



IN THIS NEW MURAL OF THE JURASSIC PERIOD BY OTTMAR VON FUEHRER, PTERANODON, A WINGED REPTILE, ANNOYS CLIDASTES, A MARINE LIZARD

FLYING REPTILES

J. LEROY KAY

THE Spanish proverb, " 'Take what you want,' says God, 'and pay for it,' " sums up pretty well in folk terms a fundamental truth about the evolution of living things. For some sixty millions of years, including a mere million or so witnessed by Man, the warm-blooded, hairy creatures that suckle their young have been successfully lordling it over other forms of animal life. But for all their eminence they have remained earth-bound or water-bound—all, that is, but one group, bats, and certain gliding forms. The bats are all we have to show that mammals can take to the air as the chief means of getting from place to place. With this excep-

tion, the power of true flight has been developed only in birds and reptiles.

During the middle Mesozoic Era, some 150 million years ago, there were deposited in what is now Europe the remains of various pterosaurs or winged lizards. These were among the first fossil vertebrates discovered in the early days of paleontology, and the first specimen described was *Pterodactylus* (the wing-fingered), with the result that the whole order has become commonly known as pterodactyls.

This famous contemporary of the dinosaurs is represented at Carnegie Museum by a short-tailed skeleton, about the size of a dove, dis-

covered near Solenhofen in Bavaria. If you examined it casually, you might conclude that it was a remote ancestor of the birds. There are some points of resemblance: the bones are hollow, like bird bones, and many are fused or joined together to give strength to the wings. However, a closer study makes it clear that the pterosaurs are not in the direct line of the bird group, but are more closely related to another order.

Our knowledge of these winged reptiles owes much to the art of lithography—an early example of the aid rendered to modern science by industry. The search for stone that would faithfully reproduce fine details of a drawing led to quarries in southern Germany where the fossil remains of pterosaurs had been so well preserved that impressions of the wing and tail membranes could be clearly seen. Thus, the bony structure of pterosaurs is as well known as that of most extinct vertebrates.

Their wings are built quite differently from bat or bird wings. The bones of the fourth "finger" were elongated to form an attachment for the wing membrane, which spread between this finger and the hind legs and tail. The other fingers were short claws, and the thumb was either missing or vestigial. A bat's wing, in contrast, has all four fingers elongated to support the membrane, something like the stays of an umbrella, whereas in birds the fingers are coalesced and the wing feathers attached to the skin covering the fingers.

The Baron de Bayet collection of European Jurassic pterosaurs, purchased by Andrew Carnegie and presented to Carnegie Museum in 1903, is probably the largest one of European pterosaurs in the United States. This collection includes, in addition to *Pterodactylus*, several more-or-less-complete skeletons, skulls, and other parts. Among these is *Rhamphorhynchus* (prow-beam), now to be seen

at the Museum, perhaps the best-known Jurassic pterosaur. The skeleton on exhibition has a wingspread of three and a half feet, and boasts a long tail, the tip of which is missing. The skull is rather long, with large eye sockets and sharp conical teeth projecting forward.

Most pterosaurs have small, weak hind feet, and probably did very little walking on the ground. However, *Campylorhamphus* (crooked-jaw), another Jurassic form, had a long tail and fairly strong hind feet. This skeleton contrasts with the other specimens on exhibit because it is the only one that is encased in a dark matrix, and the bones are black.

A fourth Jurassic genus, *Cycnorhamphus* (swan-beak), is represented by a complete skeleton of a small pterosaur with a skull shaped very much like a bird's, with small teeth. It has a complete ring of sclerotic plates in the eye socket. Probably most pterosaurs, like many reptiles and birds, had this protective ring of bony plates surrounding the eye, but *Cycnorhamphus* is the only one in the Carnegie collection that shows it clearly.

Most of these older pterosaurs, dating from the Jurassic, had not only teeth but very long tails as well, which serve to distinguish them from their Cretaceous successors. The latter, as if by way of compensation, sometimes de-

veloped enormous wings, covering a wing spread of nearly thirty feet. One species shown at Carnegie Museum is *Pteranodon* or "toothless one," the largest of all the pterosaurs. *Pteranodon* and *Dactylus*, both found in the Cretaceous beds of Kansas. Although this is a considerable collection of pterosaur material, there are no complete skeletons in the collection, the one on exhibition being represented by the bones of one wing more than six feet long. The skull is long, with a prominent occipital process extending back and slightly upward to balance the large beak. The Carnegie collection of *Nyctodactylus* is fairly complete, showing the fourth fingers of the wing. This specimen, short-tailed and slender, has a small, slender wingspread of about five and a half feet. How the pterosaurs evolved from reptile forms to become the fully developed reptiles of the Jurassic has yet to be determined. Their habits of life are a matter for conjecture. Although usually pictured as flying or soaring over seas, and it has been suggested that they were like fish found near the surface.

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Dr. Kay, curator of vertebrate fossils at Carnegie Museum, has spent many years in research on the Museum's world-famous collection of Jurassic reptiles. Each summer he adds to this collection by field work in western United States and Canada. He joined the Museum staff in 1910, while working at Dinosaur National Monument in his native Utah.

For those of CARNEGIE MAGAZINE's readers who may be a little hazy on their prehistoric dates, the Mesozoic Era, usually called the Age of Reptiles, was the time in the earth's history when the great dinosaurs lived. The Cretaceous was the latest period of this Era; the Jurassic, the middle; and the Triassic, the earliest.

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veloped enormous wings, covering a maximum spread of nearly thirty feet. The two species shown at Carnegie Museum are *Pteranodon* or "toothless one with wings," the largest of all the pterosaurs, and *Nyctodactylus*, both found in the Cretaceous chalk beds of Kansas. Although this Museum has a considerable collection of *Pteranodon* material, there are no complete skeletons in the collection, the one on exhibition being represented by the bones of one wing, which is more than six feet long. The skull also is long, with a prominent occipital crest extending back and slightly upward, as if to balance the large beak. The Carnegie skeleton of *Nyctodactylus* is fairly complete, with parts of the fourth fingers of the wings restored. This specimen, short-tailed and toothless like *Pteranodon*, has a small, slender head and wingspread of about five and a half feet.

How the pterosaurs evolved from earlier reptile forms to become the full-fledged flying reptiles of the Jurassic has yet to be determined. Their habits of life also are still a matter for conjecture. Although they are usually pictured as flying or soaring over the seas, and it has been suggested that they fed on fish found near the surface, I doubt

whether they could light upon the water and take to the air again without great difficulty. Moreover, their hind feet are not constructed for picking up food, like those of a predatory bird. The first three front toes are built for grasping, but probably were used only to cling to a tree or ledge while resting. It seems logical to suppose that they got their food from the air, like bats, at least until such time as further evidence may prove otherwise. Unfortunately there is little immediate hope of learning more about the pterosaurs, since the stone in which they are most likely to be found is no longer quarried for lithography, and funds for extensive research in paleontology are not readily available.

CHRISTMAS CAROL FESTIVAL

(Continued from page 333)

their sojourn of several months in Syria, where their son is working with the American Friends of the Middle East. Mrs. Eliot is coordinator of the Carol Festival.

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