Wood conservation

Material for Primary Schools

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Teacher's notes

Overview

The Mary Rose is a wooden Tudor warship that sank off Portsmouth in 1545, during the reign of Henry VIII (1509–1547). While on the sea bed, most of her hull became covered in silt, which effectively sealed it and the artefacts it contained in anaerobic (air-free) conditions and preserved them from decay. In 1982, the hull was raised and ever since then it has been undergoing conservation treatment in a former dry dock at Portsmouth. Over 19 000 artefacts were recovered from in and around the trip and these are also being preserved. Many of them are on display in a museum next to the hull. The ship and the objects give historians and the general public a rare insight into life in Tudor times.

The material presented here is suitable for years 2–4, *ie* the upper part of KS1 or the lower part of KS2. It offers some practical activities based on the topic of floating and sinking from the point of view of properties of materials and also the effect of shape. It also includes some pencil-and-paper activities about the properties and uses of wood as a material.

The material would link with a topic on Tudor history and provide a science input to this.

To help teachers introduce the background to the Mary Rose, teachers might wish to read the separate document *The Mary Rose – a historical introduction*. This is part of the book *Conservation Chemistry – an introduction* and can be downloaded free at **http://www.chemsoc.org/networks/learnnet/conservtnchem.htm** (accessed January 2005). The publication provides an introduction to the historical context of the Mary Rose, her sinking, preservation on the sea bed, subsequent raising and conservation. It does not deal with science in any detail. Further information about the Mary Rose can be found at **http://www.maryrose.org** (accessed January 2005).

All the material presented here is also available for free download as Word documents from **http://www.chemsoc.org/networks/learnnet/conservtnchem.htm** (accessed January 2005). This means that teachers may edit it to tailor it to their own requirements.

The material is also available at the same URL as pdf files that can be read using Adobe Acrobat Reader. This software is available free at **http://www.adobe.com** (accessed January 2005).

Practical requirements

Activity 1: Which materials float and which ones sink?

Each group of students will need:

- A bucket or bowl of water
- A lump of Plasticene™ or Blu-tac™
- A marble
- A paper clip or drawing pin
- A pencil
- A rubber

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- A nail
- A small piece of wood (lollipop stick would do)

Note. The objects tested do not have to be exactly the same as those listed here but they should be made of solid, single materials and there should be a good selection of both 'floaters' and 'sinkers'. A hollow item such as a rubber ball might float because it contains air although the rubber itself might sink.

A knowledge of which materials float and which sink (except for iron which is referred to in Activity 2) is less important than the classification in terms of a property difference.

Activity 2: What shapes are best for floating?

Each group of students will need:

- A bucket or deep bowl of water
- A ball of Plasticene™ (about the size of a golf ball) and lots of paperclips.

Students may need help to make a Plasticene™ boat that floats. It helps to have fairly thin sides. Students could have a class competition to see whose boat can carry the largest load. To make this a fair test each boat should be made from the same amount of Plasticene™. Boats can be much less elaborate than that shown in Figure 6 of the pupil's material and can also be constructed with much less plasticine.

Activity 3: Why does shape make a difference?

Each group of students will need:

- A bucket or deep bowl of water
- A glass bottle – a milk bottle or small beer bottle would do. The type of bottle used must sink when it is full of water. Note. Most plastic bottles are unsuitable because they float even when full of water.

The key point here is that when the bottle is held under water bubbles of air will be seen rising from it. It is the air that makes it float.

Notes

It may seem odd to talk about the silt sealing the Mary Rose in anaerobic (air-free) conditions when she was underwater. However, water contains dissolved air (which is how fish can breathe underwater).

An object will float on water if its density (its mass in grams divided by its volume in cm^3) is less than that of water, 1 g / cm^3. In the case of an object made from more than one material, it is the average density that matters. So a glass bottle filled with air will float because of the air it contains while a glass bottle full of water will sink. The density of glass is about 2.2 g / cm^3. Iron-hulled boats float because of the air they contain.

Activity 3 could be developed into a challenge for children to see who can make the boat that carries the greatest load. If so, each group of children will need to be given the same amount of plasticene to make it a fair test.

Materials not found on the Mary Rose that are in use today would include a variety of synthetic polymers – plastics, fabrics *etc* and metals (such as aluminium) which were not known in Tudor times.

Answers to challenges

1. As a fuel, canoe on river, bow and arrow, shelter made of wood, spear *etc*.
2. **(a)** For example stone, glass, gold,

   (b) For example paper, cotton, wool.
3. Metal, coin; wood, comb; cloth, shirt.
4. Many metals, such as aluminium, which were not known in Tudor times. The only metals known in the early 1500s were iron, copper, zinc, silver, tin, gold, mercury and lead.

   Synthetic materials such as plastics. The first synthetic plastic, Bakelite, was not developed until the 1870s.

More information

If you have access to the internet, you can visit **http://www.maryrose.org** (accessed January 2005) for a variety of extra information about the Mary Rose.

This site also gives contact details for The Mary Rose Trust from which a number of publications can be obtained. One particularly useful one is *The Mary Rose Museum and Ship Hall*, Portsmouth: The Mary Rose Trust, 2002. It costs just £2.50 and is suitable for all age groups.

There is an article 'The Mary Rose' in *Catalyst* magazine: Chris Young, *Catalyst*, 1998, 8 (3), 1. This is written for KS 4 (and equivalent) students but could be used for teacher background.

A wealth of technical information about the conservation of the Mary Rose can be found in Mark Jones (ed) *For Future Generations conservation of a Tudor maritime collection*, Portsmouth: The Mary Rose Trust, 2003. This is an academic book giving a good deal of technical detail.

Acknowledgements

The authors and the Royal Society of Chemistry would like to thank the Mary Rose Trust for their help in preparing this material and, in particular Dr Mark Jones, Director of Conservation and Dr Des Barker, formerly of Portsmouth University.

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The Mary Rose

The Mary Rose was a large wooden warship built in Portsmouth and launched in 1511, see Figure 1. She was the pride of King Henry VIII's navy. In July 1545 the Mary Rose was sunk during a battle with a French fleet that was trying to invade England. She sank about two kilometres (just over a mile) from Portsmouth. We know this because the loss of the ship was recorded at the time and the King was actually there to see his flagship sink. Nobody is quite sure why she sank. The English thought that the ship was overloaded and mishandled. The French claimed that she was hit by their cannon fire.

Figure 1 The Mary Rose as she would have looked before her sinking

About 20 years ago (in 1982) the hull of the Mary Rose was lifted to the surface after over 400 years on the sea bed, see Figure 2. About 19 000 objects were found in and around her. These were everyday items used by the sailors such as plates, musical instruments and tools *etc* as well as the cannons and weapons you would expect with a fighting ship, see Figure 3. Scientists are trying to preserve the ship and these objects so that we can study them and find out how people lived over 400 years ago. As part of this process, the hull of the ship is being sprayed with a special chemical to help preserve it, see Figure 4.

Figure 2 The Mary Rose in 1982, being lifted from the water

Figure 3 Some of the objects found in the Mary Rose. Sailors would have been using them just before she sank.

Figure 4 The Mary Rose's hold being sprayed with a special chemical to strengthen the wood and stop it rotting

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Floating and sinking and boat-building

Obviously a ship must float. Whether something floats or sinks is to do with the material it is made of and its shape.

Activity 1: Which materials float and which ones sink?

You will need a bucket or bowl of water and as many as possible of the following objects (or similar ones):

- A lump of Plasticene™ or Blu-tac™
- A marble
- A rubber
- A pencil
- A paper clip or drawing pin
- A nail
- A small piece of wood (a lollipop stick would do)

For each object predict whether it will float or sink. Then place each object in turn in the water. Does it sink or does it float?

Decide what material each object is made of and put your results in the table.

The first one has been done for you.

Object	Material it is made of	Prediction – will it sink or will it float?	Result – does it sink or does it float?
Marble	Glass		sinks

If you can't find all these objects you could try some similar ones. Check with your teacher if you're not sure.

Which materials sink and which ones float?

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Activity 2: What shapes are best for floating?

The Mary Rose was built from wood, which floats. We now build large ships from metals like iron and steel – the first iron-hulled ship was built in 1840.

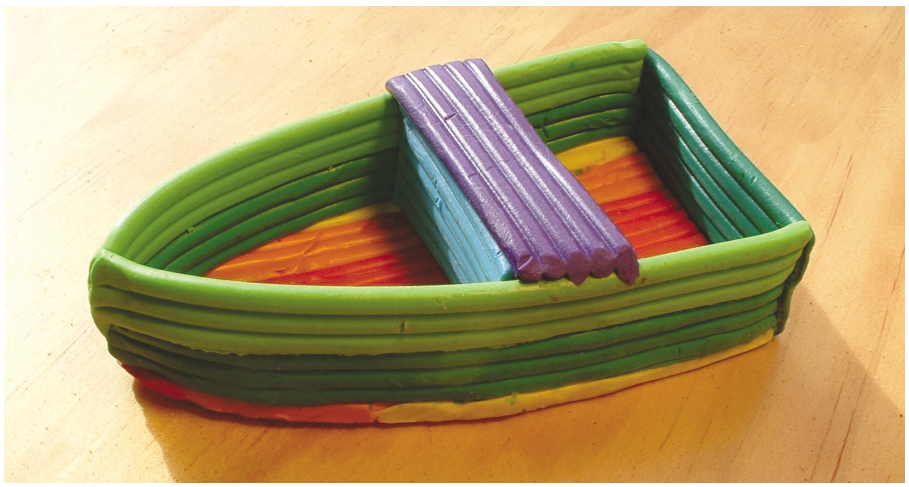
An early iron-hulled ship, the Great Eastern, built in 1853
(Picture reproduced with permission from the National Maritime Museum http://www.nmm..ac.uk)

You should have found out that an iron nail sinks. How is it that iron ships can float?

The answer to this question is to do with shape.

You will need a bucket of water, a ball of Plasticene™ and lots of paperclips.

Take a ball of plasticene and place it on the water in the bucket. You will find that it sinks. Now mould the Plasticene™ into the shape of a boat like the one shown in the picture (although you could make a much simpler shape than this one and use less plasticine™). Keep trying different boat shapes until you find one that floats when you place it gently on the water surface.



Make a simple boat shape out of plasticene

Now take this shape and push it under the water. Does it float back up to the surface?

Now float your boat again by placing it gently on the water.

How much load can your boat shape take before it sinks?

Find out by carefully adding paperclips until it sinks. How many does it hold? Can you improve the shape to make it hold more?

Activity 3: Why does shape make a difference?

You will need a bucket or bowl of water and a small glass bottle such as a 250 cm^3 beer bottle.

Take a small glass bottle. Be careful not to break it. Place it upright in a bucket of water. Does it float?

Now push the bottle under the water and hold it for a few seconds? Does it float now?

What happened while you held the bottle under the water?

Does this help you to answer the question about why shape makes a difference to floating and sinking?

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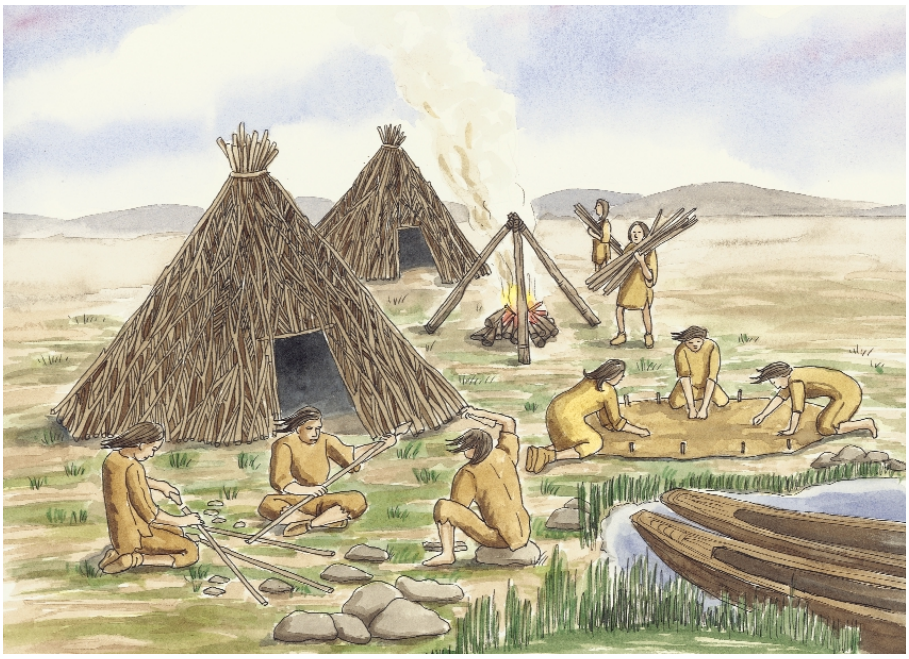
Preserving wood

Wood as a useful material

Wood is a material that has been on Earth for millions of years. We know this because fossils of trees and imprints of leaves have been found in rocks of this age. So, prehistoric humans probably used the wood around them every day of their lives.



Some of the ways in which prehistoric humans may have used wood

Challenge 1.

Write down as many different ways that you can see in the picture where Stone Age people are using wood.

When people started travelling on rivers and seas, wood could be used to make boats from hollowed out trunks, because wood floats on water.

What happens to wood when it is left outside? Think about fallen trees in a forest or old gateposts. How long do you think it would take for a tree stump to rot away completely? A day, a week, a month, a year, 10 years, 100 years?

Wood does not last for long in contact with water and air. It is attacked by tiny living creatures called bacteria and fungi and rots quite quickly. This is why most remains of the past that we find are ceramics (pottery), stoneware or precious metals, like gold. These are not attacked chemically by the oxygen in air, and bacteria and fungi are not able to digest them.

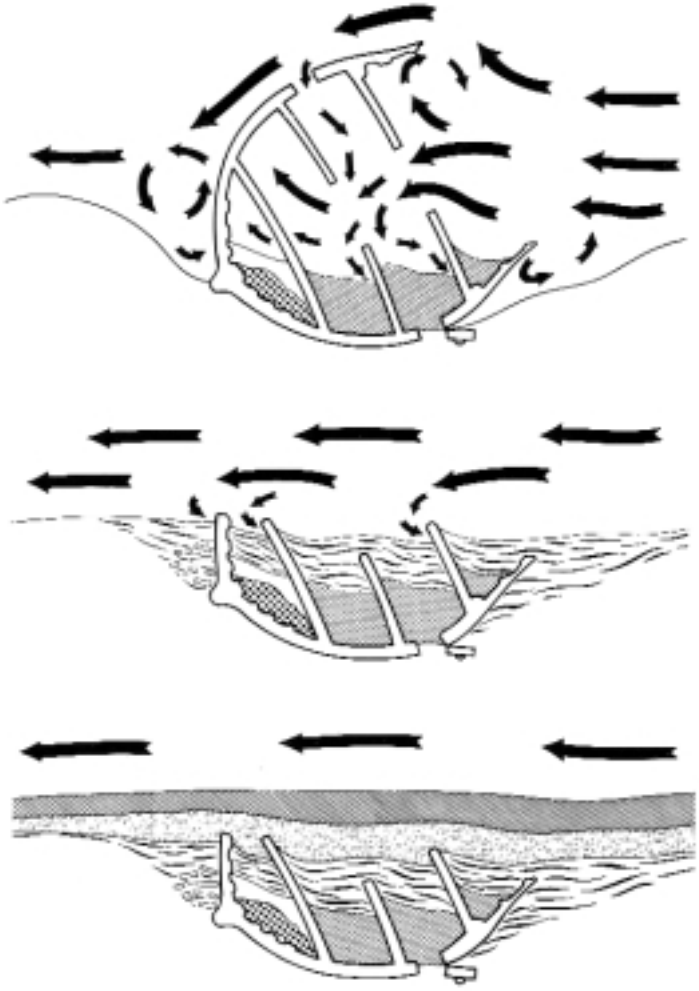
Challenge 2.

Think of three materials that you could bury in the earth

(a) that might last 500 years or more

(b) that would rot within a year.

Soon after the Mary Rose sank, her wreck became covered with silt as shown on the next page. This silt kept oxygen away from the ship and its contents and this is why the ship and its contents were preserved from rotting away for over 400 years.



The drawings show how the wreck of the Mary Rose on the sea bed became covered in a layer of silt.
Top After she sank, the lower part of the Mary Rose's hull filled with silt. This protected the lower timbers but the exposed upper ones were eroded and attacked by a variety of organisms.
Middle After some time the weakened upper timbers collapsed.
Bottom Much later a hard layer of clay and crushed shells sealed away the ship and its contents.

Some of the objects found in and around the Mary Rose

Challenge 3.

Sort the items in the picture into: metal, wood, cloth. The first one has been done for you.

Metal	Wood	Cloth
coin		

Challenge 4.

What sorts of materials that we use today would not have been found on the Mary Rose? Look at the photograph of part of a modern ship. Make a list of materials used in this ship that would not have been found in the Mary Rose and say what they are used for.

Part of the bridge of a modern ship
Photograph by courtesy of the Royal Navy http://www.royalnavy.mod.uk

Challenge 5

Wooden objects preserved from the past have also been found in the pyramids in Egypt. These pyramids were tombs of their kings, called Pharoahs. There is plenty of oxygen in the pyramids yet the wooden objects are still preserved. Why do you think that objects have been preserved in this case? Hint – think about the climate in Egypt.