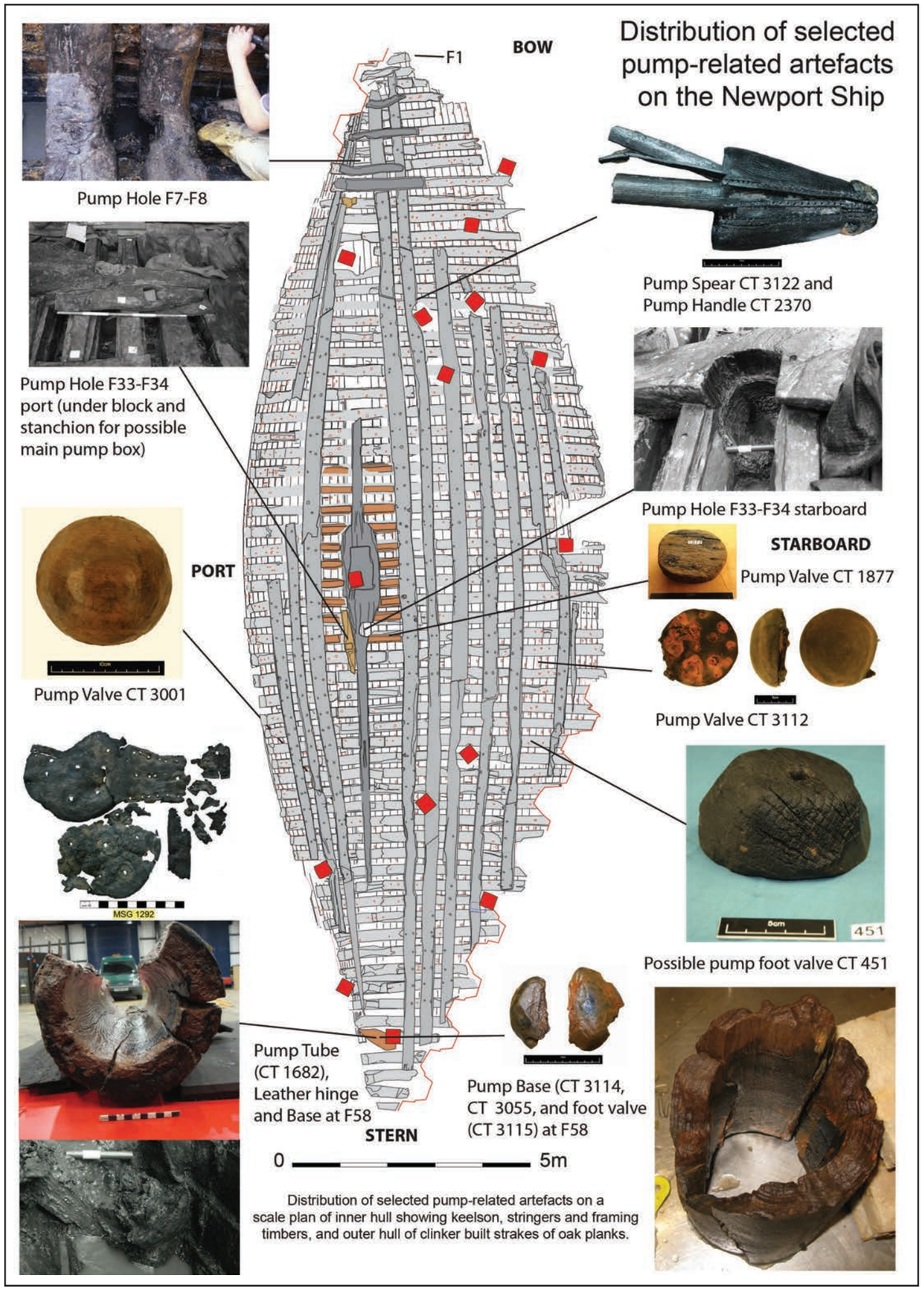
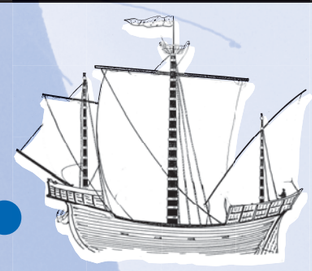


Distribution of selected pump-related artefacts on a scale plan of inner hull showing keelson, stringers and framing timbers, and outer hull of clinker built strakes of oak planks.

S.O.S.



News from the
Friends of the Newport Ship

No. 21

September 2013

Ship Update!

£3.00

Free to Members

- Editorial
- Conservation news by Marie Jordon
- The specialist reports A summary by Toby Jones

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Charity Number 1105449

Editorial

This edition of SOS has changed. From now on the Friends of the Newport Ship will issue separate news sheets to give general updates on the ship and our activities. They will include our serious concerns over the lack of future funding and the absence of plans for the eventual display of the ship. SOS will appear less frequently, with more specialist articles.

This edition of SOS includes updates on the ship. Most of the specialist reports commissioned to investigate different aspects of the ship have been received. The text for a detailed publication should be ready later this year. Eventually this will be published by the Council for British Archaeology.

This new information has fundamentally changed what we know about the Newport Ship. We now know that the initial construction of the ship dates to AD 1449 or later, probably in the Basque territory. We know more about construction of the ship, life on the ship, and environmental conditions at the time. In addition the illustrations of the artefacts from the ship by Anne Leaver and the reconstruction drawings of the ship by Pat Tanner are spectacular.

Anne Leaver is a professional artist and archaeological illustrator, possibly best known to the Friends for her birds-eye view of Medieval Newport. Pat Tanner is a traditional shipwright, boat builder, and sailor from Cork, Ireland with extensive naval architecture experience. His unique combination of skills has been brought to bear in the Newport Ship reconstruction efforts. With generous grants from the Welsh Government (through CyMAL), the Friends of the Newport Ship and Newport City Council, the project has been able to undertake ground-breaking digital reconstructions of the original hull form.

Our guide book, *Newport Medieval Ship A Guide*, edited by Bob Trett, first published in 2010 and re-issued with revisions in 2011, provides a basic background to the story of the ship. This fresh information and the new illustrations can be used as an update to sections of this guide.

Description of cover:

The minimum hypothetical reconstruction of the Newport Medieval Ship created by Pat Tanner.
See pages 8 - 9 for more of Pat's excellent reconstruction drawings

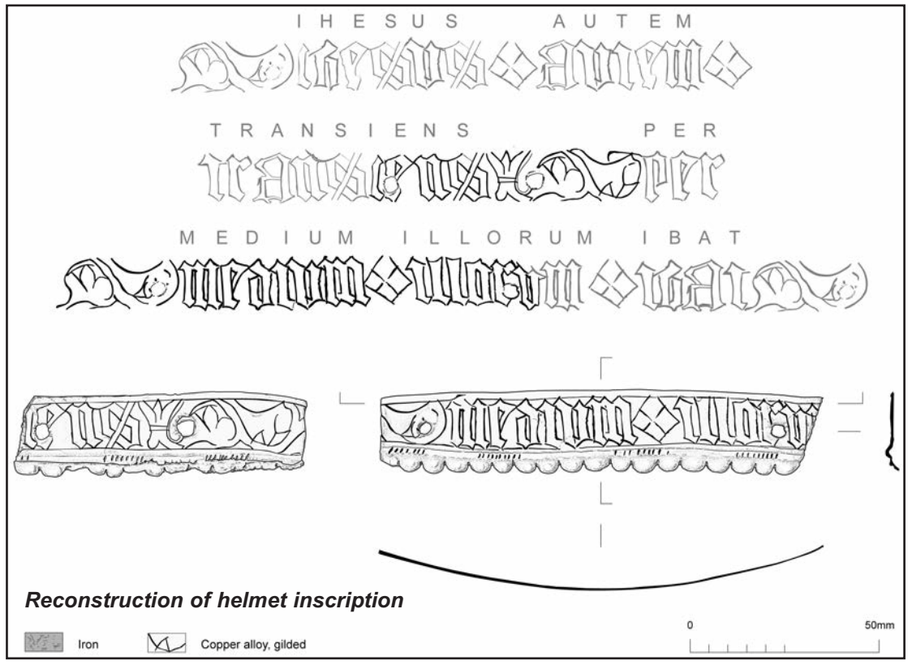
Conservation News

It's been a busy year in conservation at the Ship Centre. The freeze-dryer is humming along (literally!), and the timbers coming out look fantastic. The PEG method has worked beautifully, with the wood bulked and strengthened, but without too much excess PEG, so very little post-drying cleaning needs to take place. The timber has a natural colour and feel, and has avoided the dark, waxy look that wood that has absorbed too much PEG can take on.

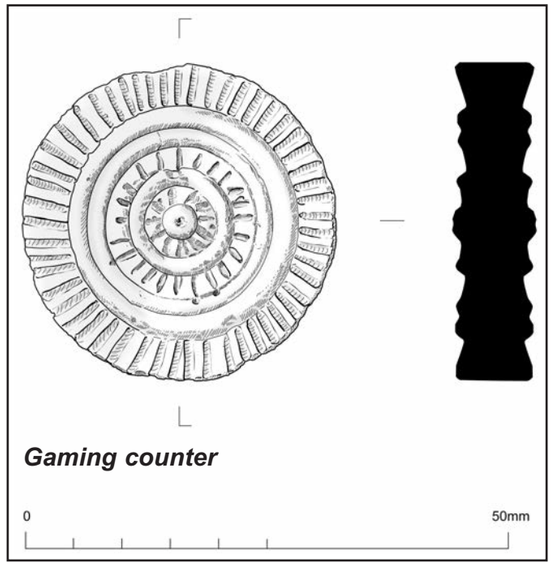
It's not all about the ship, though, as all of the small finds have now been conserved. Yes, at long last you can see the gaming piece, awl, and bowls without peering through a box of water! They should shortly be going on display at the museum, alongside some of the rigging and other artefacts.

The timbers still in their treatment tanks look good, as we learned when moving the tanks so that the warehouse could be divided. We've had our last - ever delivery of PEG, so all of the larger objects like the barrel staves and the pump are nearing the end of treatment. If all goes well, all of the non - ship timber objects will be dry by the end of the year.

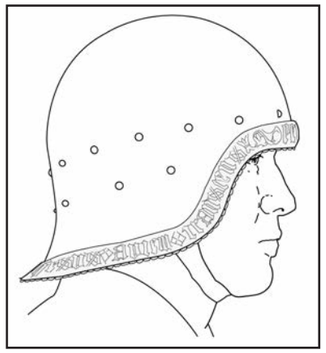
Marie Jordan

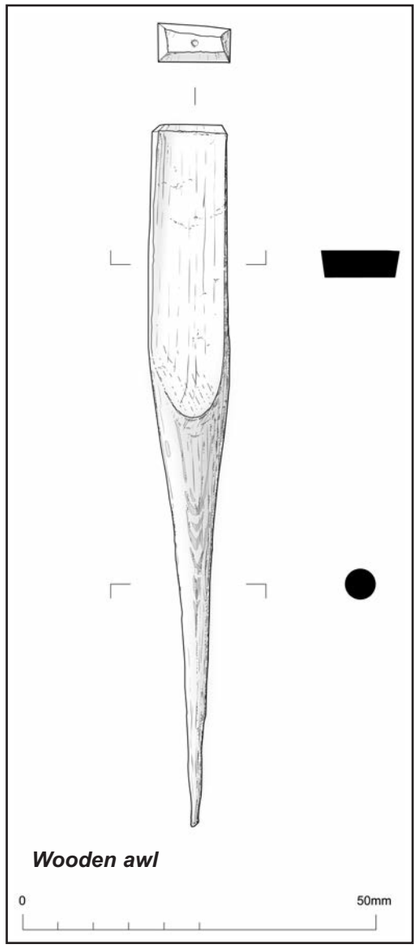


Reconstruction of helmet inscription

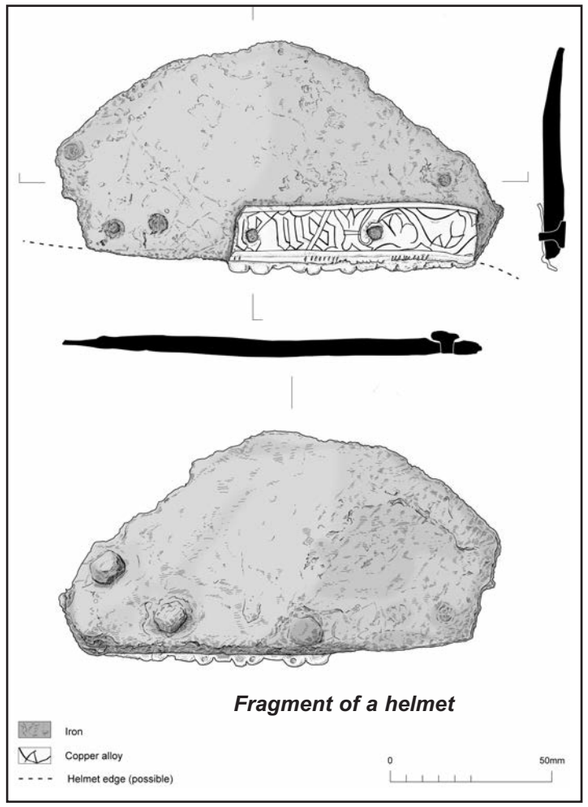


Gaming counter

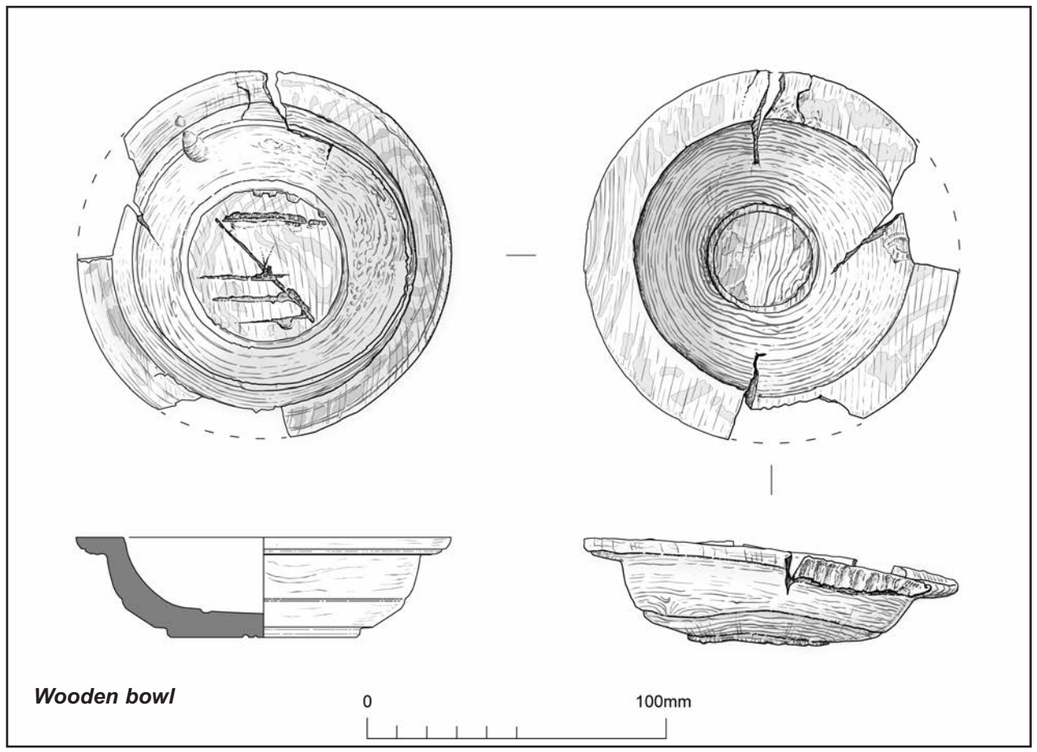




Wooden awl



Fragment of a helmet



Wooden bowl

Summary of Newport Medieval Ship Specialist Report Information

By Toby Jones

During the post-excavation research phase of the Newport Medieval Ship Project, dozens of specialist researchers were consulted for information and analysis about specific material types, such as metal or stone, and investigation of functional artefact groups, like tools or clothing. The fascinating and detailed research carried out by some of these specialists is summarised below. The full archive reports will be freely available in the soon-to-be-published online archive. These reports help to round out the picture of life onboard and around a 15th century medieval merchant vessel, and compliment the detailed archaeological analysis of the hull structure.

The Newport Medieval Ship Project is currently working with Bristol University to organise a major conference about the economic & political world of the Newport Medieval Ship. Experts from around the UK & Europe will come together to place the ship in its wider medieval context. The conference is tentatively planned for 17 - 18 July 2014. More information will be in the newsletter & the website.

Brief Summary of the skeleton found during the Newport Ship excavations

By Dr. Ros Coard, University of Wales Trinity Saint David

The Newport Body is a partial skeleton consisting of a headless upper torso and lower limbs which is truncated at the knees. Skeletal analysis shows that the Newport Body is a male, that he is a very muscular individual, especially in the upper arm region and is most probably right handed. The one surviving humerus is very muscular and bowed suggesting very strong upper arms which may be work related. The lower arm bones are less robust but still well developed. The individual could be described as 'robust' with a stocky physique with estimates of around 11-12 stone (70-80 kg.) and a height of 5'6" to 5'8" (172-176 cm.) in terms of stature and height.

There are difficulties in aging (years old at death) the individual as the many of the features of the skeleton used to age individuals are either no longer surviving or are poorly preserved. Thin sectioning of a segment of bone from the femur has been taken for the purpose of counting the osteons in the hope a better indication of his exact age at death can be determined.

The radiocarbon date places the Newport Body at the Late Iron Age/Earliest Romano British period. The Iron Age is known to be a time of ritual deposition into rivers and there are many archaeological examples of this. (*Although there is no evidence to prove this is the case with the Newport Body - Ed.)* Interestingly from a British context it is mostly the heads that are recovered. The Newport Body is a rare example of body minus the head being recovered.

It was also noted that the surviving bone is remarkably well preserved with none of the expected and usual decay due to putrefaction. This suggests that he died and was covered very rapidly in an anaerobic environment where the natural bacteria were not able to take hold. The collagen (organic content of the bone) has survived well and may well indicate the extraction of DNA a distinct possibility. Radiocarbon dates suggest that the individual has no relationship with the Newport Ship and it would appear a fortuitous set of circumstances (as far as the archaeological community is concerned) that he should be so close to the ship and was recovered due to the excavation of it. Had he been a few metres further down stream he may have remained undiscovered. The body raises interesting questions for archaeology, fluvial taphonomy and forensic archaeology.

Cordage, Basketry & Textiles

By Toby Jones

The cordage, basketry and textiles found during the excavation were carefully cleaned and recorded, before being analysed by Penelope Walton Rogers.

Cordage

Ships carried a large amount of cordage in the form of running and standing rigging, though it is rare to find substantial quantities of cordage surviving from archaeological contexts. The upper works of a vessel are often the first to degrade after a ship has been abandoned. Ropes are also salvaged for reuse. However, a substantial and diverse range of cordage was discovered during the excavation, both inside and underneath the vessel. The recovered cordage was made from either grass or hemp and ranged in size from 12mm to 40mm in diameter. The smaller ropes were used in the running and standing rigging, while the largest ropes, known as hawsers, were used for mooring and towing. Some rigging elements, including a pulley, were found to have fragments of rope still in situ.

Illustration: Rope

Textiles

Most of the textiles found during the ship excavation are fragments of well-spun natural-colour wool, woven into a heavy, coarse cloth ideally suited for making durable work clothes required by mariners. The textiles were all woven using a 2/2 twill weave or a tabby weave. Several examples have darker stripes surrounded by a lighter background. Most of the textile fragments seem to have been serving secondary purposes, such as plugging leaks, indicating that the sailors were resourceful in the reuse of worn out clothing.

Illustration: Textile

Basketry

The majority of basketry found during the ship excavation is related to the pump basket near the main mast step. This basket was made from willow and designed to act as a filter, keeping mud and debris from entering the ship's pump. Fragments of a probable pump basket were also found in the stern of the vessel, near the remains of a pump tube at F58.

Faunal Remains

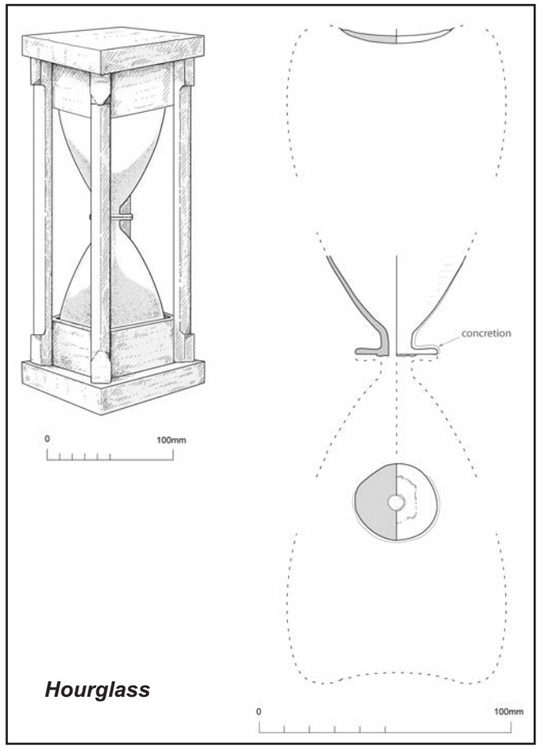
By Toby Jones

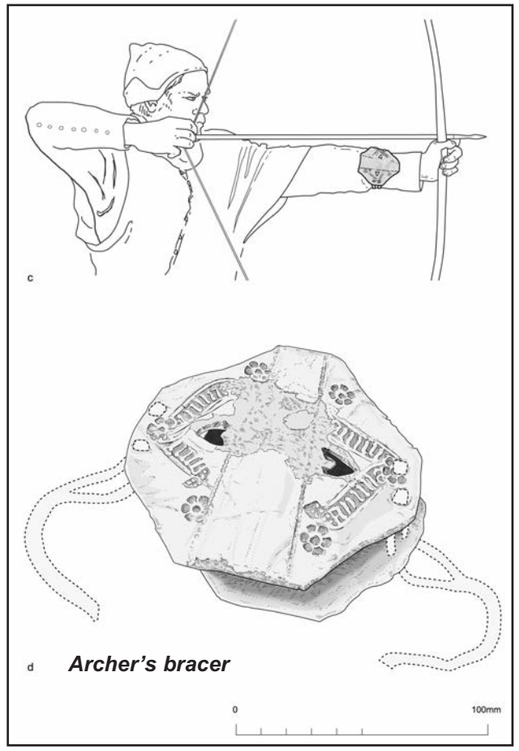
Over a thousand animal and fish bones, and numerous shellfish, were recovered during the excavation of the Newport Ship and the subsequent processing of environmental samples. Animal and fish bones can inform us about trade, diet and life on board. Specialist analysis of the animal bones was undertaken by Dr. Ros Coard. The majority of animal bones recovered belong to domesticated cattle, pigs and sheep/goats. Many of the large mammal bones show signs of butchery, with selected parts of the carcass being cut into joints. Certain bones provide evidence that the larger mammal carcasses were split and quartered, with some cut marks indicating that the butcher was right-handed and quite skilled. The butchery marks on other bones indicated that the animals kept alive for use later in the journey. The mixed nature of the animal bone assemblage indicates that a mixed diet of fresh and preserved (smoked, salted, brined) meats were carried on board the vessel. Other animal bones recovered include mandibles (jaws) from black rats and substantial quantities of domestic fowl bones, suggesting that the crew shared the vessel with a variety of living creatures, useful or otherwise.

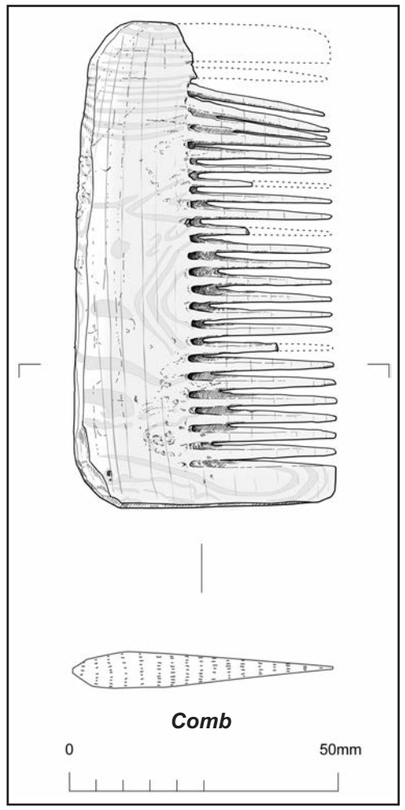
The fish bone, analysed by Dr. Hannah Russ, was found to be quite diverse in terms of species. Substantial amounts of recovered cod bones suggest the use/transportation of dried stockfish. Other species recovered include Atlantic cod,

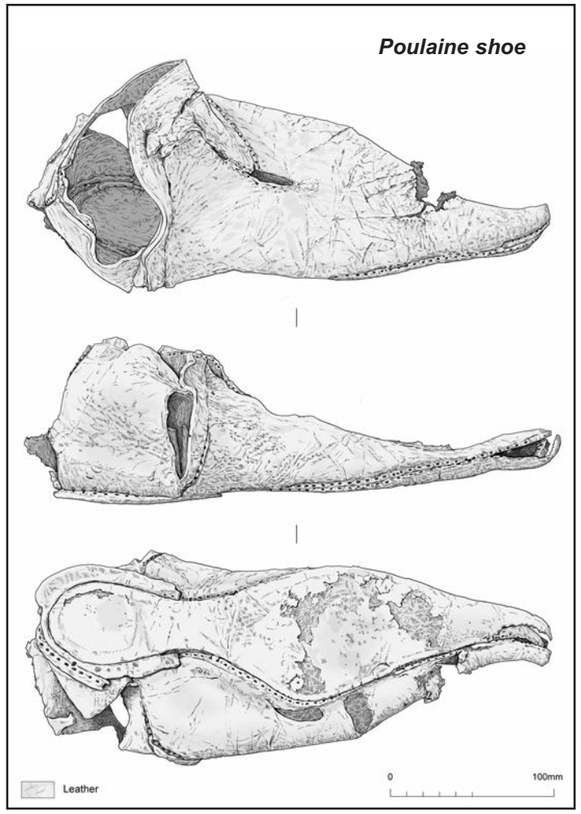
More Artefacts drawings

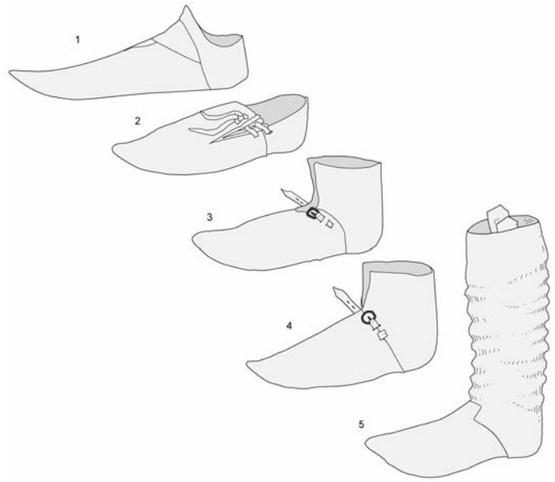
by Anne Leaver











Examples of shoes and boots

technological innovation in the late medieval period.

The archer's wrist guard, or bracer, is a fine example of medieval leatherwork, with embossed decorations and the Latin word *amilla,* which translates as bracer. It shows wear marks consistent with the repeated shooting of a bow. The bracer is made from cattle hide, with a calfskin lining. It would be common for medieval vessels to carry selected defensive weapons in order to protect against attack by pirates.

Eight distinct leather shoes and three boots were recovered during the excavation. Numerous other shoe parts were also found, drawing attention to the ubiquity of leather footwear during this period. Several of the shoes had long, pointed toes, which were stuffed with moss to hold their shape. Referred to as pikes or poulaines, these shoes were highly fashionable and subject to 'sumptuary laws' in the medieval period, These laws were designed to enforce traditional social and economic hierarchies and limit expenditure on luxury items. The specific effect on the long-toed shoes was to limit the length of the toe to two inches. The long-toed poulaine shoe found on the Newport Ship exceeds this law by over an inch!

Leather reuse was common during the medieval period, with boots and shoes being resoled or repaired several times. Leather from the relatively unworn upper part or leg of a boot could be cut off and reused. There is evidence that some of the shoes found on the ship were made from cut down boots. A large number of leather fragments were found during the excavation, which may represent those fragments of shoes that could no longer be economically rebuilt. The shoes and boots found came in a range of sizes fitting adolescents and adults, with both right and left handed footwear being identified, but with no matching pairs. Substantial amounts of waste leather were also found in the bow of the vessel, but this may represent waste leather produced by a shoemaker or cobbler and dumped inside the vessel after it came to rest in Newport.

Artefacts

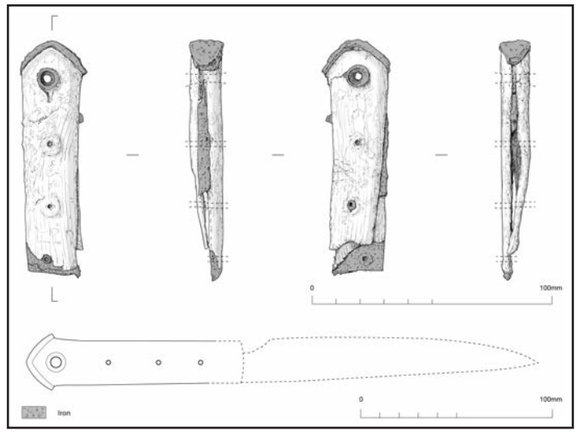
By Toby Jones

Hundreds of unique artefacts were discovered during the Newport Ship excavation. Wooden bowls, combs, and a gaming piece were amazingly well preserved and are richly illustrative of the daily life of the sailors and merchants onboard. Tools found onboard include a mortar, knife handle, awl and sandglass. Stone shot, decorated helmet fragments, and an archer's wrist guard are evidence that the ship carried defensive weaponry to protect against piracy and other unwanted visitors.

The boxwood knife handle corresponds closely with other mid-15th century examples. A replica of the knife was created by Hector Cole, the same blacksmith who made the set of medieval shipbuilding tools on display at the ship centre. (High-quality handmade replicas of the Newport Ship Knife are available, contact the ship centre if interested).

The wooden combs have been successfully conserved, and are ready to go on display in the Newport Museum. The combs, made from boxwood, closely match other contemporary examples. Medieval combs made from wood are more common than ones made from bone or ivory. One of the Newport Ship combs is double sided, with coarse and fine teeth. The coarse teeth are for straightening the hair, while the fine teeth are for removing lice!

Large amounts of fragmented pottery were found, with the majority being sherds of Portuguese Mérida-type ware. The pottery was examined by Dr. Mark Redknap, who determined that the sherds were from a variety of objects, including pitchers, jugs and jars with lids. The items appear to be primarily for use on board the vessel, as opposed to cargo. Similar Portuguese ceramics have been found on several comparable shipwrecks.



Knife Handle from the Newport Ship

Replica Knife

European hake, ling, tusk, Atlantic herring, skate, ray or small shark, blackspot seabream, European conger, flatfish and Atlantic salmon. Some of the cod and ling were over a metre in length. The fish remains could represent food stuffs carried for use on the voyage or trade goods. Additionally, fish could have been caught and consumed fresh during the voyages.

Several different types of shellfish were recovered during the ship excavation with the most common being the native oyster, with additional examples of whelks, mussels and cockles. The later specimens could have been a by-catch of raking or dredging for oysters, which served as a 'poor man's food' in centuries past, only becoming a delicacy when they became more scarce due to over fishing and habitat degradation. Shellfish would have served as a readily available food source when ever the ship was in shallow coastal waters.

Insects

By Toby Jones

During the ship excavation, numerous environmental samples were taken. The samples consisted of clay and silt taken from the areas between framing stations in the ship and from other areas of the main excavation. Trapped and preserved in this mud were the remains of numerous artefacts and 'ecofacts,' which include plant seeds and insect remains. These insects remains had the potential to reveal details about the cargo, range of operations and life on board the vessel. Five samples were selected and analysed by Dr. David Smith.

The samples were processed and the insect remains were collected and identified using a microscope. Many species of beetles and flies were noted, with some specimens, like the wood-boring *Sinoxylon sexdentatum* having never been found in the UK before. Woodworms (actually a beetle - *Anobium punctatum*) were also found, and could indicate that the ship carried a cargo of infested wood, or that the upper works of the ship were infected. As no insect damage was noticed on the lower part of the hull, it seems more likely that the ship carried an infected cargo at some point.

Beetles and weevils that target stored grain and those that are indicative of decaying hay and straw were also discovered throughout the vessel. The grain pests indicate that the ship was likely carrying legumes and grains as provisions and trade goods, while the beetles associated with decaying grasses suggest the presence of animal bedding on board, and hence, live animals. It is also possible that some of the insects may have been present in low quality food, such as horsebread, which may have been used as fodder for the animals onboard (and sustained the crew, in times of hardship).

A substantial number of human fleas and one dog flea were discovered preserved in the mud of the bilges, along with 1000s of flies and fly larvae. The presence of such insects indicates that the conditions below deck and near the bilges were quite foul, with sewage or cess mixing with the saline bilge waters and creating an unhealthy environment containing biting insects and disease carrying flies.

The Waterlogged Plant Remains

The Newport Medieval Ship Project has undertaken extensive analysis of the water logged plant remains recovered during the ship excavation. This research, carried out by Wendy Carruthers and Dr. Allan Hall, has revealed information about the diet, cargo and dunnage used onboard the vessel in the mid-15th century. The majority of the material was found within environmental samples taken between the frames of the vessel, down in the bilges of the ship. Substantial amounts of food waste (including nut shells and fruit stones), sewage and spilled cargo collected here during the working life of the ship and were preserved by the overlying alluvial mud and waterlogged conditions.

Analysis of the food remains has revealed the wide variety of plants, fruits and vegetables that were carried on board for human and animal consumption or as cargo. Durable items like walnuts, hazelnuts, almonds, pine nuts, pomegranates, millet, grapes (as raisins), figs and olives were ideal for sea voyages,

with a low risk of spoilage. Other foodstuffs include mustard, coriander, and dill, as well as flax, hemp and hops. Certain foods, like peaches and apples, were likely eaten fresh. Some food remains, like fig seeds and grape pips were evenly distributed throughout the ship, suggesting that they were consumed and that the resulting sewage entered the bilge before becoming dispersed. Carruthers notes that, when considered as a whole, this assemblage of food remains is more representative of a southern European diet than of a British one. It is important to emphasise that many of these items could also have been carried as cargo, with small amounts of the inevitable spillage becoming trapped in the bilges.

The ship probably often carried a cargo of wooden casks, which could hold all manner of contents, wet or dry. These casks were placed in the hold of the vessel on a layer of plant material called dunnage. This organic layer protected the casks from sharp jolts and damage during heavy weather, and together with wedge-shaped wooden chocks, help to secure the casks while at sea. Most of the environmental samples analysed contained large quantities of prickly juniper leaves of a species that grows in south-western Portugal. These samples also contained quantities of heather, which, upon close inspection, contained flowering bodies, indicating that they had been harvested in late summer (July-August). Dunnage was of low value and not economically viable to transport long distances. It could probably be freely collected on the dry coastal areas near the ports on the Iberian Peninsula. It is therefore likely that the Newport Ship used locally available fresh dunnage when picking up cargos of casks along the Atlantic-Iberian coast.

Distribution patterns of the waterlogged plant remains suggest that there may have been segregated areas of activity on board. For example, a variety of food remains were found in the bow area, indicating that food preparation or consumption might have occurred there. In contrast, cereals, millet, and certain weed seeds were found in the stern. These could be used as animal food and bedding, suggesting that the stern was an area used for keeping livestock or animal bedding / fodder.

Dendrochronology

By Nigel Nayling

Dendrochronology has played a key role at different stages in the Newport Medieval Ship project. It provided the first absolute dating of the site to the medieval period, thereby stressing the significance of the ship. The timely provision of dating information played its part in securing a future for the ship against a background of impending development and potential destruction. Subsequent correlation of well-replicated means predominantly from outer hull planks point to an Iberian origin for the ship. Dating of knees and riders, alterations and repairs to the later fifteenth century (including precise felling dates of AD 1465/6) against British chronologies imply episodes of repair and refit, some of which may have been in process when the ship was salvaged and abandoned. These correlations could also be taken to imply long running association between the ship and British waters pointing to the 'sphere of operations' within which the ship sailed and traded.

Original construction of the ship presumably started after AD 1449 - the date of the latest surviving ring on one of the absolutely dated hull planks. This dating has been achieved through correlation against a number of recently constructed site means from buildings in the hinterland of the northern Spanish Basque coast where the oak species *Quercus faginea* (indistinguishable on wood anatomy from a number of other deciduous oak species such as *Quercus petrea and Quercus robur*) predominates. At the present time, there are insufficient data to provide appropriate sapwood estimates for this species in this location. Until such data is collected, felling date ranges for the absolutely dated oak hull planks with heartwood/sapwood boundaries or partial sapwood cannot be calculated. This makes the collection and analysis of such data, preferably from living trees with similar age structures a research priority from a Newport Ship perspective.

The development of historical dendrochronology in the Basque area of Spain has been critical to understanding the origins of the Newport Ship. Export of timber from this area to another shipbuilding location, whilst possible, seems an unlikely interpretation of the data. Again, more research (particularly documentary) is needed to clarify the historical evidence for timber supply for shipbuilding in the region during the fifteenth century, as has been done for the sixteenth century with regard to the Red Bay wrecks (Grenier, Stevens & Bernier 2007). Nearly all the hull plank samples cross-matched to form a well-replicated site but other timbers appear to have been hewn from similarly sourced timber given correlations with bilge boards, fillers and one ceiling plank. The source location is however not well-defined and further development of site and regional chronologies in the region will be needed if confident dendroprovenancing is to be achieved.

The framing timbers analysed proved far more difficult to correlate with only seven tree-ring sequences along with that from one of the mast step braces cross-matching against each other. Ring sequences from 'compass' timber (i.e. timber with branching allowing selection to provide grown curved timbers) are inherently less likely to cross-match with the trees' morphology becoming a significant variable in ring width obscuring common climatic response. It is possible that active management of the parent trees could further impact on growth patterns. The absolute dating of framing sequences may yet prove possible - it is feasible that these trees were growing in an area from which we do not have contemporary chronologies stressing again the importance of improving temporal and spatial coverage for oak chronologies in Basque territory. Dating of oak struts from structure 1004, onto which the starboard side of the ship settled, to AD 1467 and in one case the spring of AD 1468 provide a precise date for the ship's likely final arrival in Newport.

crew and lost during voyages, becoming trapped in the bilges of the ship. The jetton was used by merchants as a counter and is made from brass or latten, a similar type of copper alloy common in the medieval period.

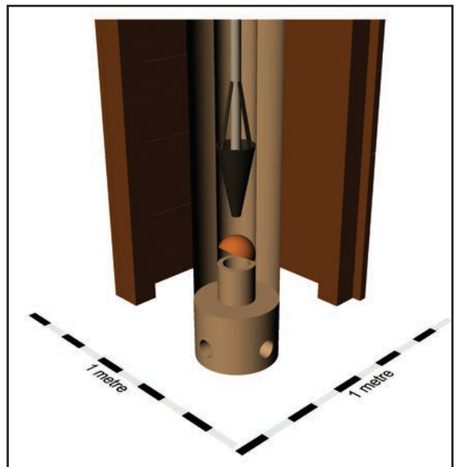
The most remarkable coin found, and one of the most significant artefacts recovered during the entire project, is the silver French coin of Louis II, Dauphin de Vienois (later King Louis XI of France), which was found purposely embedded in the keel of the vessel. A small rebate was cut on the inboard face of the keel near the forward end. The silver *petit blanc* was placed in the rebate and covered with tar and animal hair just before the stem post was attached, effectively sealing the coin in the fabric of the ship. The coin was actually found long after the excavation, during the detailed cleaning of the keel in 2006. The coin was in perfect condition and was identified as being minted at Crémieu in France between May and July 1447. This means the ship could not have been constructed before May 1447. This coin was placed in the fabric of the ship as a good luck charm, with a cross and the motto 'Blessed be the Name of the Lord'. Such practices date back to at least Roman times, and continue to today.

Ship's Pumps

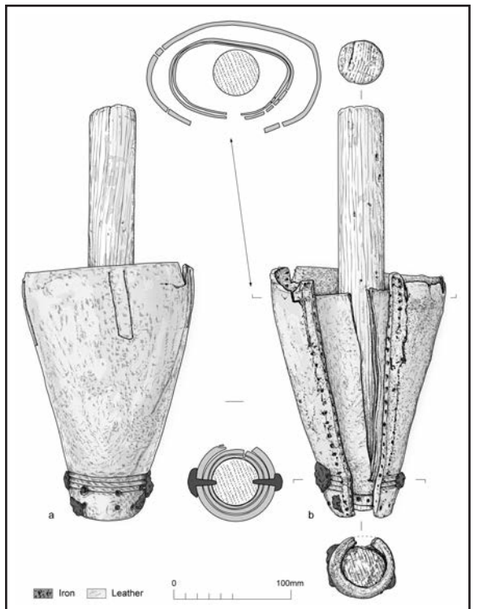
By Toby Jones

Several artefacts and objects relating to the ship's pumps were found during the excavation of the Newport Medieval Ship. These items include four pump holes, a strum box, pump tube, pump base, various foot valves, pump spear with handle and assorted basketry fragments. There was also a mortised block and associated stanchion that may have formed part of a box surrounding and protecting the amidships pump tube. Together these objects provide important evidence regarding the structure and function of medieval pumping technology.

There was a pump hole chiselled in between F7_0 and F8_0, along with a similar pump hole chiselled through F58_0 along the centreline axis of the vessel, just above the keel. The aft pump hole contained the remains of a pump tube, pump base and associated wood and leather valves. There was evidence of basketry in the stern pump hole, but no structure could be discerned. The amidships pump hole (at F33_0-F34_0, just off the centreline axis on the starboard side) contained a woven basketry strum box, but no other pump-related artefacts. There was an additional pump hole at F33_0-F34_0 (just off the centreline axis of the vessel on the port side), but this area was sealed up at some point during the use life of the vessel. Other parts of pumps, including several foot valves, were found scattered around the site. The illustration on the back cover shows the distribution of the many pump related artefacts discovered during the evacuation.



Reconstruction of a ship's pump



Pump spear (valve)

Leather Artefacts

By Toby Jones

Over 80 different leather items were recovered during the ship excavation. They were analysed by Quita Mould, and illustrated by Anne Leaver. The leather objects served a variety of functions on board the vessel, including the upper and lower valves from ship's pump, clothing, an archer's wrist guard, and numerous shoes and boots. The waterlogged nature of the site afforded excellent preservation of organic material, with some of the leather shoes still being held together with their original stitching!

One of the most interesting assemblages of leather artefacts are those relating to the ship's pumps. Pumps of the period consisted of hollowed out tree trunks with a cone shaped upper (or burr) valve, and a lower foot valve. Bilge water was drawn up the tube, and prevented from leaking out the bottom by the one-way foot valve. The use of leather was the ideal (if not only) material to make the durable hinges and cones necessary for the continuous operation of the pump. These pumps predate the earliest known similar pumps by nearly a hundred years, shedding light on

Metals and Slag

By Toby Jones

The majority of wrought iron fasteners used to build the Newport Ship were completely corroded, However, several nails were discovered during the cleaning process that still had a metallic iron core present. Metallurgical analysis, undertaken by Dr. Gerry McDonnell, looked at the composition, grain size and structure and slag inclusions of selected metallic iron samples in an effort to detect production patterns and origins. Several clenched nails from the original construction of the vessel and several repair spikes were analysed and compared. Iron bolts and slag found during the excavation were also tested and compared to the rest of the assemblage.

Metallurgical analysis revealed that the iron used to make the various fasteners was diverse in terms of composition and therefore origin. Some original construction elements and repairs were of similar composition, while others were markedly different. Some fasteners had traces of phosphorus, indicating an alloy that was more corrosion resistant than unalloyed iron. However, it was detected at such low levels that it probably had a negligible effect of the corrosion resistance of the fasteners. No geographical production centres could be determined, however some details about the manufacture process of the fasteners were deduced by detailed examination of the microscopic inclusions present in the samples.

The majority of the fasteners have large and angular slag inclusions, which indicate minimal hot working during the smithing process, meaning the iron was likely worked into nails directly from the refined bloom. Such a situation could be indicative of a dedicated ship nail production centre, which might not be unexpected, as literally tens of thousands of nails, comprising many tons of iron, were required during the manufacture of the medieval ship. Consistency in the size of the clench nail shank and head diameter lends support to this theory. It was interesting to note that the repair fasteners could have been made using new iron (albeit from diverse sources) or by reworking existing fasteners, which had been removed from the vessel. The latter suggestion is supported by the smaller average grain size in the repair fasteners, when compared to the original fasteners, indicating that the iron may have been reworked, causing the larger initial grain structure to be broken up. It is clear that the total assemblage of iron fasteners was decidedly heterogeneous, which still wouldn't preclude a single production centre, but might indicate multiple suppliers of ore and smelters with their own 'secret' recipes.

Around 109kg of slag was found underneath and around the ship during the excavation. The slag was analysed and compared to the slag present in the iron fasteners of the ship. No matches or close correlations were detected, indicating that the slag was not related in any way to the fasteners present in the ship. It seems likely that the slag was purposely placed along the river bank in order to provide a hard standing for the ship to rest upon. In this scenario, the slag probably represents local industrial waste being reused.

Tar and Luting

By Toby Jones

When the hull of the Newport Ship was built, it was covered with tar to help make it waterproof. In addition, all the joints were filled with a mixture of animal hair and tar to prevent the ingress of water. These tars were sampled during the timber cleaning process and subjected to detailed analysis by Dr. Pauline Burger. The results show that the tar used in the original construction of the vessel was made from the destructive distillation of coniferous wood products, and, based on isotopic analysis, was probably manufactured in the Basque country.

Many repair planks or tingles were fastened to the hull during the working life of the vessel. These covered areas of cracking or damage, and were made waterproof by the application of more tar and animal hair. These tars were examined and compared to the tars from the original build, and, based on isotopic analysis, found to be from a different geographic origin, namely somewhere south of the Basque country. The use of tar also helped preserve the surface details of the timbers, with inscribed lines and construction marks clearly visible after cleaning.
The animal hair luting was also analysed, with Penelope Walton Rogers producing a detailed report covering samples from all parts of the hull. Luting from along the lands and scarfs of the vessel were compared to hair found in the keel-stem scarf joint as well as material from under the tingles/repair patches. The animal hair samples were found to consist of sheep's wool (primarily hill or mountain breeds), cattle hair, goat hair and horse hair. Some of the wool was dyed, and probably represents waste from the dyeing or spinning process. The other animal hair is likely tannery waste, which would have been cut or scraped off the hide during the tanning process and collected. The mixed nature of the animal hair is unusual, and may represent the use of a variety of sources to acquire enough material for luting such a large vessel. Given the probable mountainous origin of some of the sheep's wool, Rogers suggests that the luting materials 'were collected in a port with a hilly or mountainous hinterland.'

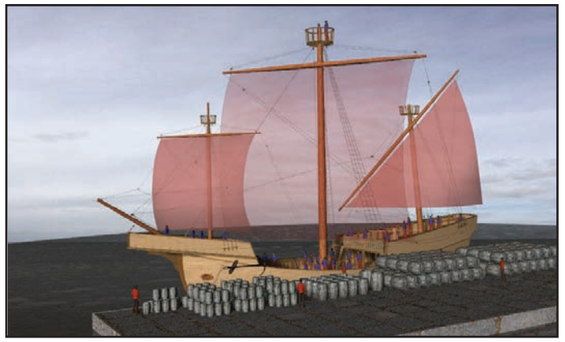
Coins

By Toby Jones

The coins found during the medieval ship excavation were analysed by Edward Besly from the National Museum of Wales. Six coins (five Portuguese and one French) and one jetton (from Nuremburg, Germany) have been recovered, all dating to the 14th or 15th centuries. The Portuguese coin assemblage consists of one *real preto* of Duarte I (1433-1438) and four *ceitils* of Afonso V (1438-1481). These coins were probably used by the

Hull Reconstruction, Rigging and Sailing Performance

By Toby Jones



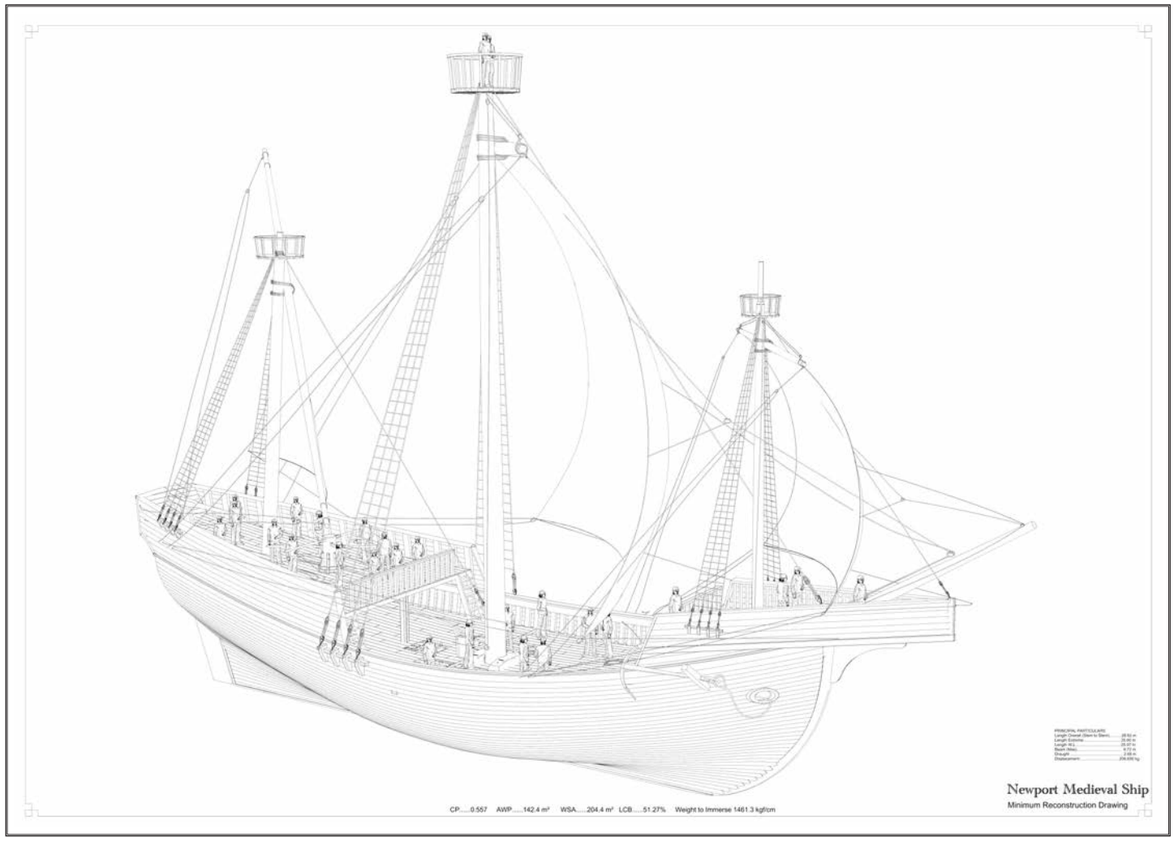
Cargo capacity of the Newport Ship

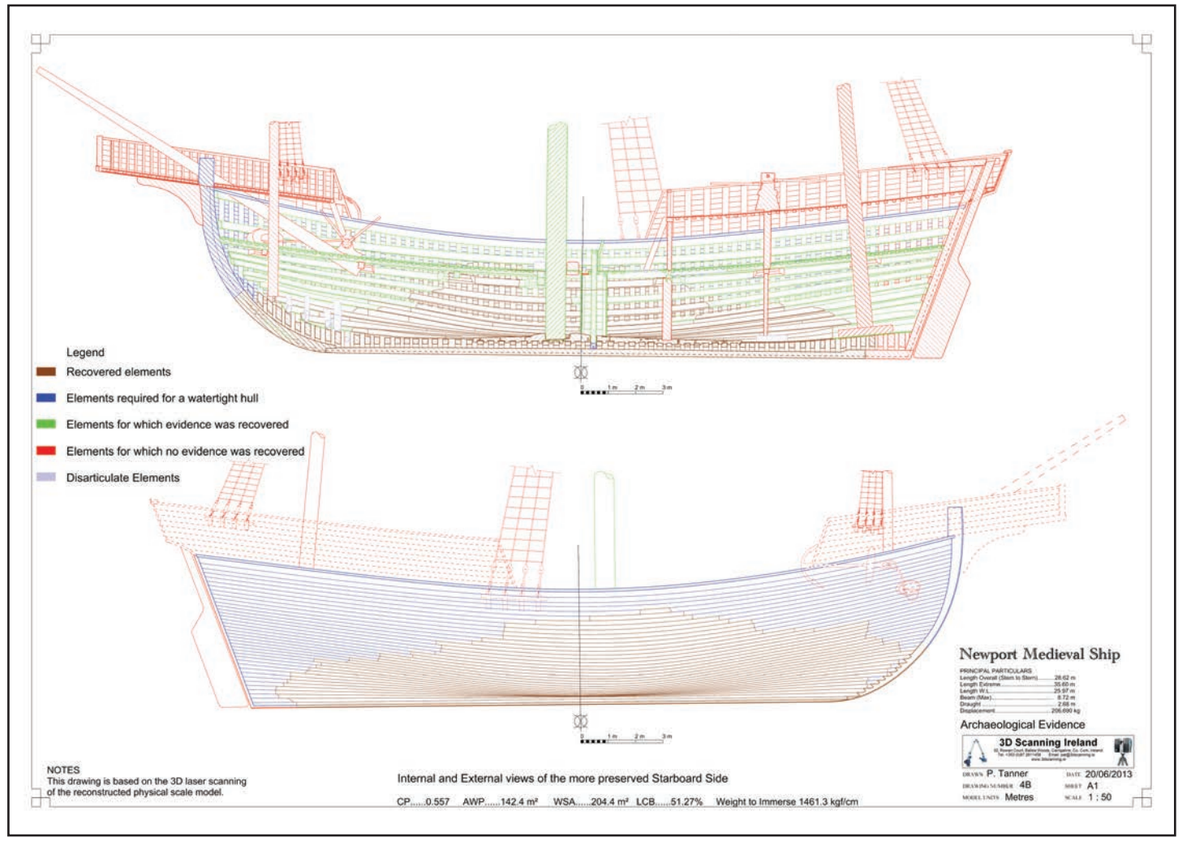
A minimum hull reconstruction was created using innovative digital modelling methods. Project staff created a 1:10 scale physical model of the extant hull remains using a process of digital solid modelling and a form of additive manufacturing (3D printing) called selective laser sintering. Using this model, the staff ghosted in the missing areas of the hull using long plastic ribbands. A reasonably-faired complete hull form was achieved, which was then digitised (laser scanned). This digital model of the complete hull was then used by Pat Tanner as a starting point for repairing the localised damage and twist present in the model, in an effort to create an ideal hull form representing the ship when it was newly built. Additionally, Erica McCarthy produced a detailed catalogue of the artefacts related to the rigging, which provided clues about how the ship was rigged.

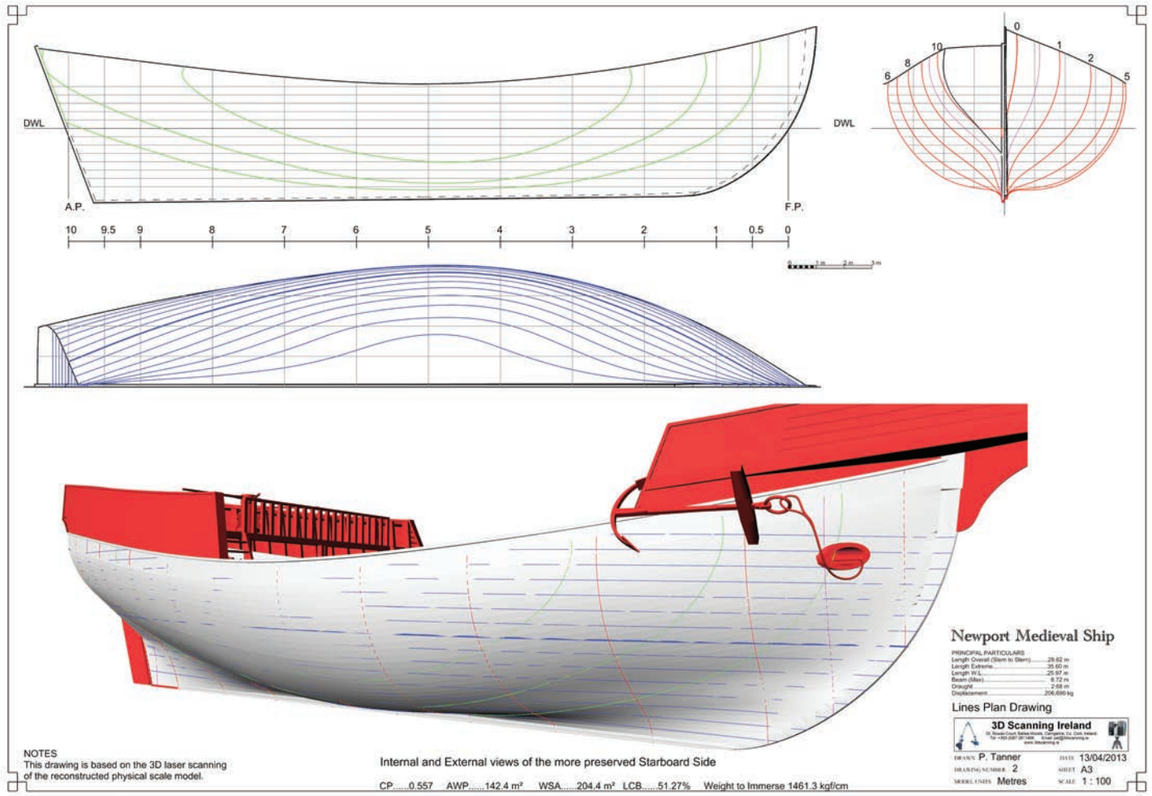
The recreation of the original hull form within the digital world has allowed for the use of sophisticated software to analyse the cargo capacity, sea keeping characteristics and performance of the vessel in a variety of situations. The hull was tested as an empty shell, ballasted, and fully laden, all states that it would have regularly experienced during its working life. The vessel was found to have a notional cargo capacity of between 107-141 metric tons, with an additional 17 tonnes of ballast. The total deadweight of the ship, when fully loaded, would have been around 207 tonnes. The main sail was estimated to be around 264 square metres, which would have required up to 31 mariners to handle. This amount of sail could propel the ship fully laden at a speed of 6-7 knots in a Force 3 wind (blowing 9-10 knots), when sailing downwind (assuming a clean and smooth hull). The additional sail area of a fore and mizzen mast would have increased speed and, more importantly, made the ship more effective when sailing to the windward. It is important to remember that these numbers are based on a minimum reconstruction, and represent the lower end of the ship's capacity and speed capabilities, when compared to the capacity and performance of a capital reconstruction. It should be noted that the numbers are also computer-modelled statistics, and are based on the hull being clean and smooth, a characteristic rarely, if ever, achieved in the medieval real world.

It is probable that the Newport Ship was sailing between Portugal and southern Britain (based on waterlogged plant remains, artefacts, and historical accounts), which was an established trading route in the medieval period. The ship was heavily framed and built to be able to withstand the pounding Atlantic swells whilst crossing the Bay of Biscay. Cargo would have been carried in casks or in sacks, with the most common cargos of the period being cloth and wool (being exported from Britain), while importing wine and oil from the Iberian Peninsula.

Scale model of the Newport Ship made from digital recordings.







Reconstruction drawings of the Newport Ship by Pat Tanner.