



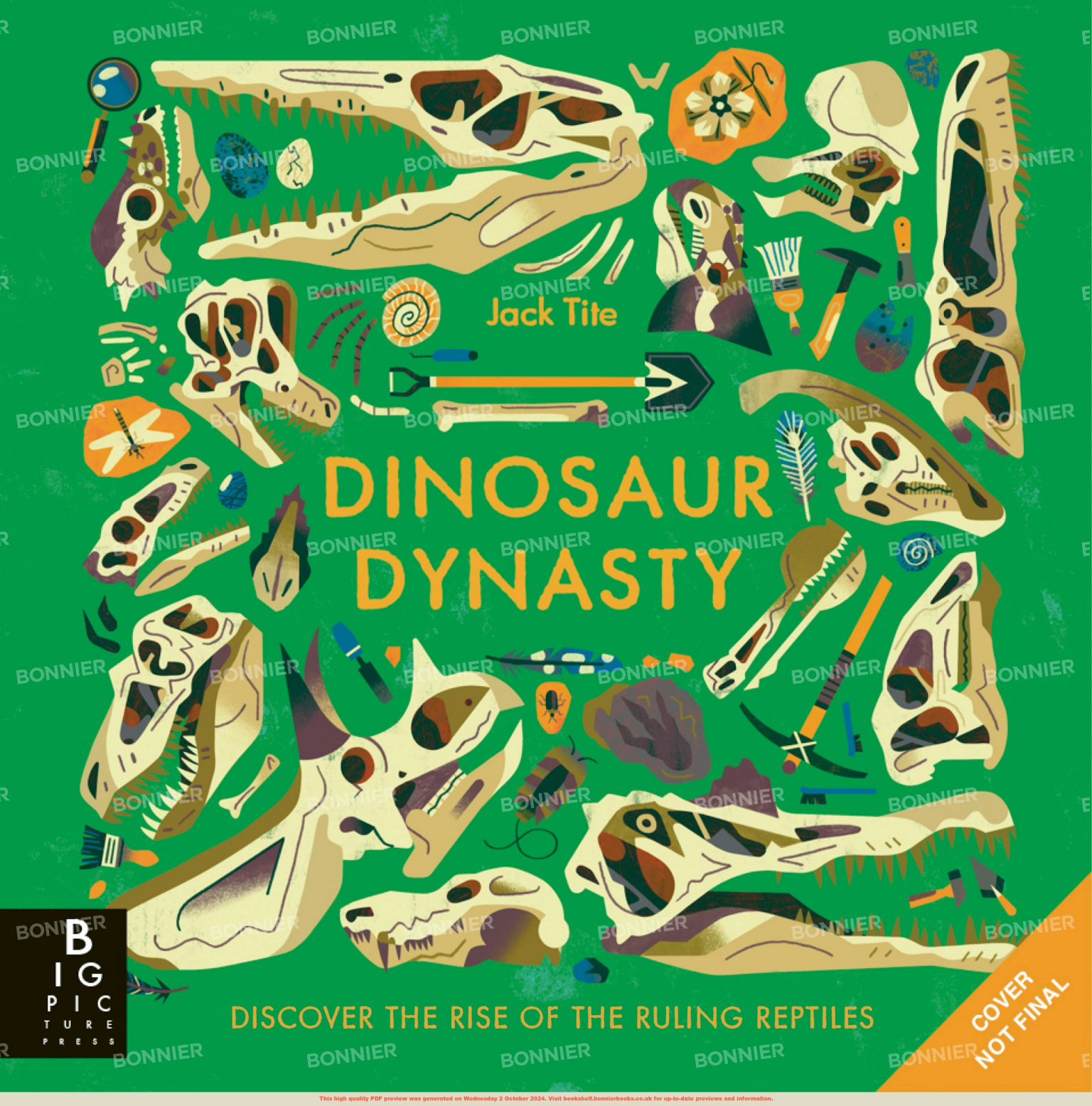
Jack Tite

# DINOSAUR DYNASTY

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DISCOVER THE RISE OF THE RULING REPTILES

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NOT FINAL



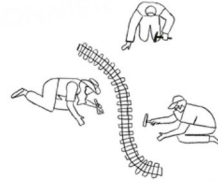
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For Ffi and our little pack – Norman and Coen

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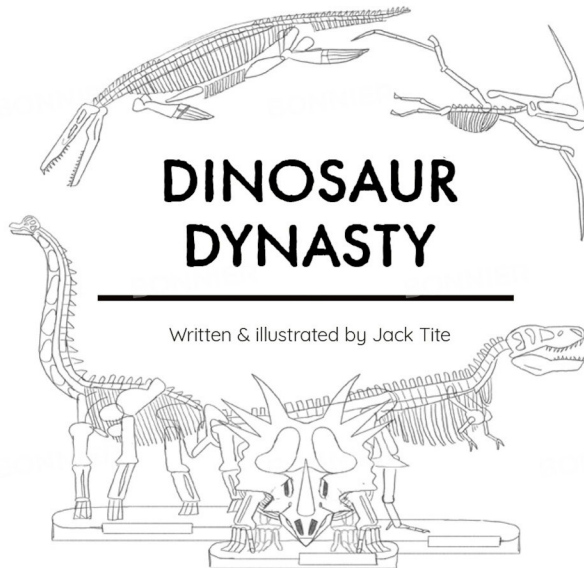
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**B P P**

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## THE AGE OF REPTILES

Hundreds of millions of years ago dinosaurs ruled the planet. This period, from around 250 million to 66 million years ago, is known as the Mesozoic era. Soaring reptiles armed with sharp beaks and claws streamed through the skies, the oceans were teeming with snappy prehistoric predators and the land belonged to a vast array of mighty dinosaurs.

### Hitting the big time

The Mesozoic era spanned 186 million years, over 600 times longer than us modern humans have been on the planet (a measly 300,000 years). This is split up into three periods; the Triassic, Jurassic and Cretaceous. During this epic chunk of time, some animals died out and others changed to survive. This is called evolution.

### The moving world

In the beginning of the Mesozoic era, all land on earth was joined together to form a giant supercontinent known as Pangea. The land - and all the creatures living on it - drifted apart during the next 186 million years to look more like the Earth as it is today. Back then, our planet was warmer, with vast desert planes, flourishing forests and everchanging habitats due to the shifting planet.



Triassic Earth



Jurassic Earth



Cretaceous Earth



### A mixed bag

Scientists now know of over 1000 different species of dinosaur, with around 50 new species discovered each year. There were speedy sprinters, gentle giants, tiny insect hunters, armoured tank-like hunks and formidable predators. They range from tiny reptiles that could comfortably sit on your finger to aeroplane-sized behemoths that proudly stand in today's museums. Our own ancient ancestors lived through the dinosaur dynasty, but they were simple, tiny rodent-like mammals that eked out a living in the shadows of the mighty reptiles towering above them.

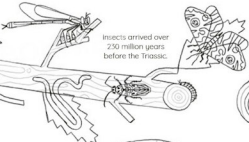
# TRIASSIC





## WHAT CAME BEFORE

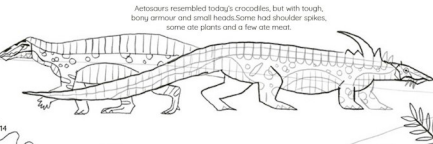
The Triassic began with the largest ever mass extinction around 250 million years ago, when 90% of all life on earth was wiped out. Entire groups of reptiles, early mammals, insects and aquatic life disappeared, but some creatures survived. These included crocodile and dinosaur ancestors called archosaurs and early mammals called synapsids; crocodile and dinosaur ancestors called archosaurs and early mammals called synapsids.



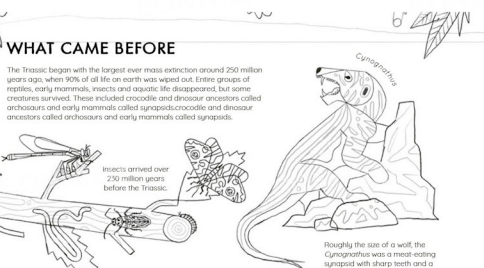
Insects arrived over 250 million years before the Triassic.



Lytrotaurus was an abundant dog-sized gangster that used its turtle-like back to snap up plants and dead bugs to dig burrows or root out food beneath the earth.



Anotosaurus resembled today's crocodiles, but with tough, bony armour and small heads. Some had shoulder spikes, some ate plants and a few ate meat.



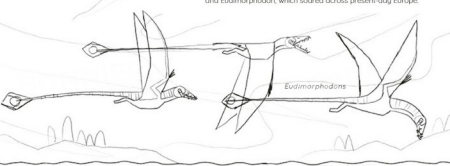
Totally the size of a wolf, the Cynocrothrus was a meat-eating synapsid with sharp teeth and a large, strong jaw.

### Ruling the skies

Towards the end of the Triassic, a group of archosaurs took to the skies tens of millions of years before birds. These are now known as Pterosaurs. The outer structure of a pterosaur wing was formed by one long finger, with a thin layer of skin stretching from the finger to the back legs. Their soft-shelled eggs (similarly to today's snake eggs) have been discovered fossilised in ancient resting grounds, where colonies of pterosaurs once nurtured their young.



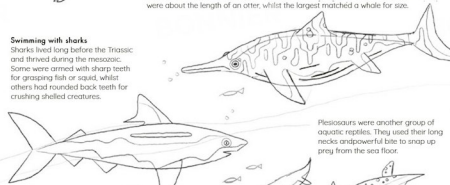
Early pterosaurs like the gull-sized Carniornithosaurus likely ate insects and fish, and scavenged dead animals in what is now America. Smaller long-tailed pterosaurs include the Pterodactylus and Eudimorphodon, which soared across present-day France.



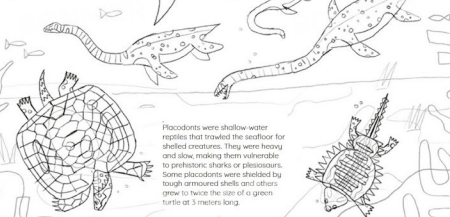
**Making waves**  
At some point in their prehistoric past, some reptiles slowly moved from living on land to braving the seas, dipping their toes occasionally or first before eventually swapping feet for flippers and mastering the oceans. Ichthyosaurs looked like a cross between a crocodile and dolphin, with flippers, a wide tail and a long, thin snout with plenty of teeth for eating fish, squid and shellfish. The smallest ichthyosaurs were about the length of an otter, whilst the largest matched a whale for size.

### Swimming with sharks

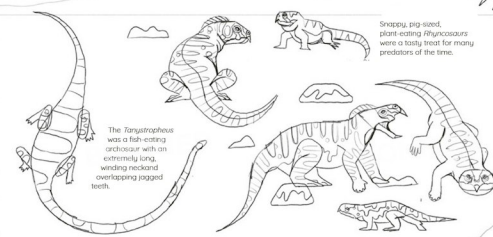
Sharks lived long before the Triassic and thrived during the mesozoic. Some were armed with sharp teeth for grasping fish or squid, whilst others had rounded back teeth for crushing shelled creatures.



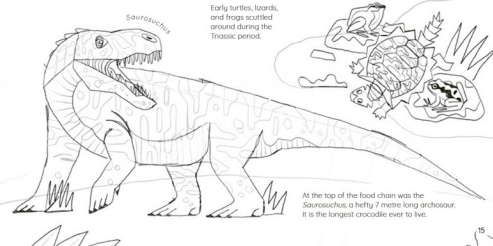
Plesiosaurs were another group of aquatic reptiles. They used their long necks and powerful tails to snap up prey from the sea floor.



Placodonts were shallow water reptiles that traveled the seafloor for shelled creatures. They were heavy and slow, making them vulnerable to prehistoric sharks or plesiosaurs. Some placodonts were shelled by tough armored shells and others grew to twice the size of a green turtle or 3 meters long.



The Tanystropheus was a fish-eating archosaur with an extremely long, winding neck and overlapping jagged teeth.



Early turtles, lizards, and frogs scurried around during the Triassic period.

At the top of the food chain was the Spinosaurus, a belly 7 metres long archosaur. It is the longest crocodile ever to live.

Graptosaurus, wing-eater, plant-eating Rhynchosaurs were a tasty treat for many predators of the time.

# HUMBLE BEGINNINGS

The earliest dinosaurs arrived around 245 million years ago, in the Middle Triassic. Instead of toppling the ruling archosaurs, they lived alongside them, probably falling prey to the larger predators of the time. We know of a few early dinosaur species that the later giants evolved from.



This is the *Eoraptor*, discovered in Argentina, South America. It most likely used its sharp leaf-shaped front teeth and curved, saw-like back teeth to eat plants, small lizards and insects. The *Eoraptor* stood on two legs about the size of a small dog. It was built for speed, with a long neck, skinny frame, powerful back legs, and five fingered hands. Only three of these fingers had claws, the other two were basically useless. Dinosaur claws were made from a type of keratin, the same material in our hair, nails and Rhinoceros's horns.



*Eoraptor* compared to a human and small dog.



Dinosaurs had small brains compared to their body size. Scientists believe they behaved like todays crocodiles and lizards.

*Eoraptor* (*E. lunensis*)



*Eoraptor* diet



*Eoraptors* had hollow bones, making them incredibly light yet strong, a trait that many dinosaurs benefited from. With legs beneath their bodies, dinosaurs could grow taller and move quicker than today's reptiles, who have shorter legs pointing out sideways.



We don't know what the *Eoraptor's* skin looked like, but it was probably scaly like many other dinosaurs. Later dinosaurs evolved bony armour plates called osteoderms, dangerous spiked spines and even funky feathers.

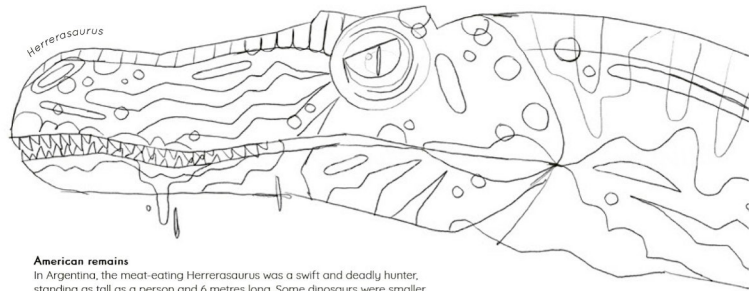
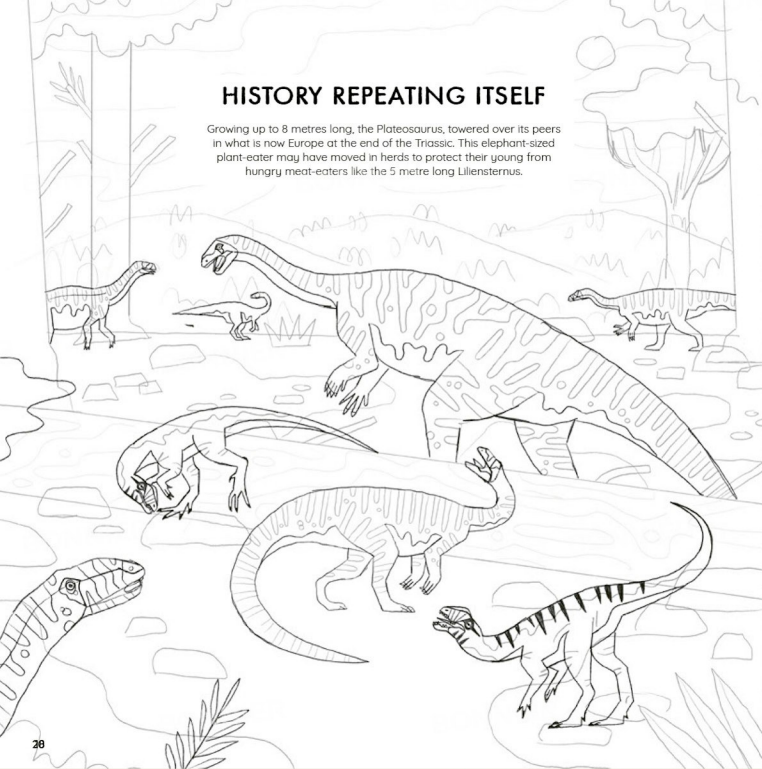
Like most lizards, dinosaurs laid eggs to reproduce. The eggs varied in shell colour, size and thickness depending on the dinosaur. Some laid 1 egg whilst others popped out a whopping 40 at a time.



**The hips don't lie**  
Dinosaurs branched out and evolved rapidly from early species like the *Eoraptor*. Later dinosaurs came in all shapes and sizes, with all kinds of diet, teeth, feet, defence mechanisms and an arsenal of weapons. They are divided into two groups based on their pelvic bones, which differed from one another. Saurischians included four-legged, long necked dinosaurs and deadly carnivores such as the *T. Rex*. The Ornithischians included the spiky *Stegosaurus* and *Triceratops*.

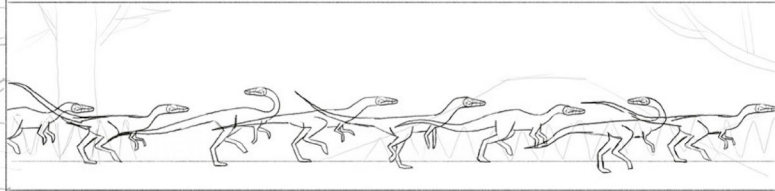
## HISTORY REPEATING ITSELF

Growing up to 8 metres long, the Plateosaurus, towered over its peers in what is now Europe at the end of the Triassic. This elephant-sized plant-eater may have moved in herds to protect their young from hungry meat-eaters like the 5 metre long Lilliensternus.



### American remains

In Argentina, the meat-eating Herrerasaurus was a swift and deadly hunter, standing as tall as a person and 6 metres long. Some dinosaurs were smaller but no less important. The Coelophysis hunted insects and small ground dwelling creatures across modern America and Africa. It was a lightweight little hunter about half the size of the Herrerasaurus. In New Mexico, USA, a site called Ghost Ranch has yielded a bountiful bone bonanza of nearly 1000 Coelophysis.



### Sauropods and theropods

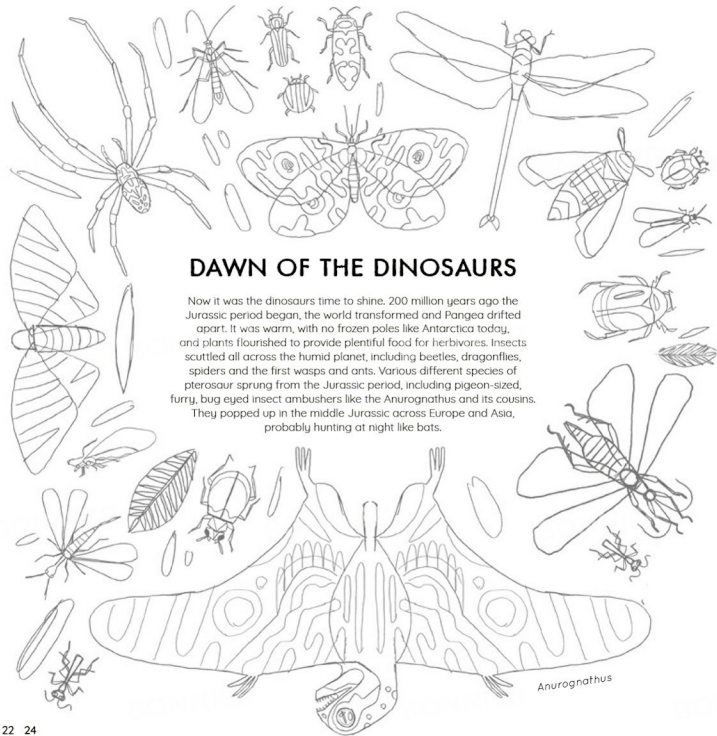
All these dinosaurs are early saurischians. The Plateosaurus and its later relatives belong to a group called sauropods, known for their long necks, thick legs and large bodies. The other three are theropods, a meat-eating group with mostly hollow bones, claws and curved teeth.

### A golden opportunity

For reasons not fully known, the Triassic period ended around 200 million years ago with another huge extinction event. Whilst this wiped out around 75% of animals on land and in the sea, it helped the dinosaurs. Less competition allowed them to muscle their way into new places, take a hold and thrive. This marks the end of the Triassic and the beginning of a new era in which the dinosaurs ruled.

# JURASSIC





## DAWN OF THE DINOSAURS

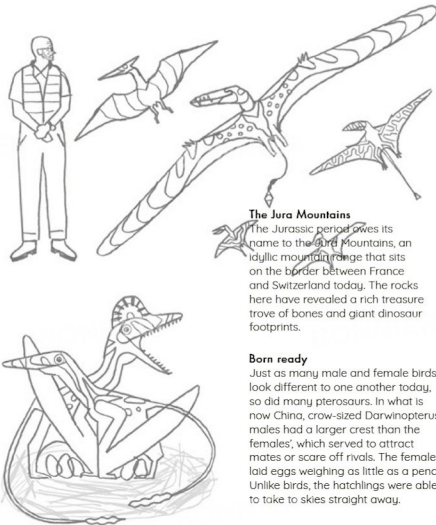
Now it was the dinosaurs time to shine. 200 million years ago the Jurassic period began, the world transformed and Pangea drifted apart. It was warm, with no frozen poles like Antarctica today, and plants flourished to provide plentiful food for herbivores. Insects scuttled all across the humid planet, including beetles, dragonflies, spiders and the first wasps and ants. Various different species of pterosaur sprung from the Jurassic period, including pigeon-sized, furry, bug eyed insect ambushers like the Anurognathus and its cousins.

They popped up in the middle Jurassic across Europe and Asia, probably hunting at night like bats.

Anurognathus

## Diverse Flyers

Some pterosaurs began to slowly ditch their teeth, grow funky crests on their heads and shorten their tails, branching off into a group called pterodactyloids. The seagull-sized Pterodactylus is one of the most well-known from this group, soaring in the skies of present day Europe and Africa 150 million years ago in search of small animals to eat. Odd-looking filter feeding pterodactyls just larger than a duck waded in European shallow shorelines during the late Jurassic, too. They combed through the water with hundreds of long, thin teeth in their beak-like mouths to catch tiny creatures like today's whales and flamingos.

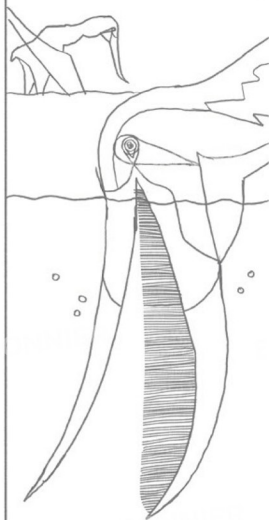


## The Jura Mountains

The Jurassic period owes its name to the Jura Mountains, an idyllic mountain range that sits on the border between France and Switzerland today. The rocks here have revealed a rich treasure trove of bones and giant dinosaur footprints.

## Born ready

Just as many male and female birds look different to one another today, so did many pterosaurs. In what is now China, crow-sized Darwinopterus males had a larger crest than the females', which served to attract mates or scare off rivals. The females laid eggs weighing as little as a pencil. Unlike birds, the hatchlings were able to take to skies straight away.



## Up in the air

Dearc, the largest of the lot, soared above what is now Scotland snapping up fish with its toothy beak. With a wingspan over twice the length of a person at 3.8 metres, it was just larger than the wandering albatross, which has the largest wingspan of any bird alive today. The much smaller Dimorphodon, with a hefty yet lightweight skull, fed on small creatures and possibly fish during the early Jurassic years.

## BORN TO BATTLE

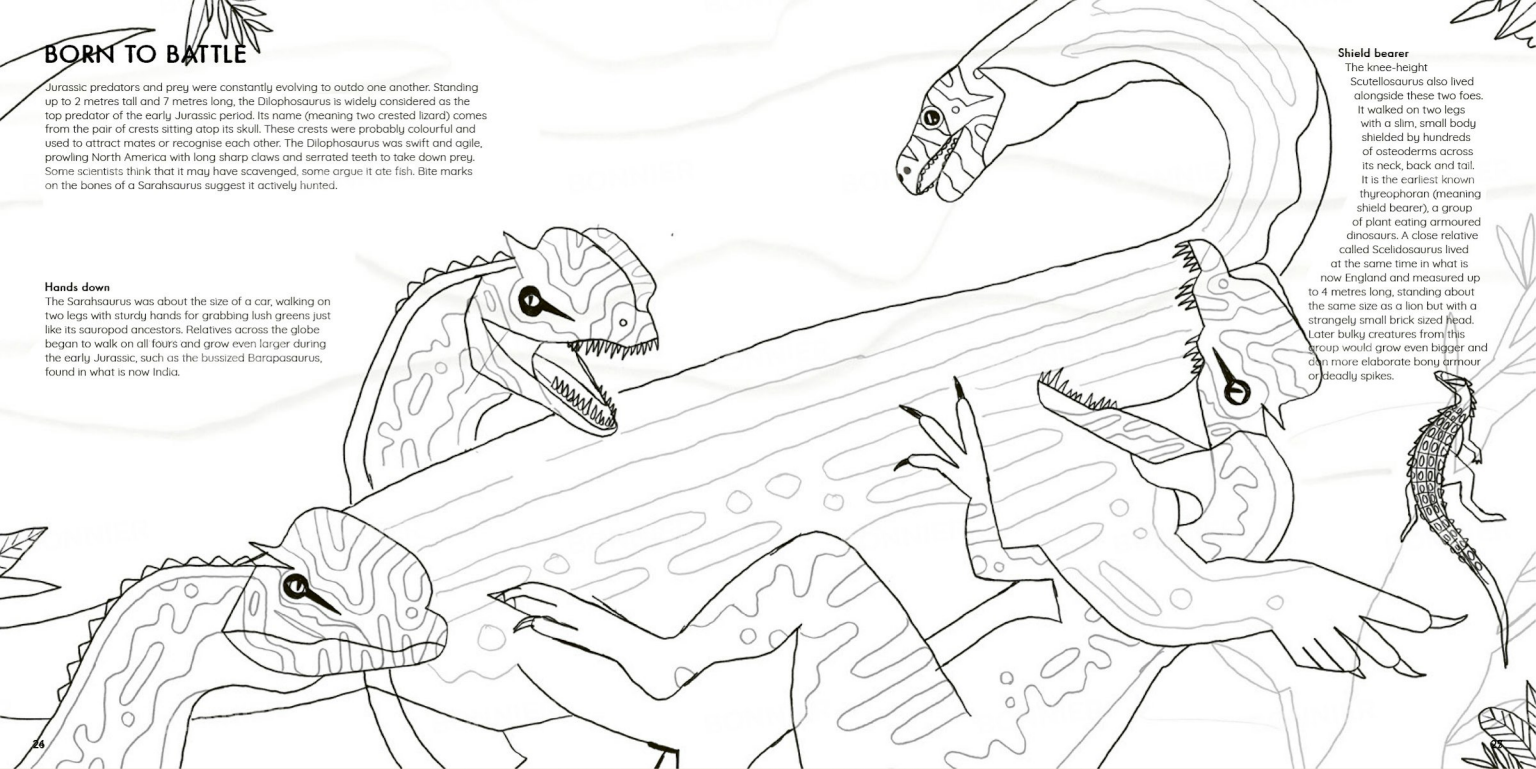
Jurassic predators and prey were constantly evolving to outdo one another. Standing up to 2 metres tall and 7 metres long, the Dilophosaurus is widely considered as the top predator of the early Jurassic period. Its name (meaning two crested lizard) comes from the pair of crests sitting atop its skull. These crests were probably colourful and used to attract mates or recognise each other. The Dilophosaurus was swift and agile, prowling North America with long sharp claws and serrated teeth to take down prey. Some scientists think that it may have scavenged, some argue it ate fish. Bite marks on the bones of a Spinosaurus suggest it actively hunted.

### Hands down

The Spinosaurus was about the size of a car, walking on two legs with sturdy hands for grabbing lush greens just like its sauropod ancestors. Relatives across the globe began to walk on all fours and grow even larger during the early Jurassic, such as the bussized Barapasaurus, found in what is now India.

### Shield bearer

The knee-height Scutellosaurus also lived alongside these two foes. It walked on two legs with a slim, small body shielded by hundreds of osteoderms across its neck, back and tail. It is the earliest known thyreophoran (meaning shield bearer), a group of plant eating armoured dinosaurs. A close relative called Scelidosaurus lived at the same time in what is now England and measured up to 4 metres long, standing about the same size as a lion but with a strangely small brick sized head. Later bulky creatures from this group would grow even bigger and don more elaborate bony armour or deadly spikes.



## LAND OF GIANTS

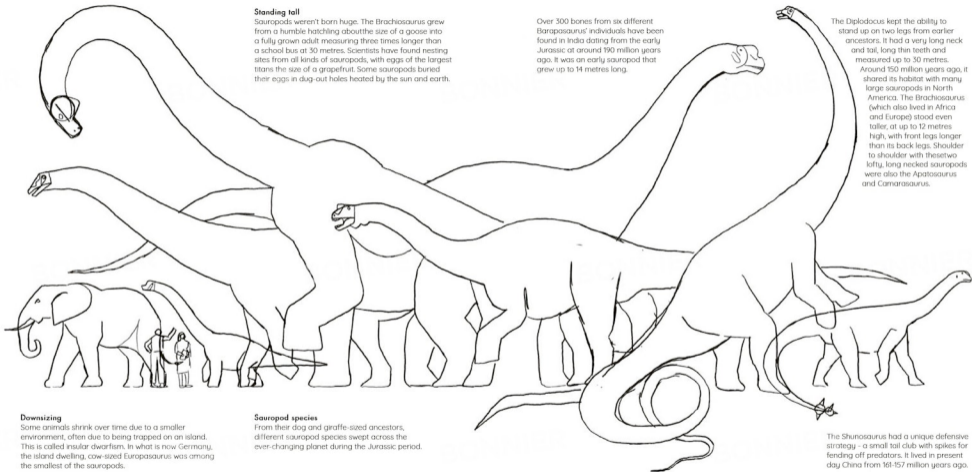
All across the planet, sauropods evolved features that turned them into towering giants. Walking on all fours with pillar-like legs was the new sauropod norm, with long, spindly necks to access food out of reach to others. Outstretched necks meant that winding tails were also needed to balance their bodies.

### Featherweight champions

Sauropods had hollowed out bones filled with air sacs to store oxygen when breathing - a feature modern birds also have. This made their skeletons featherweight yet sturdy enough to carry a hulking body.

### Safety in numbers

Scientists think that many sauropods lived in herds to protect their young. This, along with being big, was probably enough to scare away any daring hunters. If not, a long tail could have been a deadly whipping weapon when needed.



### Standing tall

Sauropods weren't born huge. The Brachiosaurus grew from a humble hatchling about the size of a goose into a fully grown adult measuring three times longer than a school bus at 30 metres. Scientists have found nesting sites from all kinds of sauropods, with eggs of the largest titans the size of a grapefruit. Some sauropods buried their eggs in dug-out holes heated by the sun and earth.

Over 300 bones from six different Barapasaurus' individuals have been found in India dating from the early Jurassic at around 190 million years ago. It was an early sauropod that grew up to 14 metres long.

The Diplodocus kept the ability to stand up on two legs from earlier ancestors. It had a very long neck and measured up to 30 metres. Around 150 million years ago, it shared its habitat with many large sauropods in North America. The Brachiosaurus (which also lived in Africa and Europe) stood even taller, at up to 12 metres high, with front legs longer than its back legs. Shoulder to shoulder with these two lofty, long-necked sauropods were also the Apatosaurus and Camarasaurus.

The Shunosaurus had a unique defensive strategy - a small tail club with spikes for fending off predators. It lived in present day China from 161-157 million years ago.

### Downsizing

Some animals shrink over time due to a smaller environment, often due to being trapped on an island. This is called insular dwarfism. In what is now Germany, the island-dwelling, cow-sized Europasaurus was among the smallest of the sauropods.

### Sauropod species

From their dog and giraffe-sized ancestors, different sauropod species swept across the ever-changing planet during the Jurassic period.

## APEX

When plant eaters grow large and learn new tricks, so do predators. The Jurassic saw the rise of terrifying meat eaters. They stood on two powerful legs with a long tail for balance and hefty jaws lined with deadly teeth.

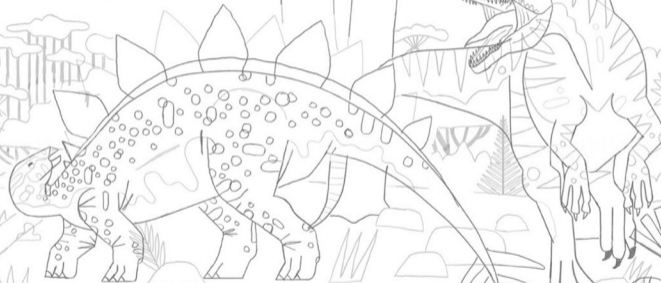


### A deadly double whammy

The truck-sized, 10 metre long *Tyrannosaurus* hunted across what is now North America and parts of Europe. A thick body, sharp teeth and huge claws helped it take down large herbivores 150 million years ago. About half its size but much more pointy, the *Coeloceras* prowled the same hunting grounds. It bore a horn above each eye and its nose with bony ridges along its back, attacking prey with long fangs, sharp claws and strong arms.

### Big Al

Completing this deadly trio of American carnivores is the *Allosaurus*. This horned dinosaur also lived in parts of modern Europe and Africa. It was among the largest predators of the time, with one skeleton given the nickname 'Big Al' by scientists. The head alone was about the size of a coffee table, filled with curved teeth that it shed and regrew and sporting pointy horns above each eye. It had strong arms and curved claws for slashing. All this firepower and a length of up to 12 metres helped the *Allosaurus* fight its way to the top of the food chain.



### The ultimate showdown

Large herbivores were on the menu. The bus-sized *Stegosaurus* is another superstar from the Jurassic, spending its days clipping away at tasty plants. Its tall plates were probably used to intimidate predators, help identify other *Stegosaurus*, or even to store heat like radiators. A fully grown adult *Stegosaurus* measured up to 9 metres long and defended itself with a swooping tail adorned with four spikes, making it a true challenge for even the mighty *Allosaurus*.

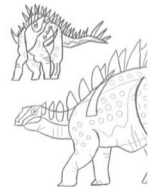
### Not alone

There were a few different spiky or armour plated dinosaurs during the Jurassic. Alongside these mortal enemies lived the *Gargoylesaurus* - standing roughly the height of a large dog and 4 metres long. Reinforced armoured plating protected its back whilst it scoured the floor for low lying plants.



### Two sides of the same coin

On the other side of the world, in what is now China, a very similar story took place during the Jurassic. The *Yangchuanosaurus* was a similar size to an *Allosaurus*, and spent its days hunting enormous sauropods and relatives of the *Stegosaurus*. These had slightly different armoured plates and builds, such as the smaller *Chungkingosaurus* and its cow-sized cousin, the *Tuojiangosaurus*.





## ABUNDANT SEAS

At the dawn of the Mesozoic era, one enormous ocean called Panthalassa surrounded Pangea. As the land shifted apart and new oceans formed, ichthyosaurs and plesiosaurs swarmed the seas, but other more familiar creatures also lurked beneath the waves.

### Life at sea

During the Jurassic and Cretaceous periods, oceans were teeming with crabs, lobsters, and rays. Squid-like creatures called ammonites also thrived, with a variety of shell shapes. Some were the size of a coin while others had huge, broad shells wider than a table. They fed on small, slow critters and ocean plants, but fell prey to marine reptiles and sharks.

### Dinosaurs for dinner

Some sharks snapped up any prey they could get their jaws on. The Cretaceous *Cretoxyrhina* and *Squalicorax* resembled today's great white sharks, and they ate turtles, other sharks, plesiosaurs, large fish, seabirds and the occasional dinosaur.

### Famished fish

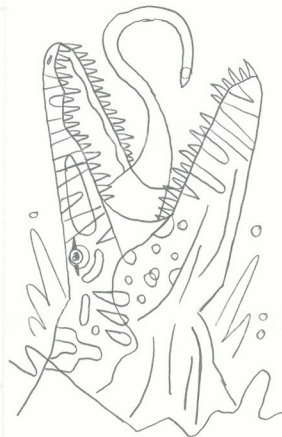
A fierce predatory fish called *Xiphactinus* dwarfed some sharks, growing up to 6 metres long. It gobbled up anything that would fit in its fang lined jaws, such as other large fish, sharks and squid.

### Titantic turtles

At the end of the Cretaceous, the gigantic car-sized turtle called *Archelon* trawled along the seafloor in search of jellyfish, squid, ammonites, fish and plants.

## BEASTS BELOW

Reptiles evolved into unstoppable predators during their time at sea. Mosasaurs had snake-like bodies and propelled through the water with their tail and wide paddle-like flippers. The smallest were a meagre 1 metre long, but the largest grew up to 17 metres in length - the size of a humpback whale today. These behemoths hunted for ammonites, fish, plesiosaurs and turtles.



### Changing shape

Some plesiosaurs branched off, ditching their long necks and super-sizing their heads to transform into well built beasts called pliosauurs. A giant of this group, measuring up to 10 metres, is known as the *Kronosaurus*. It glided through the Cretaceous oceans by moving all four flippers at once, pursuing turtles, plesiosaurs or ammonites and snapping them up in its powerful jaws. Embedded in these jaws were dozens of long, deadly teeth, the largest of which measured up to 30cm long!



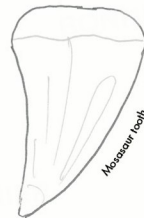
Kronosaurus tooth



Great white shark tooth

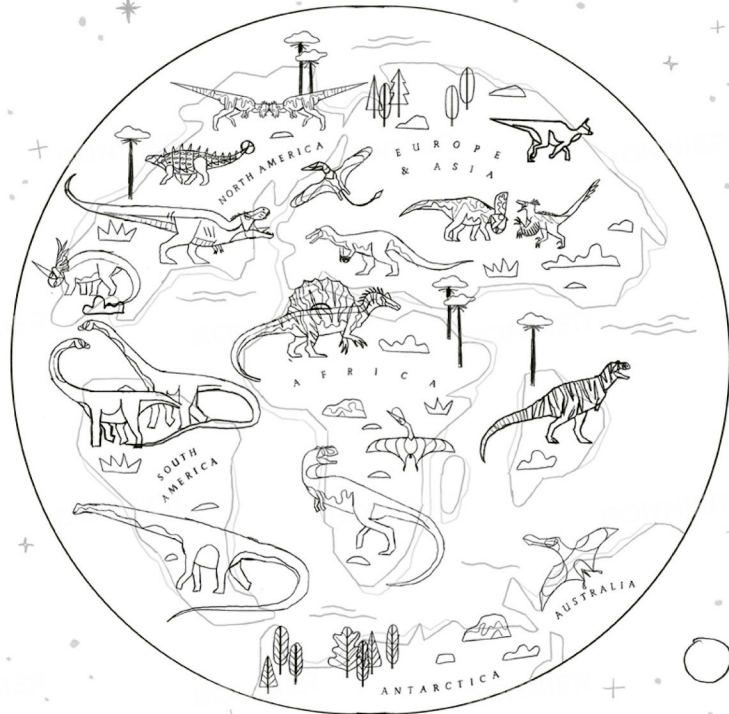
### A big bite

The mosasaurs car-sized skull housed 40-50 cone-shaped teeth, with jaws that could open up extremely wide to swallow large prey whole, similarly to some snakes today. Also like snakes, a second set of smaller teeth lined their throat to stop prey from escaping.



Mosasaurus tooth

# CRETACEOUS



## ARMoured AND DEADly

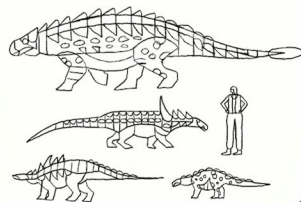
The Cretaceous began some 145 million years ago as the land transformed and new oceans formed. The first flowering plants sprouted during this time, adding a splash of colour to the wave of green plant life and prompting another explosion in insect life. This was a time of continued growth and change for dinosaurs, giving rise to the largest, most deadly and most bizarre beasts yet.

### Built like a tank

One of the largest and most well-loved dinosaurs today is the *Ankylosaurus*, a battle ready walking fortress that outweighed the biggest elephants today. Its 10 metre long body was covered in a mosaic of bony, spike studded armour, with a tough helmet fused into its skull and a deadly clubbed tail. It roamed around what is now America between 68-66 million years ago, using it's keen sense of smell and sharp beak to pluck at foliage on the forest floor. Wielding a bone-breaking wrecking ball of a tail, this tank may have fought other rival ankylosaurs or fended off daring predators.

### Assorted armour

Today, scientists know of well over a dozen different types of ankylosaurs. Some had long spikes sprouting out from their necks and shoulders, like the hippo-sized *Gastonia* and slightly larger, 6 metre long *Sauropelta*, both of which lived in what is now America. Others were smaller with lighter, simpler armour, like the sheep-sized *Mimmi* that lived around 120-112 million years ago in present day Australia.



Artwork for here?

## DRESSED TO IMPRESS

Among the vast array of herbivorous herds roaming the planet were many dinosaurs decorated with frills, horns or other features to attract mates, fend off hungry predators or bellow out booming calls.

### Horns and all

Hailing from the same family as the rather simple Jurassic Triceratops, ceratopsians spread across America, Europe and Asia for the entire Cretaceous period. They were bulky reptiles stomping on all fours, and ranged from the size of a dog to the size of a large van. Most had plant picking beaks and elaborate bony neck frills that widely varied.



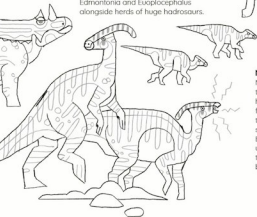
Over 60 different ceratopsian species are known, each equipped with outlandish headgear: from the sheep-sized Protoceratops, living in what is now Asia 74-40 million years ago to the highly-decorated American Kosmoceratops that lived 76 million years ago, with 10 overhanging hooked spikes, two curved brow spikes and a blunt nose horn.



### Hadrosaurs

Another family of hungry herbivores called the hadrosaurs appeared during the Cretaceous, also known as duck-billed dinosaurs thanks to their flat, wide mouths. It was packed with over 500 close-knit, thin teeth to grind down food. Herds of hadrosaurs spread all over the world, walking on all fours and standing up on their back legs to pick the highest tasty fruits and plants. Some hadrosaurs had toes that joined to form one large nail, similar to horses hooves. These 'hooves' probably allowed them to run at high speeds.

In the same fossil sites as the spiky Styraeosaurus were armoured Edmontonia and Euoplocephalus alongside herds of huge hadrosaurs.

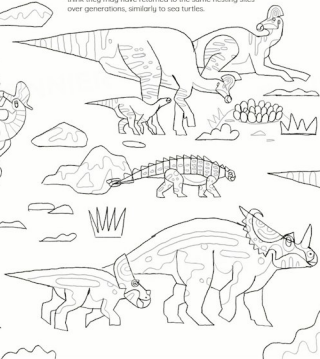


### Noisy neighbours

Most hadrosaurs had crests. Just like ceratopsians, there were lots of wild varieties. In the past people have imagined that these crests had special functions, from strange snorkels to breathing fire. Today it's thought that they could push air through these hollow shapes to create bellowing calls to communicate. Each species evolved different crests that made a unique sound, creating a dinosaur symphony across the Cretaceous landscape. The crests may have been brightly coloured for attracting mates, too.

### Good mother lizard

Maasaura (Meaning good mother lizard) nesting sites suggest that hadrosaurs looked after their babies, feeding and caring for them until they matured. Families were packed closely together in nesting groups, laying 30-40 eggs in a spiral shape on the ground. Hatchlings grew remarkably fast, exploding from 1kg to 2000kg over 10 years. That's heavier than a car! Their crests started out as stubs, developing as they aged. Scientists think they may have returned to the same nesting sites over generations, similarly to sea turtles.

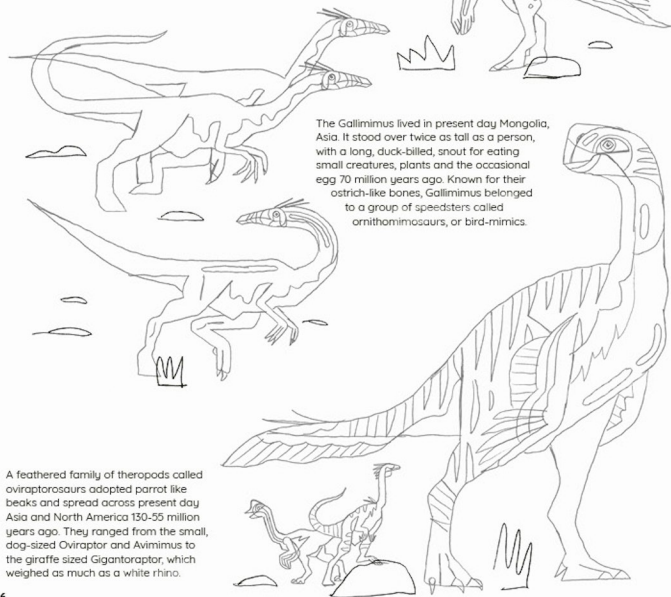


Over 60 types of hadrosaur are known today, from the crestless Maasaura that roamed America around 80-75 million years ago to the largest of all hadrosaurs, the Shantungosaurus, which stood taller than a double-decker bus on all fours and measured up to 15 metres long. It lived in present day China 78-74 million years ago.



## THE BIRDS AND THE BEASTS

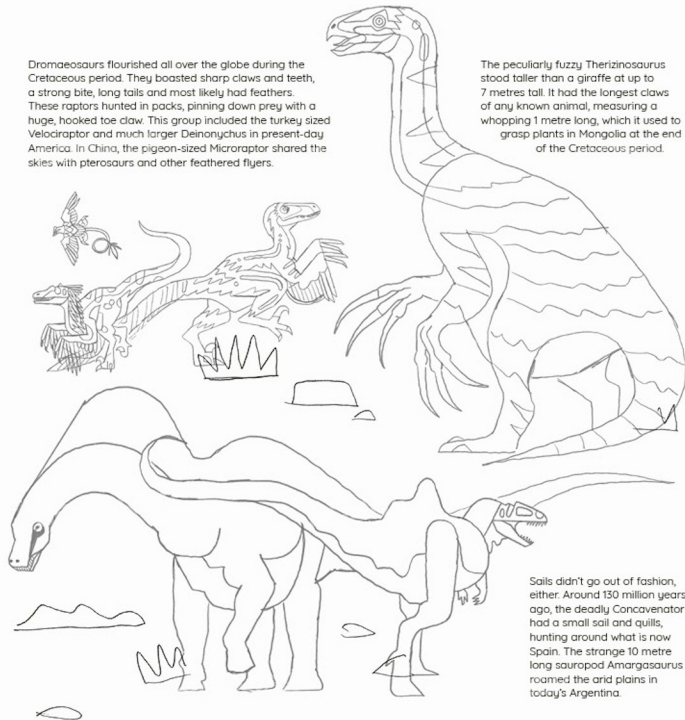
Feathers really caught on during the Cretaceous period. In Asia during the early parts of the era, the ceratopsian Psittacosaurus flaunted an odd bristly tail. Many other creatures would go on to don fully fledged feathers and fly.



The Gallimimus lived in present day Mongolia, Asia. It stood over twice as tall as a person, with a long, duck-billed, snout for eating small creatures, plants and the occasional egg 70 million years ago. Known for their ostrich-like bones, Gallimimus belonged to a group of speedsters called ornithomimosaurs, or bird-mimics.

A feathered family of theropods called oviraptorosaurs adopted parrot like beaks and spread across present day Asia and North America 130-55 million years ago. They ranged from the small, dog-sized Oviraptor and Avimimus to the giraffe sized Gigantoraptor, which weighed as much as a white rhino.

Dromaeosaurs flourished all over the globe during the Cretaceous period. They boasted sharp claws and teeth, a strong bite, long tails and most likely had feathers. These raptors hunted in packs, pinning down prey with a huge, hooked toe claw. This group included the turkey sized Velociraptor and much larger Deinonychus in present-day America. In China, the pigeon-sized Microaptor shared the skies with pterosaurs and other feathered flyers.

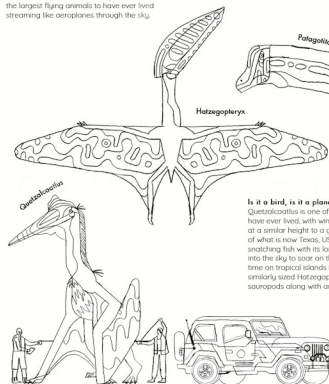


The peculiarly fuzzy Therizinosauros stood taller than a giraffe at up to 7 metres tall. It had the longest claws of any known animal, measuring a whopping 1 metre long, which it used to grasp plants in Mongolia at the end of the Cretaceous period.

Sails didn't go out of fashion, either: Around 130 million years ago, the deadly Concavenator had a small sail and quills, hunting around what is now Spain. The strange 10 metre long sauropod Amargasaurus roamed the arid plains in today's Argentina.

## THE BIG SHOTS

On land the most enormous plant eating reptiles towered over the prehistoric world like walking skyscrapers, with epic predators emerging to hunt them. In the air, the skies would have been blackened by some of the largest flying animals to have ever lived streaming like aeroplanes through the sky.



### Is it a bird, is it a plane?

Quetzalcoatlus is one of the largest flying animals to have ever lived, with wings like a fighter jet and standing at a similar height to a giraffe. It waded in the rivers of what is now Texas, USA some 67 million years ago, snatching fish with its long toothless bill and launching into the sky to soar on the winds above. At the same time on tropical islands in today's Romania, Europe, the similarly sized Hatzegopteryx probably feasted on dwarf sauropods along with an array of downsized dinosaurs.

### Punching up

Prowling the planet for super-sized prey were colossal carnivores like the powerful Giganotosaurus, boasting a thick skull as long as a door and living 112-90 million years ago. Its slightly smaller relative, the Mapusaurus, shared the lush habitat with Argentinosaurus, possibly hunting this titan in a clash for the ages.

### True titans

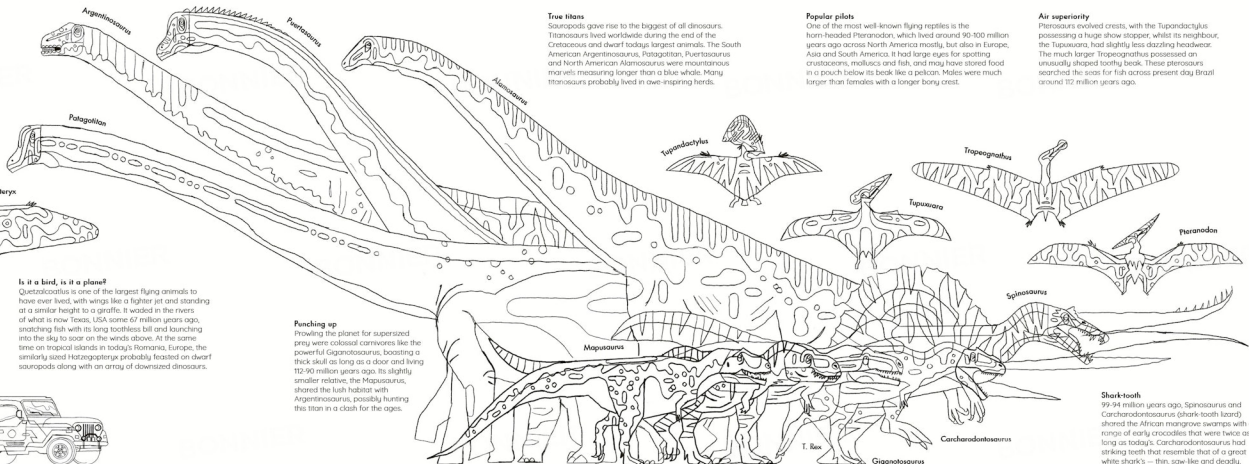
Sauropods gave rise to the biggest of all dinosaurs. Titanosaurs lived worldwide during the end of the Cretaceous and dwarf today's largest animals. The South American Argentinosaurus, Patagotitan, Pteranosaurus and North American Alamosaurus were mountainous marvels measuring longer than a blue whale. Many titanosaurs probably lived in awe-inspiring herds.

### Popular pilots

One of the most well-known flying reptiles is the horn-headed Pteranodon, which lived around 90-100 million years ago across North America mostly, but also in Europe, Asia and South America. It had large eyes for spotting crustaceans, molluscs and fish, and may have stored food in a pouch below its beak like a pelican. Males were much larger than females with a longer bony crest.

### Air superiority

Pterosaurs evolved crests, with the Tupandactylus possessing a huge show stopper, whilst its neighbour, the Tupuxuara, had slightly less dazzling headwear. The much larger Tropeognathus possessed an unusually shaped toothy beak. These pterosaurs searched the seas for fish across present day Brazil around 112 million years ago.



### Shark-tooth

99-94 million years ago, Spinosaurus and Carcharodontosaurus (shark-tooth lizard) shared the African mangrove swamps with a range of early crocodiles that were twice as long as today's. Carcharodontosaurus had striking teeth that resemble that of a great white shark's – thin, saw-like and deadly.

## GOING OUT WITH A BANG

The golden age of the great dinosaurs and other magnificent marvels of prehistoric age abruptly ended 66 million years ago. A vast, 10km wide asteroid about the size of Mount Everest burst through the sky and crashed into the coast of what is now Mexico, exploding with the force of over a billion nuclear bombs. Everything in a 600 mile radius was instantly vaporised. In the ensuing chaos, the skies blackened and mountainous waves and hurricane force winds swept across the earth. Liquid rock, dust and debris flew up into the air, cooling quickly in the atmosphere then raining down as deadly glassy spears. Acid rain fell, an array of erupting volcanoes exploded and wildfires tore through the forests. Through luck or smarts, some survivors probably took refuge in burrows or underwater whilst chaos reigned above.

### A fall from grace

The next few years were dark and cold. In the oceans, various fish, sharks, shellfish and others escaped the fate of the biggest marine reptiles, who disappeared. On land, ratised mammals escaped along with some turtles, crocodiles and small reptiles. What was once a lush planet teeming with extraordinary life turned into a barren world with scattered survivors. Around 80% of life went extinct. The dinosaurs were all but gone.

### Today's dinosaurs

Technically dinosaurs still live on. Although crocodiles share the dinosaurs ancient pasts and are a close living relative, today's birds are directly descended from theropods. They started as feathered dinosaurs such as the Archaeopteryx, retaining the theropods signature light, hollow bones and air sacs, which were fantastic for flight. A few different kinds of duck-like dinosaurs managed to survive the extinction by feeding off scraps, coming into their own as the earth rejuvenated and food was easier to come by. These eventually evolved into birds, spreading far and wide to fill our skies with colourful plumage and a symphony of beautiful birdsong. This makes the humble chicken a close relative of the revered T. Rex.



The costliest Mary Anning  
The coastline in Dorset, England boasts a rich fossil bed set into  
The rocks: Mary Anning searched for fossils here since she was a  
little girl in the 1800's, assembling and studying them to discover  
new species. Although often uncredited because she was a  
woman from a modest background, she found the first complete  
Ichthyosaurus, among marine reptiles and a Pterodactylus. People  
still flock to her stomping grounds, now known as the Jurassic  
coast, in search of countless fossil curiosities.



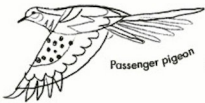


# THE DINOSAURS LEGACY

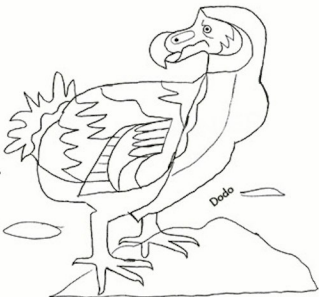
On the one hand, the age of reptiles was a world of wonder teeming with all kinds of reptiles. Their 186 million year long reign perfectly captures how beautiful and bizarre evolution can be. Dinosaurs have also captured the imagination of adults and children alike – inspiring Hollywood blockbuster films today starring rapid raptors and sparking the fossil finding fever that gripped the world 200 years ago.



Atlas Bear



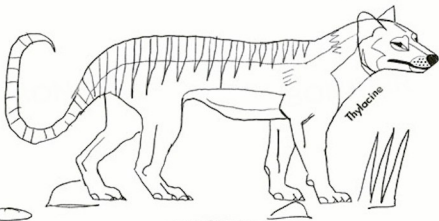
Passenger pigeon



Dodo

## Gone but not forgotten

On the other hand the dinosaurs are a stark warning. When the T. Rex awoke 66 million years ago on an abundant planet where it reigned supreme, it didn't know the terror about to befall it. We do. Unfortunately, many animals today are at risk of repeating the dinosaurs' fate. Climate change, unsustainable farming, rising sea levels, overhunting and habitat loss has pushed thousands of animals to the brink of disappearing altogether.



Thylacine

The dodo, thylacine, passenger pigeon, and atlas bear are among the many creatures lost in the past few hundred years.

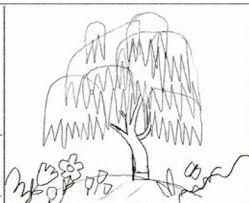
## Habitat hero

There are lots of things you can do, big or small, to save our animals and their habitats. These include:

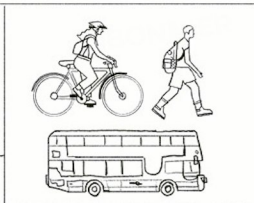
### Avoid waste and recycle



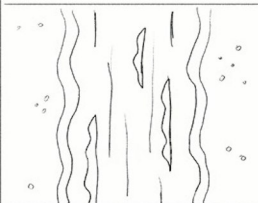
### Plant trees or local plants



### Walk, cycle or use public transport.



### Use less water



### Eat plants instead of meat and dairy



### Buy from sustainable companies



You can also spread the word. Talk about the planet, peacefully protest or join in with the noble people and organisations around the world who work tirelessly to protect our precious wildlife today.





## GLOSSARY

**Æsir** – The main group of Norse gods that includes Odin and Thor.

**Adorn** – To make more beautiful by adding something decorative.

**Agriculture** – The practice of farming.

**Ancient** – Dating back to the distant past, usually up to the end of the Roman Empire in 476.

**Ancestor** – A person's distant relative that lived a long time ago.

**Anglo-Saxons** – The people from tribes in northern and western Europe who inhabited England from the 500's.

**Archaeology** – The study of human history through remains and objects.

**Artefact** – A man-made object, usually of historical importance.

**Berserker** – Viking warriors who dressed in animal skins and were recorded as ferocious fighters.

**Asgard** – In Norse mythology, one of the nine worlds and home to the Æsir.

**Brooch** – A piece of jewellery that fastens clothes together.

**Cargo** – The load of goods carried on a form of transportation, such as a boat or train.

**Carpentry** – The trade of making or fixing wooden structures, furniture and objects.

**Ceremony** – A celebrated or public religious event with great importance.

**Christian** – A person who believes in the teachings of Jesus Christ.

**Culture** – The behaviour, beliefs, way of life and customs or a civilization or people of a particular time.

**Currency** – The system of exchange used in a particular place, such as banknotes and coins.

**Deity** – A god or goddess, such as Thor, Odin and Idunn.

**Domesticate** – Taming an animal for use on a farm or as a pet e.g. dog

**Draugr** – An undead person or spirit originating from Norse mythology.

**Dwarf** – A mysterious being from Norse mythology, often depicted as skilled at smithing.

**Expedition** – A journey undertaken

by a group of people, usually with a specific goal e.g. exploration, war.

**Faith** – Strong belief in a religion.

**Figurine** – A small, human-like model.

**Fjord** – A deep body of water between mountains and cliffs, found across Norway, Denmark and Sweden.

**Folklore** – Traditional myths, tales and beliefs relating to a group of people.

**Francia** – Also known as the Frankish empire, the kingdom ruled in western Europe during the Middle Ages.

**Hearth** – The brick, stone or wooden fireplace used as a cooking area.

**Hoard** – A large collection or store of valuable objects.

**Holy** – Something considered special and sacred due to religious importance.

**Inscribe** – To carve or write letters, words or symbols on an object.

**Ivory** – The substance that the tusks of animals, such as elephants or walruses, are made of.

**Jarl** – A noble Viking chief or ruler.

**Karl** – The middle-class of Viking society, usually farmers.

**Kingdom** – A place under a King or Queen's rule.

**Livestock** – Animals kept in a farm for food, milk or other purposes.

**Longship** – A type of long, narrow warship sailed by the Vikings.

**Loom** – An instrument used for weaving fabric and making cloth.

**Loot** – Stealing goods and property, usually in a battle or war.

**Mead** – A honey-based alcoholic drink brewed with water.

**Medieval** – Related to the Middle Ages, a European period of history spanning from roughly 500-1500.

**Mercenary** – A soldier hired to serve a foreign cause or in an army.

**Merchandise** – Objects and goods that are bought and sold in business.

**Mineral** – A substance that occurs naturally, such as rock or crystal.

**Monastery** – A place in which devout religious people live and worship.

**Mythology** – A set of stories belonging to a particular religion or culture.

**Naval** – Related to boats

**Norse** – Relating to Scandinavia in the Middle Ages or ancient times.

**Ornament** – A decorative item.

**Pagan** – Belonging to a religion with many gods.

**Plank** – A long, flat piece of wood.

**Prophecy** – A prediction for the future.

**Raid** – A surprise assault on an enemy.

**Relic** – An ancient object of extreme cultural or historic interest.

**Rune** – Any symbol or letter from the alphabet from ancient Europe and Scandinavia.

**Sacrifice** – The act of killing an animal or person as a religious offering.

**Saga** – A long story from medieval Scandinavian societies, usually telling of heroic adventures.

**Scandinavia** – Northern Europe and

its (Denmark, Sweden and Norway.)

**Settler** – Someone who travels to start a new life in a new land.

**Talisman** – An object believed to have supernatural or magical powers.

**Temple** – A building for worshipping a god or gods.

**Thatch** – A material made of straw, leaves, reeds and similar foliage, usually used for roofing.

**Thrall** – In medieval Scandinavia, a slave, servant or captive.

**Trinket** – An ornament or piece of jewellery usually small in size.

**Troll** – Originating from Old Norse, an ugly monster-like creature that usually lives in a cave.

**Tunic** – Loose clothing that reaches the knees and covers the body.

**Valhalla** – A great hall where Odin houses those he deems worthy who fell in battle.

**Vessel** – Some type of ship, boat or other water-craft.

**Worship** – The act of honouring a god, sometimes in a ceremony.

