Vertebrate palaeontology

New pterosaurs from Brazil

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PTEROSAURS took to the air in the late Triassic about 225 million years ago, preceding birds and bats by over 70 million years. The pterosaur skeleton, like those of birds and bats, was light and delicate, as required by a flying vertebrate, but quite unsuitable for fossilization. The fossil record of pterosaurs is consequently very patchy. Upper Triassic and Jurassic rocks have yielded a number of well-preserved

and echinoids) together with vertebrates (fish, turtles and crocodiles) and plants have already been identified from what is thought to have been a large, virtually landlocked lagoon⁷. In the early 1970s part of an articulated pterosaur wing was found in a concretion from a fossil-fish horizon. Many more pterosaur specimens have been collected and described subsequently. The bony remains are extremely well-preserved, uncrushed and often free of distortion. In one exceptional case⁶, part of a wing membrane has been preserved.

The pterosaurs, probably all fish eaters, varied in size from between 2 and 6 metres in wingspan, with skulls up to 0.6 metres in length. Ten species have been described so far, but may not all be valid. Although some species are represented by skulls, others such as *Araripedactylus dehmii*⁸ and *Santanadactylus brasiliensis*⁹ are based on

isolated postcranial remains and may be synonymous with those based on skull material. Despite the likely exaggeration in numbers of species, it is clear that pterosaur diversity was high during the Aptian stage. At least four pterosaur genera, *Tropeognathus*⁵, *Anhanguera*³, *Cearadactylus*² (a–c, respectively, in the figure) and *Araripesaurus*^{1,4} can be distinguished. *Araripesaurus* differs from a fifth genus *Santanadactylus*⁴ only in possessing a vertical nasal process (possibly missing in the skull of *Santanadactylus*) and in a lack of fusion between its bony elements (possibly a pathological or pedomorphic feature), so that these forms may be congeneric.

Araripesaurus resembles the poorly known pterosaur *Ornithocheirus*¹⁰ from the late Lower Cretaceous Cambridge Greensand of England. Inclusion of *Araripesaurus* within the family Ornithocheiridae^{1,4}, if correct, would support a close relationship between ornithocheirids and pteranodontids. *Araripesaurus* and *Pteranodon* share a number of advanced characters such as the virtual exclusion of the squamosal bone from the post-temporal opening of the skull.

Three pterosaur skulls from the Santana Formation of north-eastern Brazil illustrating the great diversity of Lower Cretaceous pterosaurs. a, *Tropeognathus* as preserved; b, reconstruction of *Anhanguera*; c, reconstruction of *Cearadactylus*. Scale bar, 10 cm. (Redrawn from ref. 6.)

pterosaurs including *Dimorphodon*, *Rhamphorhynchus* and *Pterodactylus*. But the Cretaceous period has been less productive, yielding just a handful of often poorly preserved species, such as *Dsungaripterus*, *Pteranodon* and *Quetzalcoatlus*. A new pterosaur fauna^{1–5} from the Lower Cretaceous Santana Formation of Araripe in north-eastern Brazil is thus of particular interest. The Santana pterosaurs represent a vital addition to the Lower Cretaceous fauna and establish Araripe as one of the most important pterosaur localities ever discovered.

The Santana Formation, a thick sequence of limestones and shales outcropping on the Araripe Plateau in north-eastern Brazil, contains a rich and well-preserved fossil fauna. Many invertebrates (bivalves, ostracods, crustaceans, insects

Charles Glen King (1896–1988)

CHARLES Glen King, who died on 23 January, was one of the world's most eminent investigators in the field of nutrition. He was a man of exceptional character and ability. He was modest, humble, religious and a hard worker. He had, like Charles Darwin who wrote concerning his own success in science: "a love of science, unbounded patience in long reflecting over any subject, industry in observing and collecting facts, and a fair share of invention as well as common sense."

King was best known for his researches from 1928 to 1932 on the isolation and identification of vitamin C. In my opinion, both King and Szent-Gyorgyi deserve equal credit for their almost simultaneous discovery of vitamin C, and the Nobel prize should have been awarded jointly, not just to Szent-Gyorgyi (see the letters from Thomas H. Jukes and Ronald Pethig on page 390 of this issue). Both King and Szent-Gyorgyi worked resourcefully and independently, at least during 1932.

King was professor of chemistry at Pittsburgh from 1930 to 1942. He then left Pittsburgh to become scientific director and then president of the Nutrition Foundation in New York City. He retired from the foundation in 1963 and became associate director of the Institute of Nutritional Sciences at Columbia University, serving as a part-time consultant to the Rockefeller Foundation and to various United Nations agencies.

In his career with the Nutrition Foundation, King supported nutrition research and the development of nutrition policy,

largely through the Food and Nutrition Board of the National Research Council of which he was a member from its beginning in 1942 to 1970. King was instrumental in bringing together, in harmony and common purpose, leading individuals in food and nutrition from industry, government and academia.

King, at the Lind Bicentennial Symposium at the University of Edinburgh in May 1953, said "... one point is intriguing to a student of nature; did the loss of one or more genes that permit biological synthesis of the antiscorbutic vitamin, without disrupting other structures essential to survival, occur only once, or more often in nature? Assuming a common heritage of man and other surviving primates, can it be that we, among all the higher forms of animals and plants, share the single successful experiment with guinea-pigs, in the process of evolution?" He continued: "In place of death and the scourge of a disease that had plagued mankind since long before the dawn of history, he [Lind] gave to his generation and ours the delights of orange juice for breakfast, lemonade on hot summer days, fresh salads at dinner, and a new, higher concept of normal health. He freed men's bodies to travel the high seas at full vigour. But perhaps of greater importance, he set their minds to travel more freely in the realm of truth."

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