ALBERT FRONEMAN

The ancestral form of the Grey Go-away-bird had longer legs than the modern version and was probably more at home on the ground.

bottleneck

By the skin of their non-existent teeth

The genetic revolution provides overwhelming evidence that all living birds belong to one of three main radiations: the Palaeognathae (ratites and tinamous) and two groups of Neognathae – the Galloanseres (ducks and gamebirds) and Neoaves (all other birds; see *African Birdlife* 3(3): 10–11 and 4(4): 14). But there has been much debate about when these groups evolved into the array of birds that we see today.

Initial attempts to date the radiations within these groups based on the rate of genetic evolution suggested that most modern bird orders evolved before the mass extinction event that saw the demise of the dinosaurs some 66 million years ago. This was supported by the assumed Gondwana origin of the large, flightless ratites, given that Gondwana broke up well before the extra-terrestrial impact that triggered the extinction event. However, we've known for some time that ostriches, rheas, cassowaries and the Emu, as well as the extinct moas and elephant birds, evolved their large size and similar appearance independently from flying ancestors (see *African Birdlife* 2(5): 18).

Jacob Berv and Daniel Field (*Systematic Biology* 67: 1–13) provide evidence that the mass extinction event was associated with a marked reduction in bird body size. Because small birds tend to mature more quickly, their generation times are shorter, speeding up the rate at which their genes evolve. Correcting for the effect of body size, the molecular dating tools now suggest that virtually all the radiation of modern birds took place after the Cretaceous–Paleogene extinction event.

The discovery of an extraordinary diversity of well-preserved fossils in north-eastern China dating back 120–130 million years confirms that the ancestors of modern birds were not the only birds in the Cretaceous period. Among those feathered dinosaurs were fossils of several other bird lineages, such as the diverse Enantiornithes and the aquatic Ichthyornithes and Hesperornithes.

Most Enantiornithes were passerine-like birds that were assumed to be part of the radiation of modern birds, but they have a distinct arrangement of the shoulder bones, indicating that they form a different evolutionary group. The few fossils from the period leading up to the extinction event suggest that the Enantiornithes and most other bird groups probably died out with the dinosaurs.

Daniel Field and colleagues used several lines of evidence to suggest that the mass extinction event was associated with the almost global loss of forest cover (*Current Biology* 28: 1–7). It has long been assumed that the asteroid that struck the Yucatan Peninsula triggered catastrophic fires, but Antoine Bercovici, a palaeobotanist on the paper, showed how the spores of two fern species dominated deposits laid down more than perhaps 1000 years after the impact event right around the world. Ferns often colonise disturbed areas such as recent lava flows and land slips.

The absence of forests for so long could explain the extinction of the dinosaurs and avian groups such as the Enantiornithes. Supporting this contention is the fact that the basal species that survived the impact were all ground-dwelling. The subsequent radiation of birds saw the evolution of arboreal forms as new forests rose from the ashes.

This hypothesis helps to make sense of some of the puzzling relationships seen among seemingly quite different bird orders. It is hard to imagine how turacos can be closely related to bustards, but they form a common group with the cuckoos, which include both arboreal and terrestrial species (such as roadrunners, couas, ground cuckoos). Most tellingly, the earliest fossil turaco had longer legs than any modern species, suggesting that the ancestral form was more at home on the ground than in trees.

We've long known that birds are the only surviving dinosaurs. This recent research suggests it was touch and go that any birds survived the Cretaceous–Paleogene extinction.

PETER RYAN