investigated archaeologically.

The excavation of the wreck has raised many questions and answered others. Excavation remains incomplete; at least one more season is required to fully understand the site. A resumption of the excavation may yield other artefacts that can help illuminate the ship's final voyage and ancient Red Sea seafaring in general. If any hull remains under the amphorae, it would give us our first finding of an ancient hull of this period in the Red Sea region. Whether is it sewn in the Indian Ocean method or built by the Mediterranean mortise-and-tenon, or other, technique the hull would give us insights into the origin of the ship as well as contribute to our knowledge of ancient woodworking technology. The finding of coins would certainly give us a solid date for the wreck and help in dating the Ayla-Aksum amphorae found on all the Red Sea sites. Such a continuation would certainly be a great benefit to the archaeology of the Red Sea and of Eritrea.

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