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Archaeological research on HMS *Swift*: a British Sloop-of-War lost off Patagonia, Southern Argentina, in 1770

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HMS *Swift* was a British sloop-of-war which sank off the coast of Patagonia, Southern Argentina, in 1770. Since 1997 the Underwater Archaeology Programme of the National Institute of Anthropology has taken charge of the archaeological research conducted at the wreck-site. This article presents an overview of the continuing *Swift* project and the different research lines comprised in it. The latter cover aspects related to ship-construction, material culture and natural site-formation processes.

Key words: maritime archaeology, HMS *Swift*, 18th-century shipwreck, Argentina, ship structure, biodeterioration.

At 6 p.m. on 13 March 1770 a British Royal Navy warship sank off the remote and barren coast of Patagonia, in the south-western Atlantic. The vessel, a sloop-of-war named HMS *Swift*, had been sent to the British station of Port Egmont, in the Malvinas/Falkland Islands, to conduct geographical surveys in an area which was still insufficiently explored. The *Swift* faced several days with strong gales from the south-west, after which she reached the shores of South America, over 300 nautical miles from the Malvinas/Falkland archipelago. Captain George Farmer decided to enter the sheltered Deseado estuary, in what is now Santa Cruz Province, Argentina, but a hidden rock would become a deadly trap for the *Swift* (Fig. 1).

Over two centuries later, in 1975, an Australian called Patrick Gower, a direct descendant of Lieutenant Erasmus Gower of the *Swift*, made a special trip to Puerto Deseado, by the estuary of the same name. His goal was to see the place where the *Swift* had sunk and gather more historical information. To his surprise, nobody in the town seemed to know about the wreck, and Gower returned to Australia without any further information. However, his trip had left a seed in Puerto Deseado, and a few years later a group of local scuba divers decided to begin searching. In March 1982 the *Swift* was found, and that was the beginning of underwater archaeology in Argentina. The recovery of the first artefacts led to the creation of a local museum and a special

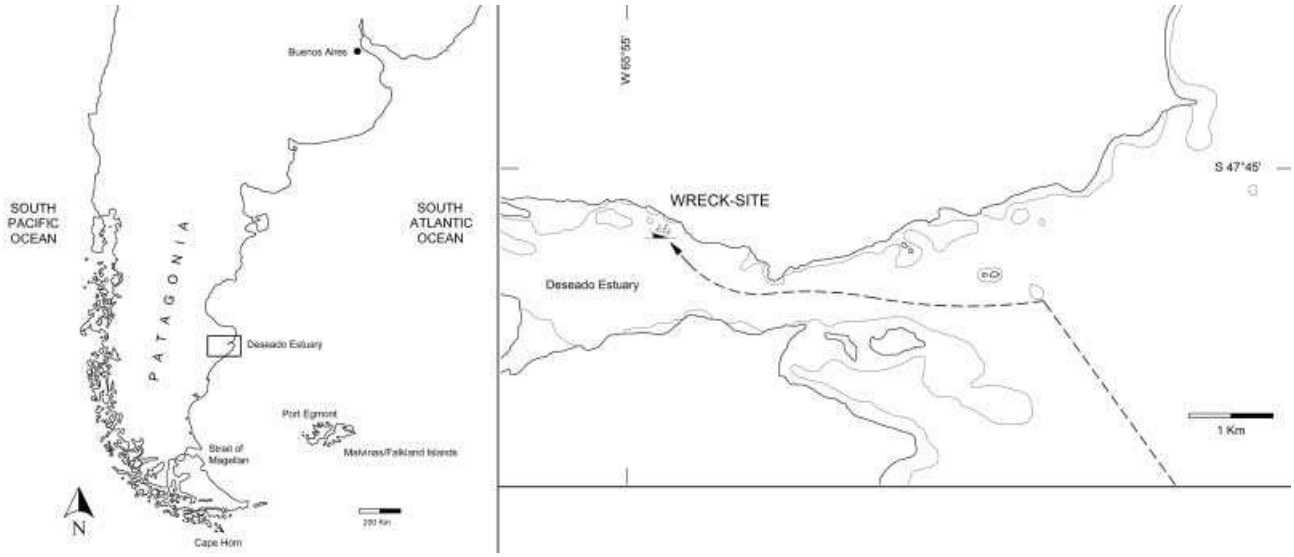

Figure 1. Location of the Swift wreck site in the Deseado Estuary. The dashed line indicates the hypothetical route of the vessel. (C. Murray)

provincial resolution declared the site of historical significance, thus automatically protected by law (Endere, 1999; Dellino and Endere, 2001). In the following years the site underwent several interventions, including some surveys conducted by ICOMOS-Argentina (Murray, 1993).

The *Swift* project

In 1997 the competent government authorities appointed the recently-created underwater archaeology team (*Programa de Arqueología Subacuática* or PROAS) of the Argentinean National Institute of Anthropology to become responsible for the academic research of the site. For the first time since its discovery, there would be professional archaeologists working on the *Swift*. The main research themes of the PROAS project (Elkin, 1997) include the role of the *Swift* within its geo-political context in the South Atlantic; the ship's design and construction characteristics and subsequent alterations; the social hierarchy and other aspects of life on board as reflected by the material culture; evidence of the technological change which characterized the 18th century; and biological and other natural agents affecting the site's preservation and formation processes. This article provides an updated and detailed overview of the ongoing *Swift* project, as conducted by PROAS since the first dives on the site in 1998, with an accumulated diving time of about 440 hours.

The South Atlantic at the time

In the 18th century the strategic location of the South Atlantic for maritime commerce justified European competition for its domination. The area was crucial for developing maritime traffic between the South Atlantic, the Pacific and the Far East (Hidalgo Nieto, 1947; Caillet-Bois, 1952). France and England were trying to open the trade route via the South Atlantic through the Magellan Strait to deal directly with the Peruvian-Chilean market (Liss, 1989). Furthermore, European countries in the South Atlantic during the 16th, 17th and 18th centuries hunted sea-lions, fur-seals and whales, in a zone mainly controlled by the Spanish (Flanning, 1924; Silva, 1984). Spain therefore, towards the end of the 18th century, started to implement new strategies to defend these areas, such as the construction of coastal forts. This generated further friction between European countries (Parry, 1971; Silva, 1984).

In 1763 the Frenchman Louis Antoine de Bougainville departed for the South Atlantic and, the following year, seized the 'Malouines' Islands (later the Malvinas) in the name of Louis XV. The Spanish Crown immediately claimed sovereignty, demanding that the French abandon them (Goebel, 1927: 225–30). The French Court accepted and in 1766 Bougainville returned the Islands to the jurisdiction of Buenos Aires (Hidalgo Nieto, 1947). At the same time the British

Admiralty had decided to establish a military base in the area, the mission being commanded by Commodore John Byron. In 1764 he arrived at Puerto Deseado (Goebel, 1927: 231; Caillet-Bois, 1952: 119) and a year later anchored off the West Malvina/Falkland ('Saunders' isle, later 'Trinidad'). Within a short time, Port Egmont was founded, comprising a fort and a harbour, and the islands were seized in the name of George III (Byron, 1773: 86; Goebel, 1927: 232). Therefore in 1766 British and French settlements were co-existing in the archipelago.

The British fleet in Port Egmont consisted of the frigate *Tamar*, the sloops *Swift* and *Favourite*, and the transport *Florida*. Although some sources state that a great portion of the coasts of the Malvinas/Falklands and of continental Patagonia was still unexplored (see Gower, 1803; Beatson, 1804), others indicate that by the end of the 18th century the Malvinas/Falklands were well-known and charted (ADM 3/77; Byron, 1773). In any event, the *Swift*'s initial orders were to protect Port Egmont against the imminent possibility of confrontation with the Spanish (ADM 1/1789; ADM 111/65; ADM 3/77). However, following Admiralty orders (ADM 1/1789; ADM 1/5304), it was decided that she would also conduct surveys of the isles and harbours, as long as at least one of the other ships was always stationed at Port Egmont for protection and assistance.

Why this interest in an area that was under Spanish dominion and therefore had the potential to provoke political conflicts? One possible reason could be that, by knowing the available resources of the Patagonian mainland and islands, the British settlement at Port Egmont could serve as a naval storage station to provide provisions to other British ships or allies in these waters. Another reason could be that, by knowing the area and what was available, the British could be in a better position to assess risks for their maritime enterprises and in this way minimise the probability of losing their strategic position in the South Atlantic. But how important was Port Egmont in maintaining this strategic position? This was probably related to British geo-political decisions to monitor and control the actions of the French, and to a certain extent those of the Spanish. The British probably perceived the presence of these European powers as a potential threat to their maritime enterprises and interests in the South Atlantic. In this context, the British base at Port Egmont could represent a strategic place for the protection and pursuit of those interests (Dellino, 2004: 125–6). The competition between European powers probably encouraged the British to explore new areas of Southern waters and establish the settlement of Port Egmont.

The wrecking

According to the court martial faced by the crew on their return to England, in early March 1770 Captain Farmer left Port Egmont with 91 men on board the *Swift* to conduct surveys (ADM 1/5304: 3). During this journey gales drove the ship towards the mainland (ADM 1/5304; Gower, 1803), and when the Patagonian coast was spotted on 13 March they were close to Puerto Deseado. This estuary had been explored previously by Commodore Byron's 1764 expedition, and the *Swift*'s Lieutenant Erasmus Gower had been part of the crew (Gallagher, 1964: 145). It was decided to look for shelter there so that the crew could rest and recover. Puerto Deseado, one of the few natural harbours in the area presents, however, many dangerous rocks which are usually hidden at high tide. Soon after the ship entered the estuary, it ran aground on a submerged rock, but got off after manoeuvring with the stream and kedge anchors.

Once within the estuary they attempted to anchor with one of the bowers but, during the manoeuvre, the fore-foot struck another submerged rock and the vessel grounded again. This time using the kedge anchor did not free the ship (ADM 1/5304: 5). The tide was ebbing quickly and the men caulked up the ports, shored up the ship and did everything they could to keep it afloat as long as possible. They sent ashore all the stores they could (mainly bread, gunpowder and small firearms). Nevertheless, at low tide the ship suddenly slid backwards, overset and sank, only the topmast remaining above water (ADM 1/5304). Although most of the men survived, their situation was desperate. In Port Egmont no-one was aware of the accident and their location; Patagonia was a harsh and desolate territory where there was no reason to expect to see humans except for the natives or Spanish sailors—both of them potentially unfriendly—and they did not have enough food or clothing to face the approaching winter. So they took the bold decision to send their largest oared cutter to Port Egmont to ask for help. The cutter was fitted as best they could, with a crew of the ship's master and six volunteer seamen. Finally, after a 5-day journey across open sea, they reached Port Egmont and reported the

Table 1. *Site characteristics and environmental conditions*

Site location	Lat. 47° 45′ 12″ S / Long. 65° 54′ 57″ W
Bottom depth	10–18 m (high tide)
Bottom slope	Maximum 8°
Tidal amplitude	4.2 m (average spring tides)
Currents	2 knots maximum
Wave amplitude	Maximum 1 m (generated by the prevailing W and SW winds)
Underwater visibility	1 m average, ranging from 10–20 cm to close to 2 m
Water temperature	4–13°C
Water salinity	33‰ (annual mean)
Water dissolved oxygen	5.6–6.2 ml/l
Water Ph	7.8–8.2
Sediment composition	Dominance of fine fraction sediments (ranging from clay to fine sands) with high calcium carbonate content (molluscs and barnacles bioclasts), accumulated over pebble bottom.
Sediment redox potential	–140 to –314
Benthic communities	Of sub Antarctic origin and belonging to the Magellanic Biogeographical Province; characterized by its high biodiversity.

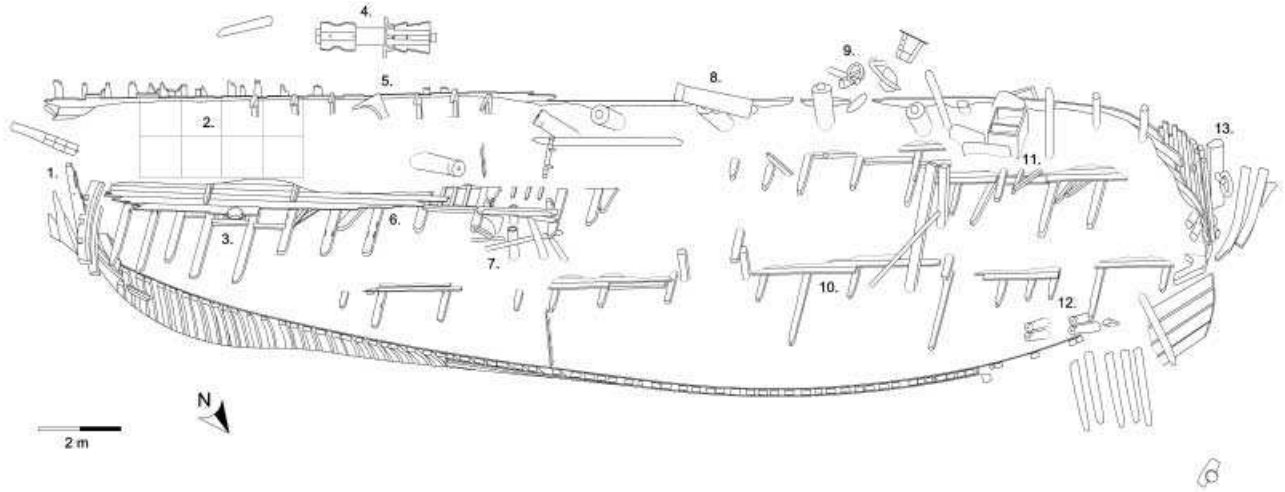

Figure 2. Plan of the wreck-site. 1. sternpost; 2. area of excavation; 3. broken mizzenmast; 4. capstan (detached); 5. quarter-deck clamp and knees; 6. upper or main deck; 7. suction pumps and partners of the mainmast; 8. cannons; 9. small anchors; 10. lower deck; 11. galley stove; 12. swivel-guns; 13. bower anchor. (C. Murray)

loss of the *Swift*. Almost a month after the accident, the survivors were rescued by the sloop *Favourite*.

Site description and environment

The characteristics of the site and its environmental conditions are summarized in Table 1. The dynamics of the wrecking and post-depositional processes have resulted in a very high archaeological integrity. There was minimal damage to the hull structure; the ship was abandoned quite suddenly; there was little salvage; the location is not affected by swell; it has a significant degree of burial; and the adjacent rock provides further protection, preventing ships from sailing right over the site, even though it is located within the harbour area. About 70% of the ship's structure has survived, and the visible archaeological remains cover an area of about 180 m^2 (Fig. 2). Most of the structure is still in its original position and only the uppermost parts have collapsed or disappeared (Fig. 3). The hull is lying on the bottom on its port side, with a list of 58°. The bow is slightly higher than the stern, following the natural slope of the sea-bottom. Due to the significant tilt towards the port, the mostly exposed sector—and consequently the one which has deteriorated most—is the upper half of the starboard side. The sectors of the ship which are best preserved seem to be those which are buried, approximately 60% of the ship's remains.

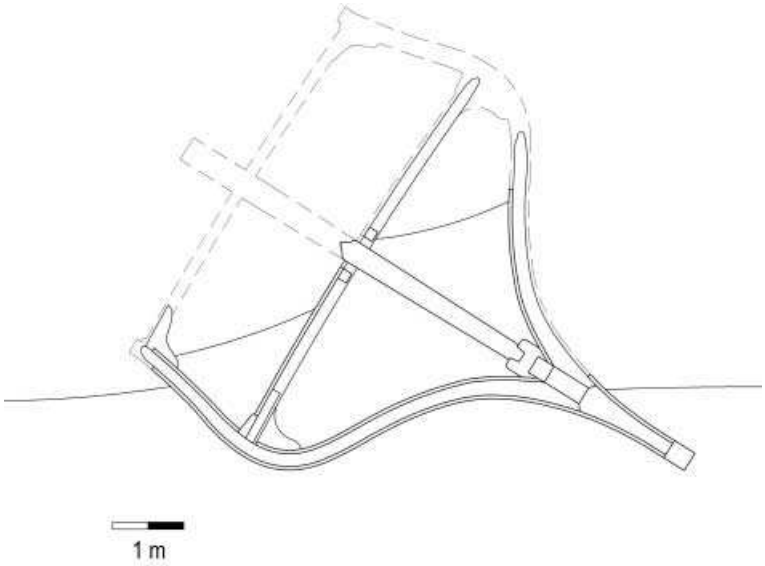

Figure 3. Cross-section of the site at the mizzenmast facing towards the bow, showing the visible remains on the sea-bed as well as the hypothetical buried structure. The dashed line indicates the missing quarterdeck. (C. Murray)

Research methodology and techniques

The survey and excavation of the *Swift* was planned with the aim of collecting archaeological data to allow us to address our research topics, and the work also needs to be adapted to the particular three-dimensional conditions of the site. Structural remains and large artefacts such as cannons were recorded by trilateration with tapes, using CAD software for the subsequent three-dimensional processing. The excavation sampling design was oriented towards covering chosen representative sectors in the bow, the midships area, and the stern, to obtain archaeological information about the ship's internal arrangement in terms of structure, function, and the people usually occupying those spaces.

The excavation began at the stern, at present covering an area of 8 m^2 (Fig. 2) and it is intended to open similar-sized areas in the midships and bow sectors. Statistically speaking, therefore, the excavation is following a non-random stratified sampling design (Thomas, 1986; Shennan, 1988). Sediment is removed by means of a water-dredge. Each artefact's three-dimensional position is recorded to the centimetre, and the general site 'stratigraphy' has been designed in the form of 40-cm artificial levels from right below the sediment surface (level 0). Our arbitrary archaeological levels provide additional provenance information for the recovered artefacts, and it is worth taking into account that we are dealing with a very well-preserved, single-component site. To date, all the almost 300 artefacts recovered by the PROAS team come from either level zero (in any part of the site) or from levels one and two in the stern excavation zone. In addition, there are several objects which were collected by avocational divers in the first years after its discovery. Although there is no data regarding their archaeological provenance, we have been able to infer that at least some of them must have been found at the stern.

The ship

HMS *Swift* belonged to one of the smallest categories of fighting ships in the 18th-century British Navy—sloops-of-war. Classified immediately below the smallest rated vessels (6th-Rates) they consisted of different types of ships, of a limited range of size and power. Sloops could have 2- or 3-masted rigs, comprising snows, ketches, brigantines, brigs and ships, and frequently had small ports between the gunports for oars (Lyon, 1993: xiv). They were multi-purpose vessels, and the smallest men-of-war fit for transoceanic voyages (Murray *et al.*, 2003: 104).

The *Swift* and its twin the *Vulture* were ordered to be 'Of the same dimensions and as near as may be to the Draught of the *Epreuve*' (ADM 180/3: 484). Originally a privateer (*L'Observateur*) the *Epreuve* had been purchased by the French navy and then captured in 1760 during the Seven

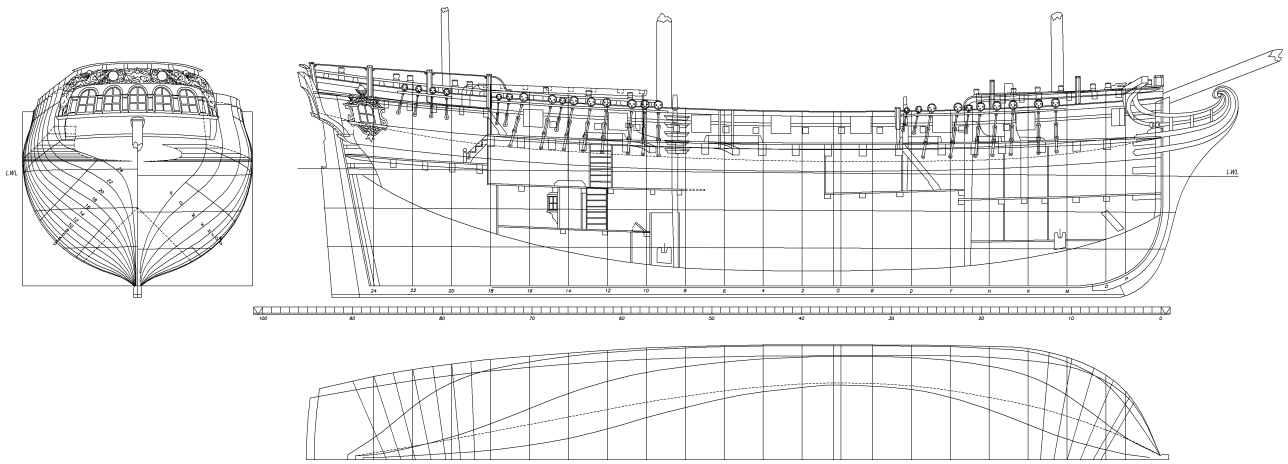

Figure 4. An 'as fitted' sheer and profile plan of the *Swift*, after draught 3606A, National Maritime Museum, Greenwich. (C. Murray)

Years War (Lyon, 1993: 211). The original drawings of the *Swift*, at the National Maritime Museum in Greenwich, show a quite unusual design for British naval practice in this period: steep floors, a sharp entry and underwater run and an unusually deep hull (Fig. 4). The *Swift* was built at John Greaves' shipyard on the Thames in 1763. Its length on the upper deck was 91 ft 4 in (27.8 m), its beam 25 ft 11 in (7.9 m), and the depth 13 ft $5^1/_2$ in (4.1 m). Assessed at 263 tons, it carried 14 guns and a crew of 125 (ADM 180/3; NMM 3606A).

The ship's 7-year career was relatively short compared to the average life-span of small warships of the time of *c*.20 years, but quite active, with three missions to overseas stations, one to Jamaica and two to Port Egmont (Malvinas/Falkland Islands). The structural remains described below are only the parts exposed above the sediment. Nevertheless, these parts represent a significant portion of the ship's hull and allow us to understand several aspects of its construction. All the surveys and analyses were conducted by non intrusive techniques.

Framing

Observations on the framing system were made in the portion of the starboard side not covered by planking (the port side is almost completely buried), close to the turn of the bilge. There are no floors exposed; only part of the first and second futtocks. This situation naturally limits the analysis and interpretation of the framing, which will be tested in the future using intrusive techniques. The framing pattern consists of full double frames with two filling single frames in between. The distance between the full frames ('room and space') varies between 1.30 and 1.36 m, which is consistent with the dimension on the original plans of 1.32 m (4 ft 4 in). Near amidships there is a change in the arrangement. Towards the stern the first futtock is located abaft the second futtock, while towards the bow this order is reversed. That place would correspond to the midship frame. This alteration in the arrangement of the futtocks was a common naval practice at the time (Morris *et al.*, 1995). The cant frames (frames not perpendicular to the keel), usually positioned at the bow and stern, have not yet been identified. The joining between the first and third futtocks is made with a triangular chock fastened to both futtocks with treenails. The second futtocks are between 19 and 22 cm sided and between 11 and 12 cm moulded. A sample taken from one of the frames (pers. comm. Castro, 1999) was identified as oak (*Quercus* sp.).

The shape of several frames was recorded with an inclinometer, measuring on the external surface of the starboard side. In all cases the shapes coincided or were very similar to the lines on the original body plan. Along the exposed starboard side it is possible to see several external planks, fastened to the frames with treenails. These heavily-eroded planks measure, on average, 28 cm wide and 4 cm thick. To date no traces of copper sheathing have been found, although by 1761 the Royal Navy had begun to experiment with copper sheathing on the underwater portions of hulls (Staniforth, 1985).

Stern and bow assemblies

The sternpost and the transoms in their original three-dimensional location are clearly distinguished. The dimensions of the sternpost (in the head) are 28 cm moulded and 24 cm sided. The inboard face of the sternpost presents, at its upper end, an unusual and elaborate pattern of notches, which depress and elevate alternatively. Their purpose was to join another piece (which lies detached on the sea bed), thus extending the sternpost 1 m upwards (Fig. 5). This could be the result of a modification during the ship's life, probably related to a change in the decks (see below). Fixed to the sternpost are five transoms: the deck transom beam, the wing transom and three filling transoms. Both the deck transom beam and the wing transom have two notches on each side of the sternpost for the missing counter timbers. On the external side of the wing transom it is possible to see the complex surface to fit the curvature of the external planking. The starboard ends of the transoms are joined to the fashion-piece, the aftermost frame of the normal structure.

The bow structure is much less homogeneous, possibly because it is more exposed and could have suffered differential damage during the sinking process. It has not yet been possible to identify the stempost, which has probably collapsed. Towards the port side can be seen the hawse-pieces with fragments of the external planking. Two hawse-holes can be distinguished, one with a sleeve, apparently of copper alloy, of 35 cm internal diameter. The starboard hawse-pieces have collapsed or disappeared. Inboard is a breast-hook in its original position, which would be the deck-hook of the lower deck. Starboard of this structure can be seen four semi-buried timbers, with a sided dimension of 20 cm and a variable moulded dimension, which would belong to the bow deadwood. In this sector two lead draught-marks were found (VII and XV).

Decks

The upper or main deck, of which nearly the entire port half is complete, is formed by beams, carlings (running fore-and-aft) and ledges (running athwartships). The beams have an average moulded dimension of 16 cm and a sided dimension of 19–22 cm, and in their upper edges are the recesses to receive the ends of the carlings. In the exposed structure only one carling and some ledges can be seen in their original position. It has not been possible yet to confirm the presence of deck knees, although according to the practice of the

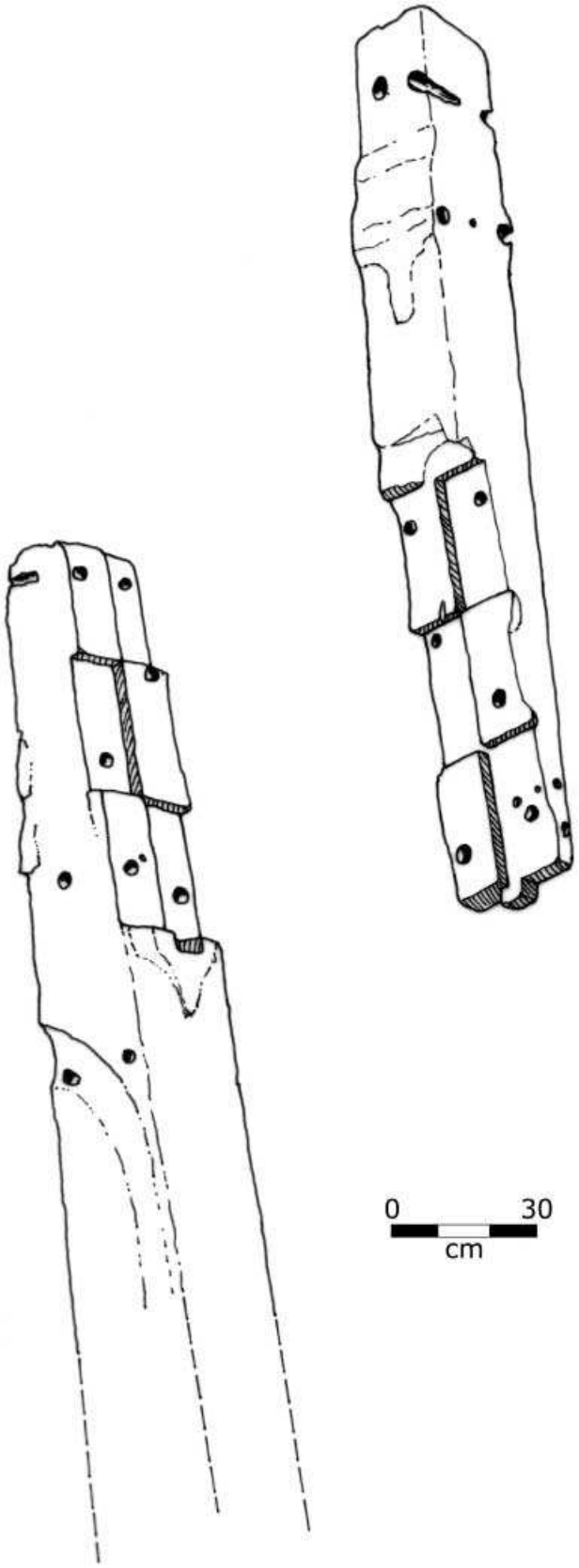

Figure 5. Sketch of the timber used to extend the sternpost. (C. Murray)

time it is presumed that it had hanging knees as well as lodging knees.

The planks of the deck are 5 cm thick with an average width of 23 cm. The caulking has been preserved very well. The main deck is full length, running from stem to stern in a continuous structure. This is different from what is drawn in the Admiralty plans, where there is a step where the captain's cabin begins. The identification of the mizzenmast sheds light on the way in which the ship was rigged, in this case contradicting one of the plans; the 'lines and profile' plan shows three masts (ship-rigged) while the deck plan has only two (it is probable that the plans were originally drawn with two masts and that the mizzenmast was later added to one plan). The mizzenmast, made of *Pinus sylvestris* (pers. comm. Castro, 1999) has a diameter of 30 cm, and is broken just above the main deck. It is possible to see the carlings, the partners and the triangular chocks which brace it (Fig. 6).

In spite of these changes in the plans, the general layout and the disposition of the beams is consistent in most of the deck. Forward of the mizzenmast there are remains of two hatchways, possibly the 'bread hatch' and the 'after hatch and ladder way'. In the location of the mainmast, of which there are no exposed remains, the bitts and two suction pumps can be seen. In this area it is also possible to distinguish the ends of the curved half-beams of the port side, as they appear in the original plans. Further towards the bow are two big collapsed timbers of square cross-section (22 × 22 cm), which would be the riding bitts for the anchor cables. There are no visible remains of the foremast.

The galley stove lies on the port side in the bow area. It is a rectangular iron box measuring 115 × 75 cm on what would be the upper side, and 100 cm high. Close to it are some lead sheets which could have been used for protecting the deck. The location of the galley on the main deck differs from the Admiralty plans, where it is in the bow area but on the lower deck.

The structure of the lower deck is lighter than that of the main deck and is only formed by the beams (without carlings nor ledges), quite reasonable considering that it does not have to hold the weight of the cannons. The average dimensions of the beams, which are quite eroded, are 15 cm sided and 10 cm moulded. This deck also has differences from the plans. Amidships, where in the plans there is no lower deck, in the wreck there are beams and planking-remains, indicating that the lower deck does extend along that sector. Of the quarterdeck only some deck-knees remain in place, while the beams have collapsed or disappeared. Under the deck-knees are remains of the quarterdeck clamp, where it is possible to see the notches on which the ends of the missing beams lay. The deck-knees are hanging knees, which were placed vertically, and

Figure 6. Mizzenmast, broken just above the partner. (S. Massaro)

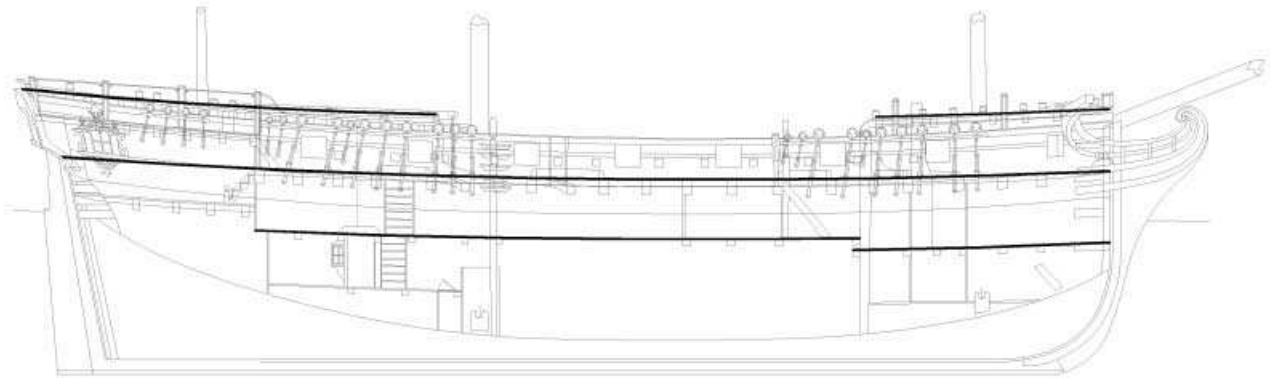

Figure 7. This illustration shows the differences in the arrangement of the decks between the original plan and the archaeological remains. (C. Murray)

the length of their horizontal arms averages 60 cm. The location of the knees and the notches of the deck clamp allows us to reconstruct the layout of the quarterdeck. Here there is also an important difference from the plans. Instead of a short deck which covers only the captain's cabin, on the site there are remains of a quarterdeck which extends almost to the mainmast. So far we have not found evidence of a forecastle, as the Admiralty's 'lines and profile' plan shows. However, the find of the galley on the main deck suggests the existence of an elevated deck to cover it, which strengthens the hypothesis of a forecastle (Fig. 7).

Fittings

The capstan, detached from its original position, lies beyond the port side, between the main- and the mizzenmasts. It has a double barrel, that is, it was operated from two decks. According to the plans of similar sloops (with a continuous main deck and a quarterdeck), the spindle of the capstan rotated on a step lying on two beams of the main deck, while the upper drumhead protruded above the quarterdeck. The dimensions of the capstan allow us to infer that the vertical distance between the planking of the quarterdeck and the main deck was 1.83 m, which would allow a free space of approximately 1.55 m.

The suction pumps are located near the partners of the mainmast. They consist of two pipes made of copper alloy, one each side of the mast. Their internal diameter is 127 mm and they are covered by a wooden casing. Inside the pipes can be seen the wooden upper valves. There are no exposed traces of chain pumps. Outside the ship, close to the port side in the bow area, was found a detached small suction-pump made of lead. It consists of a rectangular reservoir-box 16 × 25 cm on the sides and 21 cm high, with a suction tube of 86 mm and a dale of 36 mm (both internal diameter). It has been suggested that it could be a 'head-pump', used to pump seawater into the ship for washing down the decks (pers. comm. Coleman, 2003). On one side of the reservoir box is the inscription 'G.R.3', for Georgius Rex III, with a crown and '1769', which corresponds to the date of a major refit (ADM 180/3) (Fig. 8).

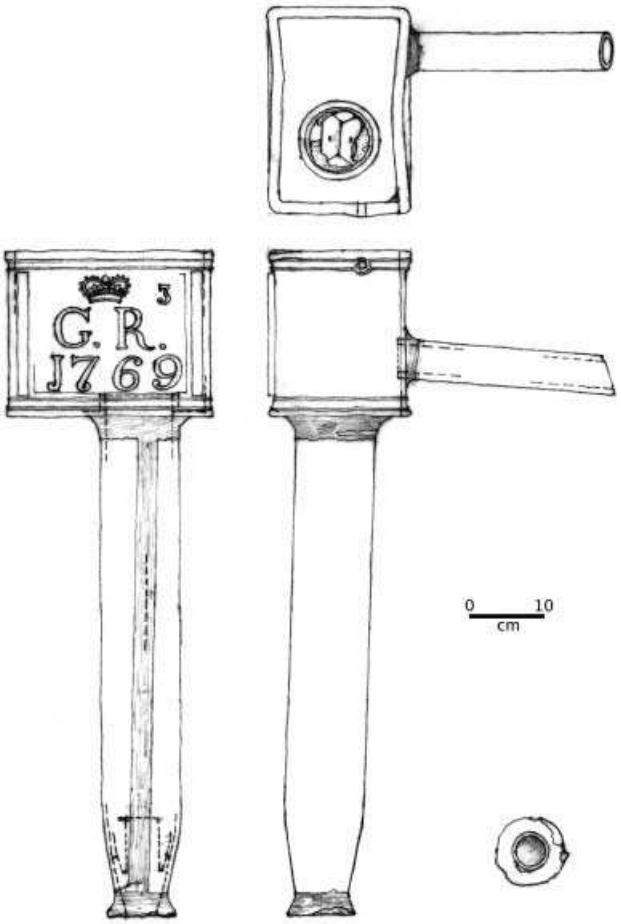

Figure 8. 'Head pump' made of lead. (C. Murray)

A similar pump has been recovered from the *San José* shipwreck of 1733 (Oertling, 1984: 35–9).

Abaft the sternpost is a large semi-buried timber with the upper end broken, which could be the rudder. Before the intervention of PROAS the rudder-head was recovered. It measures 32 × 32 cm in section, and has four iron hoops to hold the tiller, which is iron, cylindrical, with a diameter of 12 cm. Finally, two scuppers have been recovered. They are lead tubes with an internal diameter of 100 and 75 mm respectively, with lips on both ends which were attached to the waterway of the deck and the external side planking. The smaller had inside a coarsely-made wooden plug, which could be for sealing the openings before the flooding and sinking of the ship.

Differences from the original design

The survey conducted so far of the archaeological remains of the *Swift*—which have a great structural coherence—has provided valuable information about the design and construction of the ship. One of the most interesting conclusions is that the original plans do not reflect accurately how the ship was constructed, at least at the time of sinking. The *Swift* was built in a transitional period, in which the average size of sloops increased considerably. By comparing plans of several contemporary sloops two aspects become apparent. Firstly, it seems that the increase in size caused, in most cases, a change in rig: from 2-masted to 3-masted. Secondly, the deck-layout of the largest sloops, which had a full-length main deck, a quarterdeck and a forecastle, seems definitely to have been adopted.

The plans of the *Swift* show a sloop of the early style: a stepped main deck with the captain's cabin located at a lower level, a lower deck interrupted amidships, a short quarterdeck and a 2-masted rig (this differs in one of the plans). The archaeological remains, however, show that the main deck is full-length, with the captain's cabin located at the same level; the lower deck runs complete amidships; the quarterdeck extends to the mainmast; and the rig is 3-masted. All these features are consistent with the later typology of sloops. Therefore the *Swift* was either constructed as this new type from the beginning, or modified later. There is at least one piece of evidence that the ship was modified after its original construction: the notches made to the sternpost to extend it with another piece to adapt it to the new deck layout, raised at the stern. More exhaustive archival research might shed light on this issue. On the other hand it is worth remarking that, as stated above, the curvature of the frames does fit the lines of the plans. This demonstrates that the basic hull-form, which was copied from a French design, was maintained in spite of the other modifications which were made, which suggests that its sailing performance was considered satisfactory. The construction characteristics, such as the room-and-space, scantlings and framing pattern, fit British naval practice of the time.

Anchors

Since the mid-18th century, the anchors which equipped British ships of war were of the 'Admiralty pattern'. The number and size of anchors assigned to the ship was related to the class to which it belonged. At the time the *Swift* was built, 14-gun sloops were equipped with three bower anchors of 20 cwt 2 qrs (1040 kg), one stream anchor of 7 cwt (355.15 kg) and one kedge anchor of 3 cwt 2 qrs (177.5 kg) (Curryer, 1999). This is consistent with information in the log of the *Swift*'s lieutenant during her penultimate voyage (ADM/L/S/594).

For the period we are considering much is known about the construction, proportions and angles, and materials. For example, 'The wooden stocks of the Admiralty type during the 18th and 19th centuries were made in two horizontal halves of best oak held together by bands driven over and bolted' (Curryer, 1999: 109). In turn, 'naval anchors were fabricated only from either Swedish or Spanish iron, while English irons were considered to be good enough for merchant-ship anchors', and the angle of the arms was around 60° (Stanbury, 1994: 72). In the sources which specifically refer to the sinking of the *Swift* there are references to the bower anchors, the stream and the kedge (ADM 1/5304), two of which were in use when the ship went down: the best bower (or the bower anchor according to lieutenant Gower, 1803) and one of the smaller anchors (the kedge according to the lieutenant and the stream anchor according to the master, ADM 1/5304).

On the site two anchors of different sizes were found, in the bow towards the port side and partially buried in sediment. In both it is possible to see different portions of the upper part of their structure: the ring, part of the wooden stock, and the upper part of the shank. It was also possible to observe, on the same side, a fluke and an arm which could be either a broken part of one of

these anchors, or part of a third. The recorded dimensions of the exposed parts, such as the diameter and thickness of the ring, the cross-section of the shank and the cross-section of the stock, are consistent with anchors of ships similar to the *Swift* (Curryer, 1999). The anchor located closer to the bow would correspond to the bower anchor, one of the two large anchors (because of being on the port side it could be the small bower). Its position is consistent with the list of the hull. The fact that there is no visible evidence of the best bower on the starboard side would be consistent with references to its use during the manoeuvres prior to the sinking. It is also worth mentioning the presence of a wrought-iron anchor in the town of Puerto Deseado, apparently recovered from an area close to the wreck-site. Until specific studies are made, our preliminary judgement is that its dimensions do not coincide with any of the types mentioned above for the *Swift*.

Armament and associated elements

By the 18th century the poundage of the guns on warships of the Royal Navy was homogeneous for each deck. Sloops-of-war had between 8 and 18 cannons, usually 6-pounders, all placed on the main deck in the open air. The *Swift* was equipped with 14 6-pounder cannons (ADM 180/3: 484) complemented by smaller weapons such as swivel-guns and muskets. According to regulations, the cannons would be of the Armstrong pattern (Hohimer, 1983). This refers to six different iron models, all of them 6-pounders, which had been in use since 1761, of lengths ranging from 6 to 9 ft. They were always mounted on a wooden carriage, and in the case of the 6-pounders were usually operated by a minimum of five men.

To date, seven cannons have been identified at the *Swift* (Fig. 9), half the total on board. Some even have their gun-carriages. The rest of the cannons are supposed to be buried. None of those found is completely exposed, and all are covered by concretion. Two could be measured and the average length is *c*.1.9 m. Considering the layer of concretion that covers the cannons and estimating a long-term corrosion rate of about 0.1 mm a year—some 24 mm after 233 years (Pearson, 1987; MacLeod, 1995; MacLeod, 1996; Gregory, 1999)—the *Swift*'s cannons would belong to the smallest size of the Armstrong pattern, measuring 6 ft. The distribution of cannons, concentrated on the port side, is a direct consequence of the severe angle of the hull on the bottom. The position of four of them is consistent with the original layout on the deck on the port side, as well as with the distance between the gunports. Two of the remaining three cannons would have originally belonged on the starboard side, since their position is unlikely to relate to the port side.

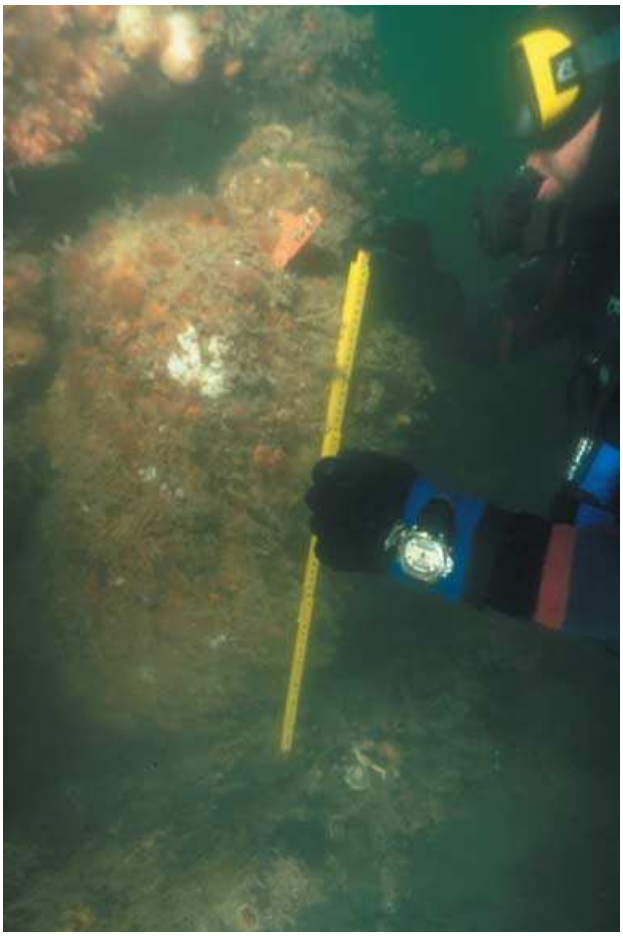

Figure 9. One of the 6-pounder cannons carried on the main deck. (S. Massaro)

With regard to ammunition, although different types were used in the Royal Navy at that time, the most common was round iron shot. Five such shot have been found so far. Their weight is quite variable, but their average diameter of 9 cm would be consistent with 6-pounder cannons (Hohimer, 1983: 25). Some have a circular mark, about 3 cm in diameter, which could be related to the manufacturing process. Swivel-guns were small anti-personnel weapons mounted on the gunwale, and usually had half-pound iron roundshot. The *Swift* had 12 swivel-guns: eight on the quarterdeck and four in the forecastle (Lyon, 1993; NMM 3606A). Towards the bow,

below the lower deck, four cylindrical concreted metal artefacts can be seen. On the basis of their dimensions (*c*.85 cm long) they are preliminarily identified as swivel-guns which would have been stowed in that place.

Among the hand-weapons of the time flintlock muskets such as the 'Short Land Pattern' or the 'Long Land Pattern' could have been supplied (Stanbury, 1994). A wooden musket-butt was found, with two holes in the back, which could have been for the attachment of a copper plate usually used in English muskets. For hand-weapons round lead shot was the most common projectile. Twenty-seven small round lead shot were found. Their average diameter is 17 mm and their average weight 30 gm. They have circular marks *c*.6 mm in diameter, which, like the cannon balls, could result from the manufacturing process. Small round iron shot were also found, their average diameter and weight being 23 mm and 24 gm respectively. Some of the latter have a linear mould mark all round, dividing it in two halves. Another find related to hand-arms is a gun-flint of the 'Broad Wedge' type (after Cummins, 2002) typical of British 18th-century flints. It measures 34 × 31 mm, its height ranging from 1.5 to 9 mm.

Tableware and victuals

Oriental-style ceramics

Many artefacts found at the *Swift* site fall into the category of 'Oriental-style ceramics'. This group—almost exclusively tableware—has the common feature of Chinese (or oriental in a broader sense) decoration, stamps or marks. All the pieces seem to have been manufactured either in China or in England. On the basis of the type and quality of the paste the pieces were divided into four categories, which are associated with different shapes, decoration techniques and motifs, and which may or may not have oriental-style identification stamps or marks.

The vast majority of the oriental-style pottery consists of porcelain. The paste has a whitish colour and is very fine and homogeneous, thin and translucent. These pieces usually have some type of decoration. Where the underglaze paint has been preserved, the decoration is always blue, painted on the natural colour of the paste, resulting in the 'blue and white' type, widely documented in the specialized literature. These porcelain pieces can be divided into three categories related to their decoration (Table 2). Each is described below, including information on basic typological features (shape and dimensions), as well as manufacturing technique, decoration, and marks.

Porcelain with blue underglaze paint

In this category we only include pieces exclusively decorated with blue underglaze paint. This is so far the largest group (36 pieces), all found in the stern excavation area. The only exceptions are two pieces for which we lack contextual information since they were recovered prior to the presence of archaeologists in the project.

Table 2. *Oriental style ceramics*

Type of Paste	Main Artefact Categories	Decoration Technique	Main Decoration Patterns	Identification Stamps/Marks
Porcelain	Tea bowls and plates (small size); 'bread size' plates and medium size bowls	1) Blue underglaze paint	Landscape with water, islands, pagodas, trees, boat, and flock of birds	Occasionally
	Bowls (medium size)	2) Lightly incised decoration with no visible paint	Human figures, trees	No*
	Bowls (medium size)	3) A combination of 1 and 2	Floral motifs	No
Red Stoneware	Tea pots	Applied relief decoration. No visible paint	Human figures, floral motifs	Yes
Fine Earthenware	Tea bowls with lids (small size)	Relief stamp on the lids. Subtle traces of painted decoration on some bowls and lids	Oriental symbol in the relief stamp on the lids	No
	'Bread size' plates	No visible paint nor engraving	—	Yes
Coarse Earthenware	Large size bowls and decanter-like container	Polychrome paint	Human figures, trees, floral motifs	No**

* There is a floral motif in the centre of the inner side of the bowls, but they have not yet been confirmed to be identification marks.
** The decanter-like container has a mark on the base but it is not an oriental-style one.

Typologically the pieces are of just two shapes: bowls and plates. To date the collection consists of 19 bowls and 16 plates (all complete or nearly-complete), plus a rim-fragment which seems to be part of a bowl or plate. In both bowls and plates the only variation is in size and proportions. In the case of bowls there is a 'small size' with an average mouth diameter of 8 cm and an average height of 45 mm, and a 'middle size' with an average mouth diameter of 11 cm and an average height of 55 mm. The plates show a similar variation, 'small size' ones, with an average maximum diameter of 13 cm, and 'middle size' ones, with an average maximum diameter of 16 cm. The smaller sets can be interpreted as tea sets, while the larger plates are similar to 'bread plates' and the bowls to 'rice bowls', although they could actually contain—and probably did—different types of food.

We infer that at least the small bowls and plates (and possibly the middle-sized ones too) belong to the same tableware set, not just because of their matching dimensions, but also their decorative technique and motifs. A single bowl and a single plate are of slightly different sizes, as well as different decorative motifs (see below) in comparison with the two main groups, although they clearly belong to the blue-and-white porcelain group. The rim fragment also has a different type of pattern but its small size does not allow any further description.

This blue-and-white porcelain was decorated by hand-painting with a blue pigment (cobalt oxide) before the glazing process (thus the term 'underglaze'). The patterns and motifs can be exclusively geometric, figurative, or a combination of both. The geometric patterns always consist of bands around the rim, both in plates and bowls. Although they are not identical, the general patterns are quite similar (Fig. 10). The figurative motifs, on both plates and bowls, are mainly classical landscape scenes which include islands, water, trees and structures—generally pagodas.

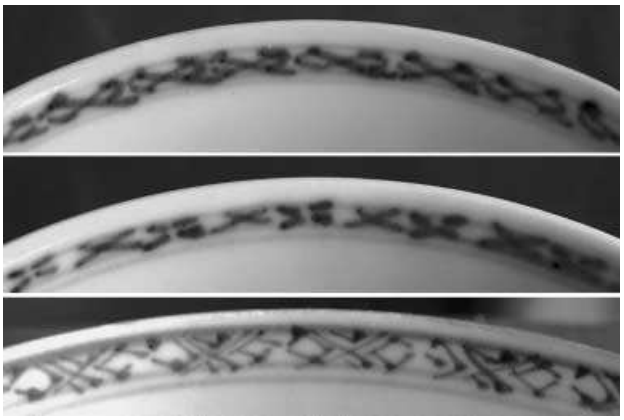

Figure 10. Different internal rim-bands which decorate the blue-and-white porcelain. (D. Vainstub)

These landscapes always include a human figure in a boat and a flock of birds.

However, there are two exceptions among the assemblage found so far. One is the only bowl in which human figures are the central topic instead of the landscape (Fig. 11). The other is a plate painted in light blue on white. This has as the central motif a creature with an anthropomorphic face and serpent-like body, which adopts different aspects depending on the perspective from which the plate is seen (Fig. 12 a and b). Sadly, there is no provenance for these unique pieces.

Some of the blue-and-white porcelain pieces have special marks painted in blue, all of them different. Although these have not yet been studied in detail, the preliminary interpretation is that they are identification marks of the artisan (or one of the artisans) who participated in the manufacturing process, like a signature. These marks are present on some of the bowls and two plates.

Porcelain with lightly-incised decoration

There are two pieces in this category. Both are bowls, and larger than those previously described (*c*.15 cm and 20 cm maximum diameter). They

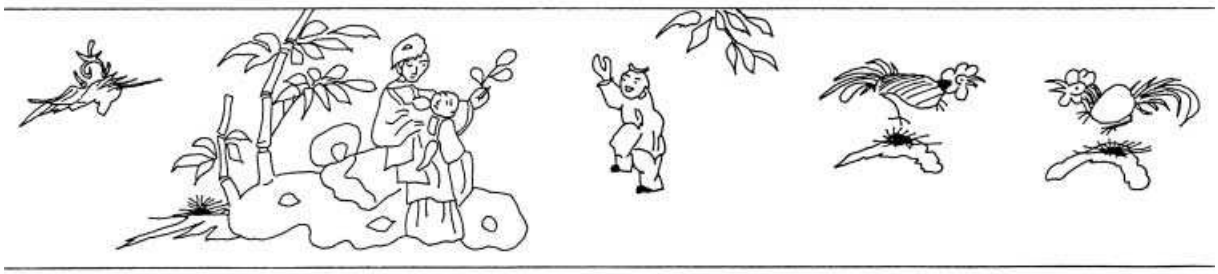

Figure 11. External decoration of a blue-and-white porcelain bowl. (C. Murray)

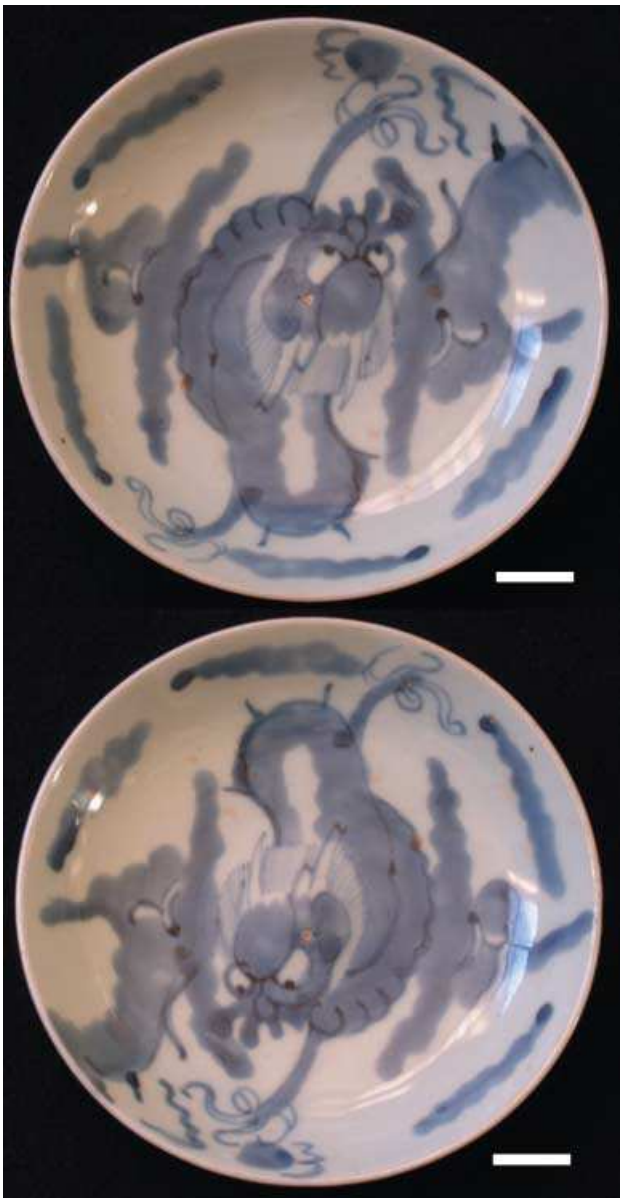

Figure 12. Blue-and-white porcelain plate (scale 2 cm). Note the different aspect that the central figure adopts depending on the perspective from which it is seen. (D. Vainstub)

are lightly incised, and there are no traces of paint. This subtle decoration is almost invisible; the motifs only 'appear' when the piece is held up to the light or when powdered graphite is spread on the surface. This type of decoration might be what is called *an hua*, the uncoloured 'hidden' or 'secret' Chinese decoration which could be produced either by carving, incising or impressing the design into the porcelain before glazing and firing (Miller and Miller, 1988). In some cases it is possible that the piece originally had an overglaze decoration which is now lost. The

Figure 13. Detail of one of the oriental-style bowls decorated with incised figurative motifs. (D. Vainstub)

patterns are varied, and mostly consist of figurative motifs although one of the bowls has an internal geometric band. This purely incised category features different scenes in which human figures are conspicuous (Fig. 13). Both pieces have a single floral motif in their internal centre. Although some ceramic marks in different parts of the world consist of flowers (Saavedra Méndez, 1948; Cushion, 1996) they will not be considered as marks until they can actually be identified.

Porcelain painted and incised

Some pieces present a combination of painted motifs with the subtle incisions described above, and we therefore refer to this decoration as mixed. This category consists of only two bowls, found at the stern, above the main deck. They are the same size, with a maximum diameter of 145 mm. Their decoration consists exclusively of floral motifs distributed on the outside. One also has a single floral motif in its internal base, but we are not yet able to tell whether it is a workshop or an individual artisan mark. This piece also has an orange rim.

By the 18th century blue-and-white porcelain was produced in great quantities in China. The city of Jingdezhen (Ching-te-chen), which was later known as the 'porcelain city', had more than 3000 kilns operating in its different factories (Vainker, 1991; Staniforth and Nash, 1998). Just on this basis, it is probable that the blue-and-white porcelain from the *Swift* comes from there (Elkin, 2003b), and this is also the interpretation of other researchers, for at least some of the pieces (pers. comm. Shinsuke Araki, 1999). Nevertheless,

one of our priorities in the near future is to try to determine the specific provenance of the pieces with identification marks.

Red stoneware

The colour of these pieces is given by the reddish paste, producing a fine-grained, non-porous stoneware. This category consists of two teapots, one with its lid. They have no paint or glaze, except for an internal glaze which makes them waterproof. One of the teapots recovered in the early 1980s has no provenance, and the other was from the captain's cabin. Both have mould-applied relief decoration with oriental-style motifs with an impressed imitation-Chinese seal. On the basis of similar examples in the specialized literature (Wills, n/d: 8; Hume, 1982: 121; Barker, 1984: 75–6), we are almost certain that they were made at one of the Staffordshire potteries in England, in imitation of Oriental examples imported by the English East India Company (Godden, 1974; Hume, 1982; pers. comm. Barker, 2005).

Fine earthenware

This category comprises four small, tea-size bowls, three of them complete with their lids, as well as plates. None has glaze, and their colour is given by the paste, which is of a light ochre colour in the case of bowls and lids, and reddish-ochre in the case of the plates. The bowls are of high-quality manufacture, with thin walls. Some retain very subtle traces of what seems to have been painted decoration in either blue or black. All the lids have geometric and circular oriental stamps, located in the knob (Fig. 14). These bowls are interpreted as tea-cups, the lid presumably for retaining heat. Very similar bowls, both in shape and the type of ceramic, have been recovered on underwater sites from the island of Takashima (currently Japan), although they belong to older periods than the one considered here (Kyushu Okinawa Society for Underwater Archaeology, 1992: 67, 72). The geographical source of this set of bowls would be provincial South China (pers. comm. Shelagh Vainker, 1993). Only two plates have been found so far, made in a similar fabric to that of the bowls, but more reddish in colour. On their base they have an impressed oriental-style seal. All the examples for which we have contextual data were found in an area between the mainmast and the mizzenmast.

Figure 14. Oriental stamp on earthenware bowl-lid. (D. Vainstub)

Coarse earthenware

This category comprises two pieces which are clearly made with a thicker-grained, coarser paste, and of poorer quality of manufacture. Both have polychrome decoration with oriental-style motifs. One, found in the excavation zone, is a bowl with external figurative decoration and just a central flower pattern on the inside. Both the external and internal decoration are in tones of blue, yellow, and grey. It is a big piece, 202 mm diameter at its mouth and 87 mm high. All the decoration lacks the precision and detail of the other pieces described above (whether painted or engraved). A single scene covers most of the body, consisting of a male human figure, a prominent floral motif, and a pagoda-like construction. All these patterns are combined or surrounded by vegetation. The painting is in different tones of blue and yellow—the latter with occasional golden tones—on a greyish light-blue background. The paste is orange-beige.

The other artefact is a small container, painted in light blue, blue and dark reddish colour. It also has an external guard around the base and a mark on the base. This piece was found lying on the sediment several metres outside the ship, on the port side. Among the Chinese artefacts recovered from the Sydney Cove wreck there is a small container interpreted as a washing-bottle, very similar in shape and size to this piece (Staniforth and Nash, 1998: 18, pl.12). The decoration of this piece includes two human figures. A noteworthy feature is that the mark on its base, the letters E and S, does not look oriental, and consequently it was probably not manufactured in China, although its decoration clearly places it within the 'chinoiserie' category.

Other ceramics

White salt-glazed stoneware

In this category are several white or nearly-white plates and platters. The main production centre in England for white salt-glazed stoneware was Staffordshire. The standard product, from the early 18th century, contained calcined and powdered flint (Godden, 1974: 71). At least some of the white salt-glaze plates and platters from the *Swift* are press-moulded (formed by pressing bats of clay onto prepared moulds). In general, such pieces are not as thin as thrown ones. The period when Staffordshire white salt-glazed stoneware was most popular was from *c.*1720 to 1780 when it was gradually superseded by creamware.

Creamware

This cream-coloured ware resulted from firing white flintwares to a moderate temperature (compared with highly-fired stoneware) and dipping them in a lead glaze. Creamware was introduced *c.*1740, and by 1760 was the standard English pottery body, produced not only in Staffordshire but in other places such as Leeds, noted for the quality of its creamware (Godden, 1974: 140). The early, pre-1760, creamwares often show a marked similarity to salt-glazed stoneware shapes and many pieces were produced from the same moulds (Godden, 1974: 72). One factory might be making salt-glazed stoneware while its neighbour had changed over to producing the new creamware, or one factory might have made wares in both fabrics (Godden, 1974: 140). By the second half of the 18th century there was a diversity of decorative rim-patterns for salt-glaze and creamware tableware.

A total of 16 platters and plates with moulded decorative edges were found, namely the patterns known as 'Feather', 'Gadrooned', 'Barleycorn', and 'Queen's' (Fig. 15) (see also Hume, 1982: 116). In addition, 24 plates with plain 'flat rims' (*sensu* Wills, n/d: 22) were recovered. All the creamware and salt-glazed tableware for which there are records of provenance have been found at the stern, on the main deck.

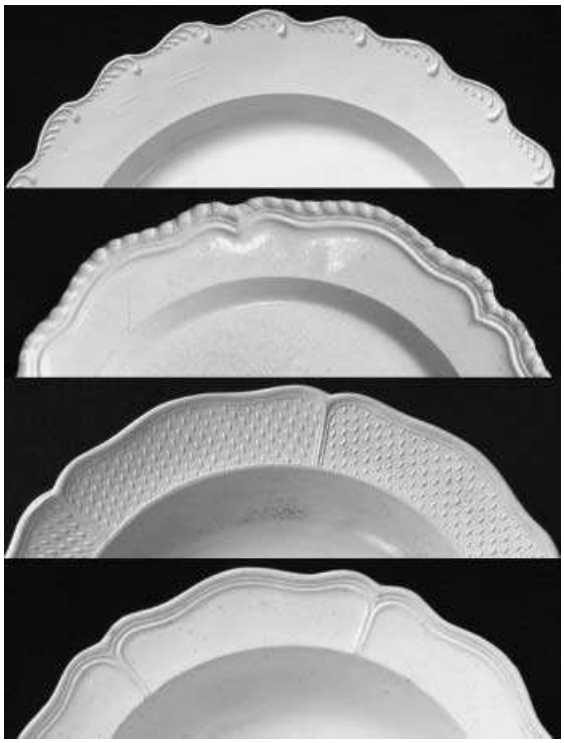

Figure 15. English creamware and saltglaze rim decoration, from the top: 'Feather', 'Gadrooned', 'Barleycorn', and 'Queen′s'. (D. Vainstub)

Slipware

Slip-decorated earthenware was made by coating the surface of ordinary pottery with one or more types of a more refined (or coloured) clay, called 'slip' (made by diluting the clay with water to approximately the consistency of cream or even milk) (Godden, 1974: 17). The decoration could be made with different coloured slips, and the use of a 'slip trailer' was quite common (drawing a thin object or a comb across to create parallel lines). Two platters have been found (one complete), plus one sherd. Those whose provenance is known were recovered from the surface sediment (level 0) in the midship area. This slipware could have been made in Staffordshire where there are many records of pieces with very similar decoration (for example Godden, 1974: 19 pl.1, 25; Hume, 1982: 107 fig. 29, 136 fig. 51), or Bristol, where slipwares in the style of Staffordshire wares were also being manufactured (pers. comm. Barker, 2005).

Brown salt-glazed stoneware

These are containers including wide-mouthed jars with no handles as well as narrow-mouthed jars with a single strip-handle. They are made of a very hard and thick stoneware, and have no decoration other than being divided horizontally by the use of darker and lighter browns. Some also have one or two thin grooves, either around the body or along the handle. Although many are unprovenanced, those recovered by our team come from surface collections (level 0) in the bow

area, apparently part of the galley. One of the biggest handled jars contained a whitish substance which seemed to be animal fat (pers. comm. Boveris, 1998). The production of stoneware is very well documented in western Europe (see Hume, 1982: 55–7, 276–85), but there were also several potteries in England and even Scotland which manufactured stoneware pieces, most of them utilitarian food containers (Godden, 1974).

The olive oil jar

This is a very large jar, about 80 cm tall, with the stamped letters I and F on its upper part, and was one of the first artefacts recovered after the wreck's discovery, and therefore unprovenanced. Similar jars have been recovered from many 18th-century archaeological sites and can be seen in several publications (for example, Ashdown, 1972; Hume, 1982; Campbell and Gesner, 2000; Coleman, 2003). The thorough research conducted by Coleman—clearly the most comprehensive and up-to-date study—helped us to interpret ours: it was made in Tuscany, in Italy, and contained olive oil. The initials I and F are the Italian merchant's mark. These jars were originally encased in wicker, and our example shows traces, in the form of 'negatives', of a wicker net or basket. Coleman (2003) also points out that the British Navy was one of the main customers for this Italian specialty.

Glassware and contents

Different types of glass bottles have been found, most of them complete. Twenty eight have a circular cross-section, round shoulders and deeply concave bases, of the type normally called 'wine bottles'. Their colour varies from green to dark brown. They were all free-blown and consequently asymmetrical. Their height ranges between 22 and 25 cm, and the length of the necks from 70 to 95 mm. Their capacity is also variable, between 760 and 900 cc. The other main group of bottles is square in cross-section, with a very short neck, and moulded. They are known as 'gin' bottles since this was what they usually contained (Moreno, 1997). There are two main sizes, with volumes of *c*.4 litres and slightly over 2 litres (1 gallon and $^1/_2$ gallon). A total of 17 have been recovered to date. They were purposely made square to fit into compartmented wooden cases, and one such case was found during the stern excavation, still with 13 bottles inside.

The most interesting aspect of the study of these bottles is their contents. Some were found with the cork in place, which allowed chemical analyses to be carried out, revealing that one 'wine bottle' contained a sweet, white wine (Dirección Nacional de Química, 1982). On the two trips the *Swift* made to Port Egmont they stopped at Madeira (ADM/L/S/594; ADM 1/1789), and at least on the first trip took aboard some wine. Therefore, it is possible that the wine on board the *Swift* on her final voyage was, at least partly, Portuguese. Archaeological work also showed that at least some of the cylindrical bottles were used for storing mustard and pepper seeds; a way of 'recycling' containers after their original use (Elkin, 2003a). Several of the square bottles also had the cork in place, but unfortunately these corks have an incision which allowed the passage of liquid in both directions. The Anion Ion and Gas Liquid Chromatography analyses conducted on several samples revealed significant contamination with seawater, and only very slight traces of ethanol (UDV Laboratory Harlow, 2001). The only archaeological interpretation is that they contained an alcoholic drink, but it is not possible to state the type.

The glassware recovered also includes drinking glasses, both stemware and tumblers, all of plain, colourless glass. In the stemware group two types of bowls are represented, ogee-shaped and trumpet-shaped. In both cases the stems are plain and straight, and most of the feet are slightly conical with a flat edge. The capacity of the ogee-shaped bowls is 70 cc, the trumpet-shaped ones 50 cc. This is quite consistent with the fact that many 18th-century drinking glasses were small by today's standards, holding two ounces or less (Kaplan, 1999). They could have mainly been used for drinking sweet dessert wines or the potent brandy-based liqueurs popular in England then. The tumblers are of two sizes, 265 cc and 600 cc. Interestingly, some of the drinking glasses also had a secondary use. At least one wine-glass and one tumbler were found full of mustard seeds, and another tumbler contained a King Penguin (*Aptenodytes patagonicus*) eggshell (pers. comm. Frere, 2002).

The last two glass items so far recovered are a faceted and ground stopper, and a big demijohn (Fig. 16), both found in the captain's cabin. The demijohn, still to be studied in detail, was found in association with remains of a net made of botanical fibres. The 'gin bottles', tumblers and stemware were recovered from the stern. The

Figure 16. Glass demijohn found in association with remains of a net made of botanical fibres (scale 10 cm). (M. Setón)

'wine bottles' have been found not only in the stern but also in level 0 in several other parts of the ship.

Finally, other artefacts related to tableware, food and related topics include six handles (four of them actually half-handles), possibly from table knives, made of wood, bone and ivory; five pewter spoons and one silver spoon; a particular artefact made of wood and bronze which we interpret as a spice rack; a ceramic strainer; a stave-built wooden tankard similar to those recovered from the *Mary Rose* (Rule, 1982: 201); two half coconut-shells which could have served as liquid containers; a metal spigot, similar to spigots recovered from the wreck of HMS *Sirius* (1790) (Stanbury, 1994: 52 fig. 83) and another from HMS *Sirius* (1797) (Von Arnim, 1998: 44, fig. 17). A copper cauldron-lid was also recovered from the bow area, close to the galley. It is oval, measuring 30 × 44 cm, its handle fixed with two rivets. On its upper face an Admiralty broad arrow is engraved.

Other artefacts

A few finds relate to clothing: metal buckles, mostly from shoes (one of them, found in the captain's cabin, is of silver); two shoe soles and one toe piece, found in the bow area; and one wooden shoe last recovered from the excavation zone (Fig. 17). The silver buckle would have belonged to one of the officers, and is representative of a high social status (Hume, 1982: 86).

Figure 17. Wooden shoe last. (M. Setón)

In an early field season a group of six small copper disks, apparently plain, was found on the surface sediment (level 0), above the main deck and on the starboard side of the stern. Removal of the corrosion on one revealed that it was a British halfpenny coin. On the obverse it is possible to see the legend GEORGIVS II and the king's head in profile left (known as the 'old' head, his second coinage portrait). The reverse has the figure of Britannia, and the letters [BRITAN]NIA, as well as part of a date. All these features fit copper halfpennies minted between 1740 and 1754, the date of this coin probably being 1753. Further microscopic analyses conducted with SEM and EDX revealed that the coin was not of pure copper but an alloy of copper, zinc and tin, and the structure of fusion corresponded to a piece which was cast instead of struck, as it should have been. The main conclusion, therefore, is that this coin was a forgery (De Rosa *et al.*, 2005). The absence of copper coins issued between 1755 and 1770, when the first copper coin of George III appeared, ensured that most George II coins remained in use for a long time. Whenever there was a shortage of copper in Britain, forgeries of George II and George III coins, made in brass or

underweight copper, became quite common (Hume, 1982).

Three ceramic chamber-pots were found prior to the intervention of the PROAS team, and so have no provenance. But since chamber-pots were not used by ordinary seamen, it is very probable that they belonged to officers. Interestingly there are clear differences in quality between the three pots: one is plain and coarsely-made, another is plain but of high-quality creamware, and the third is salt-glazed with relief decoration in blue, and probably imported from the Westerwald district of the Rhineland (*cf*. Hume 1982: 280–1).

The metal artefacts recovered from the excavation in the stern also include two copper-alloy candlesticks, both with a square foot and made using a two-piece mould.

So far a total of four sand-glasses have been found, two of them complete. The three smallest are 127 mm high and were found in a sector of the bow on the lower deck. Similar sand-glasses have been recovered from the *Invincible* (1758) and would have been used for measuring the ship's speed together with the log-line (Bingeman, 1985). The fourth, 225 mm tall, was found by the divers who discovered the wreck and is therefore unprovenanced. All four are formed of two globular ampoules of translucent glass joined at flanged lips and supported by a wooden frame. Some of the top and bottom wooden discs have a carved broad arrow.

In the stern sector, within what would be the 'Great Cabin', a fireplace was found (Fig. 18). The main fire-box is made of thin, riveted copper sheets with internal iron straps, its interior lined with plates made of a still-unidentified material which must be insulating or refractory. The external dimensions of the fire-box are 81 cm high, 32 cm wide and 20 cm deep. The grate was of iron, and only concretions remain. At the top are traces of a copper smoke-funnel. The front has two solid brass panels on the upper part and an ornate brass frame fixed with bolts and nuts. Other isolated parts were found, such as a socle, a cylindrical leg and a finial. They are all brass and would have been part of the front of the ash pan. Other evidence of the use of fireplaces on board Royal Navy ships has been recorded on the wreck-sites of the *Pandora* (1791) (Gesner, 2000: 74–7) and the *Sirius* (1790), as well as in a contemporary model of the *Royal George*, a first-rate ship of 1756 (Stanbury, 1994: 43–4). It is not clear if these fireplaces were provided by the Admiralty or were personal belongings of the officers, but their use on board ships sailing in high latitudes, such as the *Swift*, is quite logical. Two other brass artefacts recovered from the stern are a furniture knob and what may be a coat-hook. The knob is globular with a diameter of *c*.35 mm and has no decoration, while the hook has a flat rhomboidal shape, *c*.5 cm high and wide, with very ornate decoration (Fig. 19).

Among the glass artefacts is a group of 17 rectangular colourless glass panes of two sizes. The smaller are 19 cm wide and 22–31 cm long; the larger 23–28 cm wide and 27–34 cm long. The dimensions of the Great Cabin's window panes drawn in the ship's plan (NMM 3606A) are consistent with the smaller size. Some of the panes were found in the bow area and others in

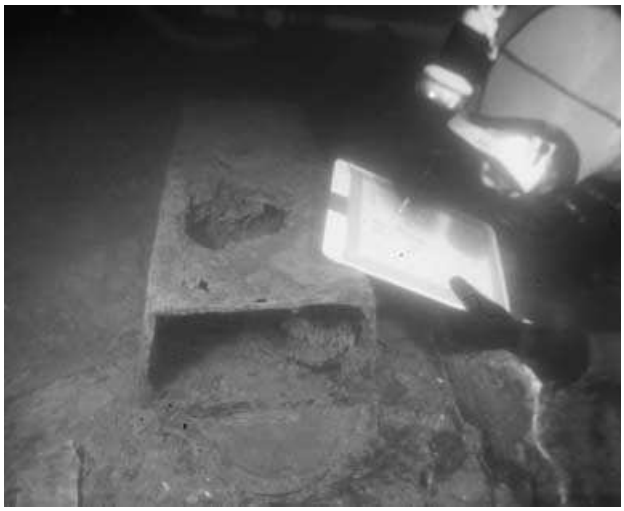

Figure 18. Fireplace located within what would be the 'Great Cabin' of the ship. (S. Massaro)

Figure 19. Ornate brass hook, *c*.5 cm high and wide. (D. Vainstub)

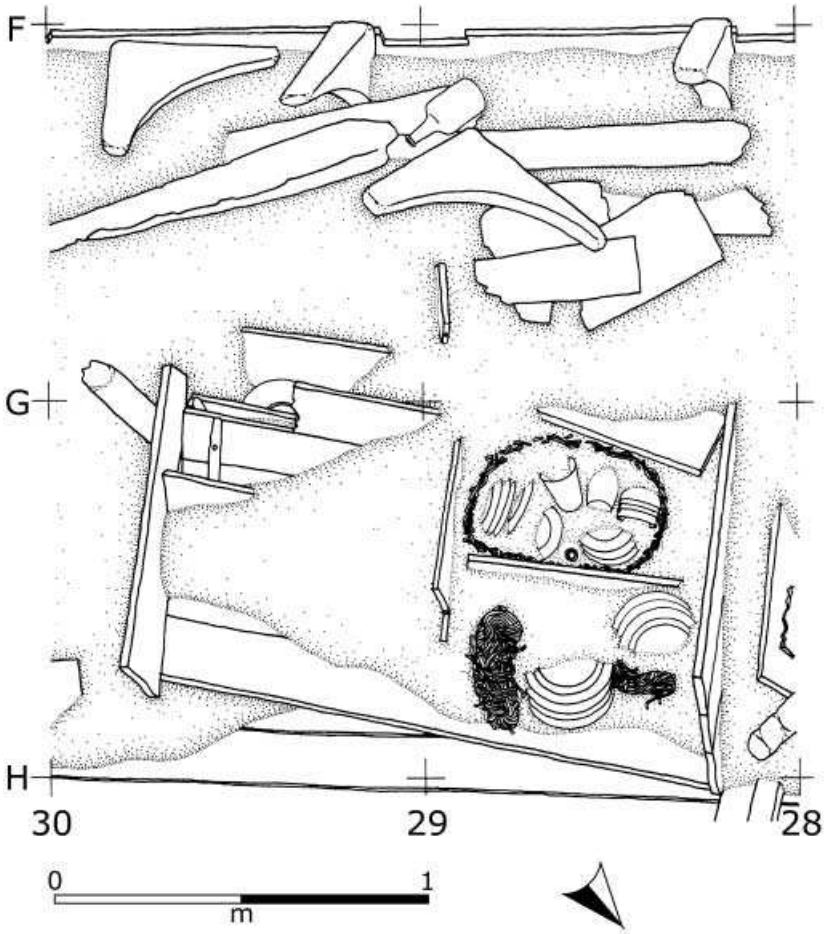

Figure 20. Detail of the excavation zone showing rope and assorted tableware. Note that some of the latter is inside a wicker basket. (C. Murray)

the excavation in the stern. The vast majority of them have the Admiralty broad arrow engraved. Some of them were found stacked, so they must have been spares. In the excavation four rectangular lead pieces were found. They are interpreted as counterweights, possibly for sash windows. Their length ranges between 15 and 27 cm, being slightly shorter than the ones found on the *Pandora* but similar in shape (Campbell and Gesner, 2000: 73–4).

The base, a section of the edge and one handle of a wicker basket were found in the stern excavation, in direct association with other artefacts such as drinking glasses and porcelain plates and bowls (Fig. 20). A sample of the wicker was identified as *Salix viminalis* (Rodríguez, 2002).

Biological site-formation processes

The non-traumatic circumstances of the wrecking and the beneficial environmental conditions allow very good preservation and integrity of most of the *Swift* wreck. However, the marine dynamic has played a fundamental role in its formation and evolution. Therefore site-formation processes constitute the basis for an adequate understanding of the changes which took place on the site and for a proper interpretation of the archaeological record. They also contribute to guiding aspects related to conservation, and to developing predictive models applicable to other sites in the region (Elkin, 1997; Elkin, 2000; Bastida *et al.*, 2004; Bastida *et al.*, forthcoming).

Bio-deterioration studies have been orientated to the identification and evaluation of the action of two principal biological agents: biofouling and wood borers. The aim is to understand the diverse effects these agents have on archaeological artefacts and structures. Hence, two objectives have been proposed. The first is to identify the fouling species present, to understand their mechanisms and cycles of colonisation and growth, and to

determine their deleterious effects on different archaeological materials. The second goal is to determine the presence of wood-borers, identify the species, and understand their biological cycles and the extent of their damaging effect on wooden remains.

The research started by conducting a systematic observation of the association between the different biofouling species and the specific archaeological materials they colonise (taking into account the raw material, texture and shape). In order to detect the presence of marine borers, diverse artefacts and ship structures were first examined macroscopically. A complementary experimental study conducted at the same time used acrylic and wood panels of 10×5 cm, fitted to a 30×40 cm acrylic frame and placed at the bow and stern for studying biofouling and wood-boring agents respectively (Fig. 21). Panels were inspected after 6, 12 and 24 months to monitor colonisation, growth and reproductive processes of the fouling organisms and to evaluate the presence of wood-borers. The general tendency is for biofouling to colonise all structural elements or artefacts found above the sediment level, except toxic materials such as copper. The most characteristic associations observed macroscopically for diverse materials are illustrated in Table 3.

It has been observed that artefacts as well as structural components of the wreck show galleries produced by marine borers of the Teredinidae family and possibly Pholadidae as well. Some galleries present a layer of calcium carbonate in their interior, while others seem to have lost it over time. The sectors of the ship attacked by borers include the lower as well as the upper works (Fig. 22). Differential attack related to wood-species was not observed, with borer action recorded on both pine (window-frame and hatch) and elm (gun-carriage wheel). Galleries or remains of Limnoridae isopods have not so far been found in the analysed wood.

Study of the experimental panels indicates that during the first six months of immersion (March to September 2001, that is, autumn and winter) a not very intense biofouling process developed. This corresponded to a stage which followed the initial biofilm and the beginning of the development of pioneer macrocomponents of the biofouling (for example incrusting briozoans, serpulid polychaetes, amphipod crustaceans). In the panels which were immersed for 12 months (March 2001 to March 2002) the community had acquired its maximum development and diversity with a clear dominance of the tunicates *Paramolgula gregaria* and *Cnemidocarpa verrucosa*. This constitutes the climax stage of the biofouling process, after which several detachments take place, which leave the original surface free for an immediate new colonisation.

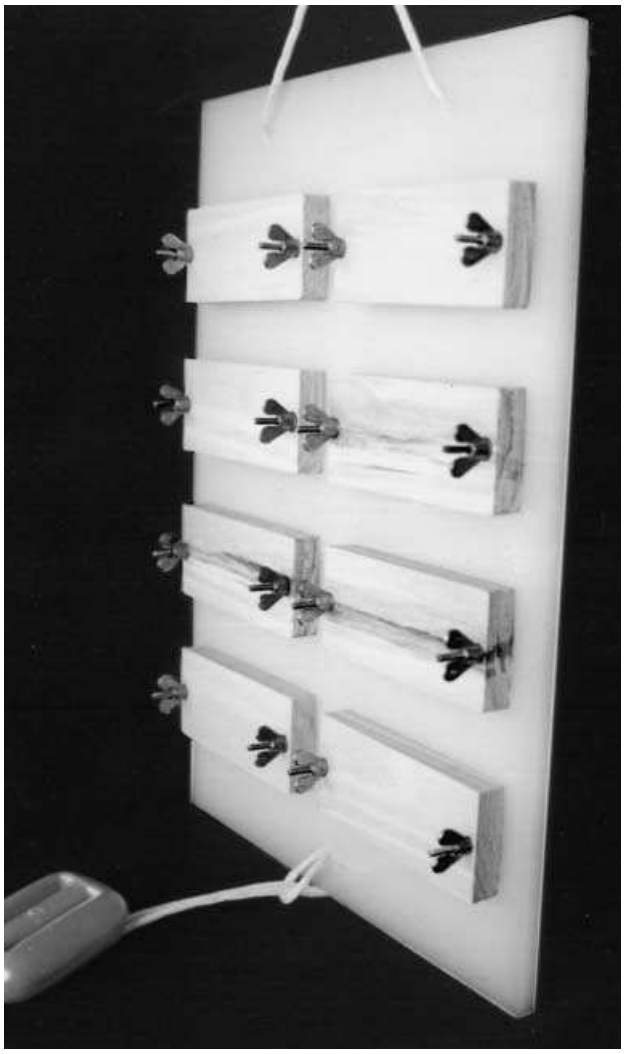

Figure 21. Experimental wood panels placed on an acrylic base for experimental studies of woodborers. On the reverse are other small acrylic panels for biofouling experimental studies. (M. Grosso)

The biofouling of the site shows variations related to water temperature: those panels which were immersed during the six warm months show a greater biomass and a higher taxonomic diversity. This means that the clean substrates which were submerged at the beginning of the cold season reach their climax within one year, while if the initial immersion takes place at the beginning of the warm season it is possible to have two climax stages within the same year. All of this indicates that Patagonian biofouling is

Table 3. *Main associations observed macroscopically between fouling species and different archaeological materials*

Materials	Substrate surface	Fouling associations (assemblages)	Biodiversity (B1) and Biomass (B2) levels
Glass	Smooth surface (bottles)	Associations represented by several invertebrate groups (Coelenterates: small anemone species); (Polychaetes: calcareous tube species of the Spirorbinae Subfamily and organic tube worm *Thelepus* sp.); (Molluscs: Gastropod species *Crepidula dilatata* and *Calyptraea costellata*); (Briozoans: encrusting dominant species *Membranipora hyadesi* and arborescent species *Hippotoa bouganvillei*).	B1: Medium B2: Low
	Rough surfaces (windows emery glass panels)	Associations represented by several invertebrate groups and chordates (Coelenterates: small anemones species); (Polychaetes: calcareous tube species of the Serpulidae Family and tube worm species of the Terebellidae and Nereidae Family); (Mollusks: Gastropod species *Crepidula dilatata, Calyptraea costellata, Lucapinella henselli* and *Pereuthria plumbea*); (Crustaceans: Isopods *Cassidinopsis* sp. and *Exosphaeroma* sp.); (Cirripeds: *Balanus laevis* and *B. psittacus*); (Briozoans: encrusting species *Membranipora hyadesi, Bowerbankia gracilis* and arborescent species *Hippotoa bouganvillei*); (Tunicates: solitary species *Ciona* sp., *Molgula* sp., *Paramolgula gregaria, Corella eumyota, Sycozoa gaimardi, Amaroucium* sp. y *Polyzoa opuntia*).	B1: High B2: Medium
Wood	Small pieces of wood on the surrounding sediment	Associations represented by several invertebrate groups: (Coelenterates: small anemones species); (Briozoans: arborescent species *Hippotoa bouganvillei*).	B1: Low B2.:Low
	Ship structural wood components (frames and beams)	Associations represented by algae, invertebrates and chordates: (Algae: red species *Rhodymenia* sp., *Ceramium* sp.; brown species *Dyctiota* sp.); (Coelenterates: small and large anemones species); (Tunicates: solitary species *Cnemidocarpa verrucosa, Paramolgula gregaria, Molgula* sp., *Ciona* sp., *Corella eumyota*; colonial species *Sycozoa gaimardi*, *Amaroucium* sp., *Didemnum* sp. and *Polyzoa opuntia*).	B1: Medium B2: High
Metal	Iron	Associations represented by algae and invertebrates: (Algae: red calcareous species *Lithothamnim* sp.); (Coelenterates: small anemones species); (Polychaetes: calcareous tube species of the Spirorbinae and Serpulinae Subfamily); (Mollusks: Gastropod species *Crepidula dilatata*); (Briozoans: encrusting species *Membranipora hyadesi Bowerbankia gracilis* and arborescent species *Hippotoa bouganvillei*).	B1: High B2: Medium
	Lead	Represented by only one invertebrate group (Mollusks: Gastropods species *Crepidula dilatata* and *Calyptraea costellata*).	B1: Low B2: Low

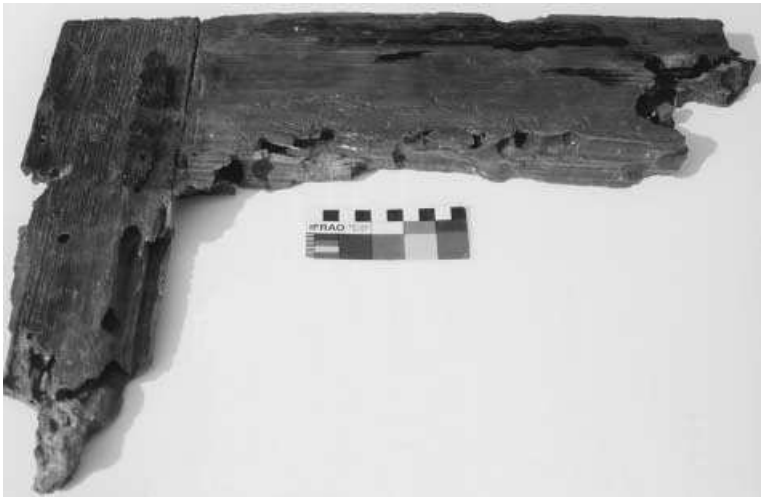

Figure 22. Window- or door-frame attacked by local wood-borer species. (M. Grosso)

Figure 23. Climax stage of biofouling at the *Swift* site, with clear dominance of the tunicate *Paramolgula gregaria* after one year of development. (D. Vainstub)

comparable, in terms of both growth and aggressiveness, to data from areas in Northern Argentina with more temperate waters (Bastida, 1971; Bastida and Brankevich, 1980; Bastida *et al.*, 1980) (Fig. 23). In the case of the experiments with wooden panels, to date no marine borers have been recorded macroscopically. Nonetheless, further inspections with X-rays and CT scans might detect the presence of juvenile specimens.

The biofouling communities of the *Swift* site are similar to those of other Patagonian harbours and localities (Bastida, 1973), although they have less taxonomic diversity than natural benthic communities associated with rocky substrates. This could be due to the effect of materials such as wood as substrates. On the other hand, the lower presence of botanical species in the biofouling is probably due to the lower light intensity in comparison with shallower natural communities. Despite preconceptions about low biofouling activity in cold waters, it is possible to state that it is present throughout the year, with quite fast-growing development periods, specially during spring and summer. In such seasons high values of biomass are achieved, as well as considerable thickness of the community, sometimes over 10 cm after one year of immersion. The climax community is mainly dominated by the tunicates *Paramolgula gregaria* and *Cnemidocarpa verrucosa* which, when they complete their biological cycle, can cause significant detachments of the biofouling. There is no doubt that biofouling is a factor which must be taken into account in order to assess the evolution of the *Swift* site. As for the relationship between different substrates and their associated species, wood presents a lower diversity, glass and iron a higher diversity.

The degree of chemical and mechanical effects of biofouling on the archaeological remains is still to be assessed. A preliminary observation is that the detachment of tunicates can exfoliate the wood. Additionally, the force of currents on the bulky colonies of tunicates attached to highly-exposed structural remains, such as frames and beams, can exert a destructive mechanical action. From a different point of view, biofouling organisms could protect archaeological materials from the water or sedimentary erosion and from the action of wood-borers (Nair, 1962; Nair and Saraswathy, 1971; Pournou *et al.*, 2001). The presence of marine-borer galleries in the upper works of the *Swift* is a clear indicator of *in situ* attack, that is, after the ship sank. Nonetheless, to date we cannot determine whether the wood-borer attack started before the wrecking in the lower works, extending to the upper works after the ship sank, or if all the attacks are post-depositional. Other observations suggest that in the last decades there have not been signs of marine-borer activity in the area. A good example is that the centenary pier at Puerto Deseado has not been attacked. On the other hand, as stated above, no differential attacks according to wood type have been detected.

The predominantly anaerobic conditions of the sediments, which limit the development of organisms, protect the organic remains from biodeterioration, which, in the case of wood-borers, can be quite fast and aggressive. Some perforated wood pieces found below the sediments must have been attacked during initial stages prior to the increasing sediment protection of the site. The finding of two valves confirms the presence of Teredinidae on the site, although it is not a sufficiently diagnostic element to determine the species. On the basis of previous data for the

region, it could be *Lyrodus pedicellatus* or *Bankia martensi* (Bastida and Torti, 1972a). Certain traces recorded in several wood remains suggest that there could have also been a previous stage of attack by the mollusc *Xilophaga globosa*.

With regard to the experimental studies, we can already state that the size which was selected for the monitoring panels proved to be appropriate for periods shorter than 6 or 9 months. For longer immersion a minimum size of about 30 × 30 cm is recommended. Although there are no hints of attack of limnorid isopods in the wreck, their presence has been recorded in the province of Buenos Aires, in the Northern coast of Patagonia and in Malvinas/Falkland Islands (Bastida and Torti, 1972b). Finally, it is worth mentioning the potential destructive action of the giant kelp *Macrocystis pyrifera* which drifts in the estuary and get entangled in the exposed structural remains, such as frames and beams, exerting a great mechanical pressure on them due to the strong currents.

Final remarks

In the previous sections a thorough and up-to-date review of the HMS *Swift* research project has been presented. Our preliminary results can already shed light on several of the topics addressed in our research aims. The role of the *Swift* within the geopolitical context of the time seems to be related to maintaining the strong strategic position of Britain in the South Atlantic (particularly for controlling maritime routes and economic resources), specially in view of recurrent potential conflicts with Spain and France. In spite of being a relatively young vessel at the time of sinking, the evidence suggests that the *Swift*'s structure had experienced several modifications, some quite significant. These mainly affected the deck-layout, and could have been aimed, among other things, at improving spatial conditions inside the ship. These changes took place without altering the lines of the hull, probably because its sailing conditions were considered satisfactory.

The main conclusion from the preliminary survey of anchors and armament is that both are consistent with what would be expected on an 18th-century British sloop-of-war. The artefact collection provides interesting information on a range of topics. Within the tableware, all the 'oriental-style ceramics' for which a location has been recorded were found in the captain's cabin. It is probable, therefore, that the entire oriental assemblage comes from the same place and might constitute a good indicator of the relationship between material culture and social hierarchies on board. Chinese porcelain has long been recognized as the highest quality ceramic, used and acquired by royalty and the elite in China and abroad. However, after the introduction of porcelain in Europe, its use gradually extended to the middle classes (Hume, 1982; Staniforth and Nash, 1998). The main English pottery-types were used by the middle classes of the time and do not necessarily represent luxury, but must have been significant for the crew in terms of their British identity (Staniforth, 2003; Dellino, 2004). It is worth noting that some 18th-century English ceramics with moulded patterns like the ones found on the *Swift*, as well as Chinese porcelain, have been reported among surface finds from Port Egmont (Barker, 1996 and pers. comm.).

The glassware from the *Swift* sheds light on technology, function and eating-habits. From a technological point of view, what was found was representative of the chronological and cultural context under study, but it is worth considering what was not found. For example, although clear glass seems to have been preferred in England throughout the 18th century (Payton and Payton, 1976: 55) coloured glass was also made in England at the time, in shades of green, blue (such as the famous 'Bristol blue'), red and purple. The drinking glasses from the *Swift* also lack decoration, whether engraved or painted, or any of the many varieties of air twists or opaque twists popular in stems throughout the century.

Regarding artefact function, as has been discussed elsewhere (Elkin, 2003a), our finds demonstrate a 'secondary function' for glass artefacts, as places to store mustard and pepper seeds. This type of re-use for a different function can be a recurrent situation on board vessels, where space and materials must be optimized. The seeds, as well as the penguin egg, provide interesting information about the eating habits of people on board and, in the case of the egg, the use of local resources. It is worth keeping in mind that none of these food items was mentioned in historical documents among the victuals supplied by the Admiralty, thus representing a significant example of the kind of data that sometimes only the archaeological record can provide.

Finally, regarding site-formation processes and site dynamics, the results of the studies and monitoring conducted to date are sufficient to reveal that the *Swift* is being affected by a series

of natural destructive agents, such as marine borers. But the real threat is not the natural environment, but the constant growth of the harbour, and the consequential increase in shipping passing the site, and potential damage from propeller-action, or from the construction work taking place very close to the *Swift*. In any event, it seems clear that the research and excavation of the site is approaching the status of rescue archaeology. A really 'swift' action is needed.

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