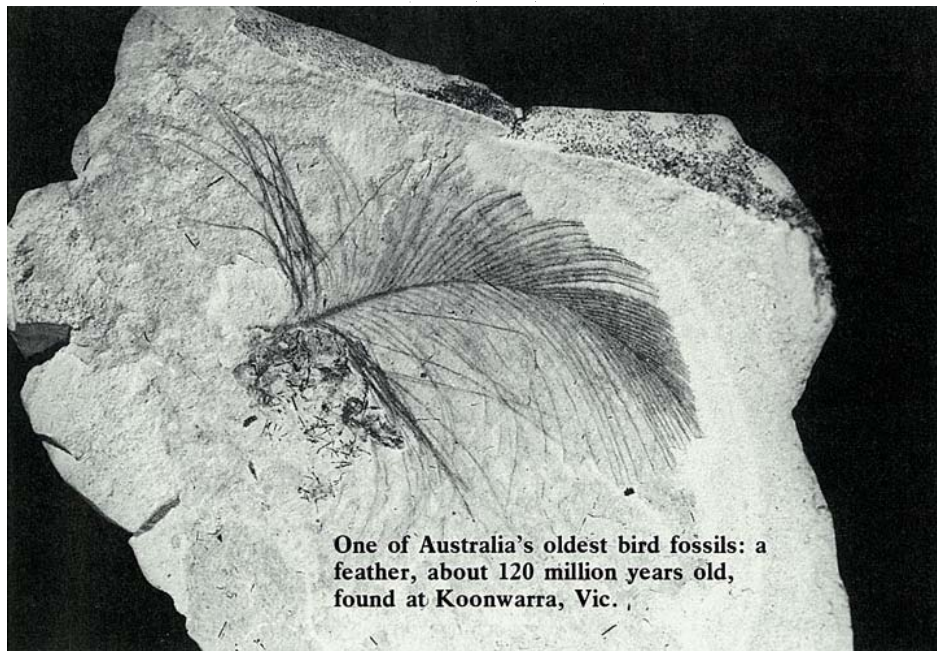


# Piecing together the fossil bird story

When the 19th Century explorers scanned the shimmering horizons of central Australia in their search for an inland sea, they were on the right track — but many thousands of years too late.



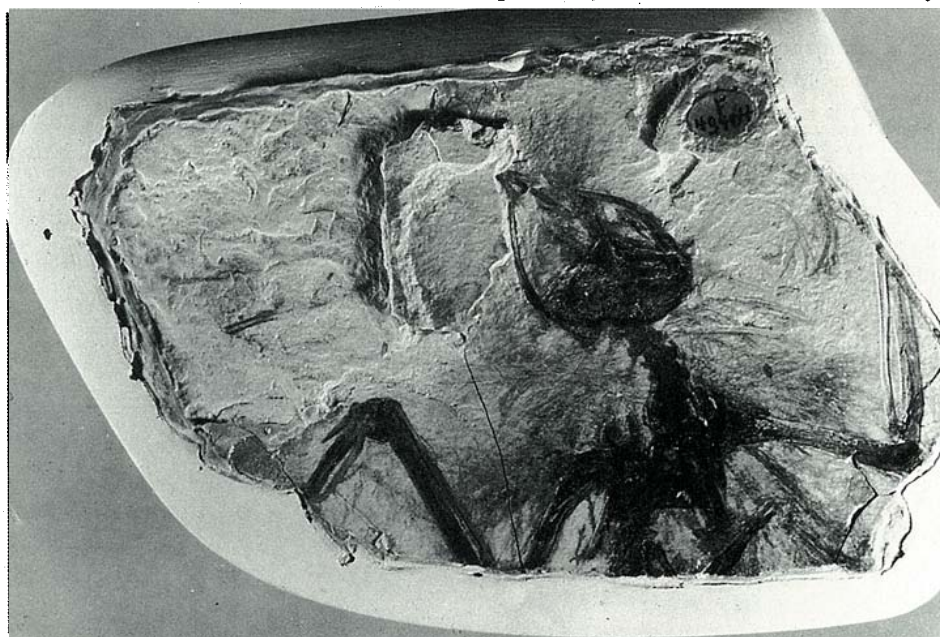
One of Australia's oldest bird fossils: a feather, about 120 million years old, found at Koonwarra, Vic.

Had they travelled a million years back through time, they could have surveyed not sandhills but a vast sea, fished by pelicans and cormorants, its muddy shallows sifted by flamingoes, and its shores inhabited by an unfamiliarly small emu and an eagle even larger than the wedge-tailed. Our time-travellers would have recognized many of these birds as belonging to the same genera, but not the same species, as birds found in Australia today. Others, including the flamingoes, are now extinct here.

Such scenes have been recreated for us by scientists studying fossil birds.

Many of their discoveries sound spectacular when briefly stated, but they have grown out of prolonged, painstaking labour, some of it expended in gathering specimens in the field, and much more in examining these relics — often mere fragments of bones — in a museum.

Major Sir Thomas Livingstone Mitchell, the explorer whose enthusiasm for the pink cockatoo led to its being popularly known as Major Mitchell's cockatoo, initiated Australian bird palaeontology about 150 years ago. His companion on a climb in a New South Wales cave fastened his rope to a projection, which broke loose and turned out to be a bone from a member of an extinct family of giant birds unknown outside Australia. Since



then, collectors have found fossils in many parts of the country.

Between 1892 and 1902, expeditions from the South Australian Museum and Melbourne University found particularly rich deposits of bird bones in north-eastern South Australia, on the site of the former inland sea. These fossils dated from the Pleistocene period, and were therefore between 10 000 and 3 million years old.

Half a century later a palaeontologist from the University of California, Dr Ruben Stirton, led a party to the same

region, and came across specimens at least 20 million years old.

## Ideal preservative

To survive so long, bones need an alkaline environment (acid will dissolve them) and must be sheltered from rain and sunlight. The shifting sands of the now-arid country around Lake Eyre and Lake Callabonna make an ideal preservative; they bury and protect bones for millions of years, occasionally exposing one or two that catch the collector's eye.

The fossils found in other parts of the country have generally come to light where land has been eaten away: on the face of an eroding cliff, for example, or, as Major Mitchell discovered, the wall of a cave, or even during building excavations. Some finds are the fruits of inspiration, such as when palaeontologists dig beneath a rock overhang that looks a likely former human shelter or animal lair.

On a dig, palaeontologists must work cautiously, excavating millimetre by millimetre. To assign a date accurately to a specimen, scientists must know exactly

This fossil of part of an owllet nightjar (*Quipollornis* sp.) is at least 13 million years old. It was discovered in the Warrumbungle Mountains, N.S.W.

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*Dromornis was probably the largest bird that ever lived, weighing in at about 460 kg!*

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## *The shifting sands of arid country make an ideal preservative for bones:*

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at which level in the earth it was found. They sieve each sample of soil to separate any bones — always few, and often tiny — from other matter, and at the end of the expedition deposit their finds in a museum. Then — perhaps decades later — the really hard work begins.

### **Giant jigsaw**

One of those poring over the accumulated store of bones in Australian and overseas collections is Dr Jerry van Tets of the CSIRO Division of Wildlife Research. He describes the task of sorting and identifying these specimens as like a giant jigsaw puzzle, whose pieces become available in a slow trickle.

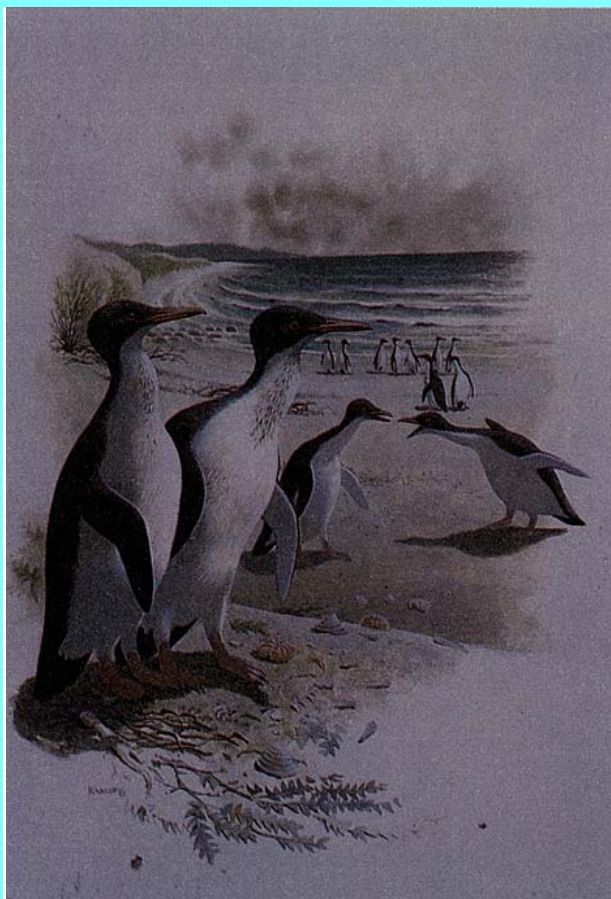
His introduction to fossil birds illustrates this well. The very first bone he examined came from a limestone cave near Naracoorte in South Australia. It was clearly a coracoid or 'collar-bone', and Dr van Tets recognized it as belonging to a bird something like a chicken, but of a species new to science.

(On each side of a bird, the coracoid takes the strain between the wing and the breastbone; being strongly built, it is one of the most likely parts of the skeleton to survive as a fossil. The bones of the foot and upper arm also preserve well.)

Over the years more and more bones have been unearthed, and he has now reconstructed virtually the entire skeleton. The bird was a megapode (literally 'big-foot') or mound-builder, related to our modern mallee fowl and brush turkey, but distinctly larger than any living member of the group.

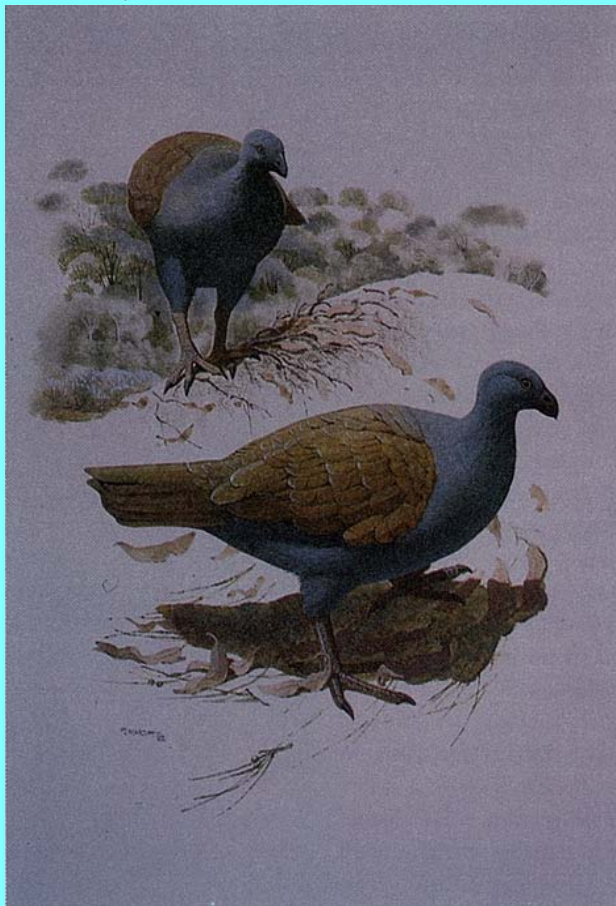
Field workers rarely find a complete skeleton. Most fossils are solitary bones, and must be identified by exhaustive comparisons with other fossil bones and with those of modern species. For example, Dr Pat Rich of Monash University and Dr van Tets recently completed a revision of Australian fossil pelicans; this involved assembling all the fossil specimens of this group from Australian and overseas museums and checking them against one another and against bones of modern pelicans.

To complicate matters, many of the specimens of fossil birds deposited in museums around the turn of the century



About 45 million years ago parts of Australia and New Zealand shared the same latitude with an island near the Antarctic Peninsula, and remains of extinct penguins have been found in all these places. This reconstruction shows *Anthropornis nordenskjöldii*.

An impression of *Progyura naracoortensis*, a large extinct mound-builder related to the modern mallee fowl.





or earlier were wrongly identified. It is not enough to ask a museum to 'send me your pelican bones', as these may be scattered through a collection under quite different names.

Assembling specimens in this way may permit discoveries that would have been impossible otherwise. For example, Dr Rich and Dr van Tets found a new species of pelican, no larger than a cormorant, and new information on previously known fossil species.

Unfortunately such studies take a long time, and there are few bird palaeontologists. As a result, a great deal of fossil material awaits scrutiny. Work is further hampered by a shortage of reference material from modern species.

### Windows on the past

Nevertheless, our knowledge of the Australian birds of yesteryear is steadily growing. Dr van Tets likes to describe fossils as windows on the past. The most opaque window consists not of bones but of about half a dozen feathers, whose impressions have been retained in mudstone at Koonwarra in southern Victoria.

About 120 million years ago a lake occupied this site. The feathers were among a variety of biological specimens, including insects, fish, and leaves, to become preserved in mud on the bed of the lake and remain hidden until 20th Century man found them while digging a road cutting.

Dr van Tets calls this 'window' opaque because palaeontologists have no idea what type of bird grew these feathers. The bones needed for identification have not been preserved. All we can say is that birds inhabited Australia in early Cretaceous times, perhaps 40 million years after that interesting animal *Archaeopteryx* — part reptile, part bird — lived in the Northern Hemisphere.

### Some finds are the fruits of inspiration.

The next window opens onto a much later period. Professor Richard Jenkins of the University of Adelaide and Professor George Gaylord Simpson of Harvard University have shown that a giant penguin occupied parts of southern Australia about 45 million years ago. Only the most massive bones have survived, but these are sufficient to establish that the penguin, *Pachydyptes*, stood about 1.4 m tall — about one-third larger than the emperor penguin, the biggest living species.

Apparently roaming across the warm southern seas of that time, *Pachydyptes* and similar penguins left fossil remains not only in Australia but also in southern New Zealand and on Seymour Island, near the Antarctic Peninsula opposite the tip of South America. These sites at that time shared the same latitude.

A third window overlooks the mid to late Miocene period, from about 22 to 12 million years in the past. Our knowledge of the birds of that time comes from bones found in the sediments left by former inland seas, lakes, and rivers in central and northern Australia.

### 'Giant emu' . . .

Many of the bones belong to birds associated with water: cormorants and pelicans, ducks and geese, gulls, rails, flamingoes, and cranes. Specimens of stone curlews and owlet nighjars have also been found, as well as that curious extinct group, first collected by Major Mitchell, the mihirungs. They take their name from an Aboriginal word meaning 'giant emu' — a word that has survived in legends that associate the birds with 'mountains spouting fire'. The last time an Australian volcano erupted was about 8000 years ago, and perhaps mihirungs were still alive as recently as that.

All the mihirungs so far discovered dwarfed most other birds. The smallest was slightly larger than our modern emu, and the giant of them all, *Dromornis*, was probably the largest bird that ever lived, outgrowing even the biggest of the extinct elephant birds of Malagasy. It weighed in at about 460 kg!

From the shape of their feet and massive skulls, palaeontologists have inferred

that mihirungs were plant-eaters or omnivores. They left not only their bones, but also some footprints found in Tasmania and egg-shell fragments in South Australia. A complete giant egg, found in coastal sand dunes of Western Australia, may be a mihirung's or may have floated in from Malagasy or mainland Africa. The mihirungs perhaps also inspired some Aboriginal rock art that has survived to the present day.

Inland Australia provided a well-watered and wooded contrast to today's arid outback. From fossils, we know that extinct birds shared their habitats with platypus, lungfish, crocodiles, and dolphins, as well as koalas.

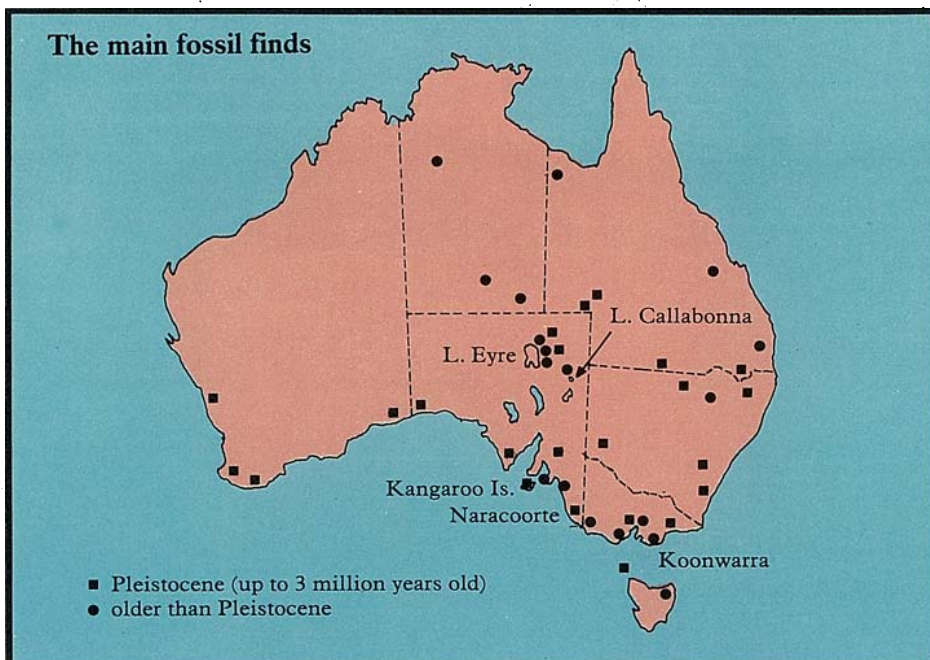
Over millions of years the inland seas gradually dried up. The ranges of some birds contracted; other species died out. Our next window shows us the Pleistocene period, about one million years ago; the fossils include those collected in north-eastern South Australia around the start of this century.

### . . . and flamingoes

A number of Pleistocene birds have become extinct. The flamingoes provide a good example of how the Pleistocene bird fauna links those of the Miocene and the present.

From the Miocene fossils we know of two families of flamingoes. One, now extinct, also occurred in France and North America, but had died out both here and in those regions by the Pleistocene period, when four species of the other family still lived in Australia.

Of these, two seem identical in size to the modern greater and lesser flamingoes, both of which occur in southern Africa;



of the other two, one is much larger and the other much smaller than extant species of flamingo. All flamingoes have now disappeared from Australia, presumably because suitable habitat (the modern species have a liking for big alkaline lakes) has disappeared.

A large species of darter and the small species of pelican have also died out since the Pleistocene, but most of the fossils of that period are indistinguishable from modern species.

Our final glimpse into the past is afforded by limestone caves, mainly in southern and eastern Australia, including the one near Naracoorte in which the giant megapode (*Progyura naracoortensis*) was first discovered. The fossils in these caves are only 30 000 years old or younger, and are therefore recent enough for carbon-dating.

Most of them clearly belong to extant species, but some, like the giant megapode, have disappeared, including one that comes in the swan—goose group and is still being 'pieced together'. The other extinct birds include eagles — one giant and some smaller species.

The Tasmanian native hen was not, as now, confined to Tasmania; remains have turned up in caves in south-eastern Queensland and south-eastern South Australia. The species may have died out

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### *In Miocene times, two families of flamingoes inhabited Australia.*

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during droughts on the mainland before or after Tasmania became separated by rising sea level about 10 000 years ago, and was thereafter unable to return to the mainland.

Fossils of the Tasmanian devil occur in the same mainland deposits. Indeed, most of the bird bones found under a rock shelter on Kangaroo Island, S.A., came from Tasmanian devil droppings; the bones had all been bitten into short pieces.

The deposit at this site includes a number of layers. Two of these show that man used the shelter: the bone fragments in them are longer, and lie in charcoal ash. Man had disappeared from Kangaroo Island by the time the first European explorers arrived.

The haul from a dig under this rock shelter typifies the challenge facing a bird palaeontologist. All the bird bones found would, as Dr van Tets puts it, only fill a teacup. Some of the specimens represent only a tiny part of the bird — a Tasmanian

devil might, for example, have left just two knuckle bones from a goose — but eventually he was able to compile a list of at least 37 species.

The fossil songbirds, being smaller and less well known, have not been so thoroughly identified, and their study remains one of the major tasks facing scientists compiling a picture of the bird life of Australia's past.

John Seymour

#### **More about the topic**

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'The Fossil Vertebrate Record of Australia.' P. V. Rich and E. M. Thompson, eds. (Monash University Printing Office: Melbourne, in press.)