

Earth News

from Kevin Dermody, CPRMC

Paleo

The 69th Annual Meeting of the Society of Vertebrate Paleontology in Bristol, England, [which the author attended] had its usual amount of new and interesting talks. There was a symposium on marine reptiles. The talk's speakers told about the ichthyosaurs, which arose soon after the beginning of the Triassic Period, and other marine reptiles.

The early ichthyosaurs were generalized feeders, with similar-shaped teeth in their mouths. The Early Triassic seas were still recovering from the great Permian Extinction event. There were no reefs, and many shellfish-like gastropods and pelycopods were small and thin-shelled.

As marine life increased and diversified, so did the ichthyosaurs and their teeth. By the Mid-Triassic, ichthyosaurs had straight conical teeth for piercing prey and smashing bones and shells, large conical teeth with serrated edges for slicing flesh, different size-and-shape heterodont teeth for grasping and crushing, blunt durophagous teeth for crushing shellfish, and sometimes no teeth, perhaps for sucking through the soft bottom mud. What type of teeth they had sometimes depended on the size of the animal.

The last group of ichthyosaurs to evolve was the ophthalmosaurs. They lived 155 to 82 million years ago, and made up half the known species of ichthyosaurs in the upper Jurassic, when ichthyosaurs were at their most diverse.

Meanwhile, it was determined that plesiosaurs swam like sea lions, and had fibro-lamellar bone, which may indicate they were endothermic and had a fast growth rate similar to dinosaurs.

But these early marine reptiles began to decrease in size and diversity during the Late Cretaceous, becoming small predators. One reason for this may have been competition with mosasaurs, which arose 93 million years ago. During their heyday, they included 60 species spread worldwide; some growing over 50 feet long, and their teeth were beginning to diversify as the other reptiles' teeth did. Even the large-headed plesiosaurs, like *Kronosaurus*, couldn't match them. It has been estimated that the bite force of *Kronosaurus* was no stronger than that of the smaller modern salt-water crocodile. Instead of a top predator, *Kronosaurus* might have been a generalized feeder, taking anything smaller than itself. Mosasaurs continued strong with sea turtles until the end of the Cretaceous.

It has been thought that dinosaurs replaced the crocodile-like archosaurs, the mammal-like therapsids, and other early reptiles that dominated the Triassic. But it may not have been that simple. The therapsids, archosaurs, and other reptiles experienced several cycles of diversification, while dinosaurs increased very gradually. Dinosaurs only increased swiftly in size and number after the other reptiles began going extinct. Dinosaurs might have remained minor players in terrestrial ecosystems if the other reptiles, especially the croc families, survived.

Dinosaur diversification wasn't so simple either. Sauropods and prosauropods have generally been considered less sophisticated than ornithiscians, and were eventually replaced by them. But sauropodomorph diversity has always averaged six times greater than theropods throughout the Jurassic and Cretaceous, and seven times that of ornithiscians. One reason for this is that sauropods were more generalized feeders which tolerated harsher environments. During environmental good times, such as Late Cretaceous North America, ornithiscians became dominant. But when the environment deteriorated, sauropods recolonized the area.

Modern insect families arose and diversified during the Late Triassic, and other animals exploited this new food source, including the pterosaurs. Feeding on insects might have led pterosaurs to become fliers. As pterosaurs evolved, their pectoral girdles, scapulas, and neural spines became modified to increase the size and power of their flight muscles.

The pterosaurs evolved into two major groups—the basal rhamphoryncide, and the pterodactylids, which arose in the Late Jurassic and diversified throughout the Cretaceous, alongside the birds. These were the pterosaurs that could land on the ground and leave tracks. The rhamphoryncids, however, became extinct by the Middle Cretaceous. A link between these two groups was found in the famous fossil beds of Liaoning, China.

This pterosaur has short wrists, elongated toes, and the long tail of a rhamphorynchid. But its long, flexible neck and crested head are almost ancestral to pterodactylids. Its teeth indicate it must have hunted smaller pterosaurs, gliding mammals and the flying dinosaurs that lived in the area.

Dromaeosaurs, the so-called raptors, have been depicted as using their large toe-claws to cut open and disembowel prey. But even steel or Kevlar models of these claws could not penetrate an animal's hide like that. Real raptors, the hawks and eagles, hold prey down with their weight as the second and third talons impale the body just enough to hold on. The bird then either snaps the victim's neck, or plucks and tears it apart with its beak, flapping its wings for stability as the prey struggles. This does not kill the prey. It is eaten alive. Perhaps this is how dromaeosaurs hunted. *Deinonychus* had long tarsals and very short metatarsals, with digits that could not move laterally. *Deinonychus*'s feet grasped its prey, the keratin covering deforming from the stress so the bone wasn't broken, while its feathered arms either flapped to steady itself or grasped its prey. The prey was dispatched by *Deinonychus*'s teeth. Birds were to refine such foot grasping and flapping for perching and flight. Dromaeosaur could still attack and kill animals bigger than itself, if it worked in groups. But it usually hunted much smaller fare.

The earliest tyrannosaur lived 125 million years ago in northeast China. *Raptorex* was only 9 feet tall and weighed only 150 pounds, but it had the same proportions as *T. rex* and other tyrannosaurs. But tyrannosaurs didn't just stay with the classic body plan. *Alioramus* had a very gracile skeleton that was the most pneumatic of tyrannosaurs. It also had the most teeth. Yet it lived alongside the tyrannosaur *Tarbosaurus* in Late Cretaceous Mongolia.