Queen Anne's Revenge
Conservation Laboratory Report, January/February 2006

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At the *QAR* Lab we not only preserve the artifacts recovered from the shipwreck just as objects but also we are concerned to document and preserve them as sources of archaeological information and evidence, all of which contributes to the archaeologists increasing understanding of the wreck. It can take a long time, sometimes years, to take an artifact through all the conservation steps from recovery to display in the museum. Much useable archaeological evidence and information, however, can be gathered along the way. The ECU Graduate Assistants make an invaluable contribution to this aspect of our work as described in the three projects below.

Inventory of artifacts from X-radiographs

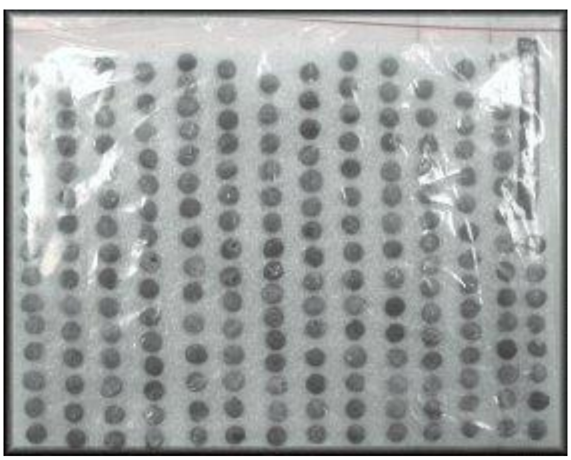
In the last *QAR* Lab report X-radiography Expeditions we described how, with a grant from The National Geographic Expedition Council, we are taking the concretions recovered from the wreck in May 2005 to the NC Museum of Art to be X-rayed. This has continued this year with a session on January 17th & January 31st. 67 sheets of films were used to take 93 exposures of 76 different concretions and artifacts.

The information revealed by x-raying concretions and other artifacts is important for the conservation process; deciding which concretions to prioritize for breaking down or excavating to reveal artifacts and also for deciding treatment strategies. For example, different techniques are needed for a concretion containing hundreds of lead shot or leaded glass beads to one containing a corroded iron nail or large iron bar shot. Whichever technique is decided on the x-radiograph will provide a map of where objects are within the concretion for constant reference as the conservator works. Extracting artifacts from all the concretions recovered in May 2005 is not likely to be completed for at least a couple of years but the archaeologists concerned with interpreting the site and planning excavation strategies need information on artifact types and their distribution on the site now, not in two years time!

Examination of the x-radiographs, with preliminary identification of artifact types, materials, and numbers, can also contribute this type of archaeological information. During January and February all the ECU graduate assistants (Kim Smith, Jim Parker and Valerie Grussing) have been working hard to compile an artifact inventory from the x-radiographs by identifying and quantifying the visible artifacts in each concretion.

X-radiographs are viewed on an X-ray Viewer - a special light box with a powerful and adjustable light source - in a darkened room. The identity of many artifacts are evident from their shape and outline as revealed on the x-radiograph - for example nails, cannon- balls, lead shot are all easily discernible. Other objects can be more difficult to identify and for now are just noted as `other'. It is also possible, from the nature of the image to identify different materials, particularly different metals, and also their physical condition and how corroded they are. Artifacts that contain lead (e.g. lead shot, leaded glass) are impenetrable to the x-rays and show as bright white objects on the x-ray film. Copper alloy objects are slightly less dense and their images on the film are also very bright and sharp. Iron artifacts are comparatively less dense, but both cast and wrought iron can usually be distinguished, as can the extent of corrosion and metal loss by examining the outline of the original surface. Organics, such as wood, can show up on x-rays, depending on the power of x-rays used and the length of exposure. However the high power and length of exposure time needed to reveal metals in the concretions usually means the film is over-exposed in relation to any organics - so they don't show on the film even though they could be present in the concretion. Ceramics and non-leaded glass artifacts if present in the concretion also do not usually show on the x-radiographs. When these materials are visually observed on the concretions themselves their presence will be recorded and added to the inventory to make it more complete. A close, visual inspection of all x-rayed concretions will take place in March.

Kim Smith has entered the information on artifacts, types, materials and number, for each concretion together with proveniences into a spreadsheet, under preliminary general categories of armament, sustenance, personal effects, ships fittings and other. This data can now be manipulated, for example creating histograms to show distributions of different types of artifacts across the wreck site. Although this data is subject to change as concretions are actually broken down and artifacts revealed, rather than just seen on the x-radiograph, it will be very useful to the archaeologists for preliminary analysis of artifact distributions. The recovery strategy for May 2005 was developed specifically to collect a representative sample across the shipwreck site to help determine the ship's layout and activity areas. Taken together with existing data the x-ray study will also help with decisions concerning further investigation of specific areas of the wreck site.



Lead Shot

Lead shot ammunition is the most numerous artifact type recovered from the site; a total of some 15,000 have so far been found loose on the site as well as in concretions. The removal of lead shot from concretion was briefly described in the March 2003 lab report.

Once lead shot was removed from concretion it was sorted by size, initially using sieves with different mesh sizes to separate out the different sizes of shot. The shot had all been made by one of two different production methods - either by the `Rupert' method or by casting in two part molds. The smaller lead shot (0.047"-0.186") about 14,000 in number were made by the `Rupert' method named after Prince Rupert of England who is credited with inventing this method in the 1660s. The shot was made by pouring molten lead in a colander or sieve from which small drops fell into a container of water and solidified producing a small round shot with a dimple although often distorted. The larger two-part mold lead shot range in size from 0.187"-0.768" and total roughly to 1,000. These lead shot were manufactured by pouring molten lead into a two-part mold, which often left a ridge of lead where the molds met, called a mold seam or `flash line'.

In the November/December report we reported that student Jim Parker had completed the long and detailed task of measuring diameters (at and perpendicular to the mold seam) and weighing approximately 750 lead shot (cast in two part moulds) individually and entered every bit of data into the database. This information has already provided archaeologist Nathan Henry with data from which he has determined likely bore sizes of firearms used as indicated from the lead shot weights and diameters and his findings will be published in the forthcoming *QAR* Interim Report (1996-2004). This completed the documentation of the lead shot required by the archaeologists and our next task with the lead shot is to prepare it for transfer to the NC Maritime Museum in Beaufort and this is now underway, the major task is to pack the thousands of lead shot so that they are individually, physically and chemically safe but also easily accessible for viewing and examination in the future.

After sorting by size the various groups of shot have been temporarily stored for the last three years or so in plastic bags in artifact storage cabinets at the *QAR* Lab, sometimes with many shot in the same bag. This has caused some physical abrasion of some of the lead shot as the bags have been moved and handled causing shot to rub against each other, evident from some of the bags and shot now being dirty with dark-gray lead dust.

To clean off the dust Jim has gently brushed the surfaces of shot while rinsing them in tap water, followed by a rinse in ethanol, to remove the water and then left to air-dry. Lead is poisonous so this work has to be done wearing protective clothing (gloves, mask, apron), which with the old dusty plastic bags have to be disposed of according to ECU Health & Safety Regulations. As each shot has been cleaned it is also checked for any signs of active corrosion - this would be indicated by powdery white corrosion (hydrous lead carbonate or hydrocerussite) appearing on the surfaces (post removal from concretion) instead of the stable dark gray form of lead carbonate. So far no active corrosion has been found on any of the shot. The presence of organic acids in the air around lead can cause the formation of active corrosion (hydrocerrusite) which if unchecked can eventually cause the object to disintegrate. In storage of lead artifacts it is therefore vital to isolate them from any sources of organic acids -for example organic acids may be given off by some woods, particularly oak or composite wood boards.

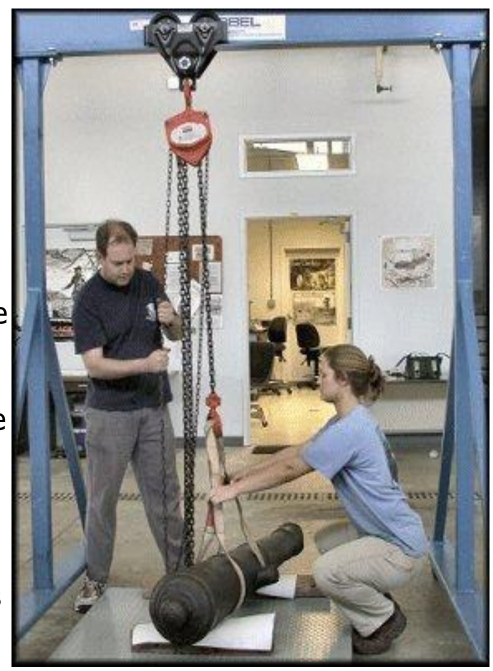
Thus to repack the clean shot a method had to be found to prevent physical abrasion and to use chemically safe materials, which would not give off organic acids. To keep the lead shot from touching one another they are now placed in hollows cut in sheets of polythene foam. Some sheets with several shot can need extra support, this is provided by placing the foam sheet on a piece of rigid plastic grating. The whole arrangement is then placed in a plastic (polythene) bag, with a label giving the groups *QAR* number. Jim is diligently working on repacking all the lead shot and we are surprised he has not yet gone cross-eyed!

Archaeological Illustrations

Valerie Grussing has been working on archaeological illustrations of some of the lead artifacts, including a sounding weight. Illustrations of an object complement and can sometimes even give more information about an object than a photograph. Drawing an object gives the illustrator a chance to thoroughly examine the object and note any overlooked features on the drawings that may not be visible in a photograph. Archaeological illustration is a very special kind of drawing - requiring more discipline and attention to detail than an interpretative artistic drawing but more creativity than just a diagram. We are very impressed with Valerie's illustrations and some are likely to appear in the upcoming *QAR* Interim Report.

Lab Development

Lab improvements continue with the purchase of a new digital floor scale and a gantry crane and we are pleased to report that our warehouse sink is now connected and operational. These developments make our jobs safer and easier and help us to process and treat artifacts more efficiently and effectively.



The floor scale replaces a Chatlier hanging scale which was used to weigh objects over 500 lbs. The hanging scale served us well, but had become unreliable in its accuracy, so we have moved into the digital age with a new Cambridge floor scale that has a capacity of 5,000 lbs. The ground level and flat, durable surface of this scale make it ideal for weighing large heavy objects, such as cannon and larger concretions. We have used the floor scale to weigh cannon C3 & C4 with weights of 1,913lbs and 718lbs, respectively. Other cannon and concretion weights will be obtained in the future.

In the warehouse lab we have a large gantry crane to move cannon and large concretions in and out of tanks and around the warehouse lab as needed while they are in the wet stages of treatment. Once desalination is completed cannon are moved to the lab inside the main building at ECU WRC. Here they dry out, can be easily monitored to ensure that they are stable and given final protective surface coatings in a low humidity environment. Now that the larger cannon (C4 and soon C2 and C3) are at this stage of their treatment we needed a second gantry crane for the inside lab - small enough to fit in the building but with capacity to safely move and turn the heaviest cannons -2,000lbs or more. The new gantry crane has a capacity of 4,000 lbs and is only 8ft tall x 6.5 ft wide, which fits perfectly into our indoor labs.

The 2005 May/June report discusses our warehouse sink and sink stand. After eight months of negotiations we finally have running water hooked up to our sink. The installation of this sink in the warehouse means that we will be able to properly wash our hand, have a wet artifacts reservoir working area, and eventually warm water. Sometimes it's the small things in life that please us, and we are excited about having a working sink in the warehouse.

Visitors
The beginning of this year has been quite busy with visitors. Two classes from ECU came for a visit, Dr. Jerry Prokopowicz's Public History class came out January 27th and Dr. Charlie Ewen's Windows on NC's Past class turned up on February 22nd. We were happy to give NC Representative Marian McLawhorn a tour of the facilities on January 27th as well. Drs. Frederic Pearl and Richard McLaughlin of Texas A&M University and Dr. David Conlin of the National Park Service toured the lab January 30th. Dr. Bradley Rodgers of ECU's Maritime Studies Program visited the lab, with student Sami Seeb, on February 8th. Suzanne Grieve, Conservator at the Mariner's Museum also stopped by for a tour on February 17th before her talk on the ECU campus. We appreciate the visitors and are always willing to talk to people about the project.

Media Update
The 2005 July/August report talks about the visit from Lone Wolf Productions. The Deep Sea Detectives episode "Blackbeard's Mystery Ship" will air March 20 at 10pm on the History Channel.