



# Adventures From the Land of Dinosaurs

## Triceratops vs. Torosaurus



Triceratops is the most famous ceratopsian of all time.

## Triceratops



Another ceratopsian, Torosaurus, looked pretty similar and was believed to be closely related.

## **Torosaurus**



Dinosaur science, however, is always changing. Over the course of a ten-year study called the Hell Creek Project, researchers formed a new theory about the two dinosaurs.



During the project, almost half of the fossils collected were from Triceratops, including 30 skulls from dinosaurs of different ages. The team found it much harder to find Torosaurus fossils, and when they did, the skulls were all large. The palaeontologists, John Scannella and Jack Horner looked at thin slices of bone under a microscope. It appeared Torosaurus had more developed bone than Triceratops, meaning it was older...



Triceratops and Torosaurus had been considered two different species, but John and Jack argued that Torosaurus was actually an adult version of Triceratops! And since Triceratops had been named first, Torosaurus would no longer be valid (poor Torosaurus). Not everyone agreed though, and to make matters worse there was another species to consider – Nedoceratops.

**Torosaurus**



**Triceratops**

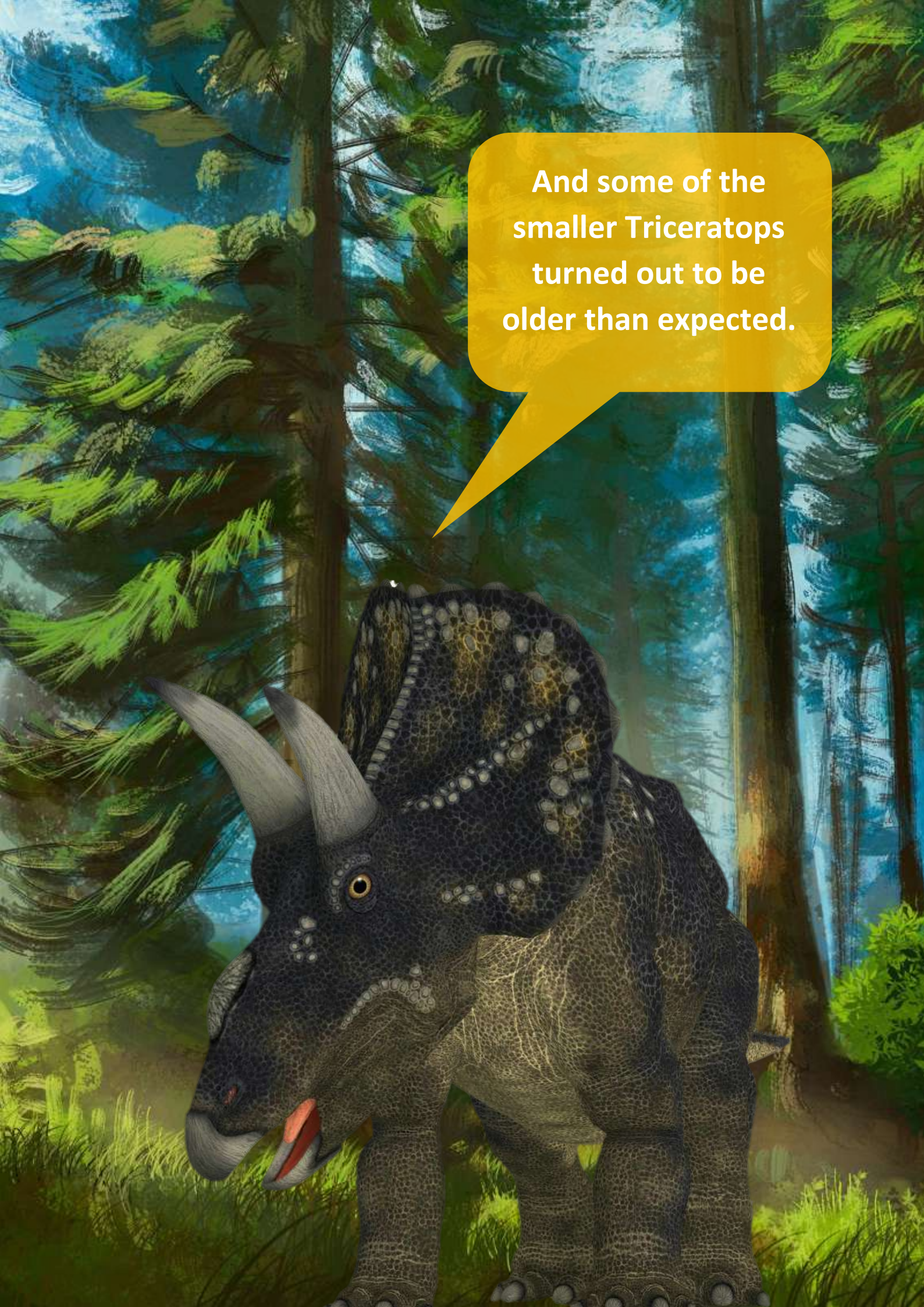


**Nedoceratops**



This ceratopsian had holes in its frill like Torosaurus, and John and Jack figured it was also a Triceratops at a different stage of its life. Meanwhile, other scientists discovered that Triceratops and Torosaurus were not always found at the same places, and that the holes in Nedoceratops' frill were formed by injury or illness. Most importantly, they looked at how the bones were fused together, which is a general indicator of age. They found that some Torosaurus had areas that were not fused – so they weren't adults.



A digital illustration of a Triceratops standing in a lush, green forest. The dinosaur is dark grey with a large, textured frill and two prominent horns. It is looking slightly to the left. The background is filled with tall, thin trees and dense foliage. A yellow speech bubble is positioned in the upper right quadrant of the image.

And some of the smaller Triceratops turned out to be older than expected.



So is the debate over? Far from it! Palaeontologists will continue to discuss these ceratopsians until fossil evidence is found that settles the argument.





# Mystery of the Stolen Fossils



On a rainy day in the Gobi Desert, Mongolia, in 1965, Polish palaeontologist, Zofia Kielan-Jaworowska was looking around her dig site because it was too wet to excavate. While searching, she discovered some large bones poking out of a 70-million-year-old sandstone. They turned out to be an enormous set of arms tipped with huge claws.



The dinosaur was named Deinocheirus, and was believed to be a giant meat-eating theropod.

## **Deinocheirus**



For a long time, nothing else was found of Deinocheirus, so in 2008 scientists decided to head to the original site.



Using just two black-and-white photos from 1965, they matched up the rocks to find the exact spot where Deinocheirus had been dug up. And it was a success! They unearthed more Deinocheirus bone fragments, some of which even had bite marks from the carnivore Tarbosaurus.



The following year the team discovered a more complete skeleton. Sadly, illegal fossil poachers had found it first. They had taken the showy parts, like the skull, claws, and feet, but left the rest of the skeleton.



The specimen showed that Deinocheirus was a gigantic ornithomimosaur (ostrich-like dinosaur).





The team also learned that a poached specimen they had found in 2006 was a young *Deinocheirus*. Between the three specimens they almost had a complete skeleton – they were just missing the skull and feet.



Then, in 2011, Belgian palaeontologist Pascal Godefroit was contacted by a fossil dealer in France. The dealer wanted Pascal to see a weird specimen he'd been asked to prepare by a private collector. Pascal realized this was something new and contacted the expert Phil Currie, who quickly jumped on a plane to Belgium.



He was stunned by the fossils – not only were they from Deinocheirus, they were from the 2009 poached specimen!



Finally, palaeontologists had the whole skeleton, and it was quite bizarre. Deinocheirus was duck-billed, humpbacked, and reached lengths over 10 m (33 ft). It also had a bone at the end of its tail for feather attachments. Fish scales were found with the fossils, indicating that this dinosaur ate both meat and plants and lived in freshwater habitats.

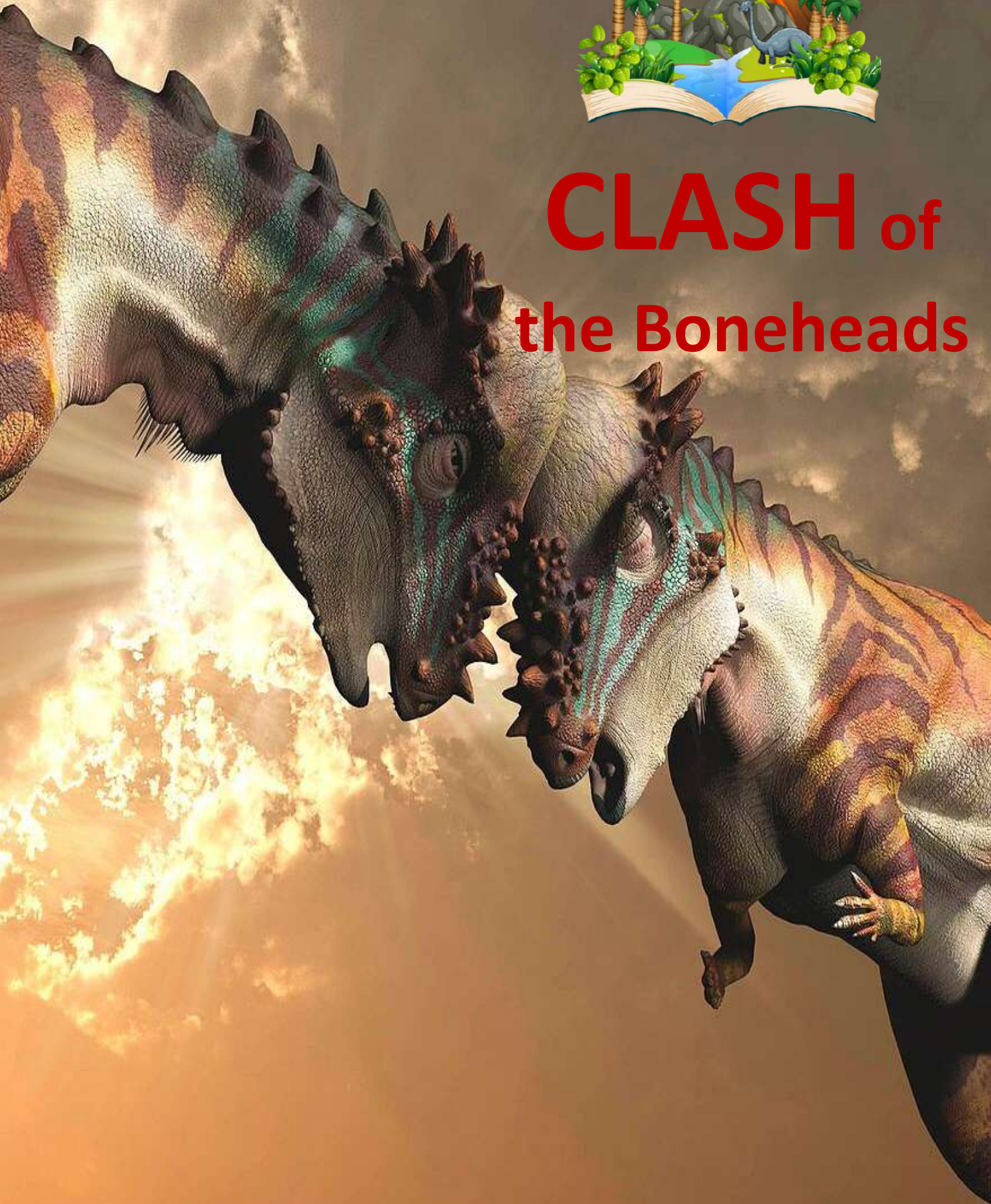




**It would have  
been quite a  
sight to see!**



# CLASH of the Boneheads



WHACK! Two large Pachycephalosaurus slowly backed away to size each other up. They pawed at the ground with their feet, sending dirt flying behind them. Then once again they lunged towards each other with heads, lowered – WHACK! They slammed their thick, dome heads together. At least that's what palaeontologists have always thought these boneheads did. But was it actually possible?

## **Pachy- cephalosaurus**



For decades, researchers have been trying to figure this out. A study from 2004 looked at the structure of seven *Pachycephalosaurus* skull bones.





It found that the spongy-looking bone in the domes was young and still growing. This meant it was probably not from adults that liked to engage in head-butting. The domes, the scientists thought, were more likely to be used for impressive visual display and not combat.

**Pachy-  
cephalosaurus  
Skull**



But in 2008, scientists used computers to stimulate head-butting collisions between the dinosaurs. They found that *Pachycephalosaurus* could handle very high-energy impacts as the thick skull protected the brain. And if the skull was covered in keratin, like a rhino's horn, it would have softened the blow.



Then a new skull dome was discovered that was covered in dents caused by infected injuries. Later, the team discovered that 22% of Pachycephalosaurus skulls show similar signs of trauma. The injuries also occurred at the top of the skull, where most impacts would happen.





So maybe these  
boneheads did like  
to clash heads  
after all!

Maybe the males  
head-butted  
during mating  
season, like deer.





# The Giant Pterosaurs



After flying over 9000 miles (14 000 km), a pair of pterosaurs the size of small planes landed in what's now Jordan in the Middle East. When standing they were as tall as giraffes – much larger than the local predatory dinosaurs, the abelisaur.



These giant pterosaurs were like storks and would walk or wade, catching whatever was unlucky enough to cross their path.

## Pterosaur





Arambourgiana was part of a group of enormous pterosaurs called the azhdarchids that ruled during the late Cretaceous. The most famous member is Quetzalcoatlus, but Arambourgiana was even larger, and was actually the first azhdarchid discovered.

## Arambourgiana



All azhdarchids are known from only a few pieces of bone, and pterosaur bone is notoriously bad at fossilizing. The first fossil was found in the early 1940s. The bone was broken, but it was still 62cm (24 in) long. The French palaeontologists Camille Arambourg thought it was a wing bone, but by the 1970s palaeontologists realized it was actually a giant neck bone – making Arambourgiania the largest flying creature of all time!



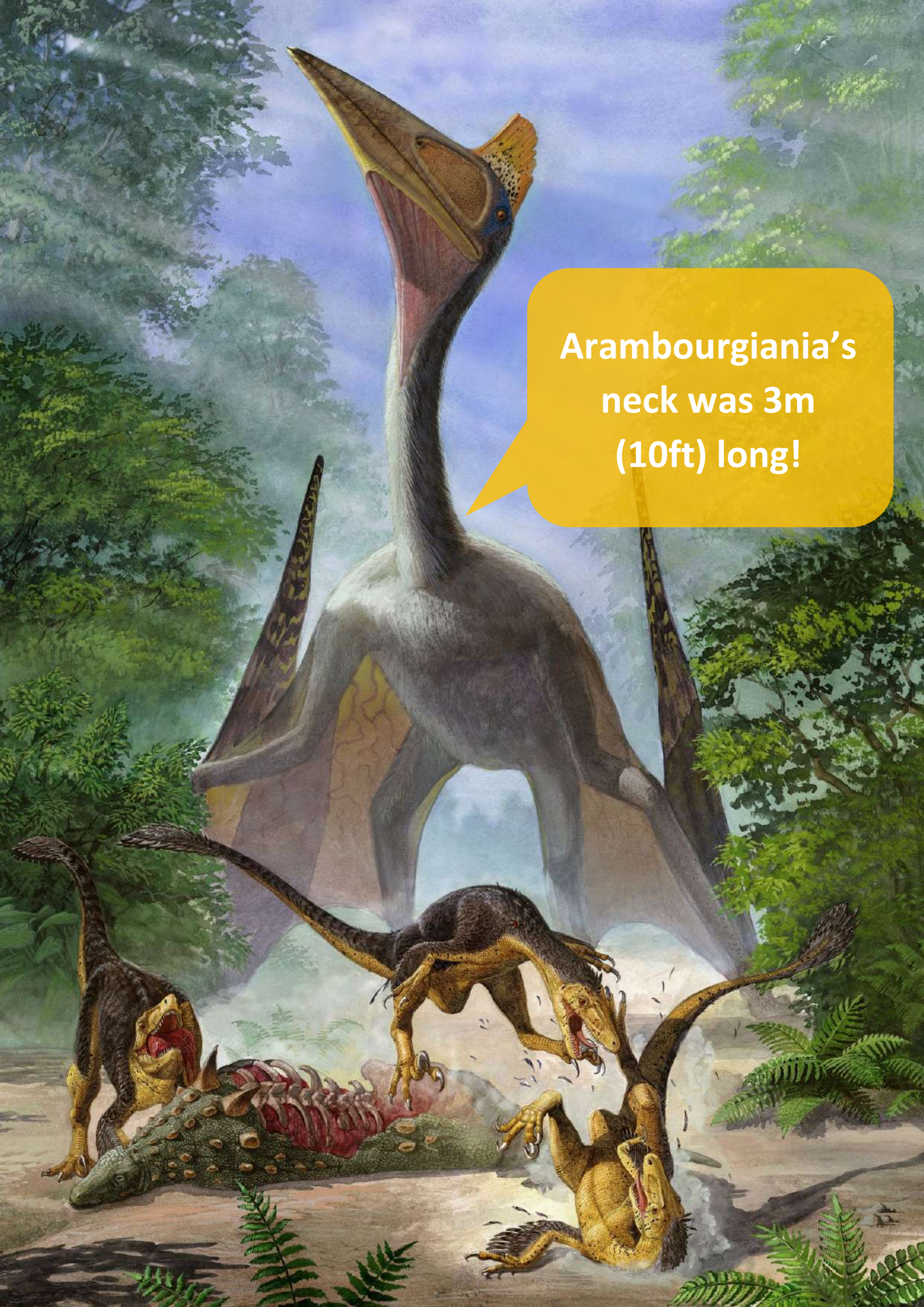
This azhdarchid was originally named Titanopteryx, which is a really cool name. however, in 1987 it was changed to Arsmbourgiana (after our friend Camille) because the name “Titanopteryx” was already in use. By what, you may wonder?



Say hello to the original Titanopteryx – a fly named in 1934!

## **Titanopteryx**



An artistic illustration of a prehistoric scene. In the center, a large, grey, feathered dinosaur with a very long, pointed beak and a crest of orange feathers on its head stands with its wings spread. In the foreground, three smaller, brown and yellow dinosaurs are gathered around a large, green, scaly creature lying on the ground. One of the smaller dinosaurs is on the ground, another is standing over it, and a third is on the left. The background is a lush, green forest with a blue sky.

Arambourgiania's  
neck was 3m  
(10ft) long!



# The King of the TYRANT Lizards



Tyrannosaurus rex is the most famous dinosaur of all time. Its name means “King of the tyrant Lizards” and it’s no wonder that this predator has captured the public’s imagination.

# **Tyrannosaurus Rex**



About 50 partial skeletons have been found so far. An adult T. rex had around 60 banana-sized serrated teeth and needed to eat a huge amount of meat every day by hunting or scavenging.





Sue is the most complete T. rex ever found – about 90% of the skeleton had been dug up.

**Sue**



Using growth rings in the bones, palaeontologists discovered that SUE reached full size at the age of 19 and died when it was 28 years old. SUE was also infected with a parasite that caused sores on its mouth.



SUE the T. rex is named after its discoverer, Susan  
Hendrickson.

## **The Human Sue**



On 12 August, 1990, the amateur fossil hunter was exploring an area of South Dakota when she noticed dinosaur bones sticking out of a cliff. It took the crew 17 days to excavate the skeleton.





**Scales and Feathers**  
Since relatives of T. Rex  
had feathers, some  
scientists think T. Rex was  
feathered at some point  
in its life

However, T. rex skin impressions from the neck, pelvis, and tail show no feather filaments, just scales. But not all of the skin was preserved, so it's still possible.



In 2005, Mary Schweitzer and her team announced that they had found in a T. rex a type of bone previously only known from egg-laying female birds. This meant that this T. rex was a female that died during egg-laying season.

## **Mother Rex**



## King of the Poos

The world's largest coprolite (fossilized poo) might be from a t. rex and has been nicknamed "Barnum". It's filled with crushed bone.







THINK

DIGITAL ACADEMY

