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**Created and produced by** Orpheus Books Ltd

**Text** Nicholas Harris

**Consultants** Professor Michael Benton,  
Department of Earth Sciences, Bristol University

**Illustrators** Julian Baker, Alessandro Bartolozzi, Tim Hayward, Gary Hincks, Steve Kirk, Lee Montgomery, Steve Noon, Nicki Palin, Sebastian Quigley, Alessandro Rabatti, Claudia Saraceni, Peter David Scott, Roger Stewart, Thomas Trojer, David Wright

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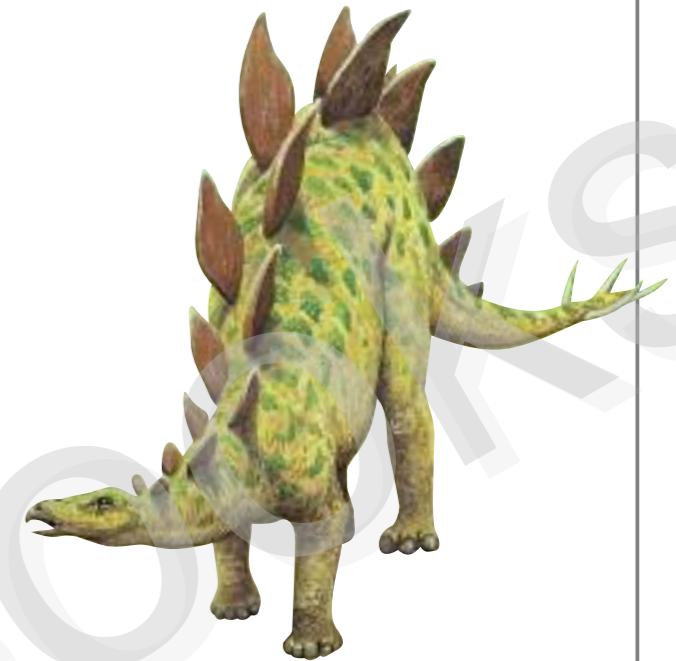
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## CONTENTS

- 4 THE STORY OF THE EARTH**  
*Geological time periods • History in the rocks • Evolution • Drifting continents*
- 6 THE ORIGIN OF THE EARTH**  
*The Solar System forms • Young Earth*
- 8 FIRST LIFE**  
*Origins of life • Earliest life-forms • Cambrian “explosion” of life*
- 10 EARLY MARINE LIFE**  
*Trilobites • First fish • Life on land • First plants*
- 12 COAL SWAMPS**  
*Carboniferous world • Amphibian to Reptile*
- 14 PERMIAN WORLD**  
*Age of Reptiles*
- 16 TRIASSIC WORLD**  
*Great extinctions • The first dinosaurs*
- 18 JURASSIC WORLD**  
*Giant sauropods and theropods • Pterosaurs*
- 20 MARINE REPTILES**  
*Ichthyosaurs and plesiosaurs*
- 22 CRETACEOUS WORLD**  
*Ornithischians • Iguanodon • Other herbivores • Cretaceous carnivores*
- 24 THE END OF THE DINOSAURS**  
*Mass extinction • Survivors*
- 26 THE AGE OF MAMMALS**  
*Rooters and browsers • Mammal giants*
- 28 THE ICE AGES**  
*Spread of ice sheets • Mammoths • Human evolution*
- 30 FUTURE EARTH**  
*Global warming • Species extinctions • Catastrophic eruptions • Asteroid impacts • Future continental drift*
- 32 INDEX**



## EARLY MARINE LIFE

THE CAMBRIAN Period was followed, 505 million years ago, by the Ordovician Period. Many species died out, to be replaced by new ones in another evolutionary “explosion”. Trilobites first appeared in the Cambrian and rapidly became, for the next 250 million years, some of the most numerous of all kinds. Trilobites were members of the arthropod group, (creatures with a hard external skeleton and jointed limbs).



A trilobite's body was covered by a hard, jointed carapace (shield) divided into three lengthwise strips (its name means “three lobes”). Its legs allowed it to scuttle along the sea bed, or to paddle it through the water as it swam. Having no jaws, it used its legs to carry food to its mouth.

## THE FIRST FISH

The first fish, perhaps descendants of *Pikaia* (see page 9), had “armour” plating to protect them from predators like the eurypterids. These were arthropods with large claws, some of which reached lengths of two metres. *Arandapsis*, known from fossils found in Australia, was one of the earliest. It fed by sucking in scraps of other dead animals floating in the water. Such fish dominated the seas for 130 million years.

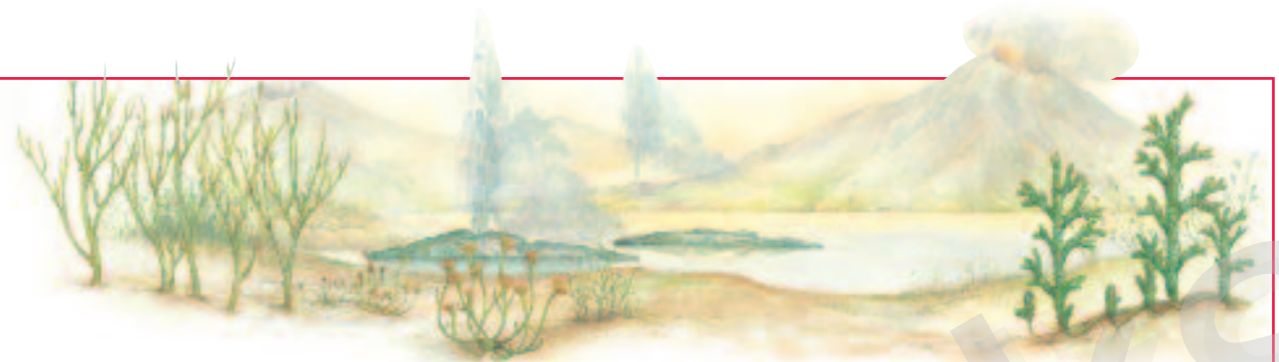


*Arandapsis*, an armoured, jawless fish from the Ordovician Period.

Fish developed rapidly during the Silurian and Devonian Periods, evolving jaws, teeth and fins. The evolution of jaws and teeth allowed fish to become active predators. Fins gave them greater speed and manoeuvrability in the water. Two distinct types of fish emerged: those with skeletons made of soft cartilage (like the sharks and rays of today), and those that had hard, bony skeletons. This second group became dominant in late Devonian seas and rivers.

Some species with fleshy fins, called the lobe-fins, lived in warm waters in Devonian times, feeding on lakeside plants. One, a long, slender fish known as *Eusthenopteron*, developed lungs and could spend some time heaving itself around out of the water.

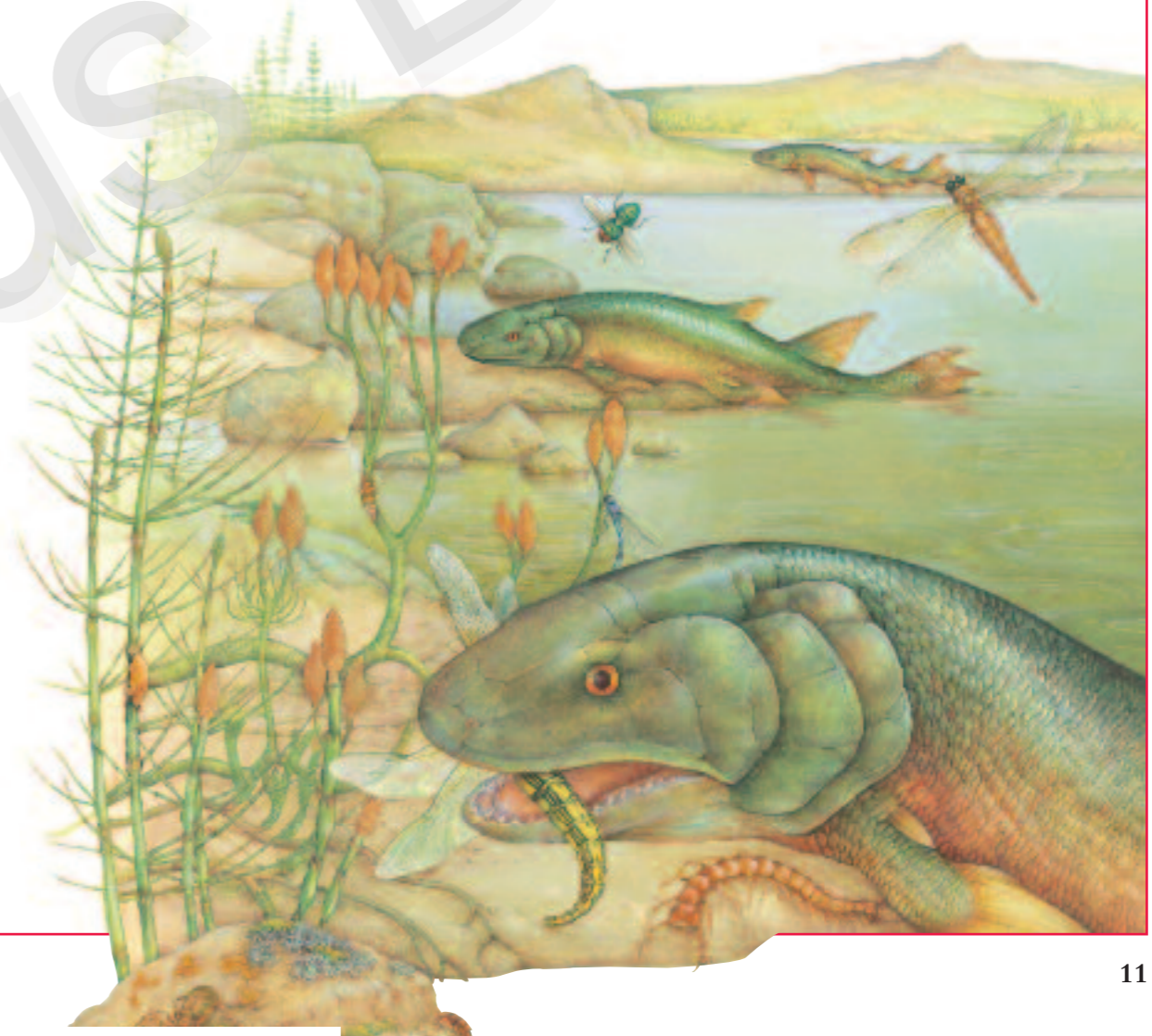
Some fish with jaws and fins grew to enormous sizes. *Dunklosteus* was longer than 9 metres. Even its skull was more than 2 metres long. Instead of teeth, its jaws were lined with massive plates of bone that sliced through its prey like guillotine blades.



## LIFE ON LAND

Until about 450 million years ago, there was no life on land. Blue-green algae may have been exposed to the air, or even washed ashore, at low tide. Very gradually, these minute plants may have acquired the means to stay alive longer on land. A waxy skin evolved to prevent them from drying out, followed by simple roots to anchor them in place. By the late Ordovician, plants had gained a foothold on land. By the end of the Silurian Period, plants had branching stems and water-conducting tubes (*above*).

Land plants were a plentiful food source and certain marine animals evolved to take advantage of it. The arthropods' external skeletons were ideal protection against dehydration while out of the water. Their jointed legs allowed them to scuttle over uneven ground. Insects and spiders became the first land animals. They, in turn, were food for fish that lived near the water's edge. Gradually, lobe-fins like *Eusthenopteron* evolved the ability to “crawl” on their fins in pursuit of prey (*below*). These fish may have been ancestors of the amphibians.



# JURASSIC WORLD

**D**URING JURASSIC times, from 208 to 144 million years ago, the super-continent of Pangaea began to split in two: Laurasia and Gondwanaland started to drift apart again. The climate, while still warm, became much wetter. Sea levels rose, causing widespread flooding of low-lying lands. Plants, especially coniferous trees, became abundant, providing a rich food source for the dinosaurs, now the only large land-living animals.

Sauropods took over from prosauropods as the dominant plant-eaters, culminating in such giants as *Diplodocus* and *Brachiosaurus*, among the longest and largest land animals that have ever lived. These enormous creatures, measuring more than 20 metres long, had very long necks and equally long, whip-like tails to balance them. Their teeth, shaped like pegs (in *Diplodocus* and *Brachiosaurus*) or spoons (in *Cetiosaurus* and *Camarasaurus*), were perfectly designed for tearing off leaves from trees.

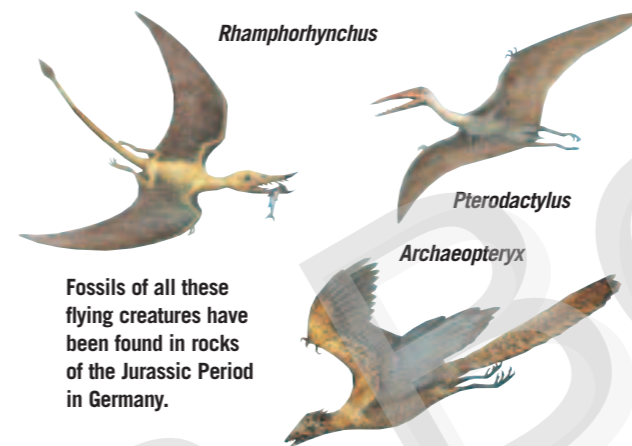
As the sauropods became larger and more numerous, so the meat-eating theropods became more powerful hunters, capable of bringing down a 20-metre sauropod, either



*Stegosaurus* was a plant-eating dinosaur. It may have been able to rear up on its back legs to feed from trees.

individually or hunting in packs. *Megalosaurus*, from Jurassic Europe, was about nine metres long. Equipped with powerful jaws, it was able to attack even quite large sauropods. (*Megalosaurus* was the first dinosaur to be discovered and, in 1824, to be given a name.) Top predator in North America at the same time was 12-metre-long *Allosaurus*. It may have hunted in packs to attack *Diplodocus*. Any prey trapped in its backwards-curving teeth would have found it hard to escape.

To defend themselves against these fearsome predators, some plant-eaters developed armour. *Stegosaurus*, a 10-metre-long, slow-moving dinosaur from North America, had a double row of diamond-shaped bony plates running the length of its back. It also possessed several long spines at the end of its tail, with which it could lash out at its attacker.



Fossils of all these flying creatures have been found in rocks of the Jurassic Period in Germany.

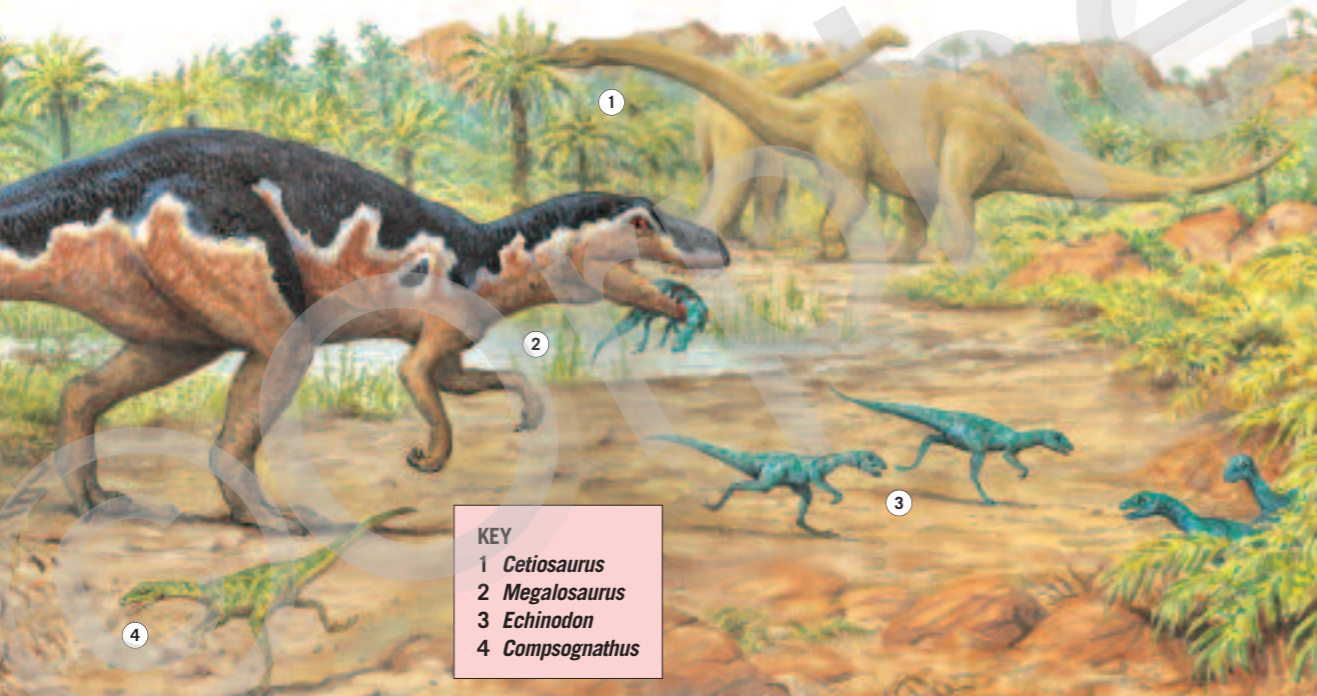
Alongside the massive Jurassic dinosaurs lived some of the smallest dinosaurs known. No bigger than a cat, *Compsognathus* was a long-legged, fast-moving predator, feeding on lizards and other small creatures it chased through the undergrowth. Fossils of its skeleton show that it had a very similar build to *Archaeopteryx*, one of the earliest-known birds, which lived in the same region, Europe, and at the same time, 150 million years ago, as *Compsognathus*. Recent evidence that some dinosaurs may have been feathered supports the widely-held view that birds are descended from dinosaurs.

The birds were not the first vertebrates to fly, however. Flying reptiles, known as pterosaurs, had first taken to the air millions of years earlier during the Triassic Period. *Rhamphorhynchus* and *Pterodactylus* were marine predators in the Jurassic.

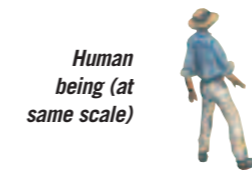
Sheets of skin between the fourth finger and the body made up a pterosaur's wings. Many had powerful, toothed beaks that were perfect for seizing, and holding on to, fish they caught while skimming the surface of the sea.

The Jurassic saw the emergence of a new kind of dinosaur. The sauropods and theropods were saurischian, or lizard-hipped, dinosaurs: their hip bones were shaped like those of other reptiles. Now a new group, the ornithischians, or bird-hipped dinosaurs, made their appearance. Their hip bones were shaped like those of modern birds (although, confusingly, birds were themselves descended from the saurischian kind). Equipped with the ability to chew their food, these plant-eaters quickly multiplied, taking advantage of the ever-increasing variety of plants found in the late Jurassic environment.

*Brachiosaurus* is the largest dinosaur known from a complete fossil skeleton. At 14 metres tall, it would have been able to look into the top-floor window of a four-storey building! It used its long neck to tear leaves from high in the trees.



- KEY  
 1 *Cetiosaurus*  
 2 *Megalosaurus*  
 3 *Echinodon*  
 4 *Compsognathus*



Human being (at same scale)