

FOSSILS AND DINOSAURS

MUCH OF DARWIN'S THEORY OF EVOLUTION WAS BASED UPON WHAT HE HAD LEARNED FROM HIS STUDY OF FOSSILS DISCOVERED DURING THE BEAGLE VOYAGE.

Fossils can provide invaluable evidence of how the earth has changed over time and how plant and animal life has evolved from its earliest beginnings. They are particularly useful when comparisons can be made between extinct and closely related living species (for example, ammonites and the nautilus, the glyptodont and the armadillo), which is what Darwin had been able to do. Palaeontologists (people who study fossil flora and fauna in order to understand ancient life) need to be both geologists, able to establish the ages of the rocks in which the fossils are found, and biologists, able to work out how the fossilised organisms once lived.

The most common fossil finds are body fossils. These are the remains of the hard parts of long-dead organisms, such as bones, teeth, claws and shells. The likelihood of an organism being fossilised is increased if the body is buried soon after death, as this helps prevent damage to the remains from exposure to the effects of air, the weather or scavengers. It is for this reason that about 90 per cent of finds are in locations that were previously under water and where the remains had quickly been covered by sediment. The soft tissues in the organism decompose while the hard parts are slowly infiltrated by waterborne minerals. The

weight of accumulated layers of mud and sand, along with the passage of time, turn the mineralised remains into a fossil. Trace fossils – such as droppings, footprints, eggs or tooth marks – record examples of animal activity. The oldest known fossils are of bacteria-like cells dating back over 3,500 million years.

There are records of fossil finds in Ancient Greece and Rome, though few at that time seem to have recognised their significance. In the seventeenth century, the Danish geologist Neils Stensen was among the first to establish that fossils were the buried remains of ancient animals and, in the 1750s, the discoveries of mastodon and mammoth bones in the USA brought the realisation that species could become extinct. Extinction was a contentious subject at this time as it suggested a flaw in what the majority still considered to be a divinely conceived creation. Some Biblical geologists – those who believed in the literal truth of the Bible – explained this by saying there had been several creations and extinctions, and that the book of Genesis only dealt with the most recent one.

One of the richest locations in Britain for fossil finds is the 95-mile long Jurassic Coast Natural World Heritage Site which runs from Orcombe Rocks, Devon to Studland Bay in Dorset. This was the hunting ground of the most famous female collector of the nineteenth century, Mary Anning, who, from an early age, had helped her impoverished father collect fossil curios from the

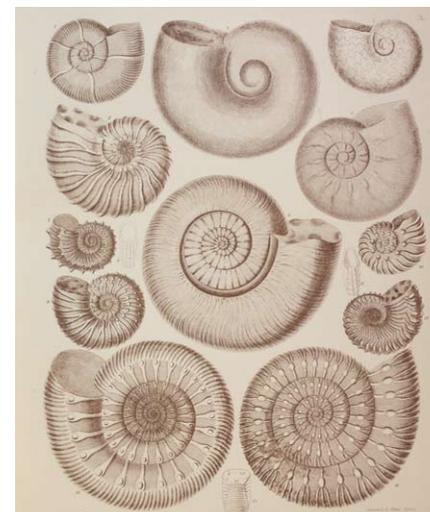
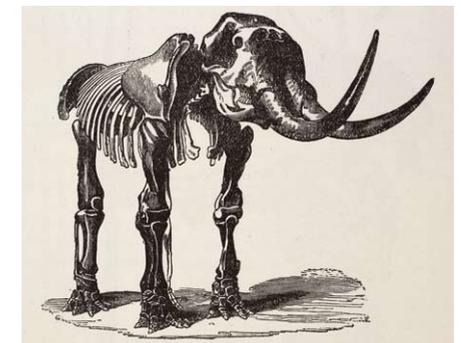


Plate illustrating ammonites from *An Atlas of the Fossil Conchology of Great Britain and Ireland* by Captain Thomas Brown (1889) (Bath in Time – Bath Central Library).

Mastodon skeleton from Alfred Russel Wallace's *The World of Life* (1910) (Bath in Time – Bath Central Library).





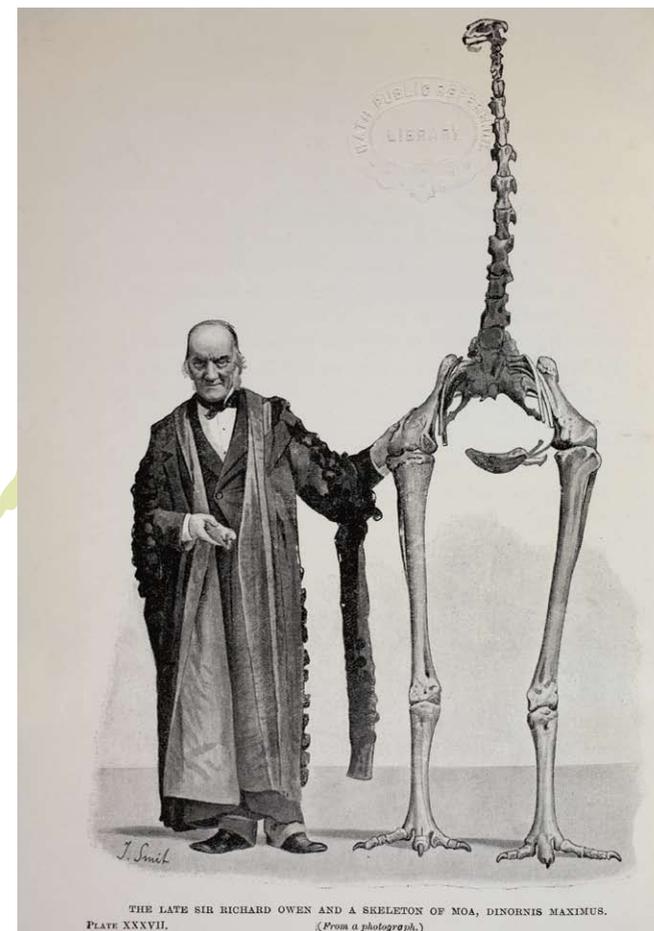
Artist's impression of encounter between ichthyosaur and long-necked plesiosaur from Louis Figuier's *The World Before the Deluge* (1865) (Bristol Libraries).

beach and cliffs at Lyme Regis to sell to tourists. These included gigantic pointed teeth, like those of an enormous crocodile, and fragments of backbones, as well as ammonites and belemnites. In 1812, Anning uncovered the first complete skeleton in Britain of an ichthyosaur, a five-metre long marine reptile that resembled a large dolphin. She also found Britain's first complete plesiosaur skeleton (a long-necked fish-eating aquatic reptile), and the first pterosaur (a winged lizard).

The fossil finds that elicit the greatest interest among the general public are those of the dinosaurs, which dominated the earth from around 200 million years ago until their extinction at the end of the Cretaceous period, 135 million years later (humans first appeared on earth long after this, around three millions years ago). The first fossilised dinosaur remains identified in Britain were discovered by the physician and geologist Gideon Algernon Mantell in a quarry at Cuckfield, Sussex, in the early 1820s. These were the teeth and bones of a gigantic plant-eating reptile comparable to a modern-day iguana, hence the name Mantell coined in 1825 to describe it, 'iguanodon' or 'iguana tooth'. This was the second dinosaur find to be officially named. The first was the megalosaurus ('big reptile'), a name given in 1824 by the geologist William Buckland to a collection of large bones acquired by the Ashmolean Museum from quarries in Stonesfield, Oxfordshire.

The name 'dinosaur' first appeared in print in 1842 in the published version of Richard Owen's 'Report on British Fossil Reptiles' which had been presented at a meeting of the British Association for the Advancement of Science in August 1841. Owen had once been a close colleague of Darwin and had been entrusted with Darwin's

Sir Richard Owen with skeleton of a moa from the Rev H N Hutchinson's *Extinct Monsters and Creatures of Other Days* (1910) (Bath in Time – Bath Central Library).



fossil mammals from the *Beagle* voyage, but he became one of Darwin's fiercest critics following the publication of *On the Origin of Species*, a reaction Darwin attributed to professional jealousy. The word 'dinosaur' was derived from the Greek, meaning 'terrible or fearfully great lizard'. It was used by Owen to describe what he had identified as a distinct species of large, advanced, extinct reptiles.

Owen's work thrilled the general public, as well as attracting the attention of the scientific community, and he was generally recognised as Britain's leading authority on palaeontological classification. He had the ability to deduce the appearance of an animal on the basis of a single fragment of bone. One of his most



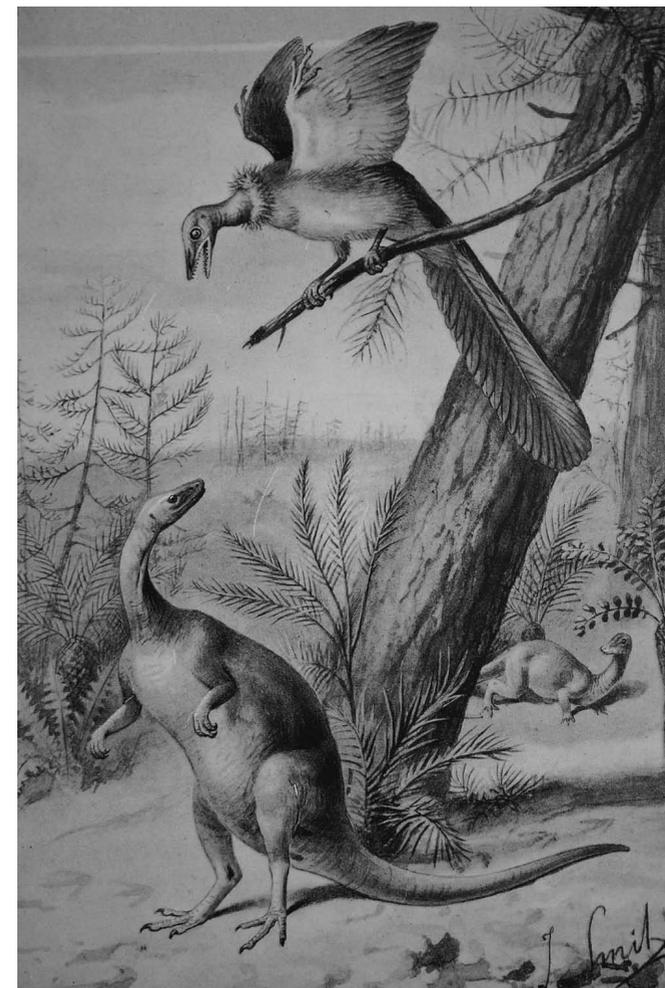
Illustrated London News' depiction of the dinner in the iguanodon (University of Bristol Library). Owen thought the dinosaur was a sturdy, four-legged beast, whereas Mantell had correctly concluded that the creature's forelimbs were smaller than the back ones, and used to grasp objects.

impressive feats of deduction was based on a six-inch section of marrow bone originating from New Zealand that was given to him by a sailor in 1839. Owen decided the fragment must belong to a large, extinct flightless bird. He was proved right when he received a box containing a collection of bones from a New Zealand missionary in 1843 from which he could partially reconstruct a skeleton. The bird became known as the moa or dinornis.

Owen's moa prediction was brought to the attention of Prince Albert, who, contemporary reports say, led the rush of society people eager to see the remains. Owen served on the committee that planned the Great Exhibition of 1851, a project that had been largely instigated through the prince consort's efforts. When it was decided that the Crystal Palace complex should be relocated to a permanent site at Sydenham after the exhibition closed, Owen was invited to design a prehistoric park to be erected in the grounds. The dinosaurs were built out of reinforced concrete by Benjamin Waterhouse Hawkins from Owen's designs. As a publicity stunt, a celebratory dinner for 21 distinguished guests was held on New Year's Eve 1853 inside a life-size reconstruction of an iguanodon. When Owen's 'Mausoleum to the Memory of a Ruined World' was officially opened on 10 June 1854, the dinosaur sculptures were a sensation and proved a major attraction. It was exhilarating to think such creatures had once walked upon the earth.

In 1863, a lizard-bird fossil was discovered in Solenhofen, Germany, and Owen arranged to buy it for the British Museum, naming it *Archaeopteryx*; it has proved to be one of the most

important fossils ever found. For Darwin and his supporters, this fossil provided the evidence of a transitional stage between species – a missing link from the dinosaurs to modern birds – that supported Darwin's theory of evolution. Owen himself seems to have been unaware of the significance of the find, and might have been less keen to give it publicity if he had. Although he was not against the principle of evolution, he was firmly against Darwin's interpretation of it, convinced that there was a divinely ordained limit to the degree by which a species could adapt and change. Fossil hunting had proved to be a dangerous business, as it could reveal knowledge that shook such long-held beliefs.



Artist's impression of *Archaeopteryx*, the earliest known fossil bird, and *Compsognathus*, a small dinosaur, from Henry R Knipe's *Nebula to Man* (1905) (Bristol Libraries). Some creationists are now suggesting that *Archaeopteryx* was a fake.