

FOSSILS

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Left: Fossils found at Charmouth on the Jurassic Coast
Middle: Fossil lizard ©Trustees of the Natural History Museum
Right: *Allosaurus* and *Stegosaurus* dinosaur fossils Luke Jones/Wikimedia Commons



What are fossils? How do they form? Why do scientists study fossils and what can they tell us about the ancient creatures and plants that once lived on Earth?

Fossils are the **preserved evidence** of plants and animals that once lived on Earth. Fossils can be as tiny as a grain of pollen or as huge as a dinosaur skeleton! Scientists called **palaeontologists** study fossils to discover what animals and plants used to live on Earth and how life has changed (or **evolved**) over time. Without fossils we wouldn't know that woolly mammoths or dinosaurs ever existed!

When a plant or animal dies it is very unlikely that it will end up as a fossil. It will usually be eaten by **scavenging animals**, broken up by wind, ice and waves, or simply rot away. Even when fossils do form, typically only the **hard parts** such as teeth, shells and bones are preserved, so the **fossil record** has lots missing from it.

BODY & TRACE FOSSILS

There are two types of fossils, **body fossils** and **trace fossils**. Body fossils are plant and animal remains like leaves, teeth, shells and bones. Trace fossils are evidence left behind by animals, things like footprints, burrows and even poo!

Trace fossils usually form as **moulds** or **casts**. A mould forms when something leaves a hollow imprint in soft sediment, like footprints on wet sand. A cast forms when a solid mould is filled in with sediment, creating a 3D impression of the original object.

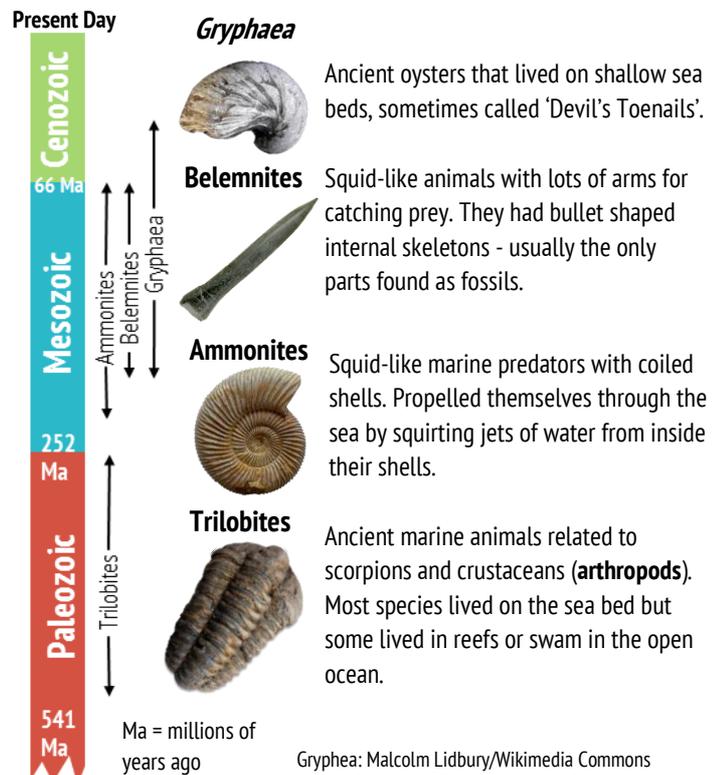
Dinosaur footprint trace fossil. Can you spot three toes? Image: Pete Loader



- **Dinosaur footprint tracks** can reveal where a dinosaur lived, how fast it could run and even what the pattern of scales looked like on its skin!
- Fossil poo, or **coprolites**, can tell us about the diets of ancient animals as they often contain tiny bones, scales or plants that an animal had eaten but not fully **digested**. Fragments of crushed bone have been found in *Tyrannosaurus rex* coprolites telling us that this dinosaur must have had extremely powerful jaws!



SOME FOSSILS COMMONLY FOUND IN THE UK



DID YOU KNOW?

Stromatolites are some of the oldest fossils ever found on Earth. They might just look like rocks, but are actually made from layers of bacteria that grow over thousands of years. Most palaeontologists agree that the oldest stromatolites, found in Western Australia, are 3.43 billion (that's **3,430,000,000**) years old, but there could be stromatolites in Greenland that are 3.7 billion years old!

Modern stromatolites in Western Australia.

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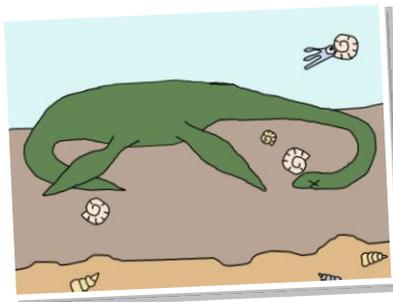


HOW DO FOSSILS FORM?

Fossils can form in a few different ways but usually an organism has to be **buried** very quickly in **soft sediment** such as mud or sand, in a calm, watery environment like the muddy sea floor, bottom of a lake or a river estuary. Here are the stages in which a fossil might form:

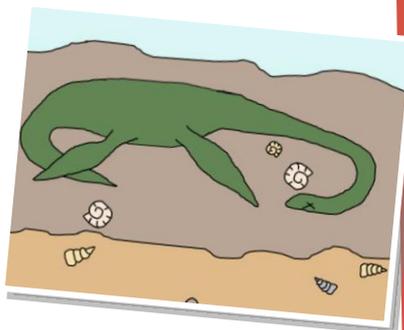
STAGE 1: DEATH

A marine reptile from the **Jurassic** period called a **plesiosaur** dies and its body falls to the sea floor.



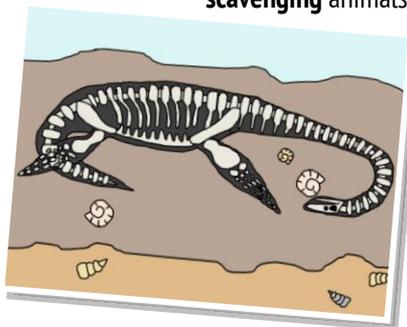
STAGE 2: RAPID BURIAL

A **landslide** occurs nearby and the plesiosaur is buried quickly in mud, preventing **scavenging** animals from gobbling it up.



STAGE 3: DECAY OF SOFT PARTS

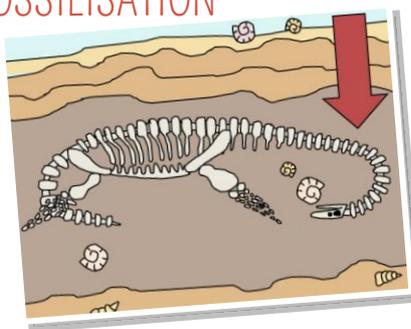
The muscles, skin and other soft parts of the plesiosaur are digested by bacteria in the sediments. Only the hardest parts such as the bones and teeth are left.



STAGE 4: BUILD-UP OF SEDIMENTS & FOSSILISATION

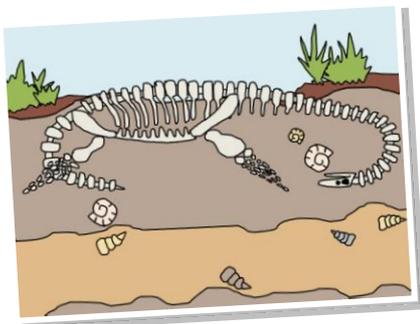
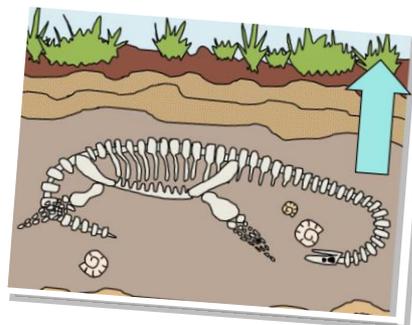
As time passes, more and more sediment builds up. The weight of the overlying layers squashes the soft mud and it begins to turn into rock. This is called **lithification**.

Water is squeezed out of the mud and seeps into the plesiosaur bones. Minerals and chemicals in this water gradually change the bones and teeth into stone. The plesiosaur is now a fossil but it is buried under layers and layers of rock under the ocean.



STAGE 5: UPLIFT ONTO LAND

Over millions of years, sections of the Earth's crust called **tectonic plates** move around. **Continents** crash into each other and shove the rocks upwards. Rocks that were previously at the bottom of the ocean can be raised above sea level!



STAGE 6: EROSION & EXPOSURE

Over time the rock layers are gradually stripped away by **erosion** (wind, rain, waves and ice). Part of the fossil is revealed at the surface to be discovered by a lucky fossil hunter!

EXCEPTIONAL PRESERVATION

Very rarely the soft parts of animals such as muscles, feathers, skin are preserved as fossils. Sometimes even entire animals made of **soft tissue**, like jellyfish and worms, are preserved. Palaeontologists call this **exceptional preservation**.

Exceptionally preserved fossil dragonfly from the Solnhofen limestones of Germany



FOSSIL COLOUR

Exceptional preservation can sometimes even show us prehistoric animal **colours**! Feathers, scales and hair contain **microscopic** structures called **melanosomes**. Melanosomes have different shapes depending on their colour and in extremely rare cases they can be preserved in fossils. Using **powerful microscopes**, palaeontologists can work out some of the colours of fossil feathers and scales.

Melanosomes have recently revealed that a dinosaur called ***Sinosauropteryx*** would have been covered in orange feathers with a white and orange striped tail! Another dinosaur called ***Microraptor*** is now known to have been covered in glossy black feathers like a starling!



Sinosauropteryx fossil from China with fossilised feathers and melanosomes!

Credit: James St. John/ Wikimedia Commons