Virtual Fossils Loan Box

LAPWORTH MUSEUM OF GEOLOGY

What is a Virtual Loan Box?

Introduction

At the Lapworth Museum of Geology, we believe everyone should have the opportunity to engage and connect with our collections. We recognise that loan boxes are fantastic for handling specimens but sometimes accessing loan boxes can be difficult. Location or circumstance should not be a barrier. Therefore, we have compiled a Virtual Fossils Loan Box.

Use these information pages to explore the geological past from your educational setting and discover more about ancient inhabitants of our modern world!

If you have any questions, queries, comments or suggestions for content, please contact our Learning and Community Development Officer, Lizzy Goodger on : e.goodger@bham.ac.uk

How to use the Virtual Loan Box

This document contains information about fossils in the museum collections. It provides an introduction to fossils, how fossils are formed and the different types of fossil. Throughout the document there will be links to 3D models created at the Lapworth Museum of Geology.

The museum uses a platform called Sketchfab to publish and share its 3D digital models. The main Sketchfab Page for the museum can be found here:

https://sketchfab.com/LapworthMuseum

For electronic device compatibility requirements please find more information here.

Explore the models and the information. There are also suggested activities and discussion points at the end of the booklet.

Fossils Loan Box

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What is a fossil?

A fossil is a remnant, impression, or trace of an animal or plant of a past geological age that has been preserved. Fossils are typically older than 10,000 years.

Why are fossils important?

Fossils are our window into the past. They tell us about prehistoric animals and plants and let us explore how life has evolved through time. Fossils can also tell us what the Earth's past climate was like and how areas of the Earth were different to how we see them now. For example, finding marine fossils on land which is now a desert can tell us that at some point in the past it used to be a sea bed.

DNA, feathers and skin?

Very rarely, fossils with soft tissue remains are found. These are called true form fossils. They are not imprints left behind and infilled like molds or casts. These fossils are the real remains of the animal or plant such as an insect trapped in amber or a large animal trapped in tar or ice.

Types of fossil

MOLD fossils are imprints of the original bone/ shell/leaf etc after the original has broken down. Mold fossils are hollow and show the reverse texture of an animal or plant. Mold fossils are comparable to a jelly mold.

OR

CAST fossils form when the hole left behind by the animal or plant remains is filled with minerals, creating a solid copy of the original body or plant part.

BODY fossils are the fossilised remains of plants or animals. They help tell us what prehistoric animals and plants looked like and include fossilised dinosaur bones, shells, fish, sharks teeth, leaves and tree trunks.

OR

TRACE fossils do not show us what an animal looked like, but can tell us about the activity or behaviour of the animal. They include footprints and trackways, nests, fossilised poo (coprolites) and scratch marks.

6 stages of fossil formation

i) An animal or plant dies.

ii) The soft parts (e.g. skin, feathers, muscle tissue) usually decompose or are eaten.

iii) The hard parts (e.g. shells, bones, teeth, bark) remain and are buried under layers of soft sediment/mud.

iv) The hard part eventually dissolves in the sediment leaving a hole in the sediment which is exactly the same shape and size. This is the mold.

v) Minerals from the ground water fill the mold like jelly. They form a solid exactly the same shape as the original hard body part. This is known as the cast.

vi) Over millions of years the sediment/mud layers build up. They harden and form sedimentary rock around the fossils.

Sometimes the soft sedimentary rock is eroded away, revealing the fossils.
Palaeontologists study fossil finds.

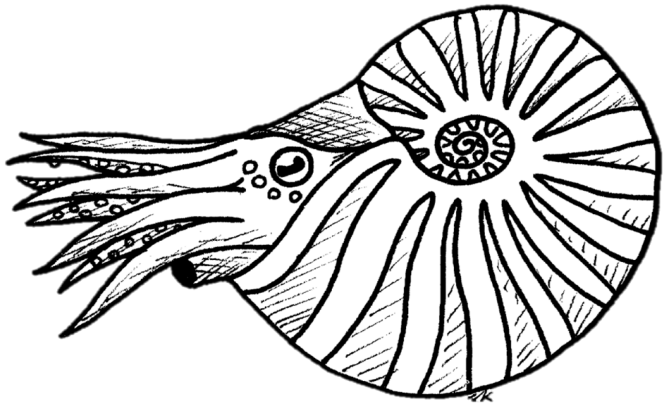
Ammonites

When were ammonites alive? - Ammonites as a group (subclass) were alive during the Devonian - Cretaceous (400-66 million years ago). They were in the animal class Cephalopoda which still has living animals in it today such as the octopus, squid, cuttlefish and nautilus.

Where does the name *ammonite* come from? - The name Ammonite comes from the Egyptian God, Ammon. Ammon was always shown with the horns of a ram. Ammonites were thought to look like the coiled ram horns.

What did ammonites eat? - Most ammonites would have eaten plankton and marine vegetation. They may have also eaten, small crustaceans and corals.

What did ammonites look like? - Ammonites looked like modern day Nautiloids. They were tentacled creatures which lived in the outer chamber of their shells. Some ammonites could squirt ink like an octopus!



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3D Ammonite Links

3D model of an ammonite fossil (Ringsteadia anglica) This ammonite shows intricate patterns on the shell.

https://skfb.ly/6RDC9

3D model of a halved ammonite fossil specimen. This shows the chambers and walls between them (septa)

https://skfb.ly/6RDCI

Ammonite shells - Ammonites lived in the outer-most chamber of their shell. The other chambers were filled with gas or fluid which could move through the chambers to control its movement and buoyancy (where it floated in the water). Man-made submarines work in the same way.

Different ammonite species can be identified by the suture patterns on their shells. Sutures show where the walls between each chamber are, some ammonites had very intricate suture patterns. The largest ammonite known grew to 2m in diameter.

Why are ammonites so important to geology?

Ammonites are important because they can act as markers of geological time. Certain types/species of ammonite were only living during certain time periods. If a rock has these ammonites in, then the rock must have formed during the time that the type or species of ammonite was alive. Often the age of a rock can be worked out by the ammonites within it.

Ichthyosaurs

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When were ichthyosaurs alive?

Ichthyosaurs were alive 251 million—90 million years ago, but they were at their most abundant during the Triassic and Jurassic (251 million—145.5 million years ago).

What did Ichthyosaurs look like?

Ichthyosaurs looked very similar to modern day porpoises or dolphins. They had an elongated body , which made them streamlined, moving through the water easily. They had large eyes for seeing in murky or dark waters. Ichthyosaurs had small, sharp, pointed teeth which could pierce fish and shells (and sometimes other, smaller ichthyosaurs!). Ichthyosaurs powered through the water using their strong tail, moving it from side to side.

Whet does *Ichthyosaur* mean?

Ichthyosaur means “Fish lizard”. It was named due to the confusion of fossil finders, who thought that the bones were very similar to fish, but the teeth seemed more like a crocodile’s.

Evolution and Adaptation

Ichthyosaurs and dolphins provide scientists with a fantastic example of animals evolving similar adaptations despite not being related (dolphins are mammals, ichthyosaurs are reptiles). Ichthyosaurs lived 200 million years before dolphins but their body shapes look very similar (such as elongated body and short necks). This is because ichthyosaurs and dolphins lived in similar environments, had similar diets and had similar predators. They both evolved to move quickly through water to catch small prey.

3D Ichthyosaur Links

This ichthyosaur skull is on display at the Lapworth Museum of Geology. The ichthyosaur was alive during the Lower Jurassic (201-199 million years ago). This ichthyosaur was a medium size at roughly 2.5m in length

https://skfb.ly/6RzKJ

Ichthyosaur limbs were called paddles. They were made of many small bones but were strong and streamlined, steering the ichthyosaur through the water

https://skfb.ly/6FnKG

Terrific Teeth

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What is a tooth?

A tooth is a hard, calcified structure which is found in jaws or mouths and is used to break down food. Some animals only ever grow one set of teeth. Others grow more than one. Humans have milk (or baby) teeth which are replaced by adult teeth as they grow. Sharks grow new teeth constantly throughout their lives, to replace any worn or broken teeth. Palaeontologists can tell a lot about an animal's diet and lifestyle from the shape and size of its teeth

Herbivore, Carnivore or Omnivore?

Herbivores

Herbivores are plant eaters. They have flat tooth surfaces with large surface areas, perfect for grinding tough, fibrous plants, fruits and seeds down.

Carnivores

Carnivores are meat eaters. They have sharp, pointed teeth which can pierce and tear flesh easily.

Omnivores

Omnivores eat plants and meat. They need to have both sharp and flat teeth. Humans evolved eating a mixed diet. That is why we have sharp teeth at the front (canines and incisors) and flat teeth at the back (molars).

Did you know...

- Teeth a very important in the fossil record. Many prehistoric animals have been named after the shape, size or arrangement of their teeth. Animals who have been named from their teeth end in "-don". For example, Iguanodon means "Iguana tooth" and "Smilodon" means "Two edged knife tooth".

- Sharks have cartilaginous skeletons. This means their bones are soft and break down easily. Their teeth are calciferous which makes them very hard so their teeth are often the only part of the shark in the fossil record.

3D Megalodon Tooth

Megalodon is an extinct species of shark, thought to have been the largest shark to ever have existed. It could reach lengths of 18m, and weigh up to 50 tonnes (the equivalent of 4 double decker buses!) The megalodon's large, sharp teeth were perfect for piercing and tearing its prey. Megalodon, like modern day sharks, probably grew thousands of teeth over its life time, replacing worn or broken teeth with new ones.

https://skfb.ly/69C7P

Trace Fossils

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Introduction

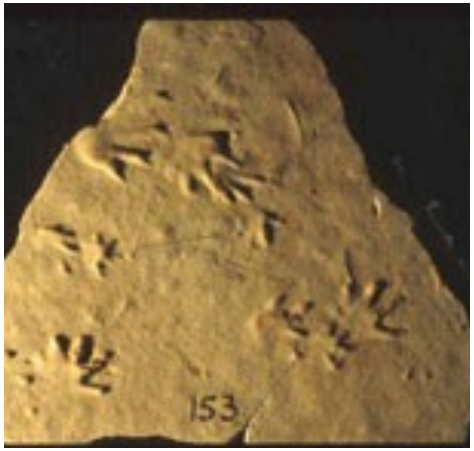
Trace fossils are any fossilised evidence for an organism existing, without containing any imprint or part of the actual plant or animal. They show us how animals or plants behaved or interacted with their environment. They can include trackways, foot or hand prints, fossilised poo (coprolites), scratch marks, burrows and nests

A fossilised turtle coprolite (poo)

Coprolites - A coprolite is a fossilised poo or dung. The name means dung stone. Coprolites are important to palaeontologists because they preserve contents, including small animals and plants. This means they can identify what the animal ate, as well as finding out more about the plants and animals in the poo. Some coprolites have even retained ancient DNA of their content!

Trackways - Trackways are sometimes the only evidence we have that an animal existed. There are many different forms of trackways. They might show hand or foot prints, they may show burrowing or they could show the imprint of a dragging tail or underbody. Trackways can help palaeontologists identify how an animal would move. How an animal walks will be different to how it runs. This can also be shown in trackways

Trackways can show if animals were sociable (lived together in groups) or solitary (lived alone), by whether a lot of trackways of different sizes are found together. They can also tell us if an animal was hurt (limping or dragging a leg) and how animals might have hunted!



Trackways from an early amphibian in sandstone

Nests - Nests show us important behaviour about animals laying and caring for young. Sometimes fossilised eggs are found in a nest. This can tell us how many babies an animal might have. Sometimes babies with no egg shells are found. This might tell us that the babies stay within the nest until they grow a little older.

Eggs are classed as pseudo-trace fossils. This means that they aren't trace fossils, because they show us the real shape / imprint of an animal. However, they can still tell us a lot about the behaviour of an animal.

3D Trace Fossil Links

The hand (manus) and foot (pes) prints of a large land dwelling amphibian from the late Carboniferous.

https://skfb.ly/69wBs

Trilobites

When were trilobites alive? - Trilobites were alive from the Cambrian through to the Late Permian (521 million – 250 million years ago). They roamed the oceans for 270 million years.

Where does the name *trilobite* come from? - The name trilobite means "three lobes". This is because of the three vertical sections of the body which are called lobes. Trilobites also have 3 sections running horizontally (head, body and tail), (Tri means three, like tricycle).

Where did trilobites live? - Trilobites were marine creatures. There were thousands of species of trilobite, some lived on the sea floor, some lived in shallow water, some buried into marine sediments.

What did trilobites look like? - Trilobites were arthropods, like modern day crustaceans, insects and arachnids. They had many different shapes and forms, with thousands of different species discovered. Some of these species had spikey head gear, some had eyes on stalks, others had flatter eyes, some had very large heads. The trilobite's body was made up of small segments which helped many species to roll up when they were in danger, similar to how woodlice roll up. Trilobites had jointed legs, one pair per segment of their body. They also had antennae.

The huge variation in trilobite shapes and sizes helps palaeontologists identify how and where they might have lived.

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3D Trilobite Links

Some trilobites could roll into a ball for protection https://skfb.ly/6RDBG

The Dudley Bug is a well known trilobite from the Wren's Nest, Dudley. It's true name is Calymene blumenbachii

https://skfb.ly/69wRW

Why are trilobites so important to geology?

Trilobites are important because they can act as markers of geological time. Certain types/species of trilobites were only living during certain time periods. If a rock has these trilobites in, then the rock must have formed during the time that type of trilobite was alive. Therefore, often the age of a rock can be worked out by the trilobites within it.

Trilobites can also help geologists understand how the surface of the Earth has changed. One species of trilobite which was alive 500 million years ago is only found in North West Scotland and North America. This tells geologists that 500 million years ago, North West Scotland and North America were close together.

Trilobite myths - In south Wales, trilobites tails are quite common in the rocks. The tails look like butterflies which have turned to stone and local legend links them to the magician Merlin.

Activity / Lesson Ideas

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On the following pages are a selection of activity ideas and printable worksheets.

Activity 1—Fossil formation cartoon

Activity 2—What footprints can tell us

Activity 3—Ichthyosaur adaptations

Each activity has;

- A description of the suggested activity and worksheet.
- Links to the National Curriculum.
- An example of a completed worksheet.

Fossil Formation

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National Curriculum Links

- Describe in simple terms how fossils are formed when things that have lived are trapped within rock

You will need:

- Cartoon strip template
- Pens / Pencils
- The stages of fossil formation sliced and in packets (mixed up) (the stages of fossilisation can be found below for slicing)
- Scissors

The Stages of Fossilisation

An animal or plant dies.	An animal or plant dies.	An animal or plant dies.
The soft parts (e.g. skin, feathers, muscle tissue) usually decompose or are eaten.	The soft parts (e.g. skin, feathers, muscle tissue) usually decompose or are eaten.	The soft parts (e.g. skin, feathers, muscle tissue) usually decompose or are eaten.
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How A Fossil Forms

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There are 5 stages to how fossils are formed. The 5 stages are jumbled up in front of you. Can you put them in the right order?

Once you have them in order, stick each stage onto your cartoon strip. Then draw a picture for each step to create your own fossil formation cartoon.

The first stage is written in for you.

An animal or plant dies.		

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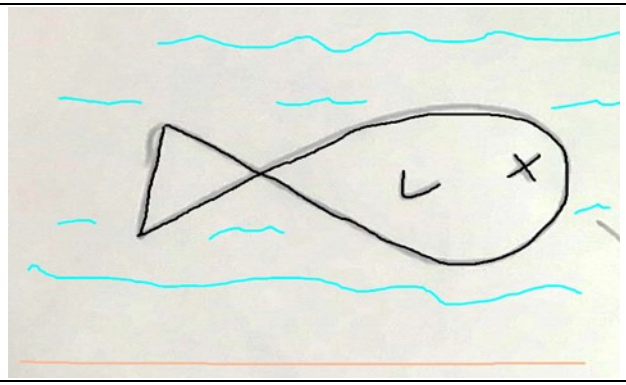	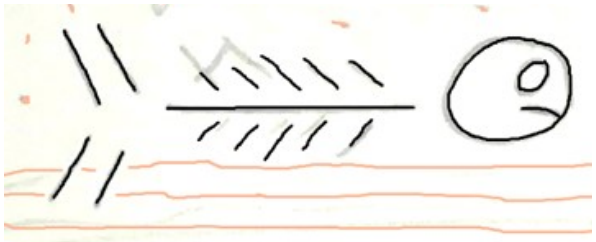	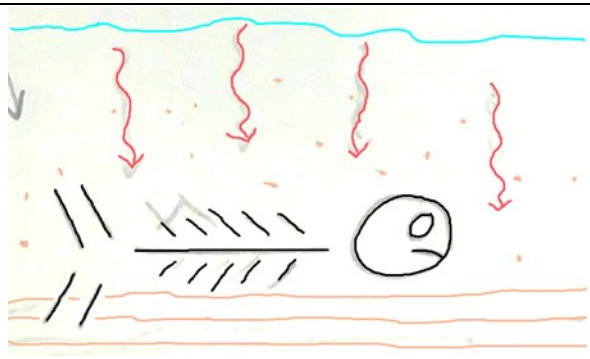
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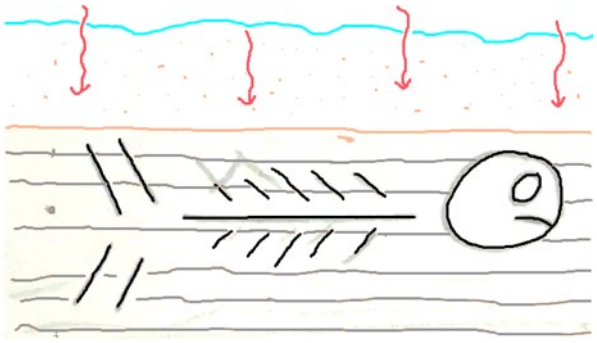	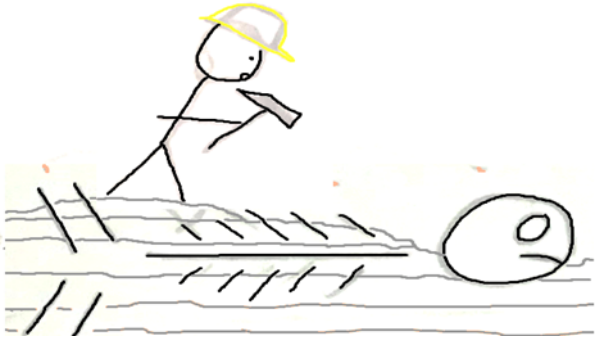	
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What Footprints Can Tell Us

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National Curriculum Links

- Measure using standard units
- I can gather and record data using tables and graphs
- I can use results to draw simple conclusions and make predictions

You will need:

- 1m rulers for measuring foot length
- 1A method of measuring height (e.g. 2 x 1m rulers attached to a wall)
- Worksheets
- Pens / Pencils

Information about this activity

- This activity explores the relationship between footprints and height.
- Palaeontologists often look at the length of trace fossil footprints to identify how large the creature who made it might have been. Space between the footprints can also tell Palaeontologists a lot about animal leg length, as well as the way in which they were moving (e.g. walking, running, limping, crawling, jumping)

What Footprints Can Tell Us

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Investigation

You are going to investigate if there is a link between a person's foot length and their height

Equipment:

- 1m ruler for measuring foot length
- A way of measuring height
- Worksheet
- A Pen or Pencil

Method

1. **Measure the length of your foot.** The best way to do this is to take your shoe off first. Place your foot next to a 1m ruler and measure from the back of your heel to the front of your big toe.
2. **Record your foot length data.** Write down what you measure in the table below.
3. **Measure your height.** This is easier if you ask someone to help you . Keep your shoes off for this too.
4. **Record your height data.** Write down your height in the table below.
5. **Collect extra data** from other members of your group and write it into the table
6. **Plot your group data**. Can you plot your data on the graph on the next page?

Person's Name	Foot Length (cm)	Height (cm)

What Footprints Can Tell Us

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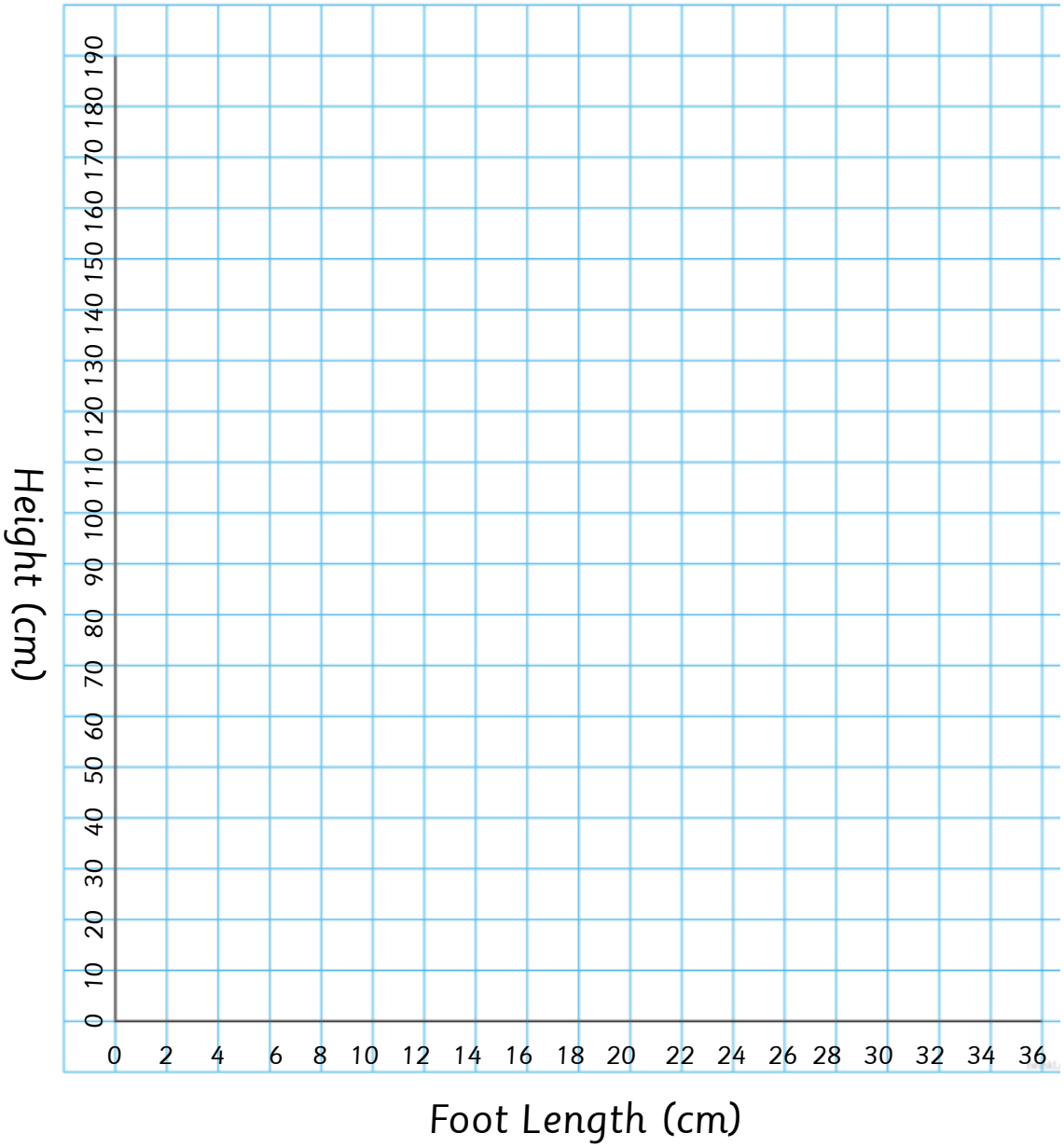

Graph Title

A graph to show

_____

_____

What does this graph show?

The tallest person was _____cm

The longest foot was _____cm

Did you find a pattern between height and foot length? What was it?

_____

_____

_____

If a person was 160cm, how long would you estimate their foot was?

_____

_____

Ichthyosaur Adaptations

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National Curriculum Links

- recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.
- identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

You will need:

- Ichthyosaur information sheet
- Ichthyosaur adaptations worksheet
- Adaptations tables (sliced.) *This can support pupils who are struggling Found on page 18)
- Pens / Pencils

Information about this activity

- This activity explores the adaptations of the ancient marine reptile, the ichthyosaur (page 5).
- Pupils could use the information about the Ichthyosaur as a reading comprehension activity to complete this activity.
- For pupils who require extra guidance, use the adaptations table provided to help the pupil to identify the adaptations.

Ichthyosaur Adaptations

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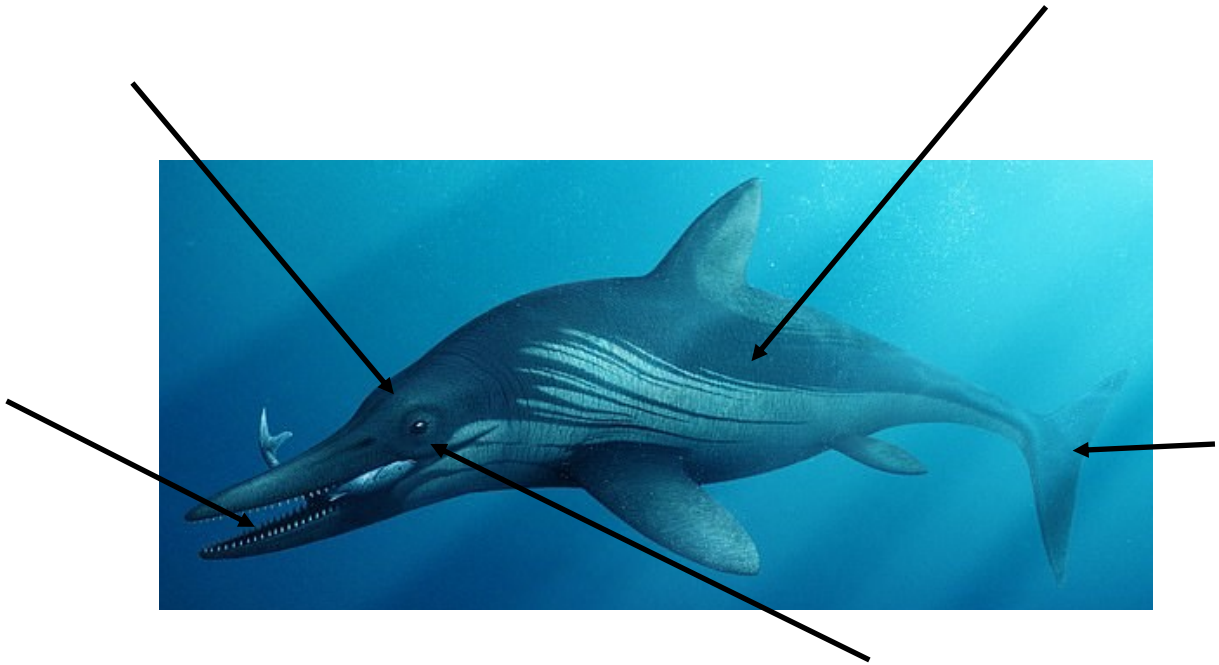
What is an ichthyosaur?

Ichthyosaurs (also known as "fish lizards") were large marine reptiles which lived in the Jurassic seas over 200 million years ago. They look very similar to modern day dolphins and porpoises and would have lived in a very similar way. The ichthyosaur's body was adapted to its life style and environment.

Activity

Look at the picture of an ichthyosaur. Label the adaptations (characteristics and features) you can see. Can you explain how these characteristics might help the ichthyosaur to live in a marine environment?



Challenge

Can you identify any other adaptations? Write them on the back of this sheet

Sharp teeth	Used to pierce the flesh of other animals and the shells of crustaceans.
Powerful tail	Used to move quickly through the water by moving it from side to side.
Pointed face	A pointed body makes it easier to move through the water. There is less water resistance or drag.
Large eyes	For seeing well in dark or murky water. The ichthyosaur was a carnivore and needed to hunt its prey.
Smooth skin	This made it easier for the ichthyosaur to move through the water quickly.

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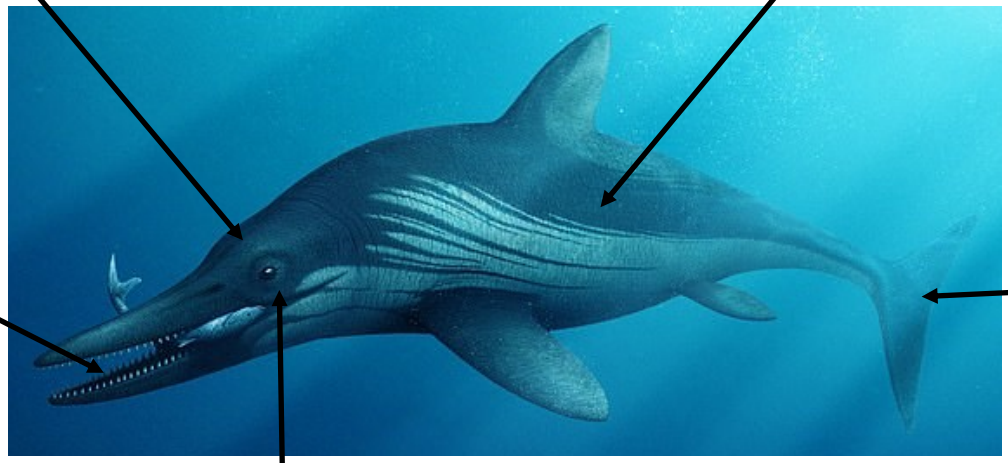
Pointed face / body shape —A pointed body makes it easier to move through the water. There is less water resistance or drag.

Smooth skin—This made it easier for the ichthyosaur to move through the water quickly.



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Answer sheet