
DINOSAURS
OF CHINA
GROUND SHAKERS TO
FEATHERED FLYERS
中国龙
从撼地巨人到飞羽精灵

Front and rear cover:

The Cretaceous Period in China about 125 million years ago.

Yangchuanosaurus

Welcome

It's our pleasure to welcome you to the world-exclusive Dinosaurs of China exhibition here at Wollaton Hall and Nottingham Lakeside Arts.

Wollaton Hall and Park has been home to one of the most important natural history collections in the UK since it first opened as a museum in 1926. Since then the offer has grown to include cafés, shops, play areas and the Nottingham Industrial Museum. We estimate that each year about one million visitors enjoy the wonderful buildings, museums and deer park. The Nottingham Natural History Museum inside Wollaton Hall contains an impressive array of 750,000 specimens, including many birds and fossils. It is therefore a fitting venue for an exhibition that tells the story of how dinosaurs evolved into the birds that live amongst us today.

The University of Nottingham's strong connections in China have proven instrumental in bringing this exhibition to Nottingham. It is 25 years since the Galleries opened and began the development of the Nottingham Lakeside Arts programme, which now includes not only visual but performing and participatory arts and annually attracts almost 200,000 people of all ages. It is therefore pertinent that the exhibition at Lakeside focuses on the amazing story of palaeo-art, a subject transformed by the discovery of China's famous feathered dinosaurs in recent years.

We encourage you to enjoy the awe inspiring exhibitions, series of talks, family workshops, and special events at both Dinosaurs of China venues, and hope that your experience is exciting and memorable.

Thank you for visiting. We hope to welcome you back very soon.

Councillor D Trimble
Portfolio Holder for Leisure and Culture,
Nottingham City Council

Professor Sir David Greenaway
Vice-Chancellor,
University of Nottingham

FATHERS OF CHINESE DINOSAUR PALAEONTOLOGY

Meet the key scientists who shaped Chinese palaeontology over four generations.

Dr Chung-Chien Young (杨钟健)

Dong Zhiming (董枝明)

Professor Tan Lin (谭琳)

Dr Xu Xing (徐星)

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Off to a flying start

'Dinosaurs of China: Ground Shakers to Feathered Flyers is a once in a lifetime experience exhibiting dinosaur skeletons and fossils never before seen outside of Asia. The strong connection between Nottingham and China has proven instrumental in bringing this world-exclusive exhibition here. It is my sincere hope that this wonderful exhibition encourages and excites all those who visit to start seeing dinosaurs differently – appreciating their variety, complexity and potential beauty – much like we do with their modern-day descendants, the birds.'

***Chris Packham** – naturalist, television presenter, writer, photographer, conservationist, campaigner and filmmaker.*

In 2006, the University of Nottingham (UoN) became the first UK university to establish a campus in Ningbo, now Nottingham's sister city in China. Since then UoN and Nottingham City Council (NCC) have worked closely together to build trade and cultural links with China. In 2012 Nottingham Castle hosted *Living in Silk*, a major exhibition of outstanding silk garments spanning 5000 years, on loan from the China National Silk Museum, Hangzhou and the Zhejiang Provincial Department of Culture, China.

It is these connections that have led to an exhibition of Chinese dinosaurs coming to Nottingham in 2017, including some of the most important fossils in the world, courtesy of the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) in Beijing, and the Longhao Institute of Geology and Paleontology Inner Mongolia.

Dating back to 1929, the IVPP is part of the Chinese Academy of Sciences (CAS) and is one of the world's leading dinosaur research centres. Its scientists have discovered, described and named hundreds of new prehistoric species. IVPP's visitor experience, the Paleozoological Museum of China, is the largest professional palaeontological museum in China, containing 200,000 objects. 24 of the 25 specimens in the Dinosaurs of China exhibition are on loan from IVPP and all 25 exhibits have been studied by IVPP scientists.

The Longhao Institute of Geology and Paleontology Inner Mongolia is the only private institute in China with a focus on palaeontology and geology. It has made important scientific contributions since it was established in 1996. The institute has helped the Ministry of Land and Resources to establish more than 20 county-level Geological Parks and Natural Preservation Zones for Fossils in Inner Mongolia. Its scientists have named more than 10 new dinosaur species, including the world-renowned *Gigantoraptor* – the largest bird-like dinosaur ever found, and one of the stars of the Dinosaurs of China exhibition (see page 23).

The exhibition has been developed and curated over several years by colleagues Dr Wang Qi, Assistant Professor of Architecture in the Department of Architecture and Built Environment, Faculty of Engineering at UoN, and Dr Adam Smith, Curator of Natural Sciences at Nottingham City Museums and Galleries (part of NCC).

Dr Wang Qi began developing links with the IVPP in 2011. His research into architectural spatial narrative and exhibition narrative to enhance visitor and learning experience, spurred on by his lifelong passion for palaeontology and biology, proved valuable for the IVPP as it sought to renovate its own museum. This connection, and a subsequent connection with the Longhao Institute of Geology and Paleontology Inner Mongolia, together with Dr Wang Qi's desire to bring their world-class specimens to Nottingham, drove this project in its early days.

Dr Adam Smith began working closely with Wang Qi when it was agreed that the exhibition would be co-hosted by Wollaton Hall and Nottingham Lakeside Arts. Adam has been based at the Nottingham Natural History Museum at Wollaton Hall since 2012, where he is responsible for its collection of 40,000 fossils. As a palaeontologist he has described and named several new prehistoric species and was therefore well placed to help develop the Dinosaurs of China exhibition.

The exhibition is divided across two Nottingham venues to highlight the collaborative nature of the project.

Wollaton Hall and Park is one of Nottingham's key attractions. Its extensive 203 hectares of open parkland is home to herds of two species of deer, formal gardens, a lake with abundant waterfowl, a renovated stable block of shops, cafés and the Nottingham Industrial Museum. Wollaton Park lies at the heart of local life and is supported by the Friends of Wollaton Park group. At the heart of the park sits the jewel in the crown, an outstanding Elizabethan hall, built for the first Sir Francis Willoughby by the architect Robert Smythson in 1588. Wollaton Hall is now home to the exceptional collections of the Nottingham Natural History Museum, which has been endorsed by the Natural History Museum, London, as a collection of "national significance" in a peer review. The architectural magnitude of Wollaton Hall echoes the magnitude of the dinosaurs in the Dinosaurs of China exhibition, which explores the scientific evidence that supports the evolution of dinosaurs into birds.

Dr Wang Qi and Dr Adam Smith.

Comprised of a theatre, several galleries, a recital hall, the University of Nottingham Museum, artist studios and two cafés, the University of Nottingham's Lakeside Arts delivers an annual programme of exhibitions and events across the visual, performing and participatory arts. The high quality and varied programme attracts almost 200,000 visitors, public and students, every single year. Dinosaurs of China at Lakeside focuses on the science of bringing dinosaurs to life in art. The exhibition has helped promote international academic links and research cooperation in the disciplines of palaeontology and palaeontological exhibition design between the University and the IVPP, providing an opportunity to evidence the impact of Dr Wang Qi's research. The exhibition has also provided a unique opportunity to the University's students, enabling MArch and PhD students from the Department of Architecture and Built Environment to explore the language of museum architecture and exhibition design by being directly engaged in designing the exhibition located in Lakeside's Angear Visitor Centre.

The partnership between China, the University and the City Council has brought Dinosaurs of China to life in a vibrant, exciting dual exhibition, set in unique venues to create a once in a lifetime event for all to enjoy. Prepare yourself for a ground shaking experience.

Above, left to right: Jin Haiyue, Director of Exhibitions and Deputy Director of the Paleontological Museum of China (Museum of the IVPP), Dr Wang Qi, Dr Adam Smith.

There has been a dinosaur revolution

Spectacular discoveries in China have drastically changed our understanding of dinosaur appearance, evolution and behaviour. We've hand-picked the most spectacular new fossils from China and brought them across the world especially for you.

Many dinosaurs were giant, scaly, ground shakers. Some of the towering skeletons in this exhibition are the tallest ever displayed in the UK. However, this view of dinosaurs has become part of a more diverse picture. Many dinosaurs were tiny and some had feathers. These feathered flyers eventually evolved into birds.

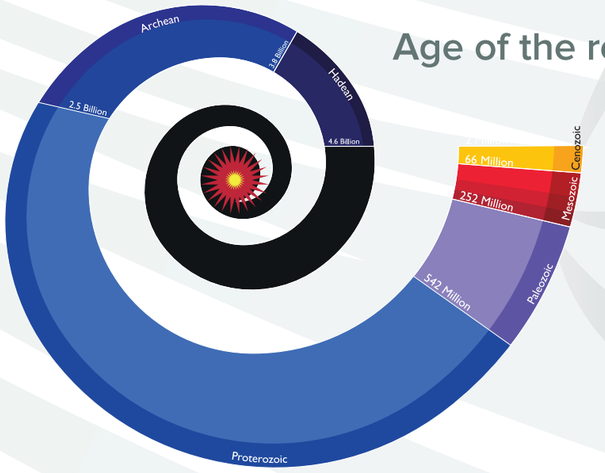
But, how do we know? The Dinosaurs of China exhibition is an exciting opportunity to explore the scientific evidence with your own eyes. You may never look at dinosaurs – or birds – the same way again!

Why China?

The last few decades have seen dramatic developments in Chinese palaeontology – the study of ancient life. Most of the dinosaurs in this exhibition were discovered and excavated from China in the last 30 years. Palaeontology is one of the fastest growing sciences in China.

Many Chinese rocks are special because they consist of fine sediments, which buried dinosaurs quickly and preserved their anatomy – bones and soft parts – in incredible detail. The rocks are also just the right age to preserve key events in dinosaur evolution.

Age of the reptiles



The Mesozoic Era or 'age of the reptiles' is divided into three periods - the Triassic, Jurassic and Cretaceous. It lasted for 186 million years. During this time, the continents remained connected, allowing dinosaur families to spread across the globe.

Cretaceous Period
145-66 million years ago
The world map began to look familiar, but North America remained connected to Europe and Asia.

Jurassic Period
201-145 million years ago
Pangaea began to separate into modern continents.

Triassic Period
252-201 million years ago
The land formed an enormous mass called Pangaea.

East meets west

CHINESE DINOSAURS MAY NOT BE FAMOUS, BUT THEY ARE CLOSE RELATIVES OF WELL-KNOWN SUPERSTAR DINOSAURS FROM THE WEST.

Protoceratops
is a horned dinosaur related to the iconic North American *Triceratops*.

Pinacosaurus
belongs to the same armoured family as the North American *Ankylosaurus*.

Sinraptor
is related to the well-known North American *Allosaurus*.

Mamenchisaurus
is a cousin of the famous North American *Diplodocus*.

Guanlong
is an early tyrannosauroid - the group that includes *T. rex*.

Lufengosaurus
is a relative of the European *Plateosaurus*.

FATHER OF CHINESE VERTEBRATE PALAEONTOLOGY

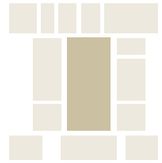
Dr Chung-Chien Young (杨钟健) (1897-1979) is known as the 'father of Chinese vertebrate palaeontology'. Young graduated from the Geological Department of Peking University in 1923 and received his doctorate at Munich University in Germany, in 1927. In 1928 he worked for the Geological Survey of China and took charge of some important early excavations in China. His work was instrumental in the creation of China's Institute of Vertebrate palaeontology and Palaeoanthropology, which houses one of the most important fossil collections in the world. He was the director of both the IVPP and the Beijing Museum of Natural History.

Young supervised the excavation and research of dinosaurs in China from 1933 to the 1970s and presided over some of the most important fossil discoveries in history. He discovered and named the long-necked *Lufengosaurus*, the duck-billed *Tsintaosaurus*, the gigantic *Mamenchisaurus*, and China's first armoured dinosaur, *Chialingosaurus*.

Lufengosaurus
禄丰龙

FIRST DINOSAUR DISCOVERED, STUDIED, AND DISPLAYED BY CHINESE SCIENTISTS

GROUND SHAKERS
THE GREAT HALL
GROUND FLOOR



Lufengosaurus is an early relative of later giant long-necked sauropods like *Mamenchisaurus*. It lived during the early Jurassic and was the largest land animal at the time. *Lufengosaurus* had closely spaced serrated teeth, suited for a diet of leaves. It may have used its strong claws for defense, or for raking vegetation. Its legs were longer than its arms, so it could walk on two legs when in a hurry, but may have also moved slowly on four legs sometimes.

Lufengosaurus played a significant part in the early history of Chinese palaeontology. It was first studied in the 1930s by C.C. Young. Young described and named *Lufengosaurus* at the height of Second World War, so he was unable to access scientific literature and comparative material around the world. Despite this, his papers on *Lufengosaurus*, and other amazing Chinese dinosaurs such as *Mamenchisaurus*, helped to shape China's reputation for exciting dinosaur research.

Keep calm and carry on

In 1941 *Lufengosaurus* became the first dinosaur skeleton ever mounted in China and was displayed in Chongqing – the war-time capital of China. Although the city suffered from serious bombing from the Japanese Air Force in 1941, the exhibition still aroused great public interest and attracted visitors every day. *Lufengosaurus* helped to raise the national morale and, as a result, was depicted on a commemorative postage stamp in 1958 – the first dinosaur postage stamp in history.

Genus:
Lufengosaurus 禄丰龙

Pronounced:
loo-feng-oh-sore-uss

Species:
huenei 许氏

Pronounced:
hoo-en-eye

Meaning of names:
'Huene's lizard from Lufeng'

Diet:
Herbivore

Place of discovery:
Yunnan Province, southwestern China

Age:
Early Jurassic, 200 million years ago

Classification:
A 'prosauropod' – an early type of long-necked plant-eating dinosaur

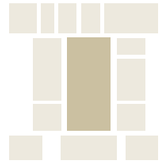
Size:
5-9 m long, about the size of a transit van

Year named:
1941

Mamenchisaurus
马门溪龙

PEACEFUL PLANT-EATING GROUND SHAKER

GROUND SHAKERS
THE GREAT HALL
GROUND FLOOR



Mamenchisaurus' extremely long neck grew up to 12 m long and contained more bones than any other dinosaur: 19 in total. The neck bones also have long ribs that overlap with those of adjacent vertebrae to provide strength, but also mean the neck was rigid.

Mamenchisaurus had simple peg-like teeth suited for stripping off leaves from branches, but not for chewing. Sauropods like this swallowed stones to help mush up the plants in their stomachs.

When threatened, it may have used its long tail as a whip to defend itself against attacking predators.

Legs like tree trunks!

Mamenchisaurus needed strong bones to support its huge weight. Its sturdy hind legs allowed it to rear up, leaning back onto its tail to reach the tallest trees or protect itself from predators. The femur, or thigh bone, is strong and straight.

FACT 1
MAMENCHISAURUS HAD CURVED CLAWS LIKE A BIRD

Genus:
Mamenchisaurus 马门溪龙

Pronounced:
mah-men-chee-sore-us

Species:
hochuanensis 合川

Pronounced:
her-choo-an-en-sis

Meaning of names:
'Mamenchi (or literally 'horse-gate brook') reptile from Hechuan'

Diet:
Herbivore

Place of discovery:
Sichuan Province, central China

Age:
Late Jurassic, 160 million years ago

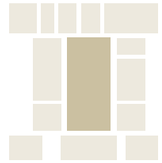
Classification:
A group of giant long-necked dinosaurs called sauropods, which also includes *Diplodocus* and *Brontosaurus*

Size:
Mamenchisaurus hochuanensis is 23m long from head to tail, but this skeleton has been specially built in a 13.5m tall rearing posture to fit inside Wollaton Hall. Higher than three double-decker buses, this is the tallest dinosaur skeleton ever displayed in the UK

Year named:
1972

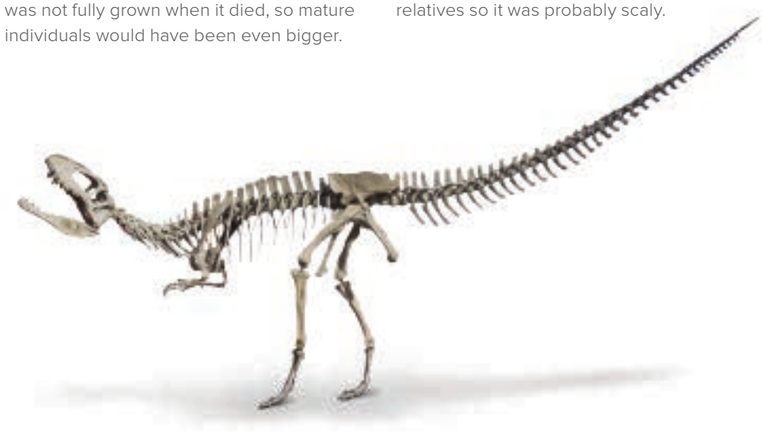
Sinraptor
中华盗龙

ONE OF THE LARGEST MEAT-EATING DINOSAURS KNOWN FROM CHINA



This terrifying super-predator was top of the Jurassic food chain in China and would have preyed upon large animals including *Mamenchisaurus*. Despite its huge size, the *Sinraptor* skeleton in this exhibition was not fully grown when it died, so mature individuals would have been even bigger.

Some skeletons of *Sinraptor* have ribs that were broken and healed when the animal was alive. This pathology proves that *Sinraptor* led a violent life. There is no direct evidence for feathers in *Sinraptor* or its close relatives so it was probably scaly.



Genus:
Sinraptor 中华盗龙

Pronounced:
sin-rap-tore

Species:
dongi 董氏

Pronounced:
dong-eye

Meaning of names:
'Dong's Chinese thief'

Diet:
Carnivore

Place of discovery:
Xinjiang Uyghur Autonomous Region, northwestern China

Age:
Late Jurassic,
160 million years ago

Classification:
A group of dinosaurs called the Allosauroidea. Despite its name, *Sinraptor* is not closely related to 'raptors' such as *Velociraptor*

Size:
7.2m long and 3m tall, about the size of a minibus

Year named:
1994

KING OF DINOSAURS

Dong Zhiming (董枝明) was born in 1937. He excelled as a student of Chung-Chien Young and began work at the IVPP in 1962. Dong Zhiming has studied and described the fossil remains of many dinosaurs, including *Mamenchisaurus*. He also organised and co-led Sino-Canadian expeditions into the Gobi Desert between 1986 and 1990. Many dramatic discoveries were made during these expeditions, including *Sinraptor*, one of the stars of the Dinosaurs of China exhibition. During his career, Dong Zhiming described and named a total of 35 dinosaur species, which led to him being regarded as the 'king of dinosaurs' in China.

FACT 2
SINRAPTOR HAD
THREE TOES LIKE A BIRD

Protoceratops
原角龙

HUMBLE RELATIVE OF THE MIGHTY *TRICERATOPS*

GROUND SHAKERS
THE GREAT HALL
GROUND FLOOR

Protoceratops is known from dozens of skeletons ranging from adults to embryos, as well as eggs and nests, so it is one of the best known dinosaurs in the world. Despite its small size, *Protoceratops* may look familiar. Its head frill and beak are also present in the famous North American *Triceratops*. As an early ceratopsian it provides information on the origins of 'horned dinosaurs'.

Protoceratops' head frill may have helped protect it from predators, but it contains a pair of large openings. These were covered with delicate skin in life so *Protoceratops* probably avoided conflict when it could.

Genus:
Protoceratops 原角龙

Pronounced:
pro-toe-serra-tops

Species:
andrewsi 安氏

Pronounced:
and-roos-eye

Meaning of names:
'Andrew's first horned face'

Diet:
Herbivore

Place of discovery:
Many sites around Mongolia and northern China

Age:
Late Cretaceous, 75 million years ago

Classification:
An early ceratopsian - the group of horned dinosaurs that includes *Triceratops*

Size:
1.2m long, about the size of a sheep

Year named:
1923

Pinacosaurus
绘龙

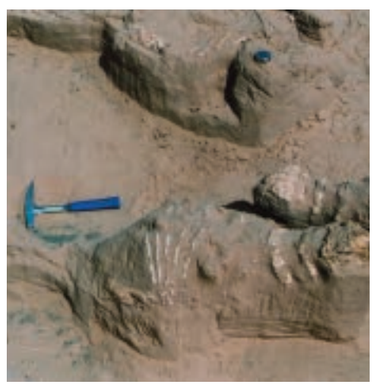
ARMOUR PROTECTS FROM PREDATORS BUT NOT FROM SANDSTORMS

GROUND SHAKERS
THE GREAT HALL
GROUND FLOOR

Pinacosaurus had heavy armour consisting of bony plates and projections embedded in its skin. It had a bony ring around its neck and a rough-textured skull.

The real fossil *Pinacosaurus* in this exhibition is one of many young individuals found huddled together. This suggests that they lived in social groups. They were preserved in life position with legs tucked underneath their bodies. The unfortunate animals were probably sheltering from a sandstorm, which engulfed and preserved them in sandstone.

The top of this *Pinacosaurus* fossil was eroded before it was found, so most of the armour from its back is missing and its ribs are exposed. The fossil is still partly covered in a plaster jacket applied when it was excavated during a joint Canada–China expedition to Bayan Mandahu, China, in 1990.



Genus:
Pinacosaurus 绘龙

Pronounced:
pin-ack-oh-sore-uss

Species:
grangeri 谷氏

Pronounced:
gran-jer-eye

Meaning of names:
'Granger's 'board' or 'plank' lizard'

Diet:
Herbivore

Place of discovery:
Inner Mongolia, northern China

Age:
Late Cretaceous, 75 million years ago

Classification:
A heavily armoured group of plant-eating dinosaurs known as ankylosaurs

Size:
Up to 5m long, about the size of an alligator

Year named:
1933

Digging dinosaurs can be time-consuming hard work. The delicate bones are protected with plaster of Paris jackets when they are excavated. These jackets are opened up back in the lab so the fossils inside can be removed from the rock and studied.

Guanlong
冠龙

ANCESTOR OF THE INFAMOUS *T. REX*

Guanlong's delicate ornamental head crest was larger and more exaggerated than any other carnivorous dinosaur. The crest was filled with air to keep it light. It was probably used to attract a mate and may have been colourful.

Guanlong provides information on the early evolution of tyrannosauroids. The infamous *T. rex* may have been massive but its earliest known cousin – *Guanlong* – was much smaller. Only the bones of *Guanlong* are known, but feathers are preserved in other tyrannosauroids, so *Guanlong* probably also had feathers.

SPOT THE SIMILARITIES!

Guanlong shares many skeletal characteristics with modern birds. They both have...

Long legs and long toes.
Curved claws on their feet.
Pointed snouts and long necks.
Air sacs in their back bones.

So...could birds be the relatives of long lost dinosaurs?

Genus:
Guanlong 冠龙

Pronounced:
gwan-long

Species:
wucaii 五彩

Pronounced:
woo-chai-ee

Meaning of names:
'Crown dragon from Wucaiwan'. The Chinese word wucai (五彩) means very colourful. Wucaiwan is a famous tourist attraction due to its rich coloured rocks

Diet:
Carnivore

Place of discovery:
Xinjiang Uyghur Autonomous Region, northwestern China

Age:
Late Jurassic, 160 million years ago

Classification:
The earliest known tyrannosauroid - the group of dinosaurs that includes T. rex

Size:
2m long and 1m tall, about the size of an ostrich

Year named:
2006

GROUND SHAKERS
THE GREAT HALL
GROUND FLOOR

FACT 3
GUANLONG WALKED ON TWO LONG LEGS LIKE A BIRD

Dinosaurs behaved like birds

DINOSAUR BEHAVIOUR
BIRD GALLERY
GROUND FLOOR

Many dinosaurs were scaly ground-shakers, but this view of dinosaurs is now part of a bigger picture. Dinosaurs share many characteristics with birds.

Some fossils provide evidence of bird-like behaviour.

Dinosaurs laid eggs and looked after their nests. They were attentive parents.

Oviraptor
窃蛋龙

DINOSAUR BEHAVIOUR
BIRD GALLERY
GROUND FLOOR

A GOOD PARENT WRONGLY ACCUSED OF EGG ROBBERY!

The first skeleton of *Oviraptor* was found lying on a nest of dinosaur eggs. It was considered to be an egg-eater caught in the act of robbing a nest. *Oviraptor* – the 'egg thief' – was given an unfair name to reflect this habit. However, many skeletons have since been found sitting on top of nests. This shows that *Oviraptor* was actually an attentive parent that protected its own eggs. *Oviraptor* had a powerful parrot-like beak that was well-adapted to crushing hard food – but probably not eggs!

Fossilised *Oviraptor* nests even show how mothers laid their eggs. First she laid a pair of eggs and buried them, then rotated to repeat the process and complete a ring of egg-pairs. She would then continue laying up to two more rings of eggs on top of the buried ones, creating a circular mound. *Oviraptor* nests contain as many as 30 eggs.

Genus:
Oviraptor 窃蛋龙

Pronounced:
oh-vee-rap-tore

Species:
philoceratops 喜欢角龙

Pronounced:
fill-oh-serra-tops

Meaning of names:
'Egg thief who loves ceratopsians'

Diet:
Uncertain - possibly an omnivore

Place of discovery:
Mongolia and northern China

Age:
Late Cretaceous, 75 million years ago

Classification:
An oviraptorosaur, a group of two-legged dinosaurs with bird-like beaks

Size:
1m tall, about the size of an emu

Year named:
1924

FACT 4
DINOSAURS LAID EGGS LIKE BIRDS

Ovaloolithus
椭圆形蛋

DINOSAUR BEHAVIOUR
BIRD GALLERY
GROUND FLOOR

GENUINE FOSSIL DINOSAUR EGG

Dinosaur eggs can sometimes be identified by their shape and size. *Ovaloolithus* eggs are oval like bird eggs, while other dinosaur eggs were circular like footballs, or stretched out like tubes. The surface of dinosaur eggs has pores that allowed the embryo inside to breathe.

Fossil eggs can be sliced into two and polished to reveal the crystals that formed inside. Sometimes dinosaur eggs contain embryos, or they are associated with the skeletons of the parents. However, most fossil dinosaur eggs are found separately, so nobody knows what dinosaur laid them. The dinosaur that laid *Ovaloolithus* eggs was probably a small plant-eater.

Genus:
Ovaloolithus 椭圆形蛋

Pronounced:
oh-vah-loo-lith-uss

Species:
chikangkouensis 金刚口

Pronounced:
jee-gan-koo-en-sis

Meaning of names:
'Egg of stone from Chikangkou'

Place of discovery:
Shangdong Province, eastern China

Age:
Late Cretaceous, 85 million years ago

Classification:
Fossil eggs have their own system of classification so *Ovaloolithus* is the name of the egg, not the name of the dinosaur that laid it

Size:
About 10cm long

Year named:
1979

FACT 5
OVIRAPTOR SAT ON ITS NEST LIKE A BIRD

Mei long
寐龙

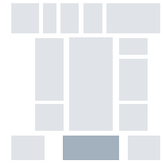
THIS ‘SLEEPING DRAGON’ SHEDS LIGHT ON HOW DINOSAURS SLEPT

The spectacular fossil of *Mei long* is coiled up in a sleeping pose with its tail wrapped around its body and head tucked under its arm, which is similar to how birds tuck their heads under their wing when resting. This is the first evidence for bird-like sleeping behaviour in a dinosaur.

This *Mei long* was buried by ash when it was sleeping or resting, which preserved its posture in three dimensions.

This young adult dinosaur is small enough to fit in one human hand. Only the bones of *Mei long* are known, but it probably had feathers, as in other troodontids.

DINOSAUR BEHAVIOUR
BIRD GALLERY
GROUND FLOOR



Genus:
Mei 寐

Pronounced:
may

Species:
long 龙

Pronounced:
long

Meaning of names:
‘sleeping dragon’

Diet:
Carnivore

Place of discovery:
Liaoning Province, northeastern China

Age:
Early Cretaceous, 125 million years ago

Classification:
A family of small two-legged predatory dinosaurs called Troodontidae

Size:
53cm long, but just 15cm long when curled up, about the size of a magpie

Year named:
2004

FACT 6
MEI LONG CURLED UP TO SLEEP LIKE A BIRD

New view of dinosaurs

ARE BIRDS LIVING DINOSAURS?

Bones and eggs become fossils easily because they are hard. Soft parts like skin and muscles are only preserved under special conditions. In China, fine volcanic ash has preserved not only beautiful skeletons, but also spectacular details including feathers.

In 1996 the first ever feathered dinosaur was described and named. It was from China.

In the last 20 years hundreds of feathered dinosaurs have been discovered and studied from Chinese deposits, and dozens of species have been named.

Before the discovery of these dinosaurs, we thought only birds had feathers. But many dinosaurs had feathers too.

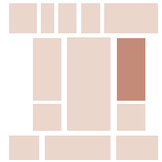
The Jehol biota

In northeastern China during the Cretaceous Period, 125 million years ago, volcanic eruptions preserved an entire ecosystem in fine ash. Most of the dinosaurs in this room belong to this ecosystem, known as the Jehol biota.

EVOLUTION OF FEATHERS – FROM FUZZ TO WINGS

Sinosauropteryx
中华龙鸟

NEW VIEW OF DINOSAURS
WILLOUGHBY ROOM
FIRST FLOOR



THE FIRST FEATHERED DINOSAUR EVER DESCRIBED

The discovery of *Sinosauropteryx* in 1996 began a revolution in dinosaur studies. The genuine fossil in this exhibition includes soft parts of the body, which have been identified by many scientists as the remains of downy feathers. These feathers were for insulation or display, not for flight. *Sinosauropteryx* was a slender meat-eating dinosaur with two long legs, short arms and a long tail.

The finely preserved fossils of *Sinosauropteryx* have allowed scientists to infer its colour when alive. Microscopic analysis suggests that it was ginger, with alternating light and dark bands on the tail. These stripes would help it to stay camouflaged.

Genus:
Sinosauropteryx 中华龙鸟

Pronounced:
sine-oh-sore-op-ter-iks

Species:
prima 原始

Pronounced:
pry-mah

Meaning of names:
'Primitive Chinese dragon bird'

Diet:
Carnivore

Place of discovery:
Liaoning Province, northeastern China

Age:
Early Cretaceous, 125 million years ago

Classification:
A family of tiny nimble two-legged dinosaurs called the Compsognathidae

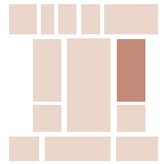
Size:
1m long, about the size of a dog

Year named:
1996

FACT 7
SINOSAUROPTERYX HAD DOWNY FEATHERS LIKE BIRD CHICKS

Gigantoraptor
巨盗龙

NEW VIEW OF DINOSAURS
WILLOUGHBY ROOM
FIRST FLOOR

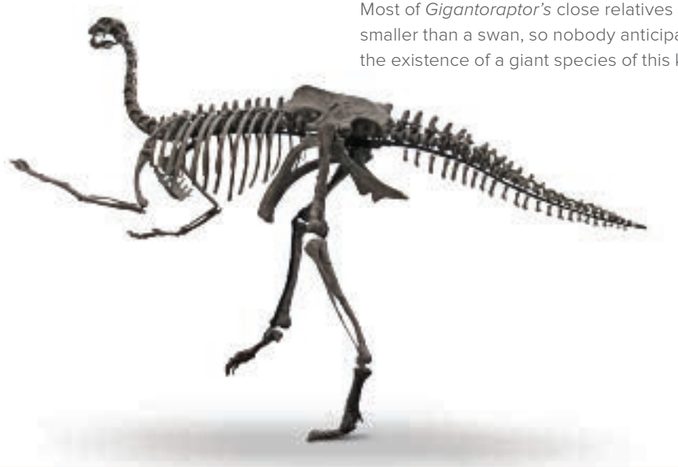


FEATHERED GROUND SHAKER – THE LARGEST BIRD-LIKE DINOSAUR IN THE WORLD

Gigantoraptor was a large dinosaur with a relatively short tail, long neck, long arms and legs, and was covered with bird-like feathers. Only the bones of *Gigantoraptor* are known, but bird-like feathers are preserved in similar dinosaurs, so *Gigantoraptor* probably had feathers too. It was too heavy to fly and may have used its feathers for courtship displays instead. It has a toothless beak but its diet is a mystery. Perhaps it was a carnivore that chased other dinosaurs, or maybe it munched on vegetation.

The bones of *Gigantoraptor* were discovered by chance by palaeontologists Xu Xing and Tan Lin. During a documentary in 2005 a dig site was selected at random by throwing a hat into the air. However, the spot happened to yield fossil bones, transforming the pretend site into a genuine dig. When the bones were first unearthed they were thought to belong to a familiar giant dinosaur. Later excavation and examination of the fossil bones led to the surprising discovery of a new type of dinosaur.

Most of *Gigantoraptor's* close relatives are smaller than a swan, so nobody anticipated the existence of a giant species of this kind.



Genus:
Gigantoraptor 巨盗龙

Pronounced:
jai-gant-oh-rap-tore

Species:
erlianensis 二连浩特

Pronounced:
err-lee-an-en-sis

Meaning of names:
'Giant thief from the Erlian Basin'

Diet:
Uncertain - possibly an omnivore

Place of discovery:
Inner Mongolia, northern China

Age:
Late Cretaceous, 80 million years ago

Classification:
A group of two-legged dinosaurs with bird-like beaks and feathers, called Oviraptorosauria

Size:
8m long and 4m high, as tall as a giraffe

Year named:
2007

DESERT DINOSAUR HUNTER

Professor Tan Lin (谭琳) was born in 1941. He is the director of the Inner Mongolia Longhao Institute of Geology and Paleontology. As a remarkable representative of an early generation of palaeontologists in China, he is widely respected as the founder of palaeontology in the Inner Mongolia desert regions. Since he graduated from Changcun Institute of Geology in 1965, he has discovered and co-named many new species of dinosaurs, including *Linheraptor* and *Gigantoraptor*, two of the stars of the Dinosaurs of China exhibition.

FACT 8
GIGANTORAPTOR HAD A HORNY BEAK LIKE A BIRD

Linheraptor
临河盗龙

NEW VIEW OF DINOSAURS
WILLOUGHBY ROOM
FIRST FLOOR

VELOCIRAPTOR'S 'BIG BROTHER' - COMPLETE SKELETON PRESERVED ARTICULATED IN THE ROCK

The *Linheraptor* specimen in this exhibition is a cast of the articulated fossil skeleton embedded in the rock, created before the bones were dug out individually and studied in detail. Only the bones of *Linheraptor* are known, but feathers are preserved in other 'raptors', so *Linheraptor* probably had them too.

Linheraptor was a moderately sized 'raptor' dinosaur that walked on two legs and balanced its body with a long tail. It had sharp recurved teeth for killing prey and three-fingered grasping hands with sharp claws. On the second toe of its foot was an enlarged sickle-shaped killing claw – a frightening weapon.

Genus:
Linheraptor 临河盗龙

Pronounced:
lin-heh-rap-tore

Species:
exquisitus 精美

Pronounced:
ex-kwiz-it-us

Meaning of names:
'Exquisitely preserved thief from Linhe County'

Diet:
Carnivore

Place of discovery:
Inner Mongolia, northern China

Age:
Late Cretaceous, 73 million years ago

Classification:
The dromaeosaurid or 'raptor' family, so it is a close relative of *Velociraptor* and *Microraptor*

Size:
1.8m long, about the size of a bicycle

Year named:
2010

CHAMPION OF THE FEATHERED DINOSAUR REVOLUTION

Dr Xu Xing (徐星) is a dynamic modern palaeontologist born in China in 1969. He is currently working as a researcher at the IVPP, where he is widely known as a champion of the feathered dinosaur revolution. Xu Xing has described many new species. Several of the superstars in the Dinosaurs of China exhibition have been studied and co-named by him, including *Gigantoraptor*, *Microraptor*, *Mei long*, *Guanlong*, *Dilong* and *Yi qi*.

Xu Xing provided essential support for the exhibition, including in-depth information for the exhibition narrative. He also helped to check the accuracy of all mounted dinosaur skeletons in the exhibition. For example, the *Gigantoraptor* has arms in an up-to-date bird-like posture, and the *Mamenchisaurus* has a neck with the correct amount of curvature.

FACT 9
LINHERAPTOR HAD A BACKWARDS-POINTING PUBIS BONE, LIKE A BIRD

Dilong
帝龙

NEW VIEW OF DINOSAURS
WILLOUGHBY ROOM
FIRST FLOOR

SMALL EASTERN ‘EMPEROR’ THAT LED TO GIANT TYRANTS

Dilong comes from the Chinese words ‘di’, meaning emperor, and ‘long’, meaning ‘dragon’. It is known from several specimens described in 2004 that provide information on the early evolution of the group that includes *Tyrannosaurus*. This early relative of *T. rex* prowled around on two legs, using its sharp claws and teeth to catch and kill small prey.

One *Dilong* fossil in China also includes traces of branched structures around the jaws and tail, probably the remains of fossil feathers. This evidence suggests that all members of the group, including *T. rex*, may have been partly feathered.

Dinosaur skeletons are not usually found completely articulated. The fossil cast in this exhibition shows how the bones were found jumbled up on a slab of rock.

Genus:
Dilong 帝龙

Pronounced:
dee-long

Species:
paradoxus 奇异

Pronounced:
pah-rah-docks-uss

Meaning of names:
‘Surprising emperor dragon’

Diet:
Carnivore

Place of discovery:
Liaoning Province, northeastern China

Age:
Early Cretaceous, 130 million years ago

Classification:
An early tyrannosauroid - the group of dinosaurs that includes *Tyrannosaurus rex*

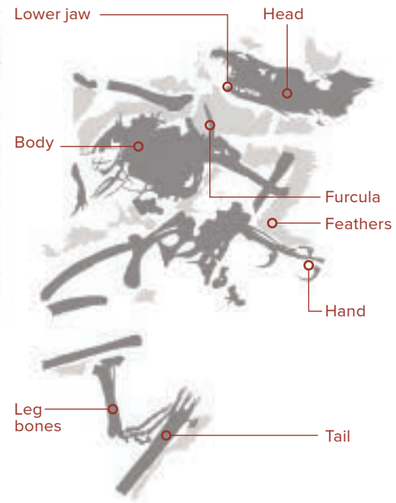
Size:
1.6m long; about the size of a lion

Year named:
2004

Sinornithosaurus
中国鸟龙

NEW VIEW OF DINOSAURS
WILLOUGHBY ROOM
FIRST FLOOR

A ‘FUZZY-RAPTOR’ THAT PROVES *VELOCIRAPTOR* HAD FEATHERS. JURASSIC PARK GOT IT WRONG!



Patches of fuzzy filaments preserved in fossils of *Sinornithosaurus* have been identified as simple feathers. These filaments are grouped together in tufts that show that the body was covered in short fuzz. The shape of these primitive feathers provides information on the evolution of feathers. Simple hollow feather follicles led to branched tuft-like structures, and eventually to complex bird-like feathers.

Velociraptor is a very close cousin of *Sinornithosaurus* and therefore probably had fuzzy feathers too. Another characteristic *Sinornithosaurus* shares with birds is a boomerang-shaped furcula, or wishbone, in its shoulder joint.

Genus:
Sinornithosaurus 中国鸟龙

Pronounced:
Sine-or-nith-oh-sore-us

Species:
millenii 千禧

Pronounced:
mil-en-ee-eye

Meaning of names:
‘Bird-like dinosaur from China to celebrate the Millennium’

Diet:
Carnivore

Place of discovery:
Liaoning Province, northeastern China

Age:
Early Cretaceous, 125 million years ago

Classification:
The dromaeosaurid or ‘raptor’ family, so it is a close relative of *Velociraptor*

Size:
90cm long, about the size of a turkey

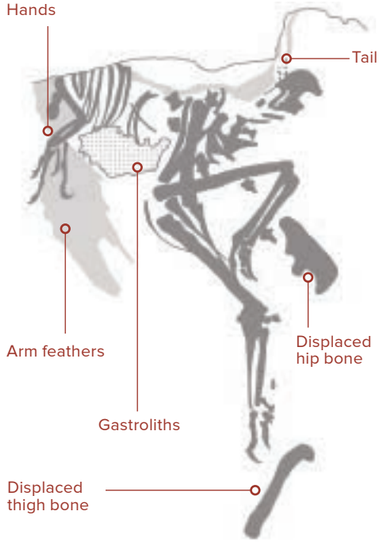
Year named:
1999

FACT 10
SINORNITHOSAURUS HAD A WISHBONE LIKE A BIRD

Caudipteryx
尾羽龙

NEW VIEW OF DINOSAURS
WILLOUGHBY ROOM
FIRST FLOOR

A FLIGHTLESS FEATHERED DINOSAUR THAT SWALLOWED STONES



The genuine fossil of *Caudipteryx* in this exhibition is the first one of its species ever described. It has large feathers preserved on its arms, and other fossils of this dinosaur show feathers on the tail too. *Caudipteryx* has small arms and long legs, which suggests that *Caudipteryx* was flightless, but a fast runner. It probably used its feathers for colourful courtship displays, as many modern birds do. It also has a mass of stones preserved in its stomach, called 'gastroliths'. It swallowed these to help grind up and digest the food in its stomach. This behaviour is also common in modern birds.

Genus:
Caudipteryx 尾羽龙

Pronounced:
core-dip-ter-icks

Species:
dongi 董氏

Pronounced:
dong-eye

Meaning of names:
'Dong's tail feather'

Diet:
Uncertain - possibly an omnivore

Place of discovery:
Liaoning Province, northeastern China

Age:
Early Cretaceous, 125 million years ago

Classification:
Oviraptorosauria, a group of two-legged dinosaurs with bird-like beaks and feathers. It belongs to the same group as the giant *Gigantoraptor*

Size:
1m long, about the size of a peacock

Year named:
1998

FACT 11
CAUDIPTERYX SWALLOWED STONES LIKE BIRDS DO

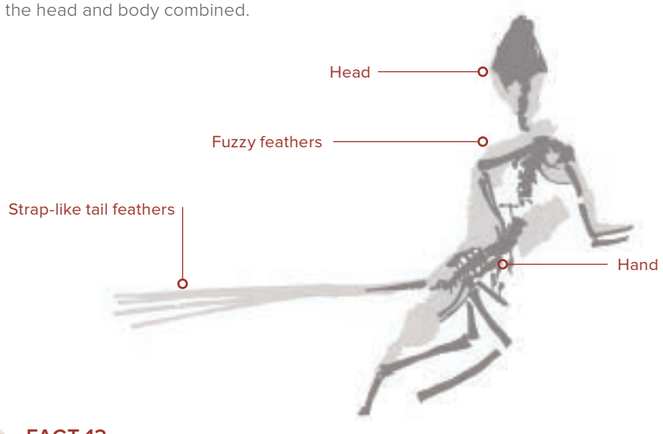
Epidexipteryx
耀龙

NEW VIEW OF DINOSAURS
WILLOUGHBY ROOM
FIRST FLOOR

ONE OF THE MOST BIZARRE DINOSAURS, WITH LONG RIBBON-LIKE TAIL FEATHERS

Epidexipteryx was a bizarre small dinosaur with a blunt skull containing prominent large teeth. It had a short neck, long arms and legs, and four extremely long ribbon-like feathers on its stubby tail. Each of these strap-like feathers was about as long as the head and body combined.

Epidexipteryx' body was covered with fuzz. The apparent absence of flight feathers suggests that it was flightless, so it may have scrambled around on the ground or in trees. Its long tail feathers were possibly colourful and used for display.



Genus:
Epidexipteryx 耀龙

Pronounced:
ep-id-ecks-ip-ter-icks

Species:
hui 胡氏

Pronounced:
hoo-eye

Meaning of names:
'Hu's display feather'

Diet:
Probably an omnivore (e.g. insects, seeds, fruits)

Place of discovery:
Inner Mongolia, northeastern China

Age:
Middle to Late Jurassic, 160 million years ago

Classification:
A bizarre group of small dinosaurs called Scansoriopterygidae (or 'scansors')

Size:
30cm long, about the size of a pigeon

Year named:
2000

FACT 12
EPIDEXIPTERYX HAD A STUBBY TAIL BONE LIKE A BIRD

Feathered Flyers

FEATHERED FLYERS
BALCONY & WILLOUGHBY ROOM
FIRST FLOOR

Flying towards a new horizon

Dinosaurs are one of the most successful groups of flying animals, with over 10,000 bird species living today. The first true birds evolved in the Jurassic. Dinosaurs were incredibly diverse, ranging from ground shakers to feathered flyers!

Flight is an important adaptation because it can help animals to escape from predators on the ground, or hunt from the sky. It also allows animals to cover long distances quickly.

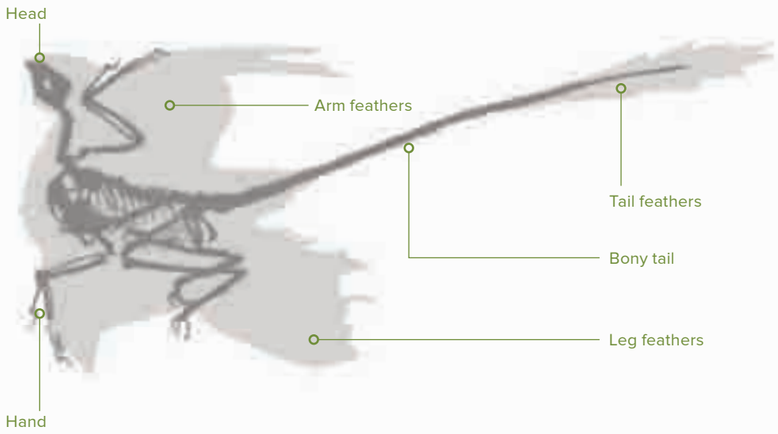
This is why wings have evolved many times, in insects, bats, birds, and pterosaurs.

Microraptor
小盗龙

FOUR-WINGED DINOSAUR – A TRUE ‘FEATHERED FLYER’

FEATHERED FLYERS
BALCONY & WILLOUGHBY ROOM
FIRST FLOOR

The genuine *Microraptor* fossil in this exhibition is the holotype of this species – the first one that was described and named in 2003. It has claws on its hands and feet, a long bony tail, and teeth – all dinosaur characteristics. However, this fossil also shows spectacular evidence of feathers including long feathers on its arms and legs. It had four wings and could fly.



Genus:
Microraptor 小盗龙

Pronounced:
mike-row-rap-tore

Species:
gui 顾氏

Pronounced:
goo-eye

Meaning of names:
‘Gu’s tiny thief’

Diet:
Carnivore

Place of discovery:
Liaoning Province, northeastern China

Age:
Early Cretaceous, 120 million years ago

Classification:
The ‘raptor’ family, called Dromaeosauridae. It is a close relative of *Velociraptor.*

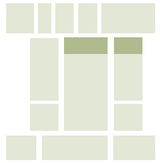
Size:
77cm long, about the size of a turkey

Year named:
Microraptor gui was named in 2003

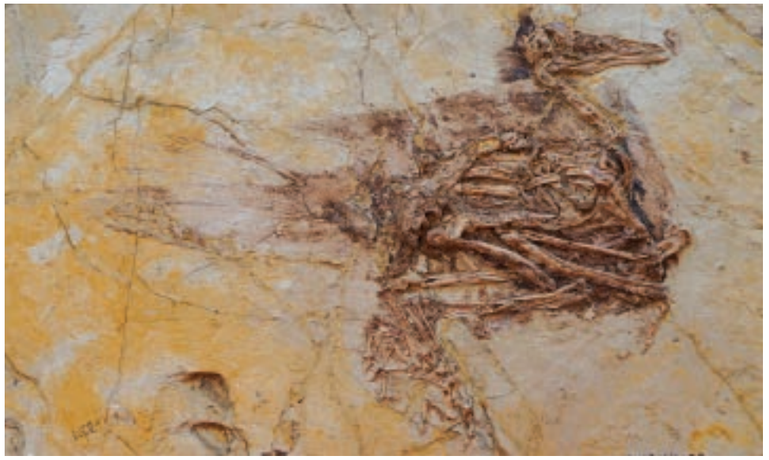
FACT 13
MICRORAPTOR WAS A DINOSAUR WITH WING FEATHERS LIKE A BIRD

Yanornis
燕鸟

FEATHERED FLYERS
BALCONY & WILLOUGHBY ROOM
FIRST FLOOR



GENUINE FOSSIL OF PREHISTORIC BIRD



Genus:
Yanornis 燕鸟

Pronounced:
Yan-or-niss

Species:
martini 马氏

Pronounced:
mar-tin-eye

Meaning of names:
'Martin's Yan Dynasty bird'

Diet:
Probably an omnivore
(e.g. insects, seeds, fruits)

Place of discovery:
Liaoning Province,
northeastern China

Age:
Early Cretaceous,
120 million years ago

Classification:
Ancient bird

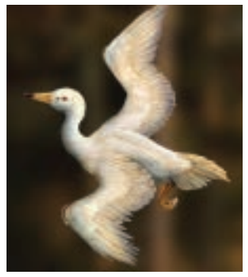
Size:
40cm long; about the
size of a chicken

Year named:
2001

Early birds such as *Yanornis* provide information on the evolutionary transition from feathered dinosaurs to true birds. *Yanornis* had tiny teeth in its jaws and claws on the ends of its fingers. This shows that the earliest true birds retained dinosaur-like features.

The spectacular real fossil of *Yanornis* in this exhibition shows the feathers, exactly the same as modern birds. *Yanornis* has large wings and a strong sternum, so it was a relatively strong flyer.

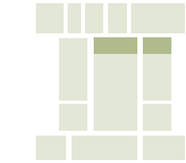
A FOSSIL *YANORNIS* LIKE THIS ONE MAKES UP THE HEAD OF "ARCHAEORAPTOR".



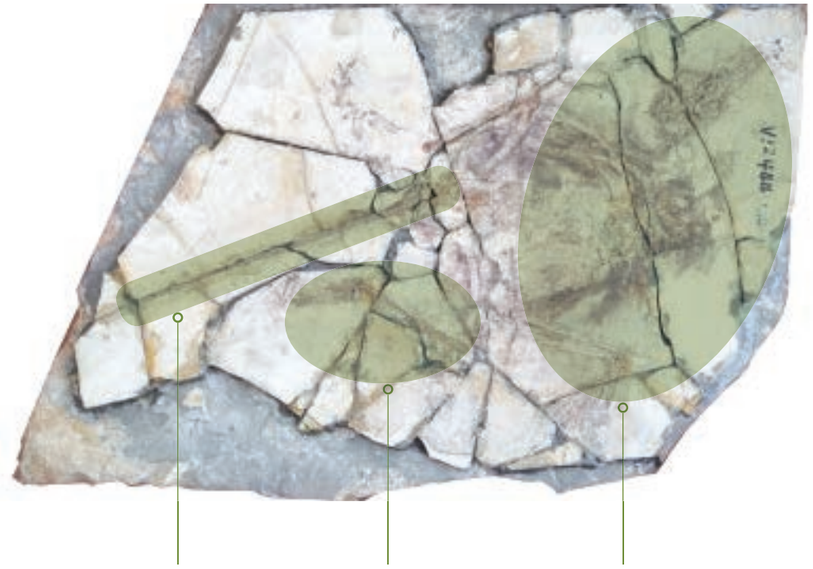
FACT 14
YANORNIS WAS A BIRD WITH HANDS LIKE A REPTILE

"Archaeoraptor"
古盗鸟

FEATHERED FLYERS
BALCONY & WILLOUGHBY ROOM
FIRST FLOOR



THE CHINESE DINOSAUR THAT NEVER REALLY EXISTED



Genus:
"Archaeoraptor" 古盗鸟

Pronounced:
ark-ee-oh-rap-tore

Species:
"liaoningensis" 辽宁

Pronounced:
lie-oh-ning-en-sis

Meaning of names:
'Ancient thief from Liaoning'

Place of discovery:
Fabricated in
Liaoning Province,
northeastern China

Size:
40cm long

Year named:
In the National Geographic
magazine in 1999

Scientists were fooled when a Chinese farmer combined two real fossils to make the fictional creature known as "Archaeoraptor". The specimen was published in 1999 as a 'missing link' between birds and dinosaurs, but the head and body belongs to the prehistoric bird, *Yanornis*, while the tail belongs to a small *Microraptor* dinosaur.

"Archaeoraptor" was confirmed as a fake by the eminent palaeontologist Xu Xing, who was involved in early studies of the convincing forgery. Detailed analyses and CT scans of the specimen have revealed how it was pieced together. The "Archaeoraptor" scandal brought attention to illegal digging in China.

This exhibition includes a cast of the "Archaeoraptor" forgery, alongside genuine fossils of the two species that were combined to make it!

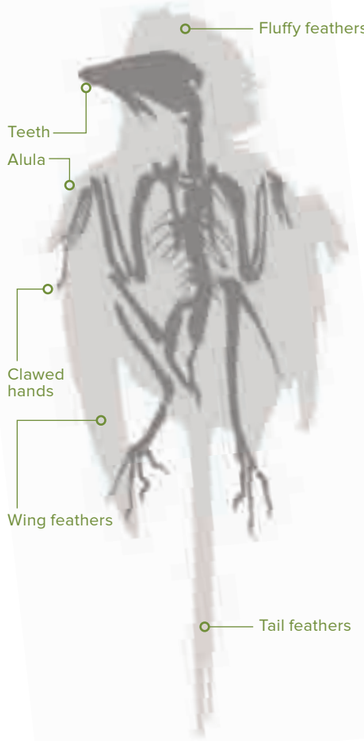
Protopteryx
原羽鸟

FEATHERED FLYERS
BALCONY & WILLOUGHBY ROOM
FIRST FLOOR

ANCIENT FLYER WITH A COMBINATION OF PRIMITIVE AND ADVANCED BIRD CHARACTERISTICS

Fossils of primitive birds such as *Protopteryx* provide information on the evolution of birds from dinosaurs. Although it is a bird, *Protopteryx* had primitive features including teeth, and three-fingered hands. This shows that the earliest birds retained reptile features.

The spectacular fossil of *Protopteryx* shows the fluffy feathers on its head and flight feathers on its arms. It also has a pair of unusually long feathers on its tail. One notable feature it shared with modern birds is a feathery structure on its 'thumb' called the alula (or 'bastard wing'), which suggests that it was a capable flyer.



Genus:
Protopteryx 原羽鸟

Pronounced:
pro-top-ter-icks

Species:
fengningensis 丰宁

Pronounced:
feng-ning-en-sis

Meaning of name:
'Primitive feather from Fengning County'

Diet:
Probably an omnivore (e.g. insects, seeds, fruits)

Place of discovery:
Hebei Province, northern China

Age:
Early Cretaceous, 125 million years ago

Classification:
Primitive bird

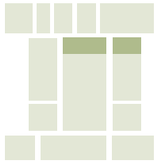
Size:
28cm long, about the size of a starling

Year named:
2000

FACT 15
PROTOPTERYX HAD AN ALULA ON ITS WING LIKE MODERN BIRDS

Confuciusornis
孔子鸟

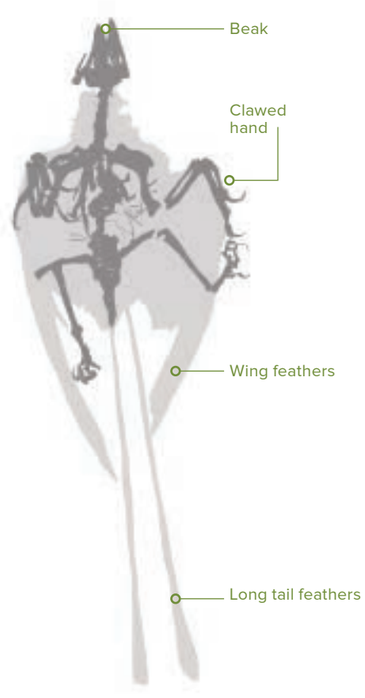
FEATHERED FLYERS
BALCONY & WILLOUGHBY ROOM
FIRST FLOOR



AN ANCIENT BIRD NAMED AFTER AN ANCIENT PHILOSOPHER

Fossils of early birds provide information about how feathered dinosaurs became true birds. *Confuciusornis* was similar to modern birds because it had a toothless beak and stubby tail bone, but it still retains fingered hands with long sharp claws. *Confuciusornis* had large wings and a strong sternum, so it was a relatively strong flyer. Fossils show that it was covered with feathers like modern birds.

Many *Confuciusornis* fossils have been found and these show that the males and females were slightly different, just like modern birds. The males had a pair of long tail feathers that are absent in the females, and may have used them to impress females, like modern peacocks do. Maybe male *Confuciusornis* were also brightly coloured in life.



Genus:
Confuciusornis 孔子鸟

Pronounced:
kon-few-shus-or-niss

Species:
sanctus 圣贤

Pronounced:
sank-tuss

Meaning of names:
'Sacred Confucius bird'

Diet:
Probably an omnivore (e.g. insects, seeds, fruits)

Place of discovery:
Shangyuan, Beipiao, Liaoning Province, China

Age:
Early Cretaceous, 125 million years ago

Classification:
Ancient bird

Size:
30cm long, about the size of a crow

Year named:
1995

FACT 16
CONFUCIUSORNIS SHOWED DIFFERENCES BETWEEN MALES AND FEMALES, LIKE MANY MODERN BIRDS

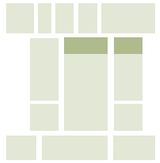
Yi qi
奇翼龙

A DINOSAUR WITH WEBBED WINGS LIKE A BAT

Yi qi is the most recently discovered dinosaur in the exhibition. However, the specimen on display is a 3D-printed replica created from laser scans of the original fossil, which is too delicate to transport.

Yi qi had a dense covering of fuzzy feathers around the head, body, and arms. This fuzz was not for flying but was probably for insulation. The most striking characteristic of *Yi qi* was its unique wings. These were formed by a web supported by an unusually long third finger and a unique rod-like bone in the wrist. *Yi qi* shows that two different types of flying dinosaurs evolved: those with feathered wings (e.g. *Microraptor* and birds) and those with membranous wings. *Yi qi* suggests that other 'scansors' (e.g. *Epidexipteryx*) also possibly had membrane wings.

FEATHERED FLYERS
BALCONY & WILLOUGHBY ROOM
FIRST FLOOR



Genus:
Yi 翼

Pronounced:
ee

Species:
qi 奇

Pronounced:
chee

Meaning of names:
'Strange wing'

Diet:
Probably an omnivore (e.g. insects, seeds, fruits)

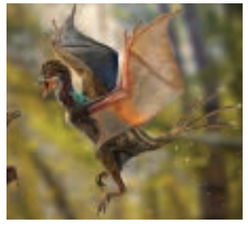
Place of discovery:
Hebei Province, northern China

Age:
Middle or Upper Jurassic, 160 million years ago

Classification:
Bizarre group of small dinosaurs called Scansoriopterygidae (or 'scansors')

Size:
30cm long, about the size of pigeon

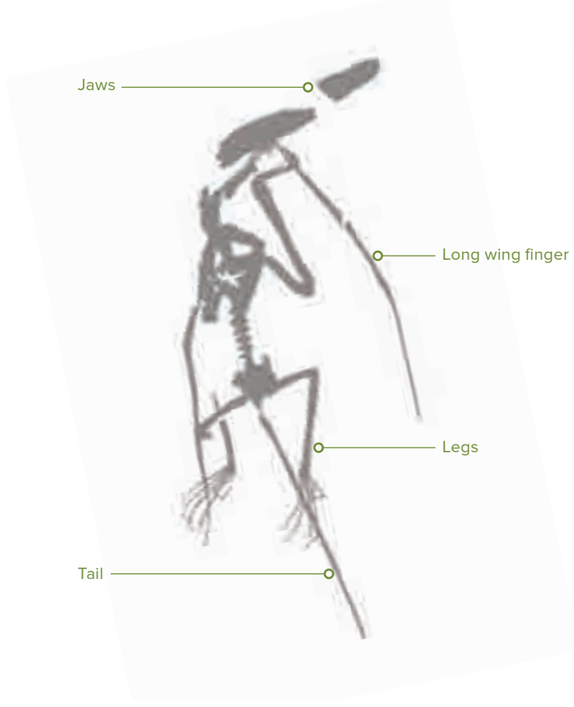
Year named:
2015



FACT 17
YI QI HAD DOWNY FEATHERS, LIKE BIRD CHICKS

Wukongopterus
悟空翼龙

FLYING REPTILE WITH A LONG WING FINGER

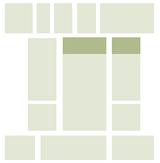


Several groups of reptiles evolved flight during the 'age of the dinosaurs'– not just birds. *Wukongopterus* belongs to a successful group of flying reptiles called pterosaurs. Pterosaurs shared the skies with birds during the Jurassic and Cretaceous periods. They all had a unique wing with a single stretched out finger that supported a membrane. This differs from birds, in which all the fingers are fused. It also differs from bats, which have wing membranes supported by several long fingers.

Pterosaurs are traditionally divided into two groups, those with a long tail and short neck, and those with a short tail and long neck. *Wukongopterus* is significant for pterosaur evolution because it had an unusual combination - a long tail and a long neck.

PTEROSAURS WERE NOT DINOSAURS BUT A SEPARATE GROUP OF FLYING REPTILES.

FEATHERED FLYERS
BALCONY & WILLOUGHBY ROOM
FIRST FLOOR



Genus:
Wukongopterus 悟空翼龙

Pronounced:
woo-kon-gop-ter-uss

Species:
lii 李氏

Pronounced:
lee-eye

Meaning of names:
'Li's Wukong wing'. Sun Wukong is the name of the Monkey King from the classical Chinese literature "Journey to the West"

Diet:
Carnivore

Place of discovery:
Liaoning Province, northeastern China

Age:
Late Jurassic, 165 million years ago

Classification:
A pterosaur – a group of flying reptiles

Size:
73cm wingspan, about the size of a pigeon

Year named:
2009

Palaeo-art

BRINGING DINOSAURS TO LIFE

Artists and scientists have always worked together to create cutting-edge images of the prehistoric world. Such ‘palaeo-art’ takes the form of paintings, sculptures, and even movies, which shape the public perception of extinct life.

Good palaeo-artists investigate the evidence like detectives, balancing science and speculation to create exciting life-like dinosaurs. New scientific discoveries constantly change how palaeo-artists depict dinosaurs.

For thousands of years mysterious bones have been found in China, where they inspired images of dragons. In the twentieth century these bones came to be identified as dinosaurs. Therefore, perhaps dragons can be regarded as the earliest examples of palaeo-art.

PAINTER OF PREHISTORIC WORLDS

Zhao Chuang created all of the spectacular dinosaur artwork in the Dinosaurs of China exhibition. As a palaeo-artist at the Peking Natural Science-Art Organisation (PNSO) he has collaborated with dozens of leading scientists from research institutions around the world, and his artwork has been published in famous academic publications including Nature and Science.

Alxasaurus
阿拉善龙

NOTTINGHAM
LAKESIDE ARTS

FEATHERED VEGETARIAN
DESCENDED FROM MEAT-EATERS

Alxasaurus was an exciting discovery because it is one of the earliest members and most complete examples of a mysterious group of dinosaurs called therizinosaurs. It proved that therizinosaurs, previously thought to be related to long-necked sauropod dinosaurs, were actually theropods. However, unlike all other theropods, from *T. rex* to *Velociraptor*, it had tiny teeth and ate plants.

Alxasaurus and other therizinosaurs may have used their large arms to pull vegetation towards them, spending most of their day lazily foraging for vegetation, similar to how pandas behave today. Other researchers have suggested that therizinosaurs used their strong hands to break open ant hills and termite mounds to feed on the inhabitants, like anteaters do.

Feathers present in other therizinosaur fossils strongly suggest that *Alxasaurus* also had feathers.

Genus:
Alxasaurus 阿拉善龙

Pronounced:
alk-zah-sore-us

Species:
elesitaiensis 阿乐斯台

Pronounced:
eh-leh-sit-eye-en-sis

Meaning of names:
‘Alxa Desert lizard from Elesitai’

Diet:
Herbivore
(but may have also eaten ants and termites)

Place of discovery:
Inner Mongolia, northern China

Age:
Early Cretaceous, 110 million years ago

Classification:
A group of dinosaurs with long arms and clawed hands, called therizinosauroids

Size:
This skeleton is 3 m long, but adult *Alxasaurus* could reach up to 4 m long, the length of an average car.

Year named:
1994

INSPIRED BY NATURE

The bewildering therizinosaurs pose an exciting challenge to palaeo-artists. How should these distinctive animals be depicted? Mark Witton depicts therizinosaurs like giant pigeons in this recent painting.

FACT 19
ALXASAURUS HAD BIRD-LIKE HIPS

Evolution of Palaeo-art

The meat-eating *Megalosaurus* and plant-eating *Iguanodon* were both discovered in England in the 1830s. They were the very first dinosaurs to be named and have been depicted by many artists over the decades.

THIS TIMELINE SHOWS HOW HISTORICAL PALAEO-ART REFLECTS THE SCIENCE OF THE DAY.

An *Iguanodon* battles a *Megalosaurus* in this 1830s painting by John Martin. The painting was used by the discoverer of *Iguanodon*, Gideon Mantell, to excite interest in geology. At the time, dinosaurs were known only from fragmentary remains.

1830s

This *Megalosaurus* illustration by Joseph Smit is from 1892. Complete dinosaur skeletons had been discovered by this time, so it was known that *Megalosaurus* stood on its hind legs like a bird. However, it was also depicted dragging its tail on the ground.

1850s

Statues of *Iguanodon* and *Megalosaurus* sculpted by Benjamin Waterhouse Hawkins have been exposed to the elements since 1854, but they are still on public view today. He depicted dinosaurs as lumbering four-legged beasts.

1890s

Depictions of tail-dragging dinosaurs, such as this *Iguanodon* by Gerhard Heilmann in 1928, persisted for most of the 20th Century.

1900s

When Jurassic Park based its iconic *Velociraptor* on the speedy *Deinonychus*, millions of cinemagoers were introduced to agile and intelligent dinosaurs for the first time.

1990s

This *Deinonychus* by Emily Willoughby looks very different to earlier dinosaur restorations. Cutting-edge research and new Chinese discoveries have revealed that many dinosaurs were feathered.

TODAY

This *Iguanodon* by Mark Witton shows a modern interpretation of this classic dinosaur.

'Dilophosaurus sinensis'
双嵴龙

NOTTINGHAM LAKESIDE ARTS

DOUBLE-CRESTED STAR OF JURASSIC PARK

Dilophosaurus is one of the earliest dinosaurs in the group that gave rise to birds. We don't know if it had completely scaly skin or a downy covering like later theropods. Its most prominent feature is a pair of crests that run along the top of its head. The purpose of these crests is unknown, but they may have been colourful to attract mates.

Recent studies suggest that *'Dilophosaurus sinensis'* may be identical to another dinosaur called *Sinosaurus triassicus*. *Sinosaurus* was one of the first theropods described from China.

FACT 20
DILOPHOSAURUS HAD HOLLOW BONES LIKE A BIRD

Genus:
Dilophosaurus 双嵴龙

Pronounced:
die-loaf-oh-sore-us

Species:
sinensis 中华

Pronounced:
sin-en-sis

Meaning of names:
'Two-crested lizard from China'

Diet:
Carnivore

Place of discovery:
Yunnan Province, China

Age:
Early Jurassic, 195 million years ago

Classification:
One of the earliest theropods, a group of two-legged meat-eating dinosaurs

Size:
4m long, the size of a Mini car

Year named:
1993

MOVIE STAR MAKEOVER

A successful film can shape how millions of people think about dinosaurs. *Dilophosaurus* was made famous by Jurassic Park (1993). In the film, *Dilophosaurus* spits poison and has a frilled neck. There is no fossil evidence for this, but speculation is a necessary and fun part of dinosaur art.

Conclusion

There are dinosaurs on permanent display in Wollaton Hall, including an ostrich and crowned crane.

CONCLUSION
AFRICA GALLERY
FIRST FLOOR

WHAT HAPPENED 65 MILLION YEARS AGO?

Mammals make a mark

During the ‘age of the dinosaurs’ all mammals were small and scurried under the feet of dinosaurs. However, when non-bird dinosaurs became extinct 65 million years ago, mammals were presented with an opportunity. They diversified quickly into the roles left behind by dinosaurs. For example, today giraffes mimic long-necked dinosaurs, while gorillas live in secluded forests, like those inhabited by fuzzy dinosaurs during the Cretaceous Period in China.

Flying towards a new horizon

Flight is an important adaptation because it can help animals to escape from predators on the ground, or hunt for prey from the air. It also allows animals to cover long distances quickly. This is why wings have evolved in many different animals, including insects, bats and pterosaurs. However, dinosaurs are one of the most successful groups of flying animals, with over 10,000 living bird species. The first true birds evolved from dinosaurs in the Jurassic Period, but they are all around us today. So, next time you feed the ducks or see a pigeon fly by, remember...

Dinosaurs are not extinct: birds are dinosaurs.

FACT 18
THE BIRDS IN OUR AFRICA DIORAMA ARE MODERN DAY DINOSAURS

Dinosaurs of China Trail

COLLECT THE EVIDENCE THAT CONNECTS BIRDS WITH DINOSAURS.

Dinosaurs at Wollaton Hall

Fact 1 *Mamenchisaurus* had curved _____ like a bird

Fact 2 *Sinraptor* had _____ toes like a bird

Fact 3 *Guanlong* walked on _____ long legs like a bird

Fact 4 Dinosaurs laid _____ like birds

Fact 5 *Oviraptor* sat on its _____ like a bird

Fact 6 *Mei long* _____ up to sleep like a bird

Fact 7 *Sinosauropteryx* had _____ feathers like bird chicks

Fact 8 *Gigantoraptor* had a horny _____ like a bird

Fact 9 *Linheraptor* had a backwards-pointing _____ bone like a bird

Fact 10 *Sinornithosaurus* had a _____ like a bird

Fact 11 *Caudipteryx* swallowed _____ like birds do

Fact 12 *Epidexipteryx* had a stubby _____ bone like a bird

Fact 13 *Microraptor* was a dinosaur with wing _____ like a bird

Fact 14 *Yanornis* was a bird with _____ like a reptile

Fact 15 *Protopteryx* had an _____ on its wing like modern birds

Fact 16 *Confuciusornis* showed _____ between males and females, like many modern birds

Fact 17 *Yi qi* had _____ feathers, like bird chicks

Fact 18 The birds in our Africa diorama are modern day _____

Dinosaurs at Nottingham Lakeside Arts

Fact 19 *Alxasaurus* had bird-like _____

Fact 20 *Dilophosaurus* had _____ bones like a bird

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DINOSAURS OF CHINA

GROUND SHAKERS TO FEATHERED FLYERS

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