

# Native land mammal fossils

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*The fossils of two terrestrial mammals about the size of a mouse are a momentous find, overturning a long-held belief that bats have always been our only native land mammal. NZASE Science Communicator Mike Stone outlines the research.*

## Background

Aotearoa separated from Gondwana about 82 million years (Ma) ago, carrying some species which have survived to the present day – southern beech, velvet worms, leiopelmid frogs (e.g., Archey's), tuatara, kauri, wrens, flax snails and others.

There were no mammals known in that group, even though a variety of terrestrial mammals occupied the adjacent Australian portion of Gondwana. Since that separation, two different types of bat arrived here; one probably flew and the other probably rafted.

Our three species of bat are small, roost in old tree cavities, and hunt at night using echolocation. The long-tailed bat (genus *Chalinolobus*) is smaller, closely related to Australian species, a fast flyer, and hunts flying insects over water

in a home range. The two species of short-tailed bats (genus *Mystacina*) are ancient and unusual animals; omnivorous, and able to fold their wings and hunt on the forest floor.

## Mammal fossil digs

For the last 20 years, a dig near the tiny town of St Bathans has yielded a wealth of fossils. Many were expected, such as bats, moa,

*The dig on the edge of the Manuherikia River in Otago, with the scientists' sieves in the foreground. This former lake shore is one of the country's richest fossil sites. Photo: Alison Balance, Radio NZ.*

eagles, wading birds and fish, and some were surprising, including crocodiles, snakes and two small land mammals, all now extinct in Aotearoa.

The Manuherikia River in Otago is near the St Bathans and Hawkdun Ranges. For two decades, Trevor Worthy, from Flinders University in Adelaide, has worked with several other scientists including Sue Hand of the University of New South Wales in Sydney, at this fossil site. These two vertebrate palaeontologists were searching for vertebrate bones.

They carefully dug out lumps of sandstone and put them in sieves to break down in the flow of the river.

Over an hour, the silt washed away, leaving pebbles and bone fragments. Teaspoons of processed sediment were then placed on a tray and observed under a microscope. Any tiny find was carefully picked up with fine tweezers, sealed in a gelatin capsule and labelled.

## Land mammal fossils

The two small land mammal fossils were dated at 16-19Ma, by analysing pollen grains from plants in sedimentary beds above and below the fossils. At this time, long after the extinction of the dinosaurs, this area was a giant lake (10 times the size of Lake Taupo) surrounded by eucalypts, palms

*A short-tailed bat feeding on a weta on the forest floor.*  
Photo: Rod Morris.



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and herbaceous peat-swamps in a warm temperate or subtropical climate. Many millions of years later, the swamps formed deep coal beds.

The mammalian fossils include a small fragment of jawbone, a femur and a premolar, all incomplete. The lower jaw has deep empty sockets, suggesting a dental formula of one incisor, one canine and two premolars. The premolar is unlike any other fossil mammalian premolars – molars are key defining characteristics of small mammals, and without them classification is difficult. Femur anatomy suggests the mammal was an adult, with a waddling walk.

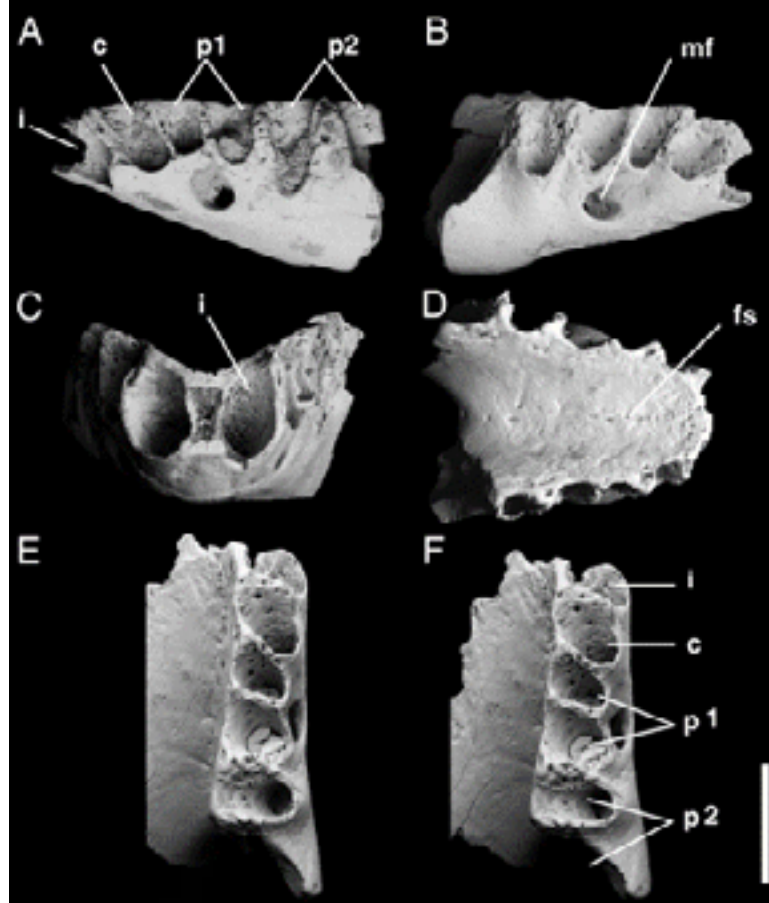
The particular combination of features in the St Bathans' mammalian fossils do not resemble any known ancestor of mammals - placental, marsupial or monotreme. Sue Hand says scientists hypothesise that the fossils belong to a very primitive mammal ancestor that evolved before the mammal line split into placental mammals and marsupials, about 125Ma.

The fossil find could suggest that a previously undetected group of terrestrial mammals survived in Aotearoa after its separation from Gondwana, around 82Ma. It is not likely that they swam or were rafted from Australia after the separation because:

- The preserved portion of the femur does not show features of swimming mammals.
- Nothing like these fossils have been recovered from the rich fossil beds in Australia, our closest Gondwanan neighbour.
- By 65 Ma NZ was more than 1,000km from Australia.

So this mammal must have been another Gondwana survivor, living here all along.

Why did they die out? They are more recent than the Oligocene drowning about 26Ma, when some scientists believe that most of Aotearoa submerged below the sea. At about 14Ma the climate cooled abruptly, by eight °C at first, then a further five degrees as an ice age began. Many of the species now only found in a tropical climate become extinct then. And the fossil “mouse” died out at the same time, likely for the same reasons, leaving bats as the country’s only land mammal.



*The fragment of a lower jaw bone from Aotearoa's first pre-Pleistocene mammal, photographed from different angles. In F, i, c, p1 and p2 are holes for an incisor, a canine and two premolars. Photo: National Academy of Sciences.*

## Reference and links

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## Ngā Kupu

[Mātai māātōka](#) – Palaeontology  
[Mātātōka](#) – Fossil  
[Mate ā-moa](#) – Extinction  
[Momo](#) – Species  
[Niho pūrākau](#) – Premolar tooth  
[Pekapeka](#) – Bat  
[Puningā](#) – Genus  
[Whāngote](#) – Mammal.

From Te Aka Maori Dictionary



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