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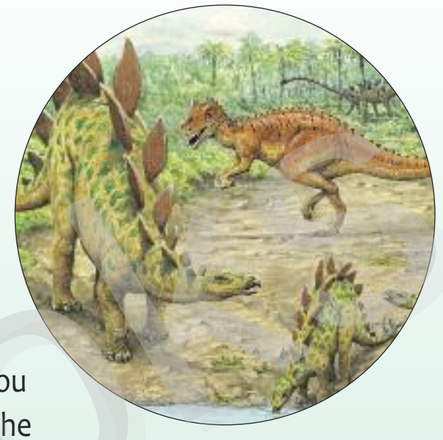


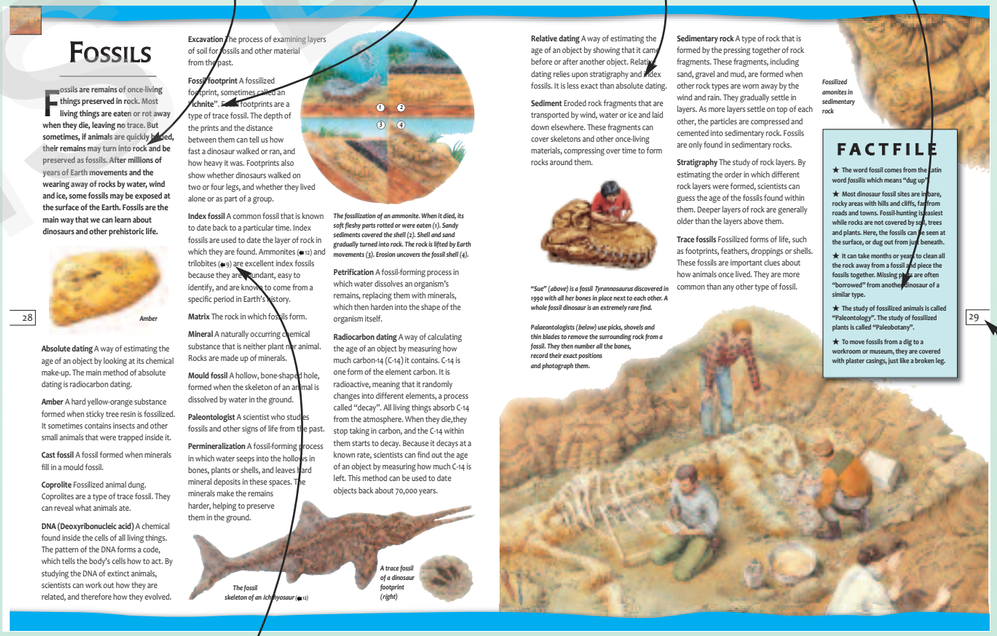
Each double page contains a brief introduction, explaining the general subject, followed by key words arranged in alphabetical order. To look up a specific word, turn to the index at the back of this book: this will tell you which page to go to. If you want to learn more about a subject, take a look at the factfile, or follow the arrows to read related entries.

INTRODUCTION
This explains the general subject and provides some basic knowledge.

BOLD WORDS
These highlight useful words that do not have their own entry.

KEY WORDS AND ENTRIES
Key words are arranged alphabetically across each double page. Each entry provides a short explanation of what the key word means.

FACTFILE
The factfile provides extra information on the subject. Facts are presented in easy to read bullet points.



Fossils

Fossils are remains of once-living things preserved in rock. Most living things are eaten or rot away when they die, leaving no trace. But sometimes, if animals are quickly buried, their remains may turn into rock and be preserved as fossils. After millions of years of Earth movements and the wearing away of rocks by water, wind and ice, some fossils may be exposed at the surface of the Earth. Fossils are the main way that we can learn about dinosaurs and other prehistoric life.

Amber

Absolute dating A way of estimating the age of an object by looking at its chemical make-up. The main method of absolute dating is radiocarbon dating.

Amber A hard yellow-orange substance formed when sticky tree resin is fossilized. It sometimes contains insects and other small animals that were trapped inside it.

Cast fossil A fossil formed when minerals fill in a mould fossil.

Coprolite Fossilized animal dung. Coprolites are a type of trace fossil. They can reveal what animals ate.

DNA (Deoxyribonucleic acid) A chemical found inside the cells of all living things. The pattern of the DNA forms a code, which tells the body's cells how to act. By studying the DNA of extinct animals, scientists can work out how they are related, and therefore how they evolved.

Excavation The process of examining layers of soil for fossils and other material from the past.

Fossil footprint A fossilized footprint, sometimes called an "ichnite". Fossil footprints are a type of trace fossil. The depth of the prints and the distance between them can tell us how fast a dinosaur walked or ran, and how heavy it was. Footprints also show whether dinosaurs walked on two or four legs, and whether they lived alone or as part of a group.

Index fossil A common fossil that is known to date back to a particular time. Index fossils are used to date the layer of rock in which they are found. Ammonites (➡31) and trilobites (➡9) are excellent index fossils because they are abundant, easy to identify, and are known to come from a specific period in Earth's history.

Matrix The rock in which fossils form.

Mineral A naturally occurring chemical substance that is neither plant nor animal. Rocks are made up of minerals.

Mould fossil A hollow, bone-shaped hole, formed when the skeleton of an animal is dissolved by water in the ground.

Paleontologist A scientist who studies fossils and other signs of life from the past.

Permineralization A fossil-forming process in which water seeps into the hollows in bones, plants or shells, and leaves hard mineral deposits in these spaces. The minerals make the remains harder, helping to preserve them in the ground.

The fossil skeleton of an ichthyosaur (➡31)

A trace fossil of a dinosaur footprint (right)

The fossilization of an ammonite. When it died, its soft fleshy parts rotted or were eaten (1). Sandy sediments covered the shell (2). Shell and sand gradually turned into rock. The rock is lifted by Earth movements (3). Erosion uncovers the fossil shell (4).

Petrification A fossil-forming process in which water dissolves an organism's remains, replacing them with minerals, which then harden into the shape of the organism itself.

Radiocarbon dating A way of calculating the age of an object by measuring how much carbon-14 (C-14) it contains. C-14 is one form of the element carbon. It is radioactive, meaning that it randomly changes into different elements, a process called "decay". All living things absorb C-14 from the atmosphere. When they die,they stop taking in carbon, and the C-14 within them starts to decay. Because it decays at a known rate, scientists can find out the age of an object by measuring how much C-14 is left. This method can be used to date objects back about 70,000 years.

Relative dating A way of estimating the age of an object by showing that it came before or after another object. Relative dating relies upon stratigraphy and index fossils. It is less exact than absolute dating.

Sediment Eroded rock fragments that are transported by wind, water or ice and laid down elsewhere. These fragments can cover skeletons and other once-living materials, compressing over time to form rocks around them.

"Sue" (above) is a fossil Tyrannosaurus discovered in 1990 with all her bones in place next to each other. A whole fossil dinosaur is an extremely rare find.

Paleontologists (below) use picks, shovels and thin blades to remove the surrounding rock from a fossil. They then number all the bones, record their exact positions and photograph them.

Sedimentary rock A type of rock that is formed by the pressing together of rock fragments. These fragments, including sand, gravel and mud, are formed when other rock types are worn away by the wind and rain. They gradually settle in layers. As more layers settle on top of each other, the particles are compressed and cemented into sedimentary rock. Fossils are only found in sedimentary rocks.

Stratigraphy The study of rock layers. By estimating the order in which different rock layers were formed, scientists can guess the age of the fossils found within them. Deeper layers of rock are generally older than the layers above them.

Trace fossils Fossilized forms of life, such as footprints, feathers, droppings or shells. These fossils are important clues about how animals once lived. They are more common than any other type of fossil.

Fossilized ammonites in sedimentary rock

FACTFILE

★ The word fossil comes from the Latin word *fossilis* which means "dug up".

★ Most dinosaur fossil sites are in bare, rocky areas with hills and cliffs, far from roads and towns. Fossil-hunting is easiest while rocks are not covered by soil, trees and plants. Here, the fossils can be seen at the surface, or dug out from just beneath.

★ It can take months or years to clean all the rock away from a fossil and piece the fossils together. Missing pieces are often "borrowed" from another dinosaur of a similar type.

★ The study of fossilized animals is called "Paleontology". The study of fossilized plants is called "Paleobotany".

★ To move fossils from a dig to a workroom or museum, they are covered with plaster casings, just like a broken leg.

ARROWS
These arrows show you where to look up other words mentioned in the entry. For example, (➡26) tells you to go forward to page 26 and (⬅6) tells you to turn back to page 6.

PAGE NUMBER
Page numbers are easy to find at the side of the page.

The Age of Dinosaurs

The dinosaurs were a group of reptiles that lived on the land during the Mesozoic era (250-65 million years ago). Unlike other reptiles, they walked upright on legs held beneath their bodies. The word dinosaur means "terrible lizard". It refers to the terrifying appearance of the first dinosaur finds, which were very large, but in fact dinosaurs came in all shapes and sizes. The dinosaurs spread out across the world and ruled the land for 160 million years until 65 million years ago, when they suddenly died out.

Bipedal Walking on two legs only. Some types of dinosaur were bipedal. Others could only walk on two legs for short periods of time, perhaps to reach treetops or to run away. Bipedal dinosaurs were generally much faster than their quadrupedal relatives.

Carnivores Meat-eating animals. All carnivorous dinosaurs were theropods.

Cretaceous period The period of Earth's history from 145 to 65 million years ago. During this time, much of the Earth was covered by shallow seas and temperatures were very warm. Flowering plants, which had evolved during the Jurassic, replaced more ancient plants, and grasses appeared.

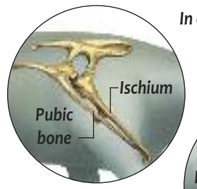
Like most reptiles today, female dinosaurs laid eggs. Some species made nests for their young.

Extinction The dying out of a species.

Gondwanaland A huge southern continent. It was once part of the "supercontinent" Pangaea, but drifted away during the Jurassic period. It included the modern continents of Australia, Africa, southern Europe, Antarctica and South America.

Herbivores Plant-eating animals. The sauropodomorphs and ornithischians were all herbivores.

Iridium A metal that is believed to be present only in the core of the Earth and in asteroids (rocky objects from space). A layer of iridium discovered by scientists is used as evidence that the K-T extinction was brought about by an asteroid impact.

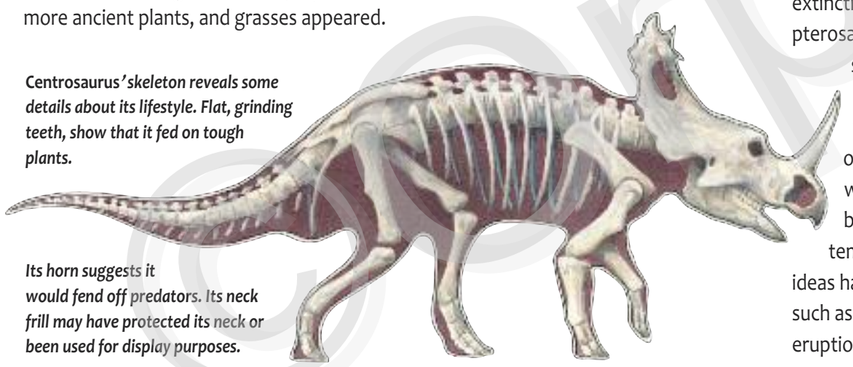


In ornithischians (left), the pubic bone slanted backwards.

In most saurischians (right), the pubic bone slanted fowards.

Jurassic period The period of Earth's history from 200 to 145 million years ago. During the Jurassic period, the climate became wetter. Plants became abundant and dinosaurs began to grow much larger.

K-T extinction The mass extinction that took place 65 million years ago, between the Cretaceous and Tertiary periods. (The letter K stands for the German word *Kreidezeit*, meaning "Cretaceous".) The extinction wiped out all dinosaurs, pterosaurs and marine reptiles. Most scientists now agree that the extinction was caused by the impact from an asteroid (a rocky object from space). The atmosphere would have been filled with dust, blotting out the Sun and lowering temperatures for many years. Other ideas have been suggested over the years, such as the theory that a massive volcanic eruption could have caused the extinction.



Centrosaurus's skeleton reveals some details about its lifestyle. Flat, grinding teeth, show that it fed on tough plants.

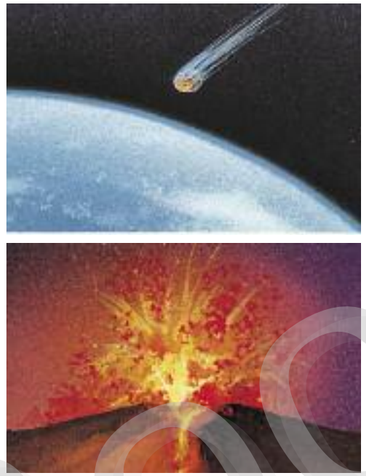
Its horn suggests it would fend off predators. Its neck frill may have protected its neck or been used for display purposes.

Laurasia A huge northern continent. It was once part of the "supercontinent" Pangaea, but broke away during the Jurassic period. It included the modern continents of Asia, North America and Europe.

Mesozoic era The span of time in Earth's history from 248 to 65 million years ago. It is divided into the Triassic, Jurassic and Cretaceous periods. During the Mesozoic era, dinosaurs ruled the land. For this reason, it is sometimes known as the "Age of Dinosaurs".

Ornithischians The "bird-hipped" dinosaurs, one of two major types of dinosaur (the other were the saurischians). Ornithischians had backward-slanting pubic bones—the lower part of the hip bone.

Dinosaur skin (above) was similar to that of modern reptiles. Their scales did not overlap, but were separated from one another by thin areas of skin.



Two possible causes of the K-T extinction: an asteroid smashes into Earth (top) and a massive volcano erupts (bottom).

Quadrupedal Walking on four legs. Most quadrupedal dinosaurs were large animals that needed all four legs to support the weight of their bodies. They were slower than their bipedal relatives, and had to rely on tough hides and sheer size as defence against meat-eating predators. Some species also developed protective body armour.

Saurischians The "lizard-hipped" dinosaurs, one of two major types of dinosaur (the others were the ornithischians). They had forward-jutting pubic bones—the lower part of the hip bone. Saurischians included the theropods and the sauropodomorphs.

FACTFILE

★ There were dinosaurs of almost every size, from tiny hunters no larger than a pet cat to giants that were the biggest creatures ever to set foot on Earth.

★ Some dinosaurs nested in huge colonies, like gannets and other birds do today, probably for protection against predators.

★ Dinosaurs were the only reptiles ever to walk with their legs directly beneath them. Modern lizards, such as the Komodo dragon *(below)*, walk with a sprawling gait. The bone structure of a dinosaur's limbs was more like that of a mammal's. It allowed dinosaurs, such as *Compsognathus (right)* to walk and run more efficiently.

Compsognathus

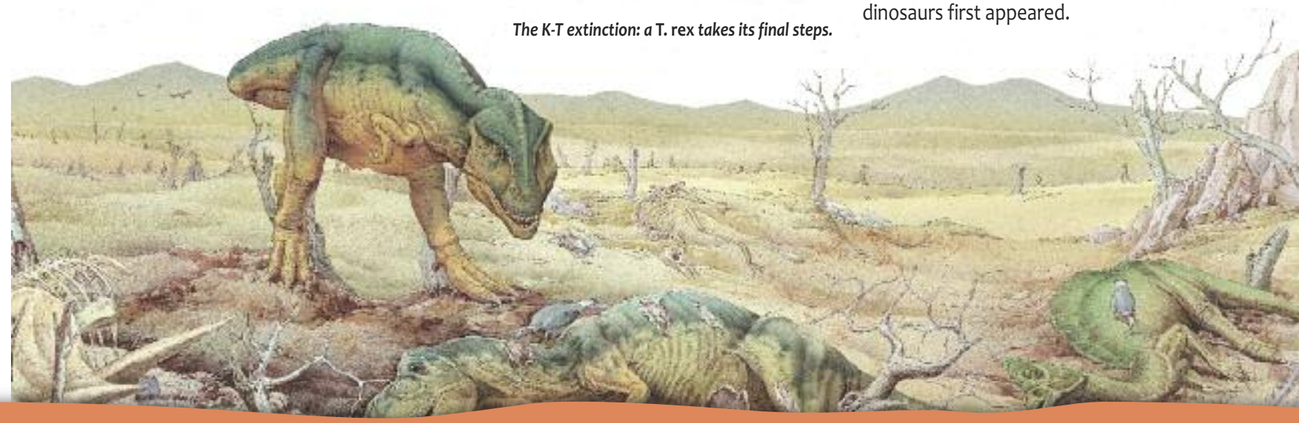
★ As well as the K-T extinction, there were large extinctions at the end of the Triassic and Jurassic periods.

Komodo dragon

Sauropodomorphs A group of large, plant-eating saurischian dinosaurs. They had very long necks and tails. This group includes the prosauropods and the sauropods.

Theropods A group of mostly meat-eating dinosaurs. They all had three toes.

Triassic period The period of Earth's history from 248 to 200 million years ago. This is the period when the dinosaurs first appeared.



The K-T extinction: a T. rex takes its final steps.

Theropods

Theropods were a group of mostly meat-eating saurischian (◂ 13) or "lizard hipped" dinosaurs. They all had three toes and their name means "beast-footed". Theropods were the first kind of dinosaur to evolve. They had large eyes and long tails.They ran on their two strong back legs, leaving their arms free to grasp or pin down their prey. They ranged in size from tiny *Compsognathus*, the size of a chicken, to 18 m long *Spinosaurus*. Most experts believe that birds evolved from theropods during the Jurassic period.

Allosaurus A large meat-eating dinosaur from the Late Jurassic. It grew up to 12 m long. It had sharp teeth and three big, clawed toes on each foot. It probably hunted in packs to bring down large prey.

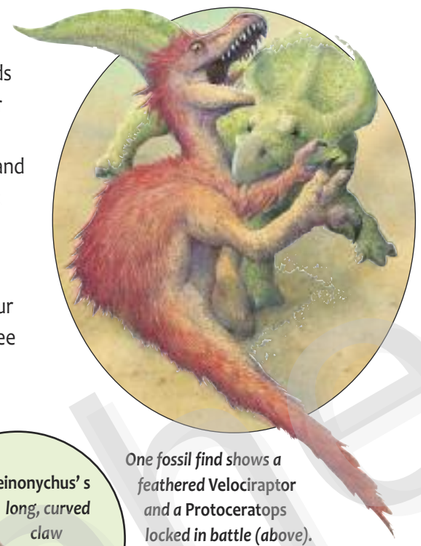
Archaeopteryx A bird-dinosaur from the Jurassic period. It is the earliest known bird. Like birds, it had feathers, wings and a small, light body. However, it had much more in common with theropods. Like them, it had strong jaws and sharp teeth, a long neck and stiff tail and three clawed fingers. It fed on meat, fish and insects.

Baryonyx A meat-eating dinosaur from the Cretaceous period. It had the body of a large carnivore, about eight metres long, but its skull was long and narrow, with small, sharp teeth, a bit like a crocodile. It probably fed on fish, wading through the shallows and hooking them out with its long thumb-claw.

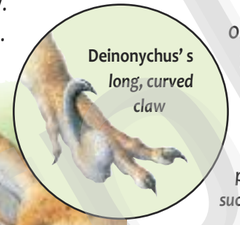
Ceratosaurs An early group of theropods that usually had horns or ridges on their snouts. Their name means "horned lizards". They had four digits on each hand and a gap between their front and back teeth. They included *Coelophysis*, *Ceratosaurus* and *Dilophosaurus*.

Coelophysis A small meat-eating dinosaur from the Late Triassic. It grew up to three metres long. It had a long, narrow head and sharp teeth, which it used to eat lizards and other small prey. It probably hunted in packs.

Compsognathus A tiny meat-eating dinosaur from the Late Jurassic. It was about the size of a chicken and preyed on insects and lizards. It was probably the fastest bipedal animal of all time, running at speeds of about 65 km per hour.



One fossil find shows a feathered **Velociraptor** *and a* **Protoceratops** *locked in battle (above).*



Deinonychus *(left) would work as a pack to bring down large dinosaurs, such as this* **Tenontosaurus.**

Deinonychus A large meat-eating dinosaur from the Early Cretaceous. It was about three metres long, with a large head, powerful jaws and a relatively large brain. Its name means "terrible claw", and refers to its lethal, scythe-shaped toe-claws. These were so long that *Deinonychus* had to raise them up while it ran. *Deinonychus* probably hunted in packs, in order to bring down prey much larger than themselves.

Tyrannosaurus rex *(above)*

Ornithomimids A group of fast-running dinosaurs from the Cretaceous period. Their name means "bird-mimic lizards" and refers to their ostrich-like appearance. They fed on plants and small animals such as insects and lizards. They had long beak-shaped mouths and most species had no teeth at all. They included *Ornithomimus*, *Struthiomimus* and *Gallimimus*.

Oviraptor A 2.5-metre-long meat-eater from the Cretaceous period. Its name, meaning "egg thief", refers to the theory that it ate eggs from the nests of other dinosaurs. A fossil of an *Oviraptor* has been found sitting on its nest with its forelimbs folded, like those of a bird. It probably had feathers, which would have helped to keep both the eggs and the young warm.

Raptors A group of meat-eating dinosaurs from the Jurassic and Cretaceous periods. They had a huge curved claw on each foot, used to slash their victims. Raptors included the five-metre-long *Utahraptor* and the two-metre-long *Velociraptor*.

Spinosaurus A large meat-eating dinosaur from the Cretaceous period. It was the largest of the theropods, growing up to 18 m long. It had a large sail of skin on its back, held up be spines projecting outwards from its backbone.

Tetanurans A group of theropods with straight tails. Their name means "stiff tails". They had only three digits on each hand. The group included raptors, ornithomimids, tyrannosaurs and therizinosaurs.

FACTFILE

★ *Tyrannosaurus Rex*'s head was about 1.5 m long. Its lower jaw was hinged in such a way as to maximize its gape. An eight-year-old child could have squatted in its jaws.

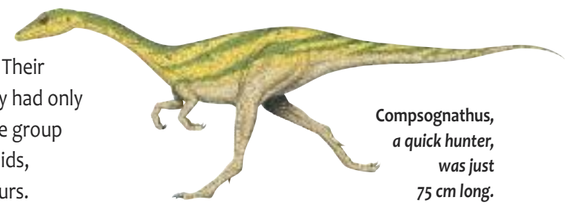
★ *Compsognathus*, discovered in Germany in the 1850s, was the first ever dinosaur to be found as a complete skeleton.

★ Most experts agree that birds evolved from small dinosaurs. *Archaeopteryx*, the first known bird, is closely related to the raptors and may have evolved directly from them. The presence of small bumps or quill bones on a *Velociraptor* fossil indicate that it definitely had feathers.

Archaeopteryx

Therizinosaurus A large meat-eater from the Late Cretaceous. It grew up to 12 m long. It had a small head with a toothless beak and three gigantic, curved finger-claws. The biggest of these claws may have been more than one metre long. Although technically a theropod, it mostly fed on plants and termites. It was probably covered with feathers.

Tyrannosaurus rex A large, flesh-eating dinosaur from the Late Cretaceous. It grew up to 12 m long. Some of its saw-edged teeth were 18 cm long. *Tyrannosaurus rex* may have hunted by ambushing its prey or it may have scavenged on carrion. It belonged to the tyrannosaur family, which included the smaller *Albertosaurus* and *Daspletosaurus*.



Compsognathus, ***a quick hunter, was just 75 cm long.***