



North Carolina Office of State Archaeology  
An office of the North Carolina Department of Natural and Cultural Resources  
[archaeology.ncdcr.gov](http://archaeology.ncdcr.gov)

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# NC ARCHAEOLOGY @HOME

## UNDERWATER ARCHAEOLOGY and CONSERVATION

Educational Activities for Kids

Developed by the North Carolina Office of State Archaeology  
2020

# Introduction

## What is archaeology?

**Archaeology** is the study of the past through what we leave behind.

Archaeologists are **anthropologists**. Anthropologists study people and archaeologists study people from the past. An archaeologist can study the Egyptian pyramids, old houses, cave paintings, arrow heads, pottery—anything that was made and left behind by people!

## What is underwater archaeology?

**Underwater archaeology**, also called nautical, marine, or maritime archaeology, is the study a specific part of human existence: how people have interacted with oceans, seas, rivers, and lakes. Unlike terrestrial (or land) archaeology, archaeologists have to dive to get to underwater sites!

Sometimes underwater archaeology is mistakenly considered the hunt for sunken treasure, but for archaeologists, the “treasure” is what we learn about people in the past!

## Who is an underwater archaeologist?

Underwater archaeologists use the same knowledge as terrestrial archaeologists, but their tools are different. Instead of shovels and trowels, underwater archaeologists use dredges (giant vacuums) and dive equipment to help them breathe.

Many underwater archaeologists are interested in how boats and ships were built through time. Others study the stuff that was on those ships. Still others look at underwater structures like ports and harbors, or entire cities! There are many ways to explore the impact of water on our lives.

## What is archaeological conservation?

**Archaeological conservation** is the science used to preserve and protect artifacts that come out of the water. After recovering artifacts from water, we must use specific chemicals and processes to protect artifacts before they dry out. If we don't, they will become damaged or fall apart completely!

## Queen Anne's Revenge Shipwreck

Over 300 years ago, the pirate fearsome Blackbeard was sailing around the Caribbean and the east coast of the American colonies, capturing ships and cargo and avoiding the British Royal Navy. His flagship *Queen Anne's Revenge*, the former slave ship *La Concorde*, was big and fast, but when he tried to enter the port of Beaufort, NC in 1718, the ship got stuck on a sandbar. Unable to free the ship, it was abandoned to the sea and eventually became buried by the water and sand.

The wreck was rediscovered almost 300 years later by a private corporation using a special underwater scanning tool called a "magnetometer," which identified several cannons on the ocean floor. Underwater archaeologists from North Carolina's Underwater Archaeology Branch have been carefully excavating the shipwreck and have finished about half of the identified site.

Artifacts from the shipwreck go to the Queen Anne's Revenge Conservation Laboratory in Greenville, NC where archaeological conservators x-rayed them, storing them in chemicals that keep them from corroding, removing them from the ocean crust that surrounds them, and preparing them with several scientific processes for display in museums!

This packet contains activities that demonstrate the work North Carolina's archaeologists and conservators do to protect and preserve the *Queen Anne's Revenge* shipwreck and all our submerged cultural heritage!

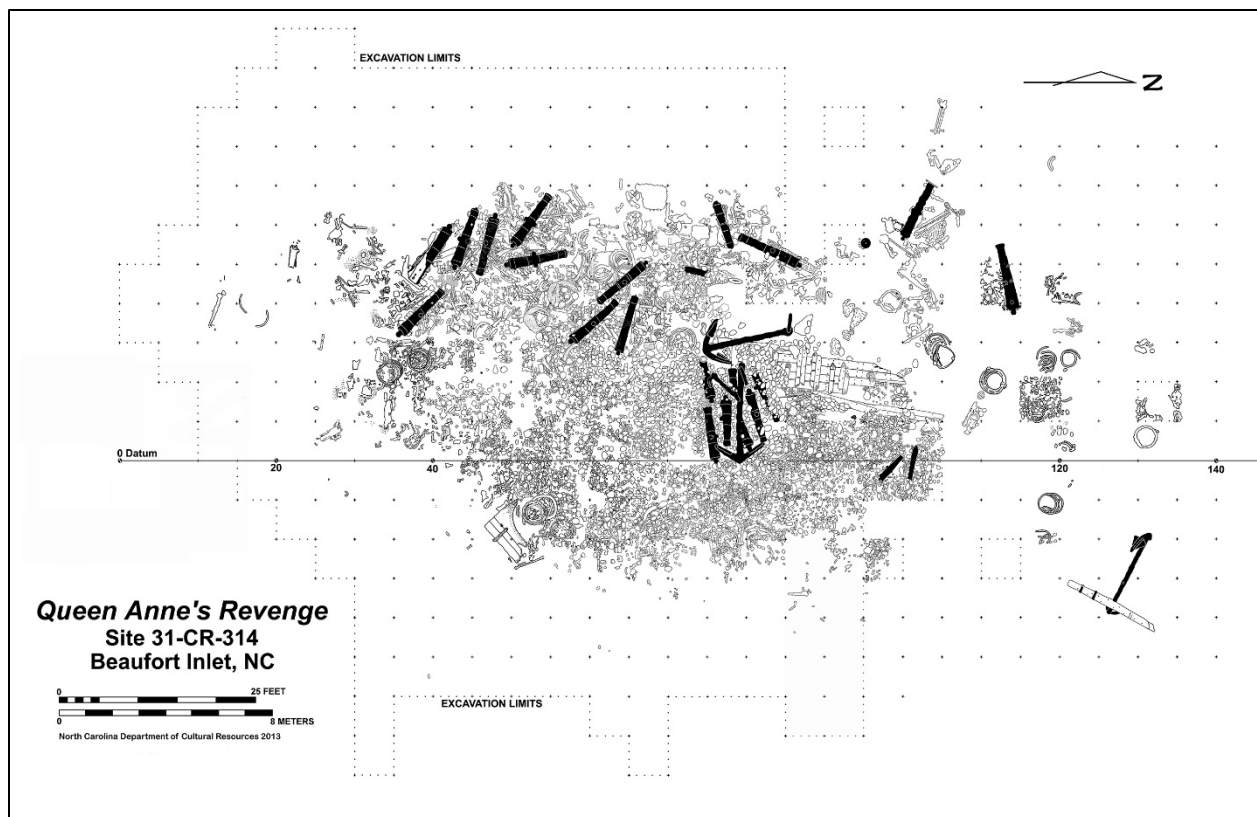
To learn more about the *Queen Anne's Revenge* Shipwreck Project, visit [www.qaronline.org](http://www.qaronline.org).

*All images within taken and provided by NC Department of Natural and Cultural Resources, unless otherwise noted.*

## Activity 1: Site Mapping

### Why does context matter?

An important part of archaeology is recording an artifact's **context**: knowing exactly where an artifact was on a site. To do this, archaeologists on land and underwater draw maps of their excavation units so they can “see” the site as a whole. There isn't always a complete and recognizable ship on the ocean floor, so site maps allow archaeologists to reconstruct where activities may have taken place. For example, finding a bunch of kitchen artifacts in one spot might tell archaeologists that is where the galley (ship's kitchen) was located. A bunch of cannons and cannon balls may tell archaeologists the location of the gun deck. Once an artifact is removed from the ocean, it cannot be put back exactly as it was, so recording context is very important.



Archaeological site map of the *Queen Anne's Revenge* shipwreck.

## Supplies

Sidewalk chalk

“Artifacts” such as toys, plates and utensils, tools, etc. **Artifacts** are anything made or modified by humans!

Printed worksheet, next page

## Activity

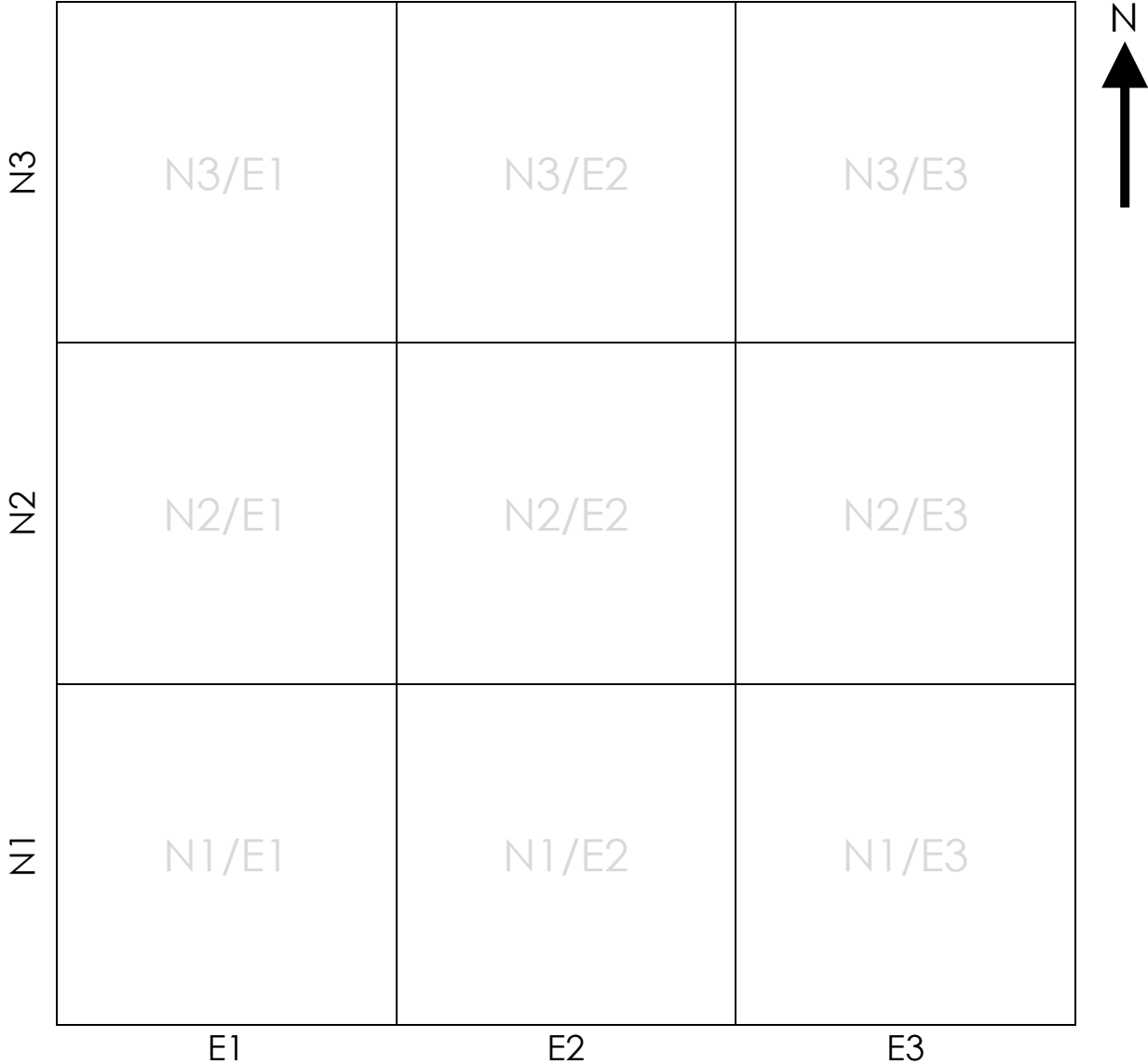
- Draw a large grid of “excavation units” like that on the worksheet on the driveway, sidewalk, or location of choice. Include a “north” arrow outside the grid for reference. Size of the grid is your choice! Optional: label the units with their east and north coordinates.
- Place the “artifacts” within the grid. For added complexity, you can group the “artifacts” in different categories for analysis at the end of the activity (such as kitchen goods in one square and tools in another). “Artifacts” can overlap squares in the grid, just as they would in an archaeological excavation.
- Have the student draw what they see on their worksheet, orienting the north arrow on the sheet in the same direction as the one on the ground.
- **Ask:** For older students, you can discuss what the location of the artifacts in relation to each other might mean. Do they indicate a certain activity took place in this location? Do they suggest a particular event may have happened here?

**Underwater Excavation Field Notes**

Site Name: \_\_\_\_\_ Date: \_\_\_\_\_

Diver Name(s): \_\_\_\_\_

Sketch the artifacts in the units.



List the artifacts in the site: \_\_\_\_\_

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## Activity 2: Sifting Sediment



### What is sediment?

Just like on land, underwater archaeologists must sift through the “dirt” they recover in excavation. They collect the sand and other debris (collectively called **sediment**) from around the artifacts in each unit with a **dredge**, which is like a large vacuum hose that goes all the way from the boat to the ocean floor. The suction brings the sediment on to the surface of the boat where it is collected to be searched through for the tiny artifacts that might otherwise be missed!

Learn more about processing sediment: <https://www.qaronline.org/blog/2017-10-15/conservation-highlights-dredge-spoil>

### Supplies

- Sand, coarser play sand will reduce dustiness, or use sand from the beach, local lake, or stream.
- Rubbermaid-type container or play pool
- “Artifacts” to be found such as coins, beads, nails, ball bearings, plastic gemstones, safety pins, etc. “Artifact” size can vary by age and skill. Natural materials like shell and stones can also be added for additional complexity.
- Screens or sieves; kitchen colanders and sifters work great!
- Cups or hand shovels for scooping
- Tarp, optional for mess control

## Activity

The activity can be made more complex for older students by decreasing the size of the items they are looking for, and including shells and stones allows students to differentiate between man-made and naturally occurring objects.

- Fill the container or pool with sand and hide the “artifacts.” This activity can be done wet or dry; add water to your container if you’d like.
- Have students use the cups or hand shovels to scoop sand into their sifting equipment. If including natural materials, allow them to sort the “artifacts” from the naturally occurring things.
- **Ask:** What artifacts have you found? What might they have been a part of and what do they tell you about what might have happened at the site? Where do you think they came from? There are no wrong answers!



## Activity 3: X-radiography

### Why do we x-ray?

Unsurprisingly, many objects, such as those made from iron, do not like being underwater in a salt environment and begin to corrode away. When this happens, the corrosion mixes with the sand and shell surrounding the artifact as it sits underwater and creates what underwater archaeologists and conservators call “**concretion**.” The concretion grows as iron artifacts corrode and it can trap other artifacts lying nearby. When archaeologists bring these artifacts up from the ocean, they look more like giant blobs than the artifacts they contain! To get a little help seeing the concretion’s contents, conservators use **X-radiography** (passing X-rays through an object onto a film to see what’s inside), just like getting an X-ray at the doctor’s office.



Outside of concretion

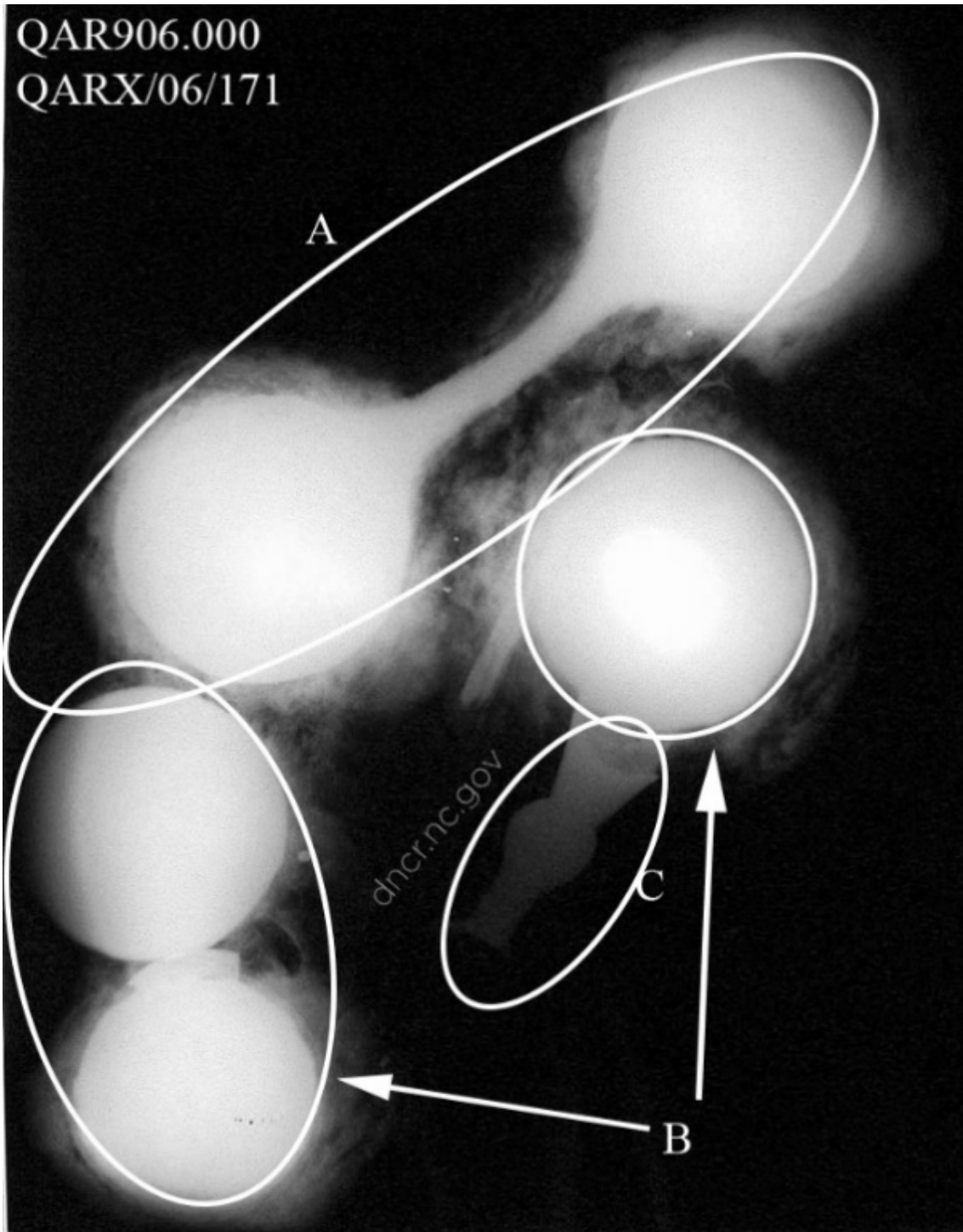
X-ray of the same concretion

Learn more about x-rays in conservation: <https://www.qaronline.org/blog/2017-07-15/conservation-highlights-x-ray>

### Activity

- Print out the three x-ray activity sheets below. Each sheet increases in difficulty.
- Have students identify each circled object and write it down.
- See the answer key for correct identifications!
- There are explanations and photos of the artifacts themselves at the end of this activity for students to see what they look like after coming out of concretion.

Concretion X-Ray #1



A. \_\_\_\_\_

B. \_\_\_\_\_

C. \_\_\_\_\_

Concretion X-Ray #2



A. \_\_\_\_\_

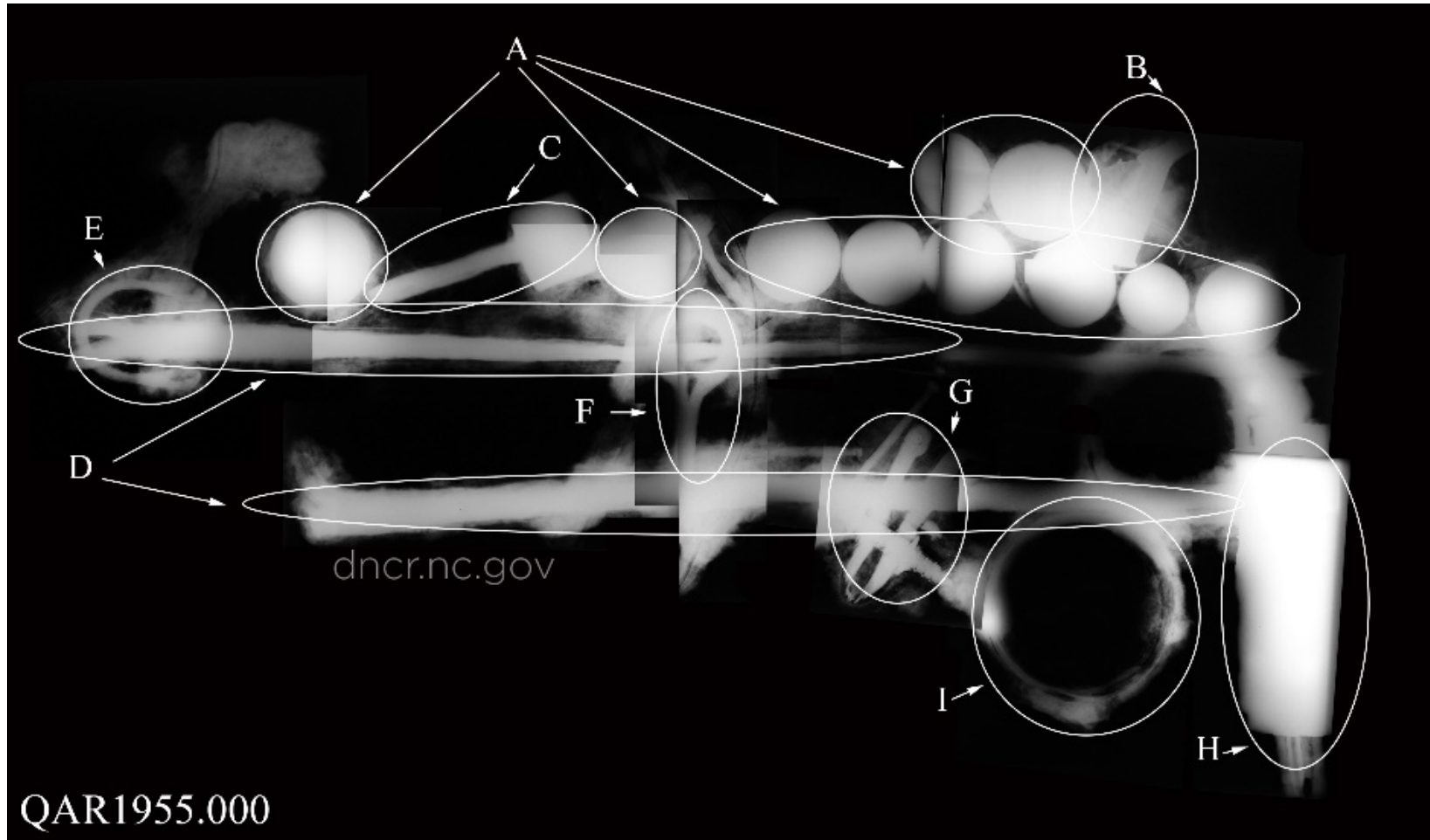
C. \_\_\_\_\_

E. \_\_\_\_\_

B. \_\_\_\_\_

D. \_\_\_\_\_

Concretion X-Ray #3



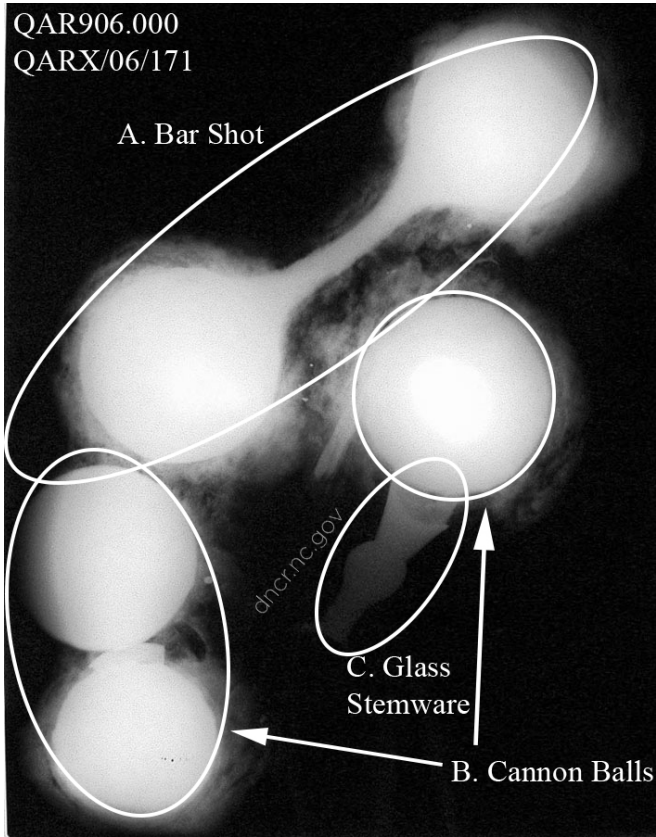
A. \_\_\_\_\_  
B. \_\_\_\_\_  
C. \_\_\_\_\_

D. \_\_\_\_\_  
E. \_\_\_\_\_  
F. \_\_\_\_\_

G. \_\_\_\_\_  
H. \_\_\_\_\_  
I. \_\_\_\_\_

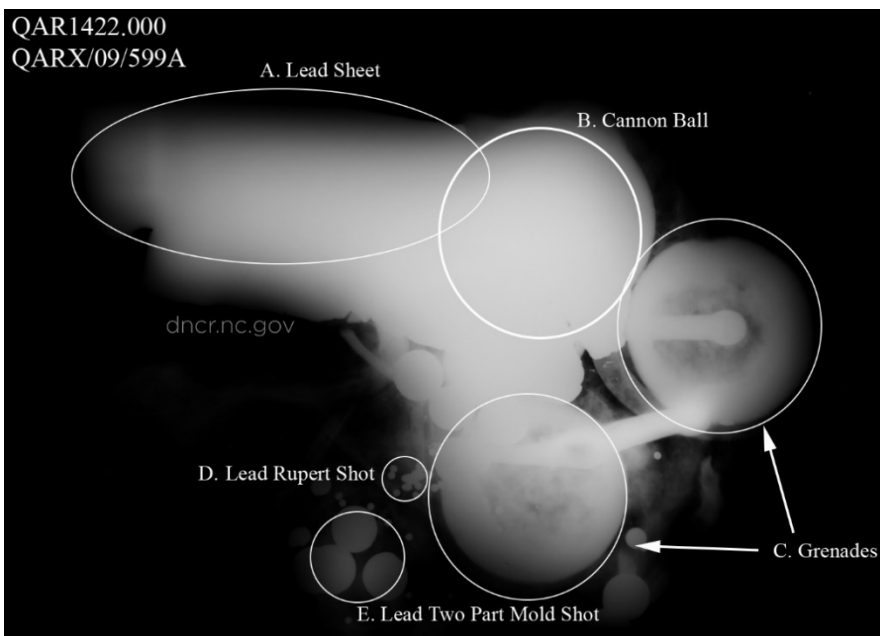
## Answer Keys

### Concretion X-Ray #1



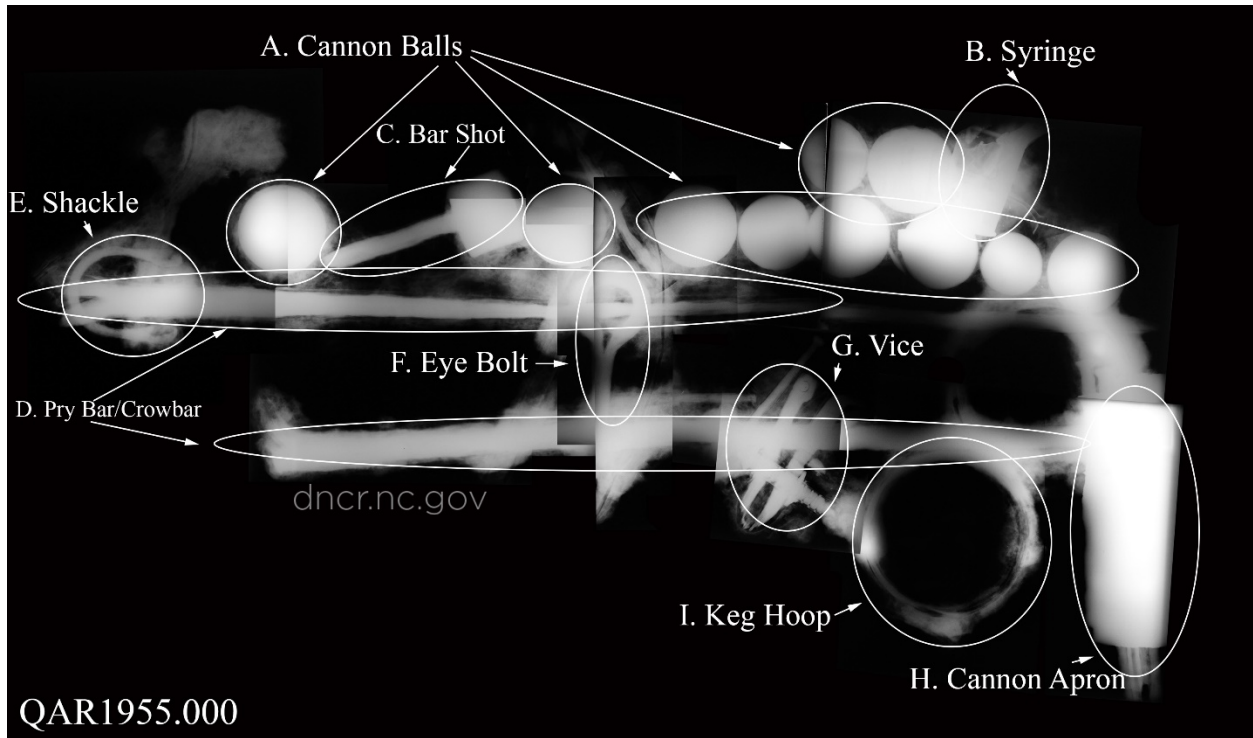
- A. Bar shot
- B. Cannon balls
- C. Glass stemware

### Concretion X-Ray #2



- A. Lead sheet
- B. Cannon ball
- C. Grenades
- D. Lead Rupert shot
- E. Lead two-part mold shot

### Concretion X-Ray #3



- A.** Cannon balls
- B.** Syringe
- C.** Bar shot

- D.** Pry bar/crowbar
- E.** Shackle
- F.** Eye bolt

- G.** Vice tool
- H.** Cannon apron
- I.** Keg hoop

## Artifacts After Conservation

### Bar Shot

Bar shot are a type of shot (like a bullet) fired from a cannon. They are usually made from two iron spheres or canisters attached by a bar. This causes the shot to spin after being fired. Unlike cannon balls, bar shot are meant to disable ships' sails and masts instead of sinking them!



### Calipers

Calipers are used for measuring diameters of things such as cannon balls. This would ensure the correct cannon ball was loaded into the correct size of cannon.



### Cannon Ball/Cannon Shot

Cannon balls are spherical shot fired from a cannon. Cannons and cannon balls come in many different sizes. Pictured are a few examples of different sized cannon balls. Over 400 cannon balls have been found on the *Queen Anne's Revenge* shipwreck!



### Cannon Apron

Cannon aprons are pieces of lead tied over the "touch hole," where the cannon fuse is lit, at the back of the cannon. This keeps the inside protected from any sea water getting inside or accidental firing and keeps the cannon ready for use.



## Concretion

Concretion is the encrustation that surrounds objects when they corrode underwater. The term also applies to the group of concreted objects.

Because of the way concretion forms, many artifacts can end up in a single concretion. The concretion shown here is the outside of Concretion X-Ray #2 before the encrustation was removed and then artifacts being exposed during removal.



## Dividers

Dividers are a tool used to measure distances on a map. Sailors previously navigated the globe using nautical charts. There was no GPS!



## Eyebolt

Eyebolts are a type of fastener used to keep the ship's ropes where they belong. This includes things like rigging for sails and the rope that keeps cannon carriages from rolling away!



## Grenade

Grenades were hollow balls loaded with black powder and stopped with a wooden fuse plug. Sailors would light the and throw it into battle.





## Keg Hoop

Keg hoops are metal straps used to keep the wooden sides of a keg together. Kegs are a type of barrel used to transport meat, water, lead shot, and many other things.



## Lead Shot: Rupert and Two-Part Mold

Lead shot were the bullets of the 18<sup>th</sup> century. Rupert shot, tiny pellets that look like today's bird shot, were made from dropping molten lead through a sieve into cold water. Two-part mold shot, the larger shot, were individually poured in a hand mold and you can sometimes even see the seam where the mold came together!



## Pry Bar/Crowbar

Pry bars were used to move heavy objects or create leverage. This bar found in Concretion X-Ray #3 may have been used to move a cannon!



## Rigging Hook

"Rigging" is the rope that holds up and controls the ships sails. A rigging hook would be used to keep the rigging in place.



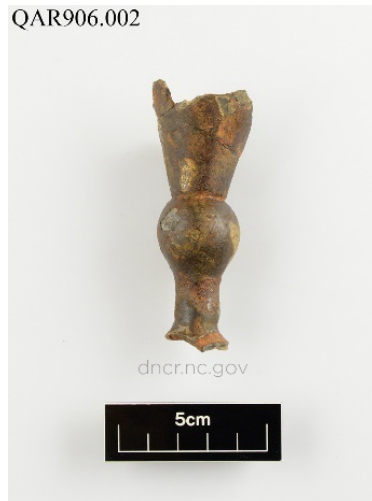
## Shackle

The historic version of today's handcuffs. Shackles like these would be used to restrain someone (maybe an unruly pirate!) onboard the ship.



## Stemware

Stemware is a glass that has a stem connecting the base and the drinking portion, like wine glasses today. Some old glass contains lead, which helped the stemware piece show up in Concretion X-Ray #1.



## Syringe

Syringes were frequently part of a ship's medical kit. Unlike the small needles found at a doctor's office today, some historic syringes were very large.



## Activity 4: Solution pH

### Concepts

Objects from an underwater archaeological site must remain wet once they are recovered. If they dry out too quickly, they may become damaged or fall apart! Conservators use the **pH scale** to make sure storage solutions are safe for the artifacts. The pH scale ranges from 0-14 and measures how acidic or basic (alkaline) a solution is. **Basic** solutions (those with a pH higher than 7) are used by conservators for storing artifacts because they prevent more corrosion of iron. **Acidic** solutions (those with a pH less than 7) are used for cleaning artifacts because they help remove corrosion from their surface. Generally, tap water is neutral, around a pH of 7, so conservators add chemicals to solutions more basic or acidic.

### Supplies

#### For the pH indicator:

Red cabbage

Water

Blender

Strainer/sieve

Bowl

Empty salad dressing or ketchup bottle

#### For the solutions:

White vinegar

Lemon juice

Lemon-lime soda

Baking soda

Dish soap

Water

6 clear cups

### Activity

**\*\*Warning:** Red cabbage is a natural dye and might stain clothes and/or work surfaces. We suggest doing this activity outside!\*\*

To make the pH indicator:

Chop and blend the red cabbage with a small amount of water. Pour the blended contents into a strainer or sieve over a bowl, straining out the pulp. Pour the juice into a clean salad dressing or ketchup bottle, or any container that can be easily poured out of (use a funnel!).

Testing solution pH:

- In six different cups, prepare the solutions. We recommend the following order, or for an added challenge, arrange them randomly!
  - Water (neutral)
  - Lemon juice (most acidic)
  - White vinegar
  - Lemon-lime soda
  - Baking soda mixed in water (just enough that it dissolves)
  - Dish soap mixed in water (most basic/alkaline)
- Have the student *\*carefully\** add the cabbage juice to each cup (about a tablespoon, more cabbage juice will create a more vibrant color). Have the student identify the color change and determine the solution's pH.



Image by Andy Brunning/Compound Interest, shared under a Creative Commons Attribution-NonCommercial-NoDerivatives license.

- Additional exercise: remembering that water is neutral, try mixing the higher and lower pH solutions together to get a more neutral color hue (purple). Acids and bases “neutralize” each other, so mixing them will bring the pH close to 7.

## Activity 5: Concretion Breakdown

### How do we get the artifacts out?

Once conservators know what is inside their **concretion**, they can begin to remove the encrustation from around the artifacts. They do this using a tool called an **air scribe** – imagine a miniature jackhammer where the end vibrates quickly from air pressure to chip away the concrete-like concretion!



A conservator uses an air scribe to remove concretion from a bar shot.

Conservators must be very careful to only remove the concretion and not damage the artifacts inside. They work very slowly and cautiously with their air scribe, paying close attention to see the differences between the artifact and the concretion.

Learn more about concretions: <https://www.qaronline.org/blog/2017-06-15/conservation-highlights-concretions>

Learn more about concretion breakdown: <https://www.qaronline.org/blog/2017-08-15/conservation-highlights-concretion-breakdown>

### Supplies

Toothpicks

Chocolate chip cookies with “candies” or M&Ms, the crunchier cookies provide more of a challenge

Tablecloth or paper towels, optional for mess control

## Activity

- Each student gets a cookie and a toothpick. The cookie represents the concretion and the candies represent the artifacts. Have them remove the candies from the cookie “concretion” without damaging them by applying pressure and percussion to the cookie with the toothpick. Broken toothpicks can be replaced.
- For an added challenge, also have the students remove the softer chocolate chips without damaging them and removing as much of the cookie “concretion” from them as possible.
- While conservators don’t eat their artifacts or concretion, students can eat these!



## Thanks for learning with us!

If you enjoyed this packet, please check out all our educational resources at:

[www.archaeology.ncdcr.gov/ncarchaeologyhome](http://www.archaeology.ncdcr.gov/ncarchaeologyhome)

Questions? Email us!

[archaeology@ncdcr.gov](mailto:archaeology@ncdcr.gov)

## Learn more about our mission and work!

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NC OSA Underwater Archaeology Branch

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