

The *Adelaar*: a Dutch East-Indiaman Wrecked in 1728 off Barra, Outer Hebrides, Scotland

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The *Adelaar*, a Dutch East-Indiaman outward bound from Middelburg to Batavia, was wrecked on Greian Head, Barra, in Scotland's Outer Hebrides in 1728. Although heavily salvaged at the time, and situated in an extremely dynamic location, the wreck demonstrates that exposed sites can retain meaningful levels of archaeological integrity, and historically valid conclusions can be drawn from them.

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The *Adelaar* (Eagle) was built in the Middelburg yard of the United East-India Company (*Verenigde Oostindische Compagnie*, or VOC) in 1722 (see Note on Sources). Her dimensions, standard by this period for a medium-sized vessel on the Indies route, were (in Amsterdam feet of 283 mm): overall length 145 ft (41 m); beam 37 ft (10.5 m); and laden draught 15½ ft (4.4 m). Cargo capacity was 140 lasts (280 tonnes), which gave the ship a loaded displacement of about 700 tonnes. She was equipped with 44 guns, their calibres indicated by the weight of shot fired in Amsterdam *ponts* of 494 gm. They comprised ten iron 12-pounders; 18 iron 6-pounders; two bronze 6-pounders (these were the pair on either side of the ship's compasses, to reduce deviation); six iron 3-pounders, and eight bronze breech-loading swivel guns (Martin, 1992: 146–7 and n.6). A closely contemporary model of an East Indiaman of this type is that of the *Padmos*, built at Middelburg in 1721 (Fig. 1). The *Adelaar* would have been similar in all significant respects.

In the first quarter of the 18th century the VOC was at the height of its power, operating in effect as a self-contained state with the authority to negotiate with nations and wage war. Its administration, shipyards, cargo procurement, and operating protocols were highly systematised, and based on trading voyages to the Far East (Glamann, 1958; Boxer, 1965; Bruijn *et al.*, 1979–87; Glete, 2000). Between 1722 and 1727 *Adelaar*

made two round trips to Batavia (modern Jakarta), the VOC's fortified *entrepôt* on the north coast of Java. Both voyages were uneventful, with exceptionally low death-rates on the outward legs (two and four respectively). In December 1727 the ship was commissioned for a third voyage under Willem de Keyser of Middelburg, carrying cloth destined for Japan, and a general cargo of domestic hardware, tools, nails, and grindstones intended mainly for European consumption at the Cape and Batavia. A large consignment of yellow bricks and lead ingots was stowed in the ship's bottom; after serving as ballast for the voyage these building materials would have been converted into colonial houses. Her outward cargo was, however, incidental to the main purpose of the venture, which was to obtain spices, tea, and porcelain for profitable resale in Europe. The most important commodity *Adelaar* carried was specie to purchase her return load.

On 6 March (Gregorian Calendar) de Keyser and his supercargo (chief merchant for the voyage) Simon Pieter Trouillaert took delivery of 500 8-mark bars of silver each stamped with the VOC monogram, six bars of gold, 32,000 silver *ducatons* minted that year at Middelburg, and 450,000 copper 2-*stuyver* coins. The specie was packed in 17 numbered chests, each of which was double-locked. The 1728 issue of *ducatons* was one of the first to be minted exclusively for the VOC, and on the reverse the coins bore the



Figure 1. Contemporary model of the VOC ship *Padmos*, built at Middelburg for the Zeeland Chamber of the Company in 1721. Her specifications closely match those of the *Adelaar*. (© Maritiem Museum Prins Hendrik, Rotterdam)

company's monogram beneath the States' lion. With a crew of 120 seamen, 60 VOC soldiers, and about 30 company officials and passengers embarked, *Adelaar* set sail from the roadstead at Rammekens on 11 March and headed into the North Sea intent on rounding the British Isles north-about, a route frequently taken instead of the more direct Channel passage because of the prevailing winds or, on occasion, political instability. Two weeks later she struck a reef off Greian Head, on the exposed north-west of Barra. There were no survivors.

The ship had been observed off North Uist some days before, in no apparent difficulty but sailing dangerously close to the lee shore in a light NNW wind. On 22 March she was sighted again as she tried to beat her way clear of Barra. By Sunday 24 March the wind had backed to WSW, and during the night veered NNW, increasing to a severe gale. The following morning the inhabitants of the hamlet nearest Greian Head discovered the ship 'intirely beat to pieces, and a great number of the Bodies & some goods floating on the Beech'. Two iron guns could be seen on

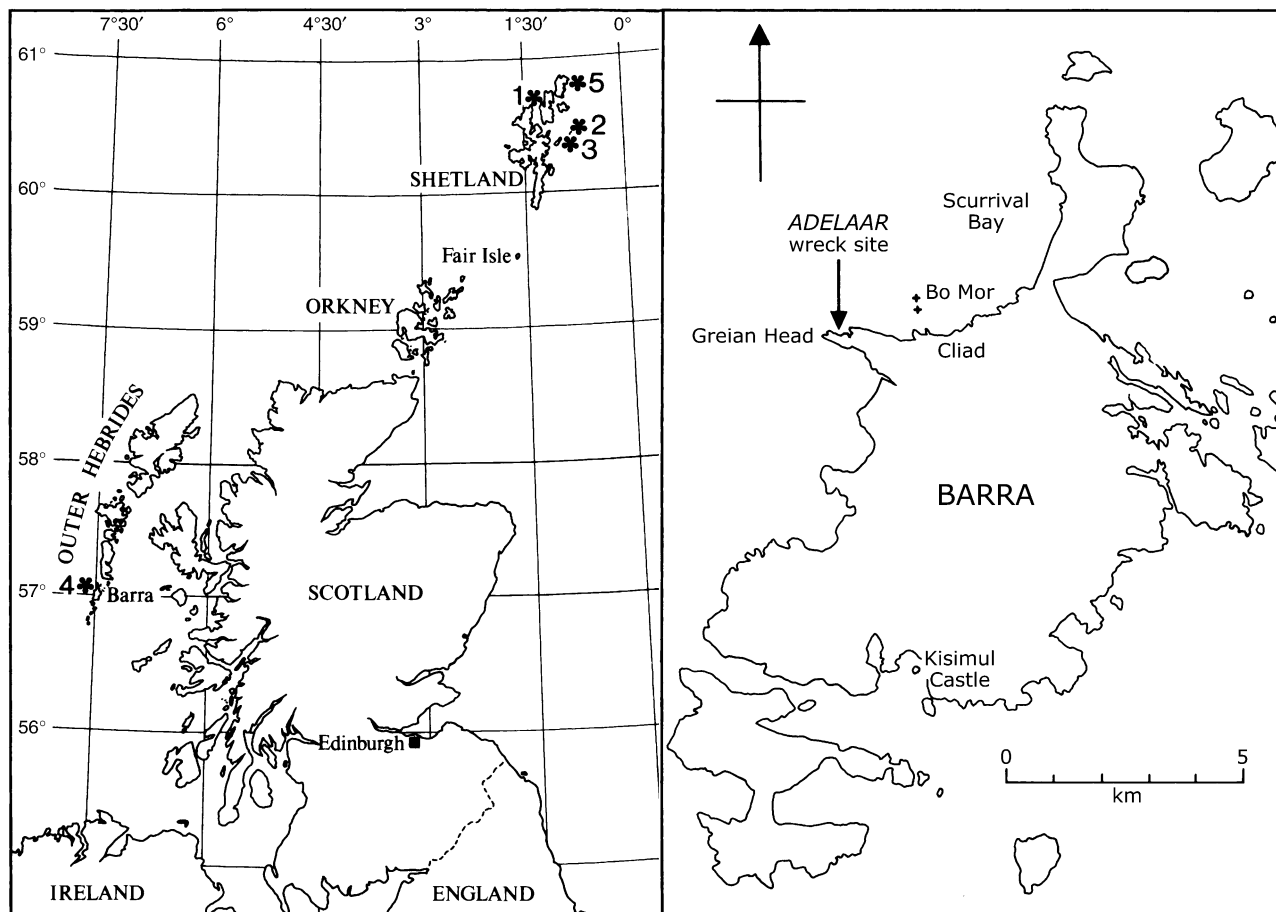


Figure 2. (Left) Scotland showing the Northern and Western Isles, with the location of VOC and associated wrecks. 1. *Lastdrager* (1654), Yell, Shetland; 2. *Kennemerland* (1664), Out Skerries, Shetland; 3. *de Liefde* (1711), Out Skerries, Shetland; 4. *Adelaar* (1728), Barra, Outer Hebrides; 5. *Curaçao* (1729), Unst, Shetland. (Right) The Isle of Barra, showing the location of the wreck site. (Colin Martin)

top of a rock which dried out at low water, together with six bars of lead and some broken spars including the foremast. More guns were visible 'upon the side of the rock where ... [the ship] was cast away'. Within a few days timbers were being thrown up on all sides of Barra, and a week later wreckage came ashore on the neighbouring island of South Uist. In the vicinity of the wreck each low tide revealed bodies and wreckage wedged in the clefts of rock, and on nearby beaches (Martin, 1992: see also Note on Sources).

The ship had evidently attempted to weather Greian Head after becoming trapped in Scurrial Bay by the onshore gale. Her chance would have come when the wind veered into the NNW, giving her an opportunity to sail south-westwards on a beam reach. Willem de Keyser must have known that it was a desperate gamble, especially by night, for the ship's progress seawards and to safety could only be gained at

the expense of drifting to leeward and potential catastrophe. But he had little choice. *Adelaar* successfully negotiated *Bo Mor*, the extensive complex of reefs in the middle of the bay, but just failed to clear Greian Head, striking an exposed reef only 300 m from the headland (Figs 2–4). Destruction had been rapid and total, and for those on board there was little hope of survival. Among the dead were a woman with two children tied to her, and a 'young gentlewoman, who had in her Breast between her Shift and her Skin, a Letter of Recommendation from her Mother to a Gentlewoman in the East Indies' (*Caledonian Mercury*, 1 July 1728, citing the *London Evening Post* of 22 June).

Adelaar's subsequent salvage and the court cases which followed have been chronicled elsewhere (Martin, 1992). In summary, news of the ship's treasure eventually reached Alexander Mackenzie, an Edinburgh lawyer who held the sinecure of



Figure 3. *Maolach Sgeir* in a north-westerly gale from above *Sloc na Frangach*, looking west. The large wave is breaking over the wreck site. (Colin Martin)

Admiral Depute for the Western Isles. Believing this gave him exclusive title to the wreck Mackenzie, with boundless energy and optimism but dubious legality, mounted a complex and ingenious operation to recover the specie. To achieve this he assembled a private army of friendly Highlanders to neutralise the local chieftain, the Macneil of Barra, a petty warlord whose isolation from central authority had given him delusions of absolute power and whose clansmen had already plundered what they could from the wreck and its victims. Protected by his mercenaries, Mackenzie arrived on the island with Captain Jacob Rowe, an Englishman with a newly-invented diving 'engine', and in a remarkable operation conducted over the summer of 1728 brought up virtually all the treasure.

In a manuscript of c.1720 Rowe (2000) described and illustrated his diving apparatus, setting out procedures for its use (Fig. 5). Another description was published by Desaguliers (1744: 215 and pl. XX), and some retrospective information appeared in the *Universal Magazine* (September 1753: 128–9) a few years later. The machine was

a truncated vessel of brass or copper (some versions were built of wooden staves like a barrel) in which the diver lay prone. His arms protruded through sealed sleeves of copper and leather, and he peered through a small glass port from which he was obliged to clear condensation with his nose. A lid secured with butterfly nuts provided entry. The engine was designed to be operated in a slightly head-up attitude, improving the diver's view and providing better arm-space when working on the bottom. It also kept water from gathering around his face in the event of a leak.

Enough lead to create slightly negative buoyancy was fastened beneath the apparatus, which was suspended by ropes from a mother-craft. A life-line provided communication with the surface. The diver could be lowered and raised with relatively little effort as long as buoyancy trim was correctly maintained, and this permitted the engine to be hauled up rapidly from time to time so that fresh air could be blown in with bellows. Under favourable conditions several hours of underwater work was



Figure 4. *Maolach Sgeir* at low water in calm conditions from the same viewpoint, showing the reef complex. (Colin Martin)

possible, with regular air replenishment. A block-and-tackle hoist was employed to lift the machine clear of the water, or to bring it up in a flooded condition. Surprisingly, no arrangement seems to have been provided to jettison the ballast for an emergency bale-out.

In effect the engine was an armoured diving dress, although no protection was provided for the arms and the full differential between atmospheric pressure inside and ambient water-pressure outside would squeeze on the diver's upper arms where they emerged from the sleeves. This naturally increased with depth. A further effect was to push the diver's body by way of his arms against the top of the vessel, and a back-saddle was provided to counter this. Even at quite modest depths these forces would have been unpleasant and disorienting, yet it is clear that such devices were successfully operated in up to 10 fathoms (18 m) of water. This must have been close to a diver's physiological limits. Desaguliers reported that a Captain Irvin, who dived for Rowe, experienced a strong stricture about his arms at 11 fathoms, and that 'venturing two fathom lower to take up a lump of earth with

Pieces of Eight sticking together; the circulation of his blood was so far stopped, and he suffered so much, that he was forced to keep to his bed six weeks'. Another diver died after reaching 14 fathoms (Martin, 1992: 154).

Depth, however, was not a problem on *Adelaar's* wreck. A preliminary inspection of the site revealed that the wreckage lay in 4 to 6 fathoms (7.3 to 11 m), though its exposed situation drew some cautionary comments: '[it is] all surrounded with steep rocks inaccessible to the smallest boat, but the places where most were lying were so surrounded with rocks over which the sea broke even in the best weather as to make it almost impractical to get at these with any boat whatsoever'. Nevertheless the difficulties were heroically overcome, and by the end of the summer virtually the entire consignment of specie had been accounted for. Other recoveries included boxes and barrels of tools and domestic hardware, lead ingots, ship's gear, and a bronze 6-pounder together with several bronze swivel guns. The iron guns were evidently not considered worth the trouble of recovering, but the salvage of a second bronze 6-pounder had to be

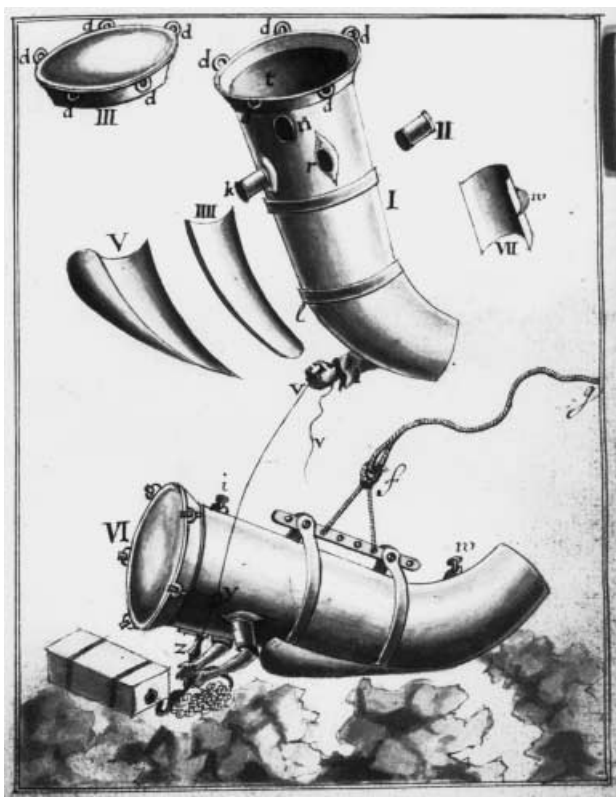


Figure 5. Jacob Rowe's diving engine of c. 1720. (© National Maritime Museum, London, ref. E0813-B)

abandoned because the gully in which it lay was too narrow for the diving engine (Fig. 6). It was raised by our team in 1972.

Small-scale salvage continued through the winter, and intermittently over the next two years, but by then the focus of activity had shifted to Edinburgh along with the treasure, which was lodged in the Bank of Scotland while four years of litigation over its ownership took place. Alexander Mackenzie's entrepreneurial genius in organising the venture was not matched by his political or accountancy skills, and the VOC played on his Jacobite leanings to mobilise the London government against him (Scotland's parliament had been abolished by the Act of Union in 1707 and Jacobite insurrection was in the air). George II personally intervened in the case, and not surprisingly judgement was found in favour of the Dutch. Mackenzie was ruined, although Jacob Rowe received a fee and his expenses. The legal processes, which involved a bewildering number of suits and counter-suits, were so complex and acrimonious that they became known collectively as 'The Scottish Case', and few of the participants profited from



Figure 6. Bronze 6-pounder in Gully A (Grid 5935). The effects of abrasion are plain. Note also the rounded pebbles and smoothly ground bedrock. (Tony Long)

the prolonged litigation (except, of course, the lawyers). From our perspective the extensive records generated by the episode have made *Adelaar* one of the most fully-documented of VOC shipwrecks, particularly in terms of her cargo, the make-up of her consignment of specie, and the contemporary salvage operation.

The wreck site

A tradition of the wreck, and its location, was remembered on Barra into modern times, and a version was recorded by John Macpherson of North Bay (the 'Cuddy') (1960: 123). The Cuddy called the spot *Maolachdag*, which he translated as 'cursed rock', although according to Malcolm McAulay of Castlebay (pers. comm. 1972) it is more properly known as *Maolach Sgeir*, or 'the cursed reef'. The location of this reef was pointed out to my colleagues Chris Oldfield, Simon Martin, and Tony Long by John MacLean of Cliad and there, on 23 March 1972, they found *Adelaar's* remains (Martin, 1998: 102).

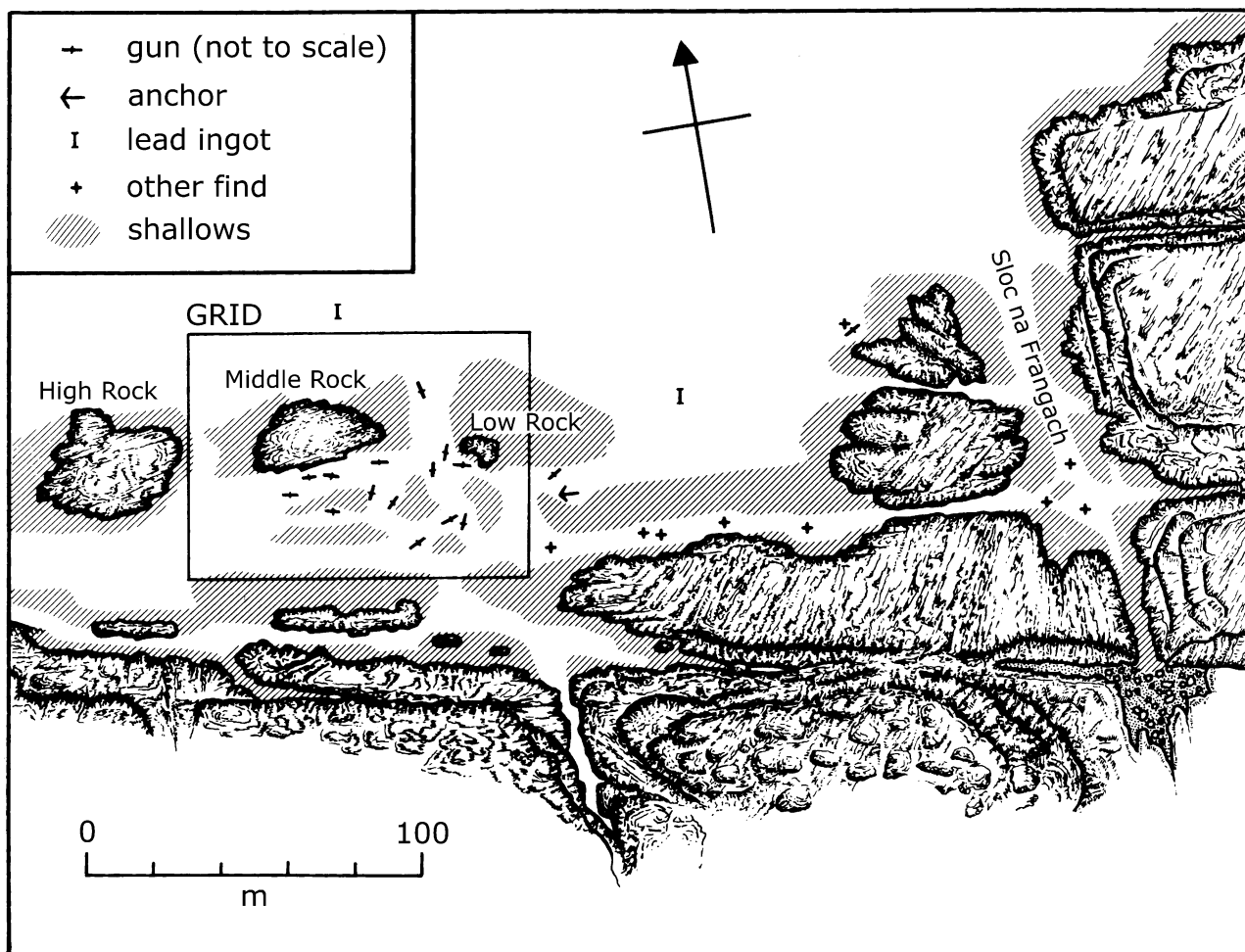


Figure 7. The wreck site and its environs. (Colin Martin)

The reef complex incorporates three rocks which rise above the surface about 100 m from the north side of Greian Head some 300 m from its westerly tip (Fig. 7). The easternmost rock covers at high water and on it, presumably, lay the two iron guns noted in 1728 (they are not there now, although two lie close to its foot). The other two rocks are, in a technical sense, dry, although, as our 18th-century predecessors observed and we can confirm, the sea continually breaks over the reef 'even in the best weather'. It is an extremely exposed location: westward the open water fetch is 3500 km (Newfoundland), north-westward 2000 km (Greenland), and northward 2250 km (Sptizbergen and the polar ice cap).

Most of the wreckage lies in a series of deep gullies on the landward side of the reef (Figs 8 and 9). These follow the local east-west trend of folded rock strata, cut at intervals by north-south fissures. The main deposit was contained in a

long, narrow cleft (Gully A) immediately beneath the south edge of the central rock and at the base of a cliff which is vertical and in places overhanging (Fig. 10). Its depth varies between 7 and 10 m indicating, together with its topography, that this was the place in which most of the 18th-century salvage took place. Gully A is narrow—in places 2 m or less—and has a U-sectioned bottom ground by boulder movement into the solid rock. In the wider parts water-rounded pebbles have accumulated, but where the gully narrows stones and sediment are usually absent, apparently flushed clear by funnelled water-movement. At intervals along its length the gully is blocked by large intrusive rocks. Water-movement, although at times unexpectedly and frighteningly violent to anyone diving there (whether in a barrel or with modern scuba), is moderated somewhat by these obstructions, and some sand is present among the stones. Gully A

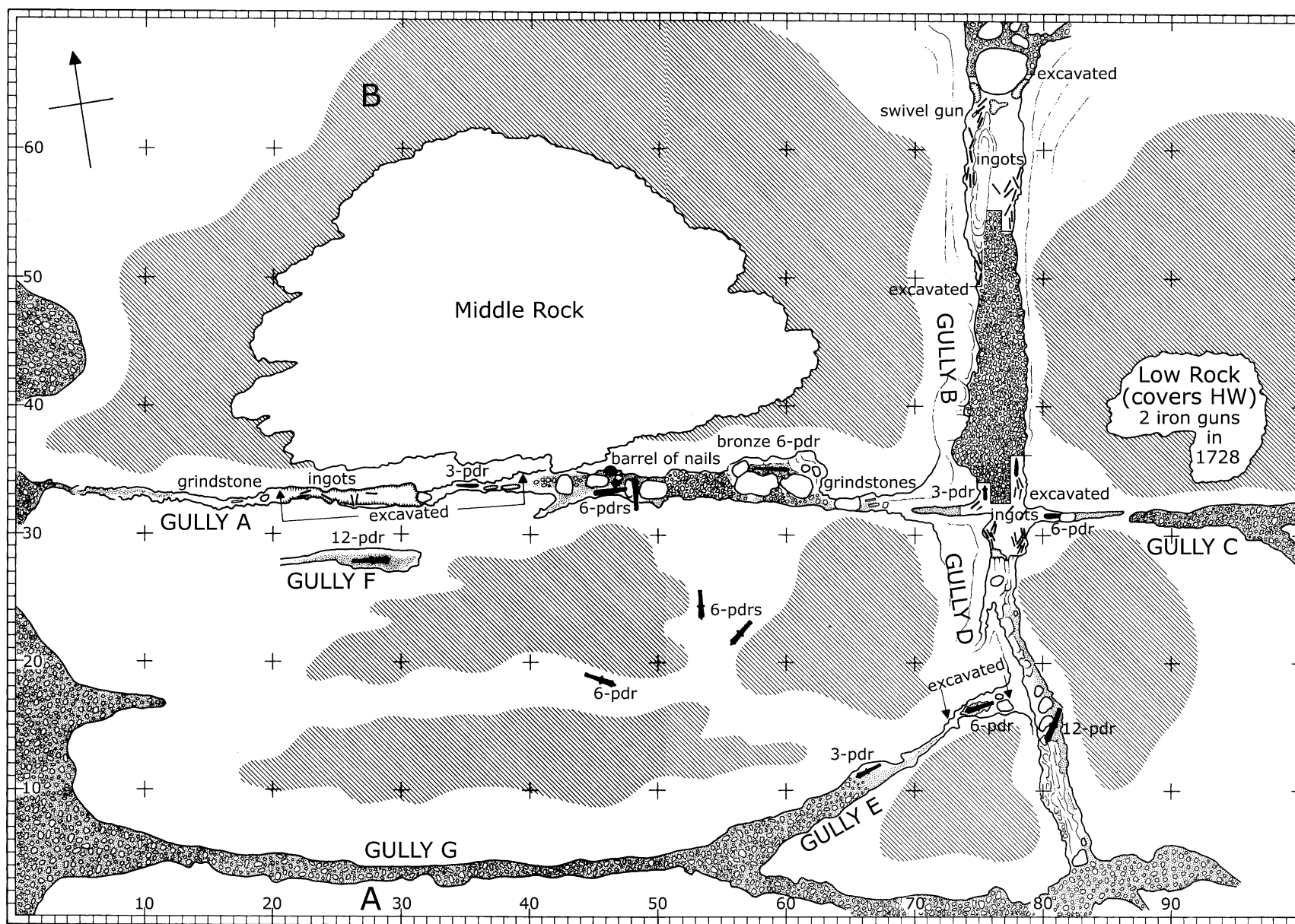


Figure 8. The nucleus of the wreck with reference grid (in metres) superimposed. (Colin Martin)

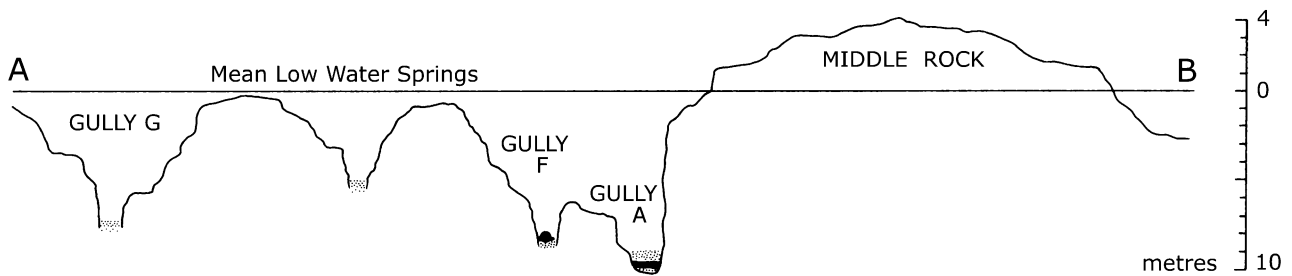


Figure 9. Section A-B across the main wreck area. The vertical scale is not exaggerated. (Colin Martin)



Figure 10. Gully A, looking west. The diver is removing overburden and dumping it to his rear. (Colin Martin)

is intersected at its east end by a wider and deeper gully running northward (Gully B), which contained wreckage up to a point in line with the north edge of the reef, where it is blocked by a massive boulder (Fig. 11).

The sides of Gully B are almost vertical, and extend close to the surface. Its average depth is 15 m, increasing at the south end to 18 m. Abrasion-



Figure 11. Metal-detector survey in Gully B. Note the rounded boulders and vertical sides of the gully. (Tony Long)

rounded stones up to 30 cm in diameter fill the gully floor to a depth which varies from a surface scatter to about 1 m. Very little sand is present. It appears that the stones move freely in the gully during rough weather, when displacement by waves breaking on the reef causes erratic but at times extremely violent water-movement through the gully systems. This process has rounded the stones and smoothed the bedrock with which they are in contact (Fig. 6). The abrasive effect is

most evident at the south end of the gully, where a cauldron-shaped terminal basin has formed. Particles of sand are presumably thrown into suspension by water-movement, to be dispersed elsewhere, explaining the general absence of sediment in this gully. Gully C continues the line of Gully A eastwards beyond Gully B.

Between the reef and the shore, rock strata come close to the surface, and are thickly covered by *Laminaria digitata*. Further wreckage was located in gullies among the shallows—in Gully D, which runs south from Gully B; Gully E which branches south-west from Gully D; and Gully F, a short fissure running parallel to Gully A just to its south. Nothing was found in the long gully (G) which runs close to the shoreline beyond the southern edge of the site. Free-swimming searches revealed no wreckage west of the gully system described above, but a debris trail continued for some 200 m along the cleft which runs from the main site towards *Sloc na Frangach* (Creek of the Foreigners), a name which suggests that some of the victims had been washed in here. Several items were found within the creek itself (Fig. 7). Further finds, including an iron gun, were made off the small rock at the north-west end of the *Sloc*, while a gun, an anchor, and a lead ingot were located between here and the main site. The difficult sea-bed topography precluded systematic search of this area, and it is likely that more wreckage is present hereabouts. A lead ingot was found c. 100 m east of the Middle Rock, and another c. 30 m to its north.

That the main break-up took place in the region of Gully A is evident from the guns concentrated in and around it. Heavy items will naturally have found their way into the gully bottoms when the hull disintegrated and, once there, are unlikely to have moved, so their present locations reflect their primary deposition. Four guns are also evident in Gully B, but three are concentrated at its southern end, where they line up with the group in Gully A. Artillery would have been disposed along the full length of the ship's main and upper decks, so the pattern of guns on the site probably provides a reliable indicator of where the main disintegration occurred. By ignoring guns more than 15 m from their nearest neighbours, on the grounds that these must have become separated from the wreck's nucleus by other site-formation processes, a zone of concentration some 55 × 40 m in extent emerges. This, allowing for outspill from the



Figure 12. Partially-excavated barrel of double-ended nails at Grid 4635, showing their criss-cross packing. (Colin Martin)

disintegrating hull, accords reasonably well with the ship's known dimensions of 41 × 10.5 m.

It is reasonable to presume that the distribution of other objects within this nuclear zone bears at least some relationship to their original locations within the vessel, although the 18th-century salvage operations may have redistributed as well as removed some of the material. Nevertheless a closely-contained concretion deposit centred on Grid Ref. 3033 was found to include a group of 16 unused hammer-heads, which may be identified from the ship's manifest as part of a consignment of 40 assorted hammers packed in a small barrel numbered '27'. Though the barrel has disintegrated, a third of its contents appears to have remained within a 4-m sector of the gully bottom. None has been found elsewhere on the site, and it may be that the balance was salvaged in 1728. Another concretion, at GR 4635, contained a packed mass of double-ended iron spikes cemented together in the shape of the barrel in which they had been packed (Fig. 12). Seventeen barrels of this type of nail are listed in the manifest. Three grindstones were also noted in Gully A: one at its western end (GR 1733) and two towards its eastern extremity (GR 6732).

Thirty silver coins were found among the concretion deposit near Gully A's western end. Many were abraded beyond recognition. Twenty-nine were of similar size (44 mm diameter), and the two best-preserved are *ducatoons* of the United Provinces and the Spanish Netherlands respectively, typical of VOC specie consignments before 1728.



Figure 13. Exposed lead ingots in Gully B (GR 7558). (Colin Martin)

It seems likely that this area represents the stern end of the ship, a hypothesis reinforced by an early description of the wreck which notes that the ship's foremast could be seen close to the easternmost rock. However no coins of the new 1728 Middelburg minting, of which *Adelaar's* consignment of 32,000 was exclusively composed, were found here or elsewhere on the site, reinforcing the likelihood that all had been salvaged in 1728, probably still intact in their iron-bound sealed chests.

Since the types and numbers of *Adelaar's* guns are known, and only bronze guns appear to have been of interest to the 18th-century salvors, the proportion of iron guns remaining at the nucleus of the wreck can be quantified. Of her ten 12-pounders only two, or 20%, remain, along with seven of her 6-pounders (39%) and four of her 3-pounders (67%). In all, 42% of *Adelaar's* original armament (not allowing for the bronze pieces salvaged in the 18th century) lies in the nuclear zone, suggesting that this is the site of the main break-up.

It does not however follow that all of the ship's contents fell in this area. A small brass swivel gun was found in the north part of Gully B (GR 7563), close to the large boulder which blocks the gully's northern end. Apart from this, a few isolated deposits of iron concretion, and four small gold items in deep fissures, the only objects

found in Gully B (other than at its southern end, which lies within the nuclear zone) were lead ingots, of which 42 were revealed by excavation and many more suggested by a metal-detector survey over the unexcavated areas (Fig. 13). Lead was commonly carried by East Indiamen as paying ballast (Price *et al.*, 1980; Whiting *et al.*, 1985; Willies, 1985), and the ingots were stowed in the lowest part of the ship, probably along either side of the keelson.

Adelaar's remaining ballast was in the form of 60,000 building bricks, which would have been stacked to fill the lower hold. The concentration of ingots in the seaward part of Gully B probably indicates the point at which the ship first struck, ripping out her bottom and dropping most of her ballast. Large numbers of bricks should also be expected here, but only a few very worn fragments have been found. All were lodged in deep fissures. Presumably nearly three centuries of continual movement within the abrasive make-up of the gully bottom has ground down and dispersed their soft ceramic fabric, except for a few pieces which eventually became stabilised in the fissures. The single swivel gun, one of eight mounted on the upper part of the stern, may have become detached during the shock of impact, while the four items of jewellery may perhaps derive from corpses which were washed into the gully after

the ship had disintegrated. They could alternatively have been personal trade goods.

These observations, coupled with documentary accounts, the site's topography, and an analysis of prevailing weather conditions, allow the wrecking process to be reconstructed with some confidence. As argued above, *Adelaar* probably approached the site from the north-east in a severe NNW gale, close-hauled in an attempt to clear Greian Head after becoming trapped in Scurrial Bay. She would have struck the shallows bow-first between Middle and Low Rocks to lodge on the upper edges of Gully B. There her bottom collapsed, releasing most of her ballast. Relieved of this weight, the ship was carried over the reef by the wind and broaching seas, pivoting across Middle Rock until she lay broadside-on beyond its southern edge, stern towards the west. Deposition here of a few bricks and lead ingots suggests that some parts of the bottom were still partially intact up to this point. Held against the reef by back-surge from the shore, a total break-up of the hull will have followed swiftly, depositing much of the armament and most of the heavy cargo into Gully A. The specie evidently remained concentrated and intact in its boxes, facilitating its recovery by Captain Rowe and his associates in 1728 (not one of the 32,000 new-minted *ducatoons* of that year has been recorded on the site). The forward part of the ship was pushed further inshore, depositing some of its contents in Gullies D and E. It will be recalled that in 1728 the foremast had been observed in this area. Isolated pieces of structure were carried to other locations, taking with them attached heavy objects, particularly guns, which eventually stabilised as sub-formations such as the one near the entrance to *Sloc na Frangach*. There may well be others further afield. Many of the bodies were driven towards the *Sloc*, dropping a scatter of artefacts and fetching up eventually within the creek, where further items were deposited. Over the following days bodies and other floating material were widely dispersed around Barra and beyond, as the contemporary accounts testify.

This wreck-formation is paralleled in several respects by that of *Hollandia*, a VOC ship which foundered in the Scilly Isles in 1743 (Gawronski *et al.*, 1992: 256–73). Here the initial impact point is indicated by a deposit of lead ingots and iron bars, without guns or other significant items of cargo. Some 60 m to the north the main break-up of the hull is indicated by a concentration of

guns, anchors, and the bulk of cargo-related material, including specie: 30 m further on a sub-formation including scattered guns, more ingots, and a couple of anchors indicates the final stage of the wreck's dispersal.

Project design and methodology

The project was initiated by an investigation of documents concerning *Adelaar* in Dutch, English, and Scottish archives, which, because of the complex litigation which followed the ship's loss and salvage, proved to be unusually numerous and wide-ranging. These documents suggested that the wreck-site might be located without difficulty, and that an investigation of what remained would complement a study of the VOC's history and archaeology. When the unusually exposed and scattered nature of the wreck became evident, an opportunity was taken to test what degree of archaeological integrity might remain, with the aim of countering claims which have been made in some quarters that such sites are beyond meaningful interpretation, and consequently nothing is lost by archaeologically-insensitive approaches to their salvage.

Following the wreck's discovery in March 1972 by Chris Oldfield and his associates, almost all work on it was conducted by the writer and Tony Long. A three-month season was completed that year, during which the site was surveyed, followed by a two-month excavation season in 1974 under the auspices of the then recently-founded St Andrews Institute of Maritime Archaeology.

Survey and excavation techniques

Because of the wreck's broken and exposed nature, and wide extent, it was impracticable to set up a physical grid on the site, but the concentration of wreckage in the gullies allowed fixed points to be established at either end of each straight sector, and from these points tape datum lines were run for recording by offset. Tape triangulation between the fixed points was not practicable because of the broken sea-bed topography and water movement, so their positions were marked on the surface under optimum conditions by buoys held vertical on tight lines for survey by plane-table resection from the shore. The resulting plots, when checked against the measured tape runs along the gully bottoms, were sufficiently reliable to allow the general layout of the site to be

established as a network of lines defining the gully axes. The individual survey of each gully in the system, because it was based on the tighter control of a straight tape run, permitted more accurate recording at a larger scale within the archaeologically-productive areas. An arbitrary reference grid covering 100×70 m of the core site area has been superimposed on the plan, and locations within this area are identified by 4-figure co-ordinates (that is, to within a nominal 1 m square). A surface survey of the reef and adjacent shoreline was also conducted by plane-table, using conventional techniques (Bowden, 2002). This was tied in to the underwater survey via the buoy-marked datum points.

Excavation in the gullies was conducted by creating a work-face by hand-fanning, where practicable down to bedrock, and depositing the spoil 5 m to the rear. The face was then advanced along the gully. This permitted a running section to be maintained, allowance being made for the angle of repose. A water-dredge was the most efficient way of transporting spoil, but since mooring a support-craft inside the reef system was hazardous except in calm conditions this was only rarely employed. Buckets and shovels provided an effective if laborious alternative. When a solid matrix of concretion was encountered at the bottom of a gully small quantities of submarine blasting gelatine were sometimes used to loosen it. This technique, which has been described elsewhere (Martin and Long, 1974), did not displace or damage archaeological material within the concretion, which was subsequently excavated and recorded in the normal way.

An *in situ* investigation was also conducted on an example of each of the three sizes of iron gun.

This involved the removal of concretion by the careful use of hammer and chisel to facilitate the accurate recording of profiles and trunnion marks without the necessity of recovering and conserving the gun. The procedure was adopted in the knowledge that it would accelerate the degradation of the objects, but it was felt justified because: circumstances precluded raising and conserving the pieces; cast-iron guns of this period are not in themselves rare, though the opportunity to sample a complete set of types from a named VOC ship was unprecedented, and might be expected to yield significant information; and several undamaged examples of each type remain on the wreck-site for further investigation or recovery if required. Such an approach was also adopted in the case of the guns of the *Dartmouth*, a small English warship wrecked in the Sound of Mull in 1690 (McBride, 1976). The issue has been the subject of debate (Green, 1977a; McBride, 1977; Martin, 1977).

The finds

Armament (Fig. 14)

One of each of the two types of bronze ordnance survived, and was recovered for recording, while an example of each of the three sizes of cast-iron gun was de-concreted and recorded *in situ*. Since the specifications of VOC ordnance had become standardized by this period (Kist, 1988: 102), and the archaeological evidence equates closely with the documentary sources, it is likely that these five specimens accurately represent the full range of weaponry carried aboard *Adelaar*. Their vital statistics are shown in Table 1.

All three iron guns carry the raised letter 'F' on their trunnion faces (Fig. 15), indicating that

Table 1. *Gun specifications*¹

Figure	Grid reference	Metal	Bore	Nominal calibre	Length (muzzle to base ring)	Estimated weight (Amsterdam <i>ponts</i>)
13.1	8015	iron	120 mm	12-pdr	2.63 m	2994 (1478 kg)
13.2	7516	iron	100 mm	6-pdr	2.14 m	2215 (1094 kg)
13.3	5935	bronze	100 mm	6-pdr	2.24 m	1365 (674 kg)
13.4	6611	iron	60 mm	3-pdr	1.88 m	1712 (845 kg)
13.5 and 15	7563	bronze	65 mm	—	—	—

Note

1. The weight calculations follow Green's formula (1989: 45)

$$Wt = \pi L \rho k [(R_2^2 - R_1^2) - R_b^2]$$

Where L is the length of the gun from muzzle to base-ring; ρ is the density of metal (7.03 for iron, 7.11 for bronze); k is the conversion factor $493.73 \text{ g} = 1 \text{ Amsterdam } \textit{pont}$; R_2 is the radius at the vent field; R_1 is the radius at the muzzle ring; R_b is the bore. Green cautions that this formula yields only an approximate weight.

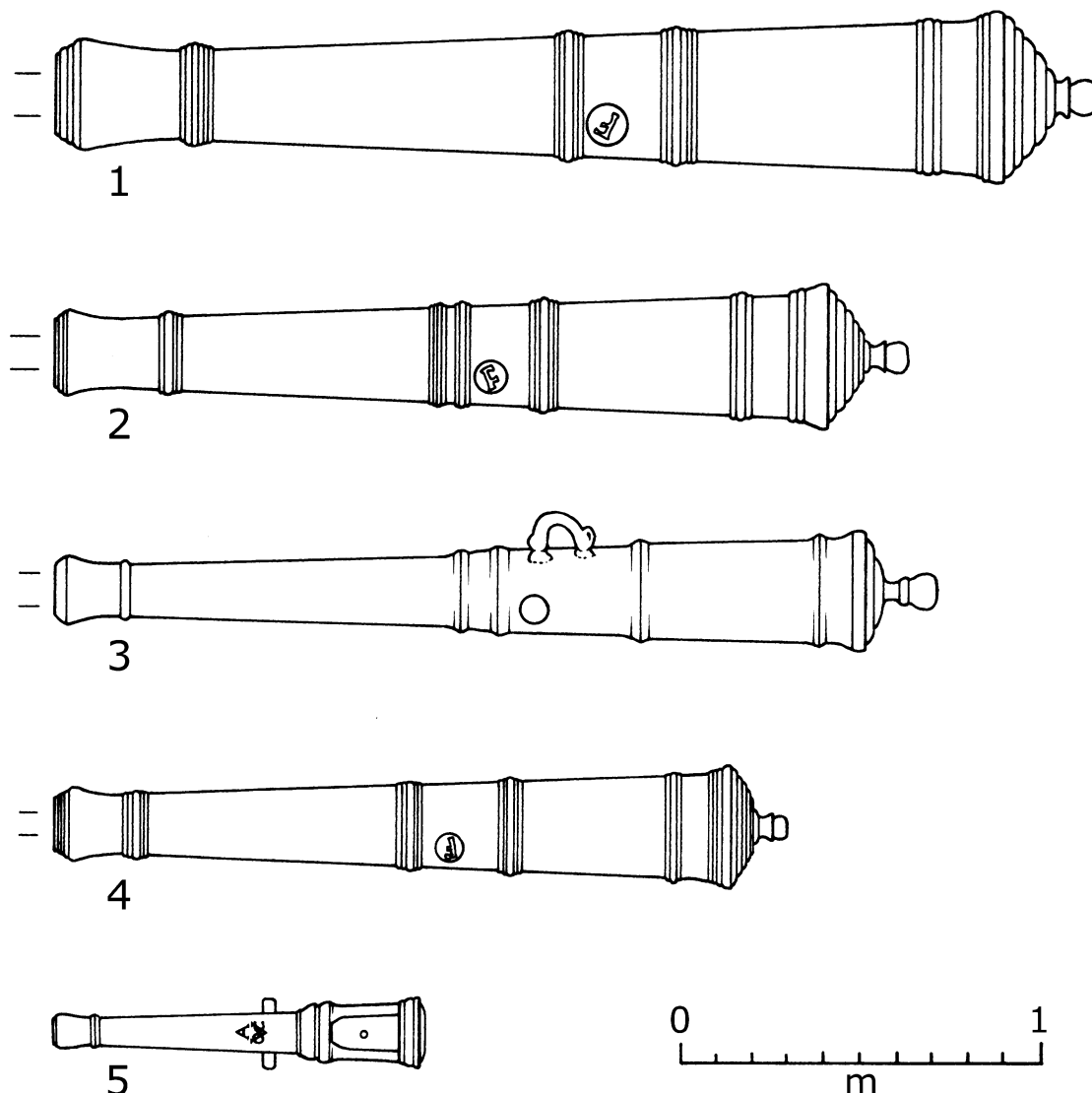


Figure 14. Gun types: 1: iron 12-pounder; 2: iron 6-pounder; 3: bronze 6-pounder; 4: iron 3-pounder; 5: bronze swivel gun. (Colin Martin)

they were cast at Finspong, the Swedish foundry north of Stockholm which supplied the VOC with the bulk of its cast-iron ordnance from c.1628 until the close of the 18th century. Such guns are often called *finbankers* after the foundry, though the name was applied to pieces made elsewhere in Sweden (Green, 1989: 45). The multiple mouldings are typical of Swedish castings, of which comparable examples produced for the Dutch market are provided by the wrecks of the *Batavia* (1629) (Green, 1989: 47–51) and *Kennemerland* (1664) (Price and Muckelroy, 1974: 263, fig. 4). The specifications of the latter example closely match those of the *Adelaar* 12-pounder. A 12-pounder *finbanker* of the same type was recovered

from the wreck of the almost contemporary *Zeewijk*, lost off Western Australia in 1727 (Ingelman-Sundberg, 1978: 39). That the proportions and mouldings of these weapons changed little during the two centuries of their currency is shown by a pattern-book of c.1770 which depicts two 6-pounder Dutch '*Find Bankers*' (cited by Green, 1989: 45, fig. 31), one of which is virtually identical to the *Adelaar* 6-pounder. These observations call into question the viability of dating *finbankers*—and perhaps cast-iron guns more generally—on purely typological grounds. It is probably safer to allow wrecks to date guns rather than the other way around, at least until the typological criteria are more reliably established.



Figure 15. Finspong foundry-mark on trunnion face of iron 12-pounder. Scale in inches. (Colin Martin)

The bronze 6-pounder recovered in 1972 was one of the pair adjacent to the ship's compasses, a standard VOC practice (Kist, 1988: 102; Puype, 1990: 4). The other was raised in 1728. Abrasion has removed any decorative detail, though the lifting dolphins remain intact. Two similar guns with dolphins and A-VOC ciphers on their first reinforce fields were recovered from the wreck of *Hollandia* (1743) (Marsden, 1975: 281, fig. 8).

Samples of cast-iron shot show a close correlation with the three categories of gun size, with due allowance for windage (about 5% of the bore diameter), confirming the standardised nature of the ship's armament. Two types of specialised shot were also recovered. The first incorporates the two sliding wrought-iron bars of an expanding projectile, from which the attached spherical or cylindrical cast-iron ends are missing, probably due to electrolytic reduction (Fig. 16.1). Blackmore (1976: 192, 200 no. 345) describes this type, while two examples have been recovered from the wreck of the VOC ship *Batavia* (1629) (Green, 1989: 58). Both the *Batavia* examples have cylindrical ends 92 mm in diameter, appropriate to guns of 6-pounder calibre. The natural spin of

the projectile in flight would throw the two halves outwards until their collared ends engaged, creating an 85-cm disc of rotating energy which would slice through any rigging it encountered.

Three bar-shot assemblies were also found, consisting of iron spheres cast onto the ends of square-sectioned wrought-iron bars, the mould-line lying diagonally across the section (Fig. 6.2–4). Two of these projectiles are of 6-pounder calibre (though their combined weight and the bar would have been a little over twice as much). The bar lengths, however, are different, at 14 and 10 cm respectively. Whether this variation is intentional, and if so what the difference was intended to achieve, is unclear. Bar-shot was effective against masts and spars. The third example is notable because its 7-cm diameter would fit none of the calibres recorded for *Adelaar* in either documentary or archaeological sources. No explanation can be offered.

Of *Adelaar*'s eight bronze swivel guns only one appears to have survived the salvage operations of 1728 (Fig. 17). It is of the common breech-loading open-chambered type, with a 75-cm-long barrel of 65 mm bore. Had it fired a solid iron shot this would have weighed about 4 pounds. It is more likely, however, to have been used with containers filled with lead shot or iron scrap. No associated powder-chambers were found, but one of appropriate size is known from the wreck of the VOC ship *De Liefde*, lost on the Out Skerries, Shetland, in 1711 (Bax and Martin, 1974: 87, fig. 4), and this has been incorporated in the figure. The *Adelaar* swivel gun carries the A-VOC cipher of the Company's Amsterdam Chamber rather than the Z-VOC mark of the Zeeland Chamber, to which the ship belonged. Presumably such equipment was interchanged within the Company regardless of where it originally came from—a practice confirmed by two similar swivel-pieces from *Zeewijk* (1727) which bear the ciphers of the Zeeland and Rotterdam Chambers respectively (Ingelman-Sundberg, 1978: 41–2). The gun has a hole at the breech end for an aiming bar or handle, probably of wrought iron.

When found the piece was in close proximity to two octagonal bronze bearing-bushes with lugs on either side (Fig. 18). These are similar to lugged bronze bearings, or 'coaks', set into hardwood sheaves which have been identified on the contemporary *Zeewijk* site (Ingelman-Sundberg, 1978: 80–82) and the slightly later *Hollandia* (Gawronski *et al.* 1992: 290). This was no doubt the primary use of such fittings. But they could

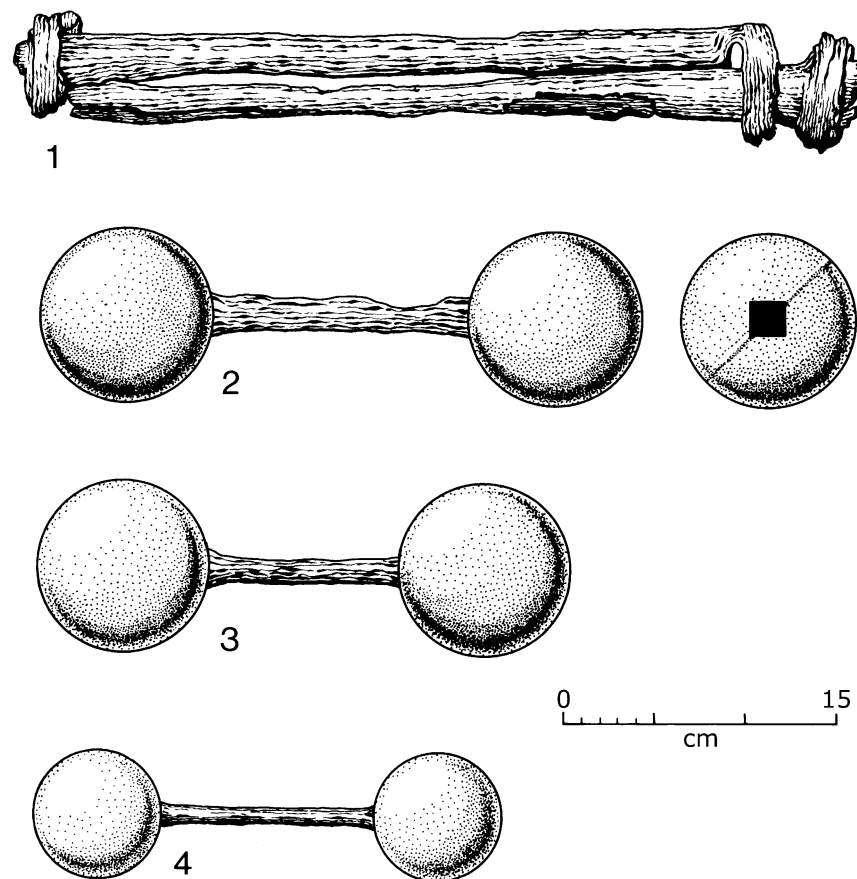


Figure 16. 1: expanding shot; 2–4: bar shot. (Colin Martin)

equally well have served for other purposes where robust low-friction bearings were required, such as the mounting of swivel-pieces. The fact that the *Adelaar* bearings were found close to the gun, and that both have one of their lugs broken at the fixing hole, suggest that they may have been positioned on either side of an upper rail for the mounting of the gun's wrought-iron swivel-cradle, which broke free during the wrecking process.

Four swivel-mounted pieces can be seen on the aft poop rail of the near-contemporary model *Padmos* (Fig. 1), while others (*Adelaar* carried eight in all) may have been deployed on either side of the waist, from which positions they could enfilade boarders. By the 18th century this type of close-range anti-personnel armament had become obsolete in Europe, where the defensive strategies of merchantmen were based on stand-off artillery tactics rather than close-quarter action. *Adelaar's* formidable main armament, backed by a 180-strong complement of soldiers and seamen, would have been enough to protect her from all but the most overbearing naval force

in European waters, or from predatory aggression on the open sea. In the Far East, however, where piracy in inshore waters was endemic, broadside firepower alone was too cumbersome and inflexible to counter a sudden ambush by numerous small boats packed with agile and desperate men. Against such a threat breech-loading swivel weapons, with their fast loading-cycle, wide field of fire, rapid adjustment of aim, and lethal close-quarter effect, represented an effective insurance policy.

Ship's equipment and fittings (Fig. 18)

Of the ship's hull or fastenings nothing was identified, while only a few items can be shown to relate to the working of the vessel. They are:

1. Sounding lead (GR 7632). Length 450 mm, max. diameter 53 mm, weight 6.8 kg. There is a 15-mm-diameter hole for a line at the top, and an arming hollow at the base for tallow. The weight suggests that it is a 14-pound lead (14 Amsterdam *ponden* of 494 gm = 6.92 kg). Sir Henry Mainwaring (Manwaring and Perrin,

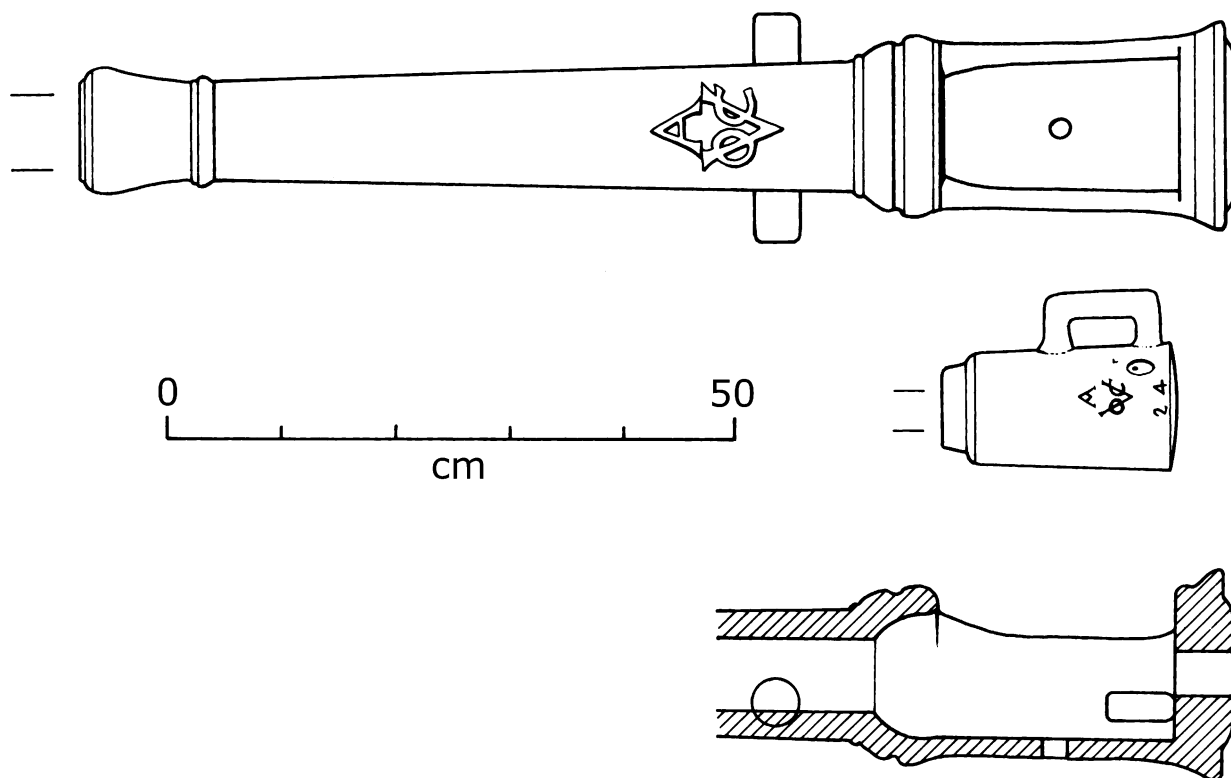


Figure 17. Bronze breech-loading swivel gun. The chamber is from *de Liefde* (1711) (after Bax and Martin, 1974: 84). (Colin Martin)

1920: 140) writes that the deep-sea lead is 'commonly 14 pounds; this hath some hard white tallow laid upon the lower end of it, which brings up [a sample of] the ground'. Similar deep-sea leads have been recovered from *Batavia* (1629) (Green, 1989: 94), *Vergulde Draeck* (1656) (Green, 1977b: 209), and *Hollandia* (1743) (Gawronski *et al.*, 1992: 460–1). Examples from each of these wrecks have weights close to the 6.92 kg 'standard'.

2. Sheet-lead disc 200 mm in diameter and 3 mm thick, pierced by 19 holes (GR 6033). Possibly a strainer, perhaps from the filter of a bilge-pump (*cf.* the lead strainer recovered from *Sea Venture* (1609) (Wingood, 1986: 156)).
3. Octagonal bronze bush 9 cm across, 6 cm deep, with 4 cm diameter hole (GR 7563). Protruding lugs with fixing holes extend 35 mm on either side: one has broken near the hole.
4. Similar to the above, 8 cm across, 5 cm deep, and 4 cm diameter hole (GR 7563). One of the lugs is also broken. These lugged bushes are paralleled by finds from *Zeewijk* (1727) (Ingelman-Sundberg, 1978: 80–82), where some are fixed as coaks or bearings in hardwood sheaves. An example associated with a sheave is also known

from *Hollandia* (1743) (Gawronski *et al.*, 1992: 290). This was undoubtedly their primary purpose, but for an alternative explanation of their use on *Adelaar* see above.

5. Part of the arms of a small boat anchor (GR 7432, not illustrated). This might have belonged to one of the ship's boats, or it may be a relic of the 1728 salvage operations.

Specie (Figs 19 and 20)

Twenty-nine silver coins were recovered from Gully A, and it is believed that several others were also found by a rival diving group in *Sloc na Frangach*, perhaps carried by bodies washed in there. The coins were generally in poor condition. Nine can be identified as *ducatoons* of the Spanish Netherlands, minted in Brabant, and all of Philip IV (1621–1665). The two legible dates are 1636 and 1639. Fourteen are *ducatoons* of the United Netherlands (nicknamed 'silver riders' because of their mounted knight motif) (Fig. 19). Only one legible date, 1670, is evident, but all appear to be of the archaic type current between 1659 and the 1680s, when they fell out of circulation (Pol, 1986: 584). In the early 18th century it was discovered that this coinage could be disposed of

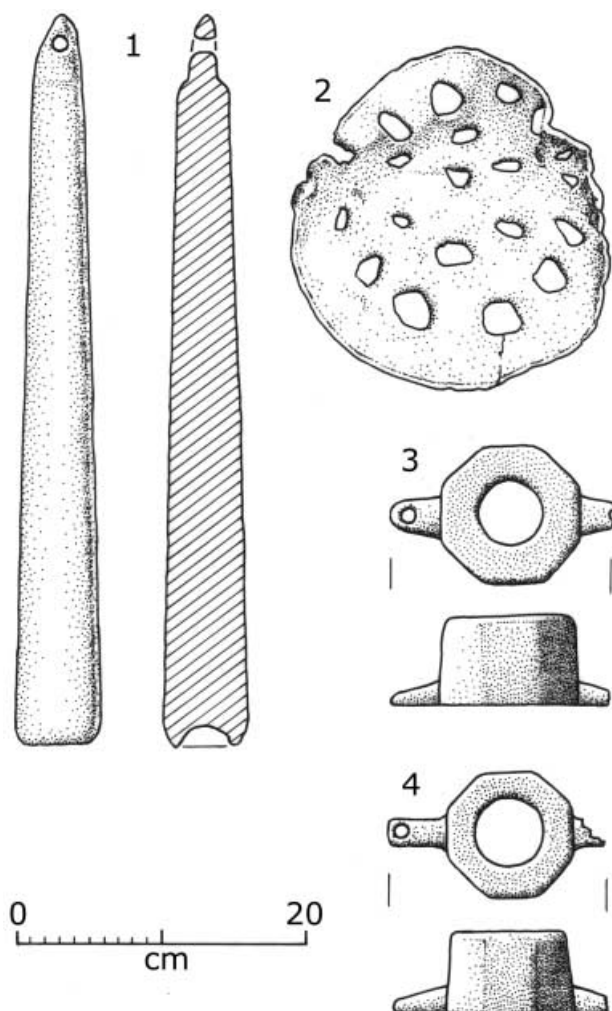


Figure 18. Ship's equipment and fittings. (Colin Martin)

profitably in Asia, and *ducats* minted prior to 1685 became the staple of VOC consignments of specie (Pol, 1986: 586). By 1710 these were being supplemented by freshly-minted *ducats*, and in

1728—the year of *Adelaar's* final voyage—a special type of *ducaton* bearing the Company's monogram was issued. *Adelaar's* official consignment of 32,000 was exclusively composed of these coins, minted at Middelburg, and so the *ducats* recovered during the excavation must have been additional to the manifested cargo and therefore privately-owned. Because of the VOC's monopoly over this type of coinage such ownership was illegal, and these coins were presumably being smuggled by a person or persons aboard the ship, a practice which was widespread (Pol, 1986: 586). That the 'illegal' *ducats* were found in the area from which the 'official' specie is believed to have been recovered suggests that their presence was known to the ship's principal officers. The consignment also included 450,000 2-*stuyver* coins, another form of currency exclusive to the VOC (Pol, 1986: 584). None has been found on the site. A silver 1-*guilder* coin of 1706 was also found.

That no *ducats* of the 1728 minting have been found suggests that most if not all of these coins were recovered by the 18th-century salvors. At the end of the prolonged litigation in Edinburgh only 1700 of the 32,000 remained unaccounted-for, and while this figure may have included some 'non-official' coinage of the kind discussed above, an unknown but significant number must be subtracted to allow for the embezzlement known to have taken place, including 1800 *ducats* allegedly spirited away in the bottom of a barrel of nails. It is known that all 500 silver bars, the six gold ingots, and all the double-*stuyvers* were salvaged in 1728, and it seems likely therefore that all 17 iron-bound boxes in which the specie had been consigned were recovered intact (Martin, 1992: 159–60).

A replica of one of the 1728 *ducats* has, however, survived in unusual form (Fig. 20). As



Figure 19. Silver *ducats* (diameter 44 mm). Left, United Provinces 'rider'; right Spanish Netherlands, Philip IV, Brabant, 1639. (Colin Martin)



Figure 20. Wax impression of the obverse (left) and reverse (right) dies of the VOC *ducato*ns struck at Middelburg in 1728. These impressions were submitted to the Court of Admiralty in Edinburgh to confirm the identity of the *Adelaar* wreck. (National Archives of Scotland, AC 9/1203)



Figure 21. The 'Z-VOC-M' cipher from the printed form on which *Adelaar*'s inventory of specie is listed. 'ADL' has been superscribed by hand; presumably this is an abbreviation of the ship's name (after a detail in NAS AC 9/1203). (Colin Martin)

part of the Admiralty Court process in Edinburgh proof was required of the ship's identity. Since *Adelaar* was the only vessel at that date to which a batch of the new VOC coinage had been consigned, and large numbers of these had been recovered from the wreck off Greian Head, this unequivocally confirmed her identity. To prove it, wax impressions taken from the coin dies at Middelburg were presented to the court for comparison with the recovered *ducato*ns. A full inventory of the specie was also submitted to

the court, and this document is of numismatic significance as the only surviving example of its kind. Specie was supplied to VOC ships by outside contractors, so bills of lading which specify the detailed make-up of consignments were not held by the Company, and consequently do not survive in its records, which note only the total sum consigned to each vessel (Pol, 1985; Pol, 1986).

The silver bars were probably similar to those in the chest of bars discovered in 1974 on the wreck of *Slot ter Hooge*, another VOC ship belonging to the Zeeland Chamber which was lost off Porto Santo, Madeira, in 1724 (Sténuit, 1975). Each of these bars was marked with the Z-VOC-M cipher of the Zeeland Chamber at Middelburg, and weighed just under 2 kg (Pol, 1986: 359, pl. 58). *Adelaar*'s specie manifest carries the same cipher (Fig. 21). Fig. 22 shows four copper bars, perhaps oriental copper bullion. Three are heavily reduced by abrasion, but one example appears to be in relatively good condition. It is 24 cm long, trapezoidal in cross-section, and weighs 280 gm. These bars may be the 'yellow copper in bundles' noted in the manifest.

Iron tools (Fig. 23)

A group of 18 iron hammer-heads was found within a 4-m radius in Gully A, centred on GR 3033. All are of wrought iron, with hardened faces. They fall into five distinct categories. Type I (1–5) have square front faces, flat bottoms, and a shouldered cross-pein at the back. Type II (6–8) have square front faces and a tapering pein.

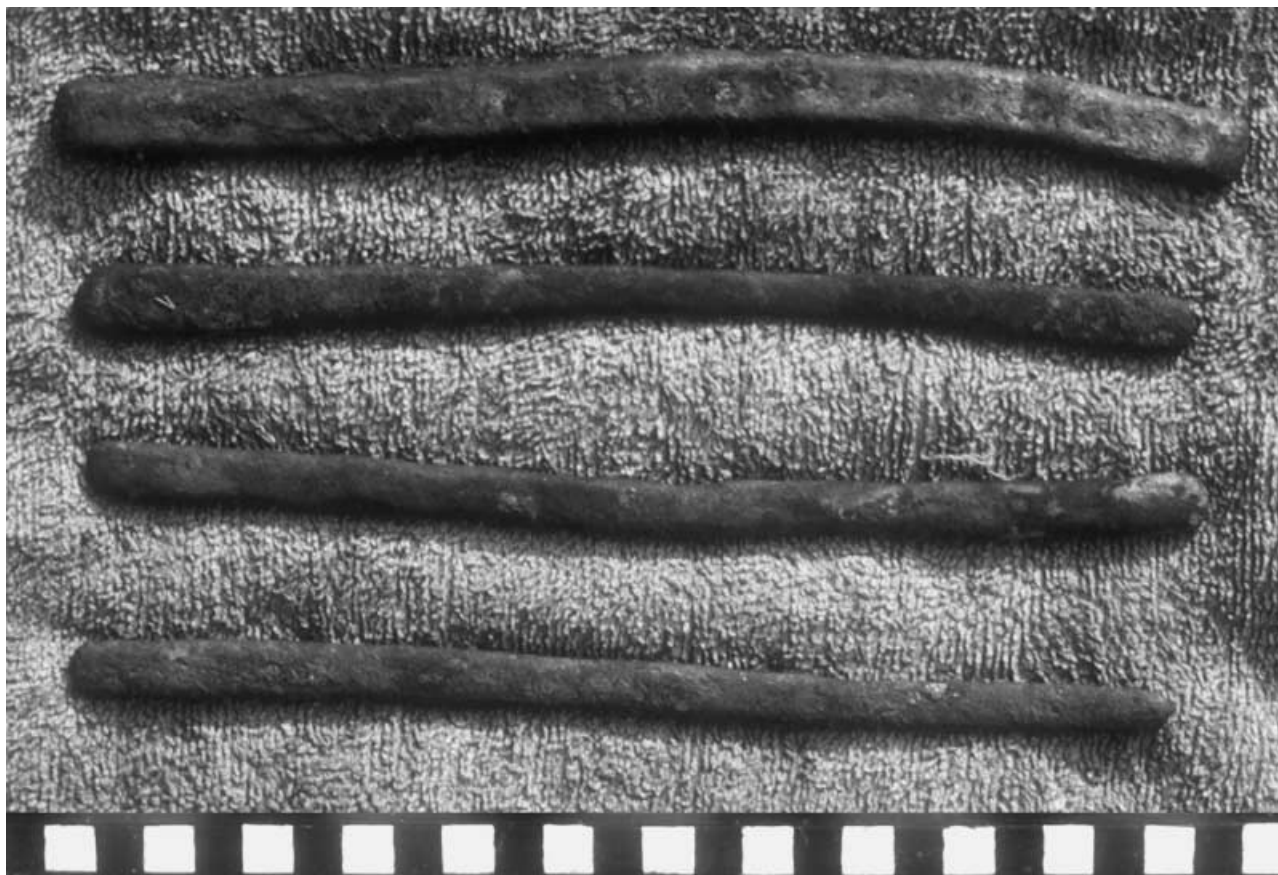


Figure 22. Copper bars. The top one is in relatively unabraded condition; the others have been much reduced by abrasion. Scale in centimetres. (Colin Martin)

Type III (9–10) are similar to Type II but much smaller, while Type IV (11–12) are flat-ended clubs or sledges. Type V (13) is a small double-ended hammer while Type VI (14) has a flared striking-end and a point at the rear. It is probable that all are metalworking hammers, Types I–IV being heavy blacksmithing tools which would have been set on long two-handed shafts, while Types V and VI would have been suitable for lighter forging or metal-beating. Five fragmentary hammers of uncertain type were also found. An example similar to the *Adelaar* Type III hammers has been recovered from the *Hollandia* (1743) (Gawronski *et al.*, 1992: 473).

Although some mass will have been lost to corrosion this is likely to have been small in the case of wrought iron, and the weight differentials across the sample are probably constant. The Type I hammers range from 2.32 to 3.97 kg; Type II from 3.66 to 3.86 kg; Type III from 1.84 to 2.04 kg; and Type IV from 3.26 to 3.43 kg. The greatest range is shown by Type I, and since the weight changes are evenly spread across the range

it seems likely that these were manufactured to fairly loose specifications. Types II, III, and IV show a closer conformity to weights within their categories, but the samples are so small that this may be fortuitous. At any event, an impression is given of small-scale craft manufacture within general parameters rather than tightly-regulated factory production.

Nails and other ironwork (Fig. 24)

A representative sample of ironwork in addition to the cast-iron shot and wrought-iron hammers was recovered from the concretion deposit in Gully A (Martin and Long, 1974). It included a quantity of nails and other fittings. The largest nails are square-headed spikes suitable for constructional work (Fig. 24.1–8). Their square-sectioned tapering shanks range in length from 245 to 130 mm and, converted to Amsterdam inches (*duim*) of 25.7 mm (there were 11 *duim* in a Amsterdam *voet* of 283 mm), can be recognised as 10-in, 8-in, 7½-in (2), 7-in, 6¼-in, 5½-in, and 5¼-in nails respectively. Fig. 24.9 is a double-ended

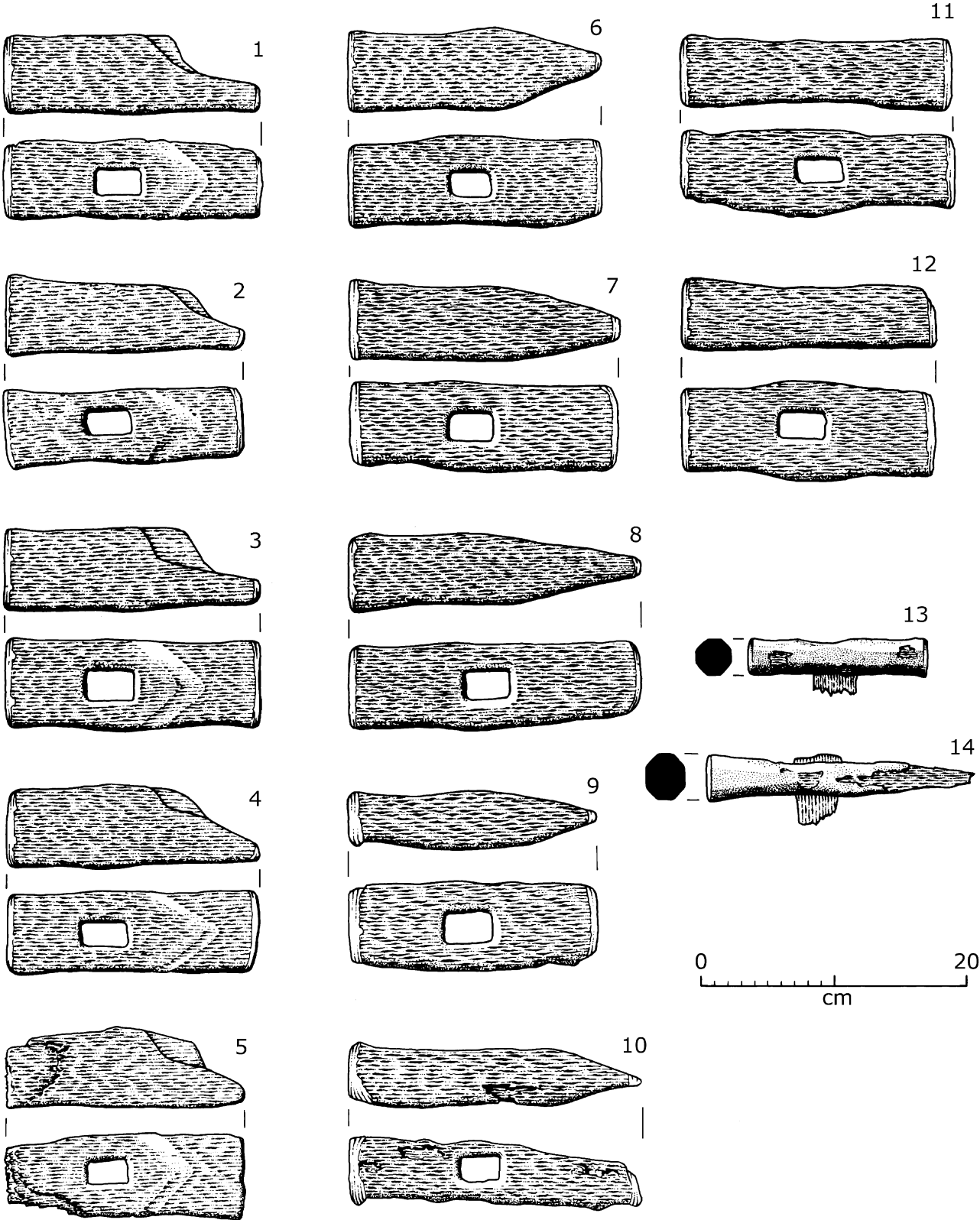


Figure 23. Iron hammer-heads. (Colin Martin)

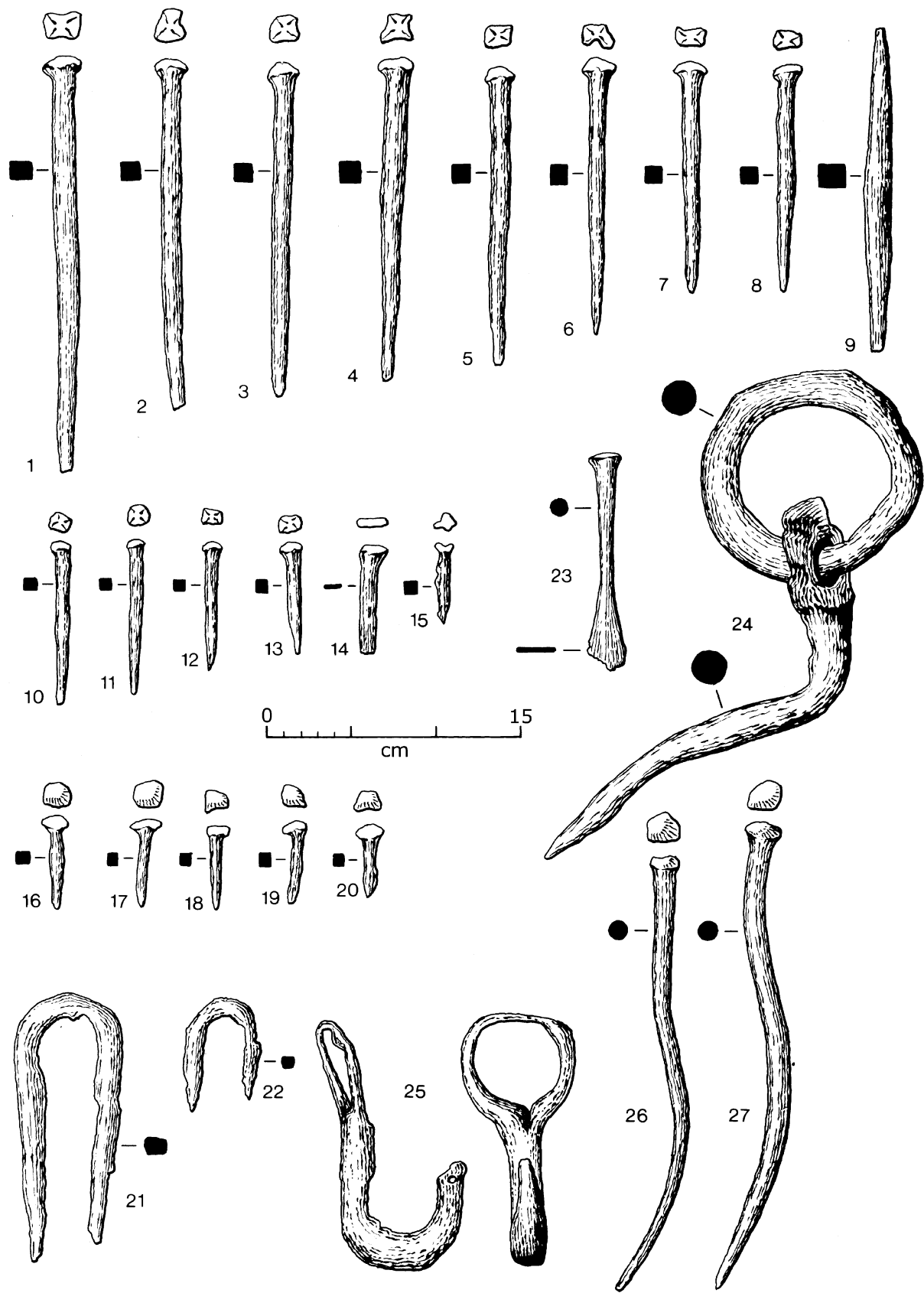


Figure 24. Iron nails and other items. (Colin Martin)

spike 19 cm (7½ in) long, identifiable as one of the 'thick doubles' listed in the manifest. It came from the concreted barrel (Fig. 12) which shows the spikes arranged within the barrel in criss-crossed layers (GR 4635). This contrasts with the radial packing of headed nails noted on *Hollandia* (1743) (Gawronski *et al.*, 1992: 490).

The smaller nails (Fig. 24.10–20) would have been suitable for general carpentry, with shank-lengths from 90 to 40 mm, giving Amsterdam equivalents of 3¾-in, 3½-in, 3-in, 2½-in (2), and 1¾ in. Two staples (Fig. 24.21–22) are 155 and 75 mm (6-in and 3-in) respectively. Like modern equivalents, one point is longer than the other to facilitate starting the staple in the work. Fig. 24.23, a chisel-like object with flared head and round section terminating in a splayed and flattened end, is probably a bricklayer's line-pin. Fig. 24.24 is a ring with fixing-spike, while Fig. 24.25 is a bale-hook with a loop for a 5 cm (2-in) rope and a hole near the point of the hook for mousing twine or wire. Fig. 24.26 and 27 are round-sectioned spikes 26 and 28 cm long respectively (11- and 12-in), and could be either cargo or hull fastenings.

Lead ingots (Fig. 25)

Fifty lead ingots were recorded. Of these six were found in Gully A, in association with the deposit of concreted iron shot, nails, and tools. The bulk however lay in Gully B, where 42 were revealed by excavation. Two further ingots lay outside the main grid area (Fig. 7). Four types were identified, and six examples were recovered for detailed recording.

Type I (Fig. 25.1–2) of which there were 21, is a parallel-sided ingot measuring 93 × 13 × 6 cm with rounded ends and a rounded flat-topped section. Each weighs 65 kg. Both recorded examples carry the same randomly-placed and repeatedly-stamped markings on their top surfaces. These include a plain 'V', a crowned 'V', and the letters 'IB'.

Type II (Fig. 25.3–4), of which there were 27, is also parallel-sided but has squarer ends than Type I. These ingots have trapezoidal sections with flat sides, tops and bottoms. They measure 86 × 14 × 6 cm and weigh 61 kg. Markings on the top surfaces include the letters 'D', 'Q', 'IB' and, on 25.4 only, the ligatured letters 'AD' within a rectangular frame. No other markings were noted on ingots of this type.

Type III, of which only a single example was noted, measures 67 × 16 × 6 cm and weighs

66 kg. It is rectangular with a flat top and bottom, tapered ends, and a slight lip on the sides. No markings are visible.

Type IV is again represented by a single example, with a flat top and bottom, slightly rounded sides, and a distinct rim which protrudes and droops slightly at the ends. It measures 60 × 15 × 7 cm and weighs 50 kg. No markings are visible.

A major source of the VOC's lead was England, particularly Derbyshire, which exported the metal to Amsterdam via Hull and London (Raistrick and Jennings, 1965; Willies, 1985: 233). It is likely that the 'IB' marks on the Type I and II ingots are the initials of John or Joseph Bright, who were active in the Peak District during the earlier part of the 18th century (Willies, 1985: 245). Lead ingots have been recovered from a number of Dutch and English East India Company shipwrecks. A group of 103 recovered from *Campen* (1627) has been analysed in detail (Whiting *et al.*, 1985). Ten sub-types were identified, the variations being mainly in the length/breadth ratios. All are roughly semi-circular in section, and all are wider in the centre than towards the ends. Many have *flèches*, or diagonal cuts, in their sides: these are thought to have been made to facilitate slinging. Their weights fall between c.60 and c.70 kg. It is thought that the weights, in spite of the relatively wide range, relate to the sixteenth part of a fother, an English unit of account applied to lead. Ingots of this size were known as 'pieces'. The fother varied according to region, with values ranging from 991.54 kg (London) to 1280.28 kg (High Peak 'Mill') (Whiting *et al.*, 1985: 107). Most of the *Campen* ingots are marked, and a high proportion carry the ligatured letters 'AD' in a similar style to those on the *Adelaar's* Type II ingots.

Another major group comes from *Kennemerland* (1664), where 119 ingots have been recovered and studied (Price *et al.*, 1980). Most have a pronounced boat shape, with wide middles and tapering ends, though there is some variation in section, some being semi-circular and others tending towards the trapezoidal or rectangular. Their weights range from c.120 to c.160 kg but cluster around the 140 kg mark, suggesting that these are 'great pigs', of which there were 8 to the fother (Price *et al.*, 1980: 20–25). Because of these variations no specific regional unit can be identified, but a number of English lead production centres have fothers of around this value. The *Kennemerland* ingots have been categorised into ten classes, and almost all bear stamped marks. Thirty seven distinct stamps have been identified, either as

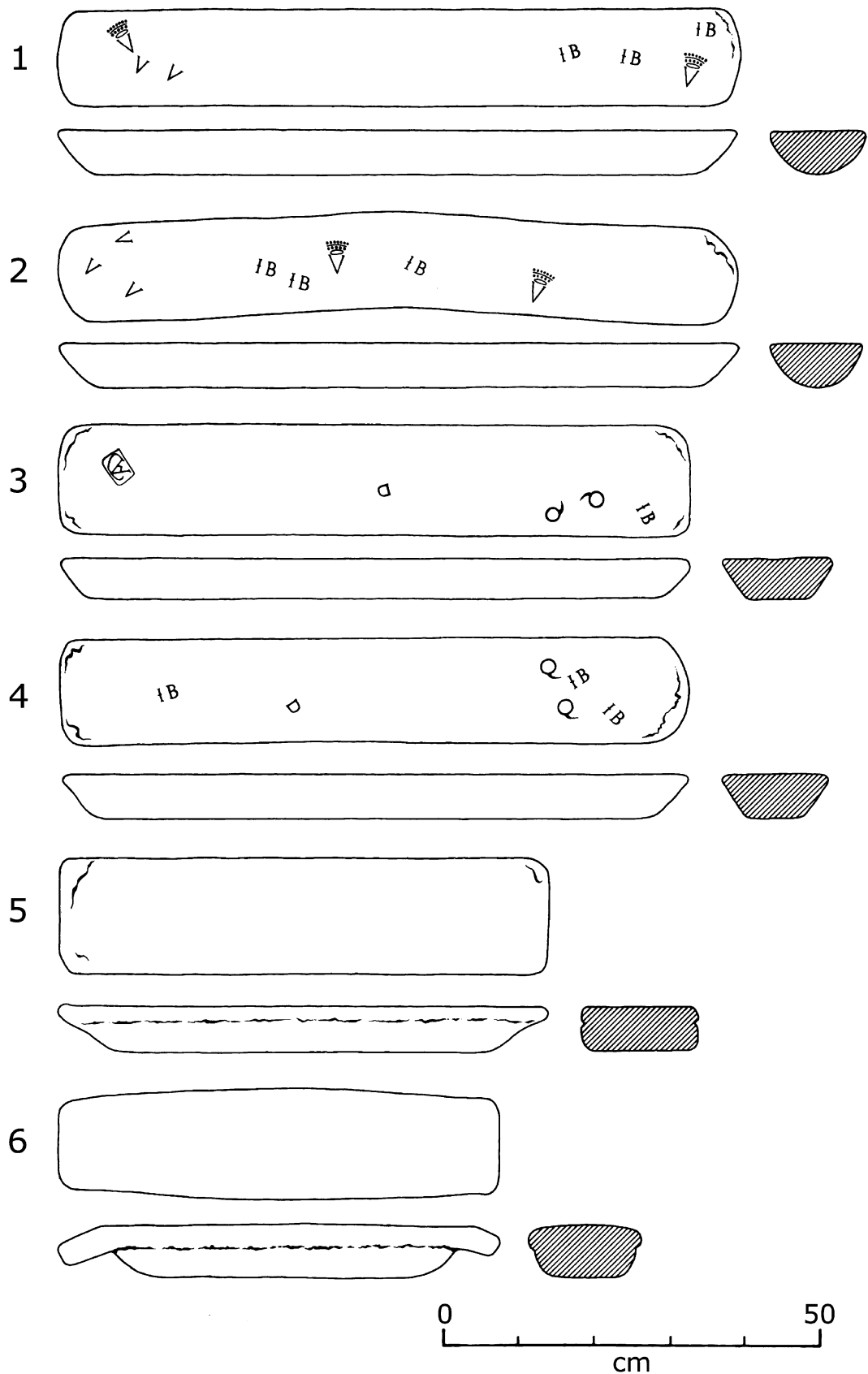


Figure 25. Lead ingots. (Colin Martin)

symbols or letters and numbers. One carries the letters 'MR' and the figures '1664' which, if a date, coincides with the year of the ship's loss. None of the marks is paralleled on the *Adelaar* ingots.

The VOC ship *Hollandia* (1743) has also yielded a large collection of lead ingots (Willies, 1985). In all 238, totalling some 18 tonnes, were examined. Ten forms were identified, of which Form 6 conforms generally with the *Adelaar* Type I ingots while Form 1 is similar to *Adelaar* Type II, though with squarer ends. Form 10 is broadly comparable with *Adelaar* Type IV. One *Hollandia* Form 1 ingot (Willies, 1985: 241, seq. no. 167) has the ligatured 'AD' mark within a rectangular frame and the 'IB' initials noted on the *Adelaar* Type II example. The *Hollandia* ingot with these markings, and the two *Adelaar* Type II ingots, each weigh 61 kg.

A group of ingots has been recovered from the wreck of an unknown late-18th-century ship off Poompuhar, on the east coast of India (Tripathi *et al.*, 2003), believed to be that of an English East Indiaman because of the 'VEIC' (United East India Company) marks on some of the ingots. About 50 ingots were noted, and more are believed to be buried in the sea-bed. Eighteen were retrieved for investigation, and four categories identified. Type 1 (8 examples) are long parallel-sided pigs with rounded ends and semi-circular sections, similar to *Adelaar* Type I. Their weights range from 66.6 to 72.4 kg, and on the rounded faces the name 'W:BLACKETT' is deeply stamped, or possibly moulded. The flat faces bear a number of stamped letters and figures, including the (presumed) dates of 1791 and 1792. Type 2 is semi-cylindrical with chamfered ends. The two examples weigh 63.8 kg and 64.4 kg. Both are marked with a deeply-indented crowned 'D' on the curved face, and this mark—which is similar in form to the crowned 'V' on *Adelaar* Type I—is repeated in smaller stamped form on the flat faces, along with the 'VEIC' mark. Type 3, of which there are two examples weighing 61.8 kg and 65.6 kg, are rectangular pigs with trapezoidal sections which bear no marks on their upper surfaces but carry various stamped letters on their lower ones, including 'VEIC' and an 'IB' mark similar to that on the *Adelaar* Types I and II. Type 4, of which there is only a single example, is of semi-cylindrical section with rounded ends. It carries only the 'VEIC' mark. Many lead ingots have been raised from the wreck of the English East Indiaman *Hindostan* (1803), but because of the salvage-driven circumstances of their recovery only three

have been satisfactorily recorded (Redknap, 1990: 25–6). All bear the VEIC mark of the Company, and are similar to the corresponding late-18th-century ingots from Poompuhar.

These six groups of lead ingots, most if not all apparently from English production centres, span 176 years with a well-spaced progression of dates (1627, 1664, 1728, 1743, 1791/2 and 1803). Their characteristics form the tentative basis of a typology, moving from the boat-shaped and roughly-cast ingots of the 17th century to the parallel-sided and increasingly regular forms of the 18th and early 19th centuries. The marks too may be of significance for dating and identification, and the relationships of some of them—for example the ligatured 'AD' (1627 and 1728), 'IB' (1728 and 1791/2), and the use of crowned letters (1728 and 1791/2)—require further exploration. Other lead ingots from VOC wrecks are known from the *Kraijenstein* (1698) and *Meresteyn* (1702), both lost off South Africa, though no details are available (Willies, 1985: 233). As with so many aspects of underwater archaeological discovery, the full potential of these closed and closely-dated assemblages as typological markers has yet to be realised.

Lead shot (Fig. 26)

Thirteen pieces of cast lead shot were found. Nine are 20 mm in diameter, a calibre appropriate to muskets, and had probably been provided for the VOC soldiers on board. The remaining four are 13 mm in diameter and are probably pistol shot. Several hundred pieces of scatter shot were recovered, of sizes ranging from 2 to 5 mm. Many were in the shape of droplets with tapered tails, suggesting that the lead had been poured though a sieve directly into a container of water rather than undergoing a long drop in a shot-tower, which would have imparted a regular spherical shape.

Clay pipes (Fig. 27)

Four unabraded fragments of clay pipes were found in concretion at GR 7516. Fig 27a shows a complete bowl with a flat-based foot and no heel-mark. Its profile demonstrates a transition between the funnel-shape which Duco (1987: 49) assigns to the early part of 18th century and the more bulbous forms of the 1730s. The closest fit in Duco's most recent Gouda pipe typology suggests a date-range for this bowl-form of 1715–30 (2003: 205 no. 14). Fig. 27b is a broken bowl with flat-based foot and the heel-mark 'SVS'. This mark is paralleled by a find from the *Zeewijk* (1727) (Ingelman-Sundberg, 1978: 90), and may

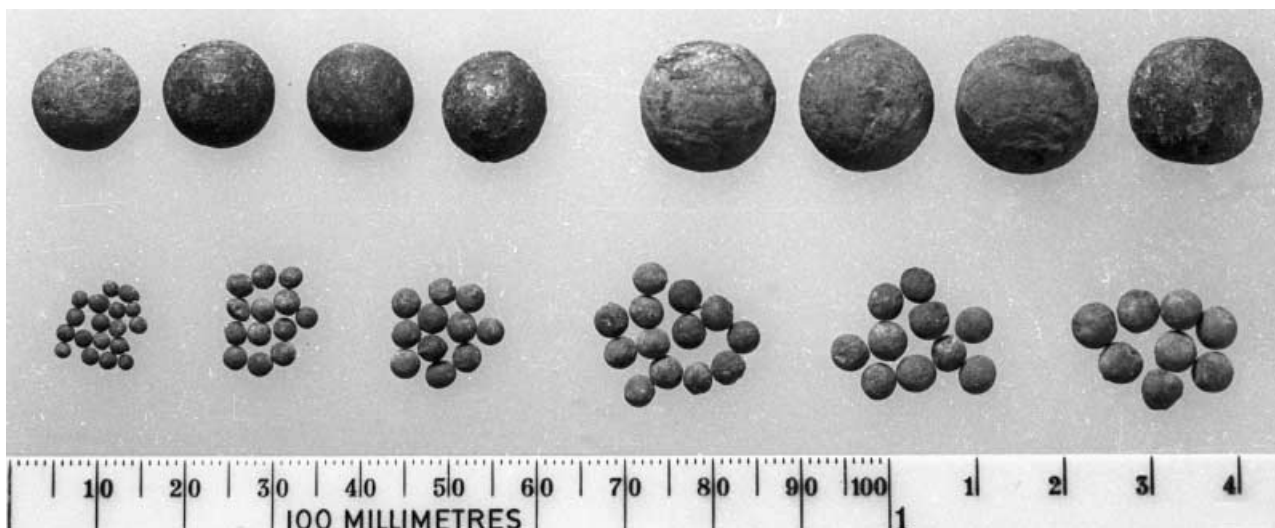


Figure 26. Lead shot. Top left, pistol shot (13 mm diameter); top right: musket shot (20 mm diameter). The lead scatter shot (bottom) has been grouped into sizes of 2, 3, 3.5, 4, 4.5, and 5 mm. (Colin Martin)

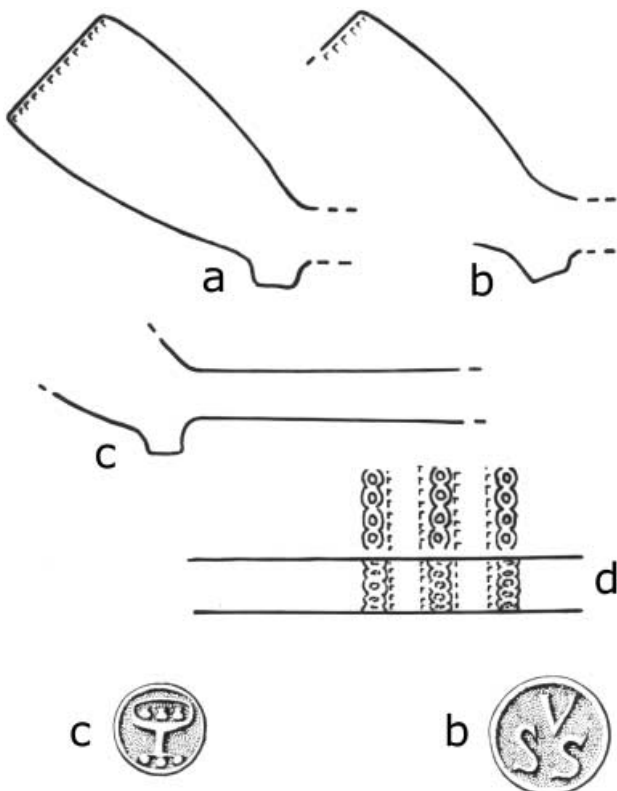


Figure 27. Clay pipes. Scale 1:1 (marks $\times 4$). (Colin Martin)

be identified as that of the Gouda pipe-maker Staats Jansz. His date-bracket cited by Duco is 1723–38 (2003: 183 no. 864). The distinctive *theetafel* (tea-table) mark (Fig. 27c), showing three cups on a pedestal table, is that of Izaak Pietersz van der Kleij, also of Gouda. His dates

are recorded by Duco as 1706–24 (2003: 141, no. 236). A stem fragment shows rouletted decoration.

Glass (not illustrated)

Seven fragments of glass were identified. They include a green bottle-base and a small piece of neck, four heavily-abraded white glass stoppers, and a fragment of a clear wine glass.

Small finds (gold) (Fig. 28)

Four gold items were found in crevices in the bedrock of Gully B, where by virtue of their mass they had worked their way into stable levels. They comprise:

1. Finger-ring with octagonal table and blank escutcheon set within an engraved foliate design. Unidentified mark on outer edge of band.
2. Finger-ring with octagonal table and blank escutcheon set within an engraved foliate design. Amsterdam arms, 'P', 'DR', and lion rampant on outer edge of band.
3. Hollow linked buttons with decorative swirls set around central studs and looped edgings. Each has a fixed ring at the back, and the two are joined by a single link. Amsterdam arms and the letter 'B' are struck on the back of each button. This may be the mark of the Amsterdam silversmith Jan Breda (1668–1725) (pers. comm. Arent Pol).
4. Flat-banded finger-ring with spiralled beading at the top and bottom edges. The central field is decorated with applied gold motifs of truncated prisms, pellet-bordered discs, six-petalled rosettes, and daisy-like flowers. No mark is present.



Figure 28. Gold jewellery. (Colin Martin)

It is not clear whether these items were personal possessions or items of cargo, perhaps from the chests individual crew members were permitted to take with them for trading on their own account (Martin, 1992: 147). The blank escutcheons on two of the rings, which could have been engraved to a purchaser's specification, might suggest that they fall into the latter category.

Copper-alloy pan (Fig. 29)

This was found trapped beneath the 6-pounder iron gun at GR 7517. One-third of its circumference is missing, but the remainder is in good condition. The vessel is 41 cm in diameter and 7 cm deep. It was beaten from a single piece of metal and has a concave bottom, sloping sides, and a rolled-over rim. Four rivets for a braced handle remain

in place. This is probably one of the 600 copper frying-pans recorded in the ship's cargo manifest. A similar pan has been recovered from *Vergulde Draeck* (1656) (Green, 1977b: 198).

Small finds (copper alloy) (Fig. 30)

1. Hollow-headed upholstery pin with flat shank and hole near the point. Lozenge and boss decoration on head.
2. Round-headed pin with circular section becoming square towards the point.
3. Copper tack with 28 mm square-sectioned shank and round head (*cf. Campen* (1627), McBride and Whiting, 1985: 18).
4. Copper tack with 20 mm square-sectioned shank and round head (*cf. Green*, 1989: 168).
- 5–7. Three sizes of knobbed handles with unbeaten rivet studs at the base. These are presumably associated with the copper pan-lids noted in the manifest. This find suggests that the pan-lids were nested for stowage without the knobs, which would have been added after they reached their destination (Martin, 1997: 8). Unbeaten handle-studs (together with riveted ones) have been found on *Hollandia* (1743) (Gawronski, 1992: 480–81), while pan-lids with attached knobs are known from the VOC wreck *Zee-wijk* (1727) (Ingelman-Sundberg, 1978: 44), suggesting in the latter case that they had been in current shipboard use.
8. Broken strap-buckle (*cf. Hollandia* (1743), Gawronski *et al.*, 1992: 331 (80H749)).
9. Strap-buckle (*cf. de Liefde* (1711), Bax and Martin, 1974: 85, fig. 6F; *Hollandia* (1743), Gawronski *et al.*, 1992: 331–4 (several examples)).
10. Arrow-headed pointer or hand, perhaps from a watch, with pivot hole and secondary hole for a locking pin.

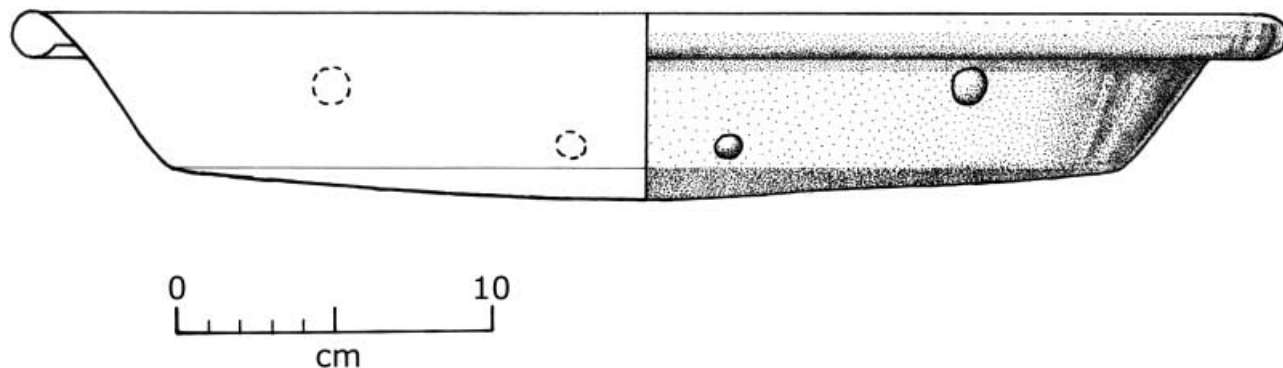


Figure 29. Copper-alloy pan. (Colin Martin)

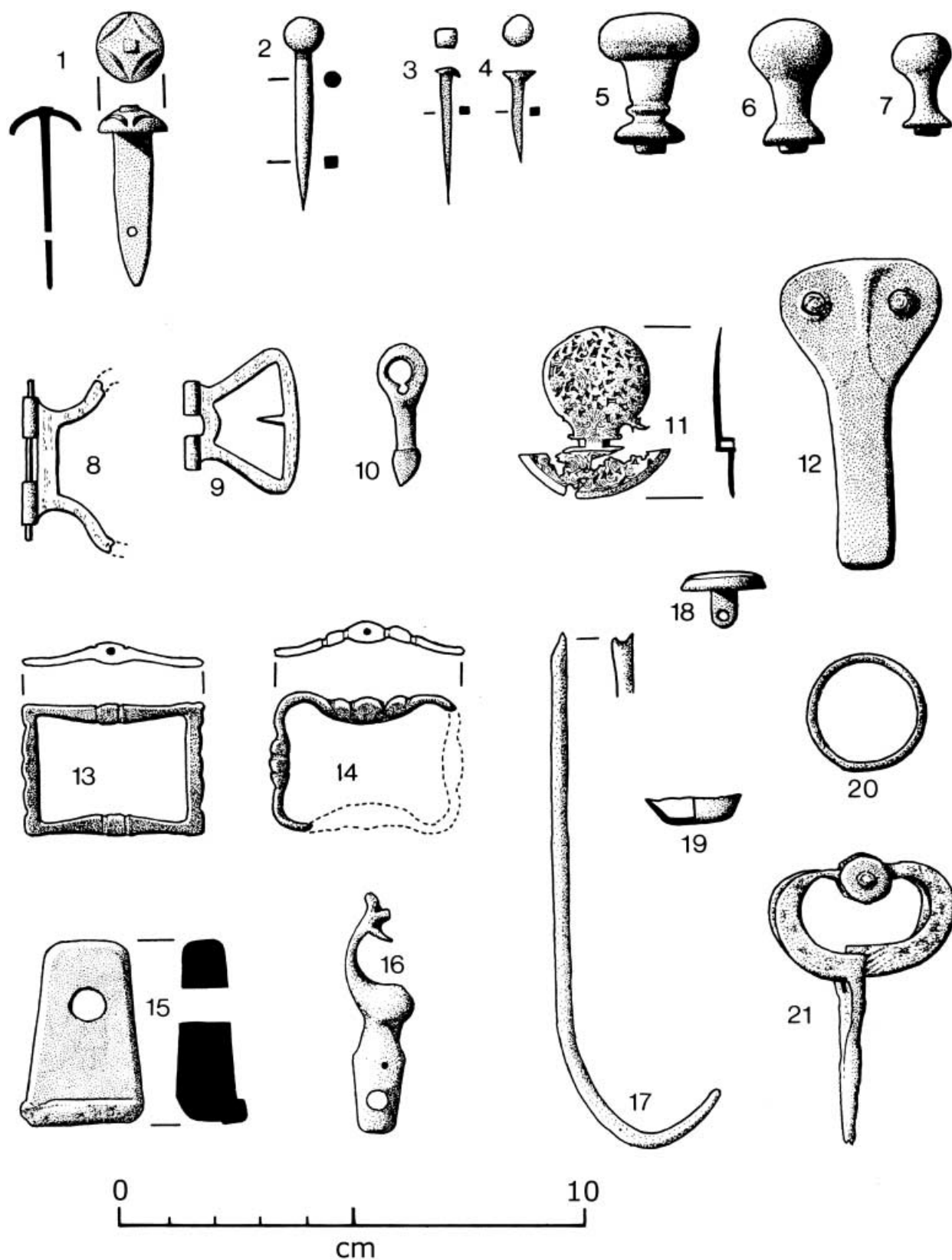


Figure 30. Copper-alloy items. (Colin Martin)

11. Pierced and engraved cock-foot from a pocket-watch, with traces of gilding. The type is common in the late 17th to early 18th centuries (Baillie *et al.*, 1956: 132, pl. 88).
12. Leg from a tripod pan or similar vessel, with flared lugs and two rivets. Tripod cauldrons are known from the VOC ship *Vergulde Draeck* (1656) (Green, 1977b: 177–8). Most have trefoil-headed legs secured by three rivets but the smallest (GT 1016), which is 78 mm in height and 147 mm in diameter, has two-rivet lugged legs like the *Adelaar* example. Legs with two and three rivets are also known from *Hollandia* (1743) (Gawronski *et al.*, 1992: 381–2).
13. Rectangular shoe-buckle (*cf. de Liefde* (1711), Bax and Martin, 1974: 85, fig. 6G).
14. Shoe-buckle with rounded corners and incurved sides (*cf. Hollandia* (1743), Gawronski *et al.*, 1992: 326 (80 H2104)).
15. Object of uncertain function, possibly a weight.
16. Dolphin-headed spigot from a tap (*cf. Meresteyn* (1712), Marsden, 1976: 209 fig. 6 no. 23).
17. Hook, probably a fish-hook, though erosion has removed most of the eye and all of the (presumed) barb (*cf. Vergulde Draeck* (1656), Green, 1977b: 182; *Zeewijk* (1727), Ingelman-Sundberg, 1978: 61).
18. Plain round button with solid lug (*cf. Zeewijk* (1727), Ingelman-Sundberg, 1978: 37, ZW 205–4; *Lastdrager* (1653), Sténuit, 1974: 247, fig. 27.7; *Hollandia* (1743), Gawronski *et al.*, 1992: 336–42 (several examples)).
19. Small pan-shaped object.
20. Plain ring, 21 mm internal diameter (*cf. Zeewijk* (1727), Ingelman-Sundberg, 1978: 83; *Hollandia* (1743), Gawronski *et al.*, 1992: 499).
21. Single-handed navigational dividers (*cf. Kennemerland* (1664), Price and Muckelroy 1974: 264, fig. 6; *Curaçao* (1729), Sténuit, 1977: 112, fig. 6; *Hollandia* (1723), Gawronski *et al.*, 1992: 459).

Conclusions

The dimensions, design, specifications, armament and appearance of *Adelaar* are exceptionally well-documented, both in the VOC's administrative records and by the contemporary model of her near-identical sister *Padmos*. The cargo of her last voyage is likewise unusually fully recorded, for in addition to routine VOC documentation the production of items during the extended legal processes in Scotland adds details which would

not normally have been preserved in the archives. These include itemised manifests of a substantial part of the cargo and, in particular, a breakdown of the specie consignment. Finally, we have extensive records of the salvage operations which subsequently took place, interesting not only in their own right but also for the light they shed on the condition of the wreck in 1728, and what was recovered from it. Historical sources thus provide a descriptive profile of the ship, her contents, and the circumstances of her wrecking and salvage which archaeology is unlikely to match, especially on such an exposed and dynamic a wreck site as this one. What therefore has been the point of conducting a careful archaeological investigation in this exceptionally exposed and difficult location?

In fact the detailed prior knowledge we have of *Adelaar* enhances rather than detracts from the archaeological value of this wreck. Because we know the answers to so many questions about this ship we can interrogate the archaeological evidence and test whether it might, of itself, have led to similar conclusions. If so, the prospect of reliably interpreting similar sites which lack supportive documentation will be given more credence.

First, as argued above, the artefact distribution allows a convincing hypothesis to be constructed about the nature of the wrecking event and the characteristics of subsequent formation processes. The main concentration of guns, with a linear axis of 55 m, would, with an allowance for outspill of 5 m each way, give an estimated overall length for the ship of 45 m against her actual length of 41 m. Her identity as a VOC vessel would have been provided by the A-VOC cipher on the bronze swivel gun, though this would probably have led to an incorrect attribution of the ship to the Amsterdam Chamber of the Company and not, as we know to be the case, the Zeeland one (had the treasure not been salvaged, however, 500 silver bars each carrying the Zeeland cipher would have overturned this misconception). A *terminus post quem* would have been supplied by the 1706 *guilder*, 22 years short of the actual date of wrecking, though again if the specie had remained on the site 32,000 Zeeland-struck *ducatoons* of 1728 in mint condition would have provided unarguable dating evidence. The clay pipes, though not capable of providing absolute dates, would have strongly suggested a period within the 1720s.

Examination of the guns would have provided a full and accurate record of all the types on board, the origin of the cast-iron pieces, and a minimum number for each category. The lead ingots would

have revealed themselves as a significant component in the cargo, and their markings, studied in conjunction with ingots from other VOC wrecks, would have indicated a probable English origin. On the other hand the brick fragments would not have provided a direct indication of how substantial this part of the cargo had once been. They might perhaps have been identified simply as parts of the galley structure. However the lack of pottery on the site, and the sheltered contexts in which the few brick fragments were found, should have led to the conclusion that ceramics were subject to particularly severe attrition, and consequently the brick fragments might be all that survived of a much bigger cargo.

The group of metalworking hammers, found in close proximity and in greater numbers than would have been required for use on board, would likewise have been identified as cargo. So too would the iron nails, including the concreted barrel of 'thick doubles'. Tools and hardware, it would have been concluded, probably represented a substantial part of the cargo. Most of the other finds would not, of themselves, have given indications as to whether they were part of the cargo, ship's equipment, or personal possessions. However the unriveted pan-lid handles would have suggested that some of the copperware was not yet fully assembled and had therefore been packaged for shipment. The clay pipes and items of jewellery probably (though not certainly) belonged to individuals, though they might have been from the small consignments of trade goods which crew members were allowed to carry.

Although in the event no evidence was found for the *Adelaar's* cargo of cloth destined for Japan, this might have been revealed by lead bale-seals, such as those found on the near-contemporary wreck of *Zeewijk* (1727) (Ingelman-Sundberg, 1978: 85). These could well have survived on the

Adelaar wreck site too. Similarly the presence of VOC soldiers on board might have been shown (though in this case it was not) by the discovery of the Company's distinctively-marked musket lock-plates and cartouche escutcheons, examples of which have been recovered from the wrecks of *Zeewijk* (1727) and *Hollandia* (1743) (Ingelman-Sundberg, 1978: 55; Gawronski *et al.*, 1992: 311, 313, 345).

The nature of the cargo would have indicated that the ship was an outward-bound Dutch East Indiaman rather than a homecoming one. Such a vessel would certainly have been carrying a consignment of specie, and the paucity of *ducats* found on the wreck should therefore have elicited comment. The possibility of contemporary salvage might well have been considered. However, the extensive 18th century recovery operations which we know took place do not appear to have left identifiable traces (other than negative ones) in the archaeological record, though these were carefully sought on shore and underwater. On the archaeological evidence alone, therefore, this part of *Adelaar's* story would have remained an open question.

It is hoped that this exercise in documentary and archaeological concordance will be of more than casual interest. Its purpose has been to demonstrate that exposed historic shipwrecks, however dispersed and chaotic their formation characteristics may seem, can retain levels of archaeological integrity from which significant and reliable conclusions may be drawn. But such potential can only be identified and realised by the application of a rigorous investigative approach and careful assessment of the evidence. By definition no wreck site, however superficially unpromising, can be devoid of archaeology. The challenge is to recognise and properly to interpret it. Indeed the more dynamic and destructive the wreck formation processes, the greater will be the demands on archaeologists who seek to record and understand them.

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Note on Sources

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