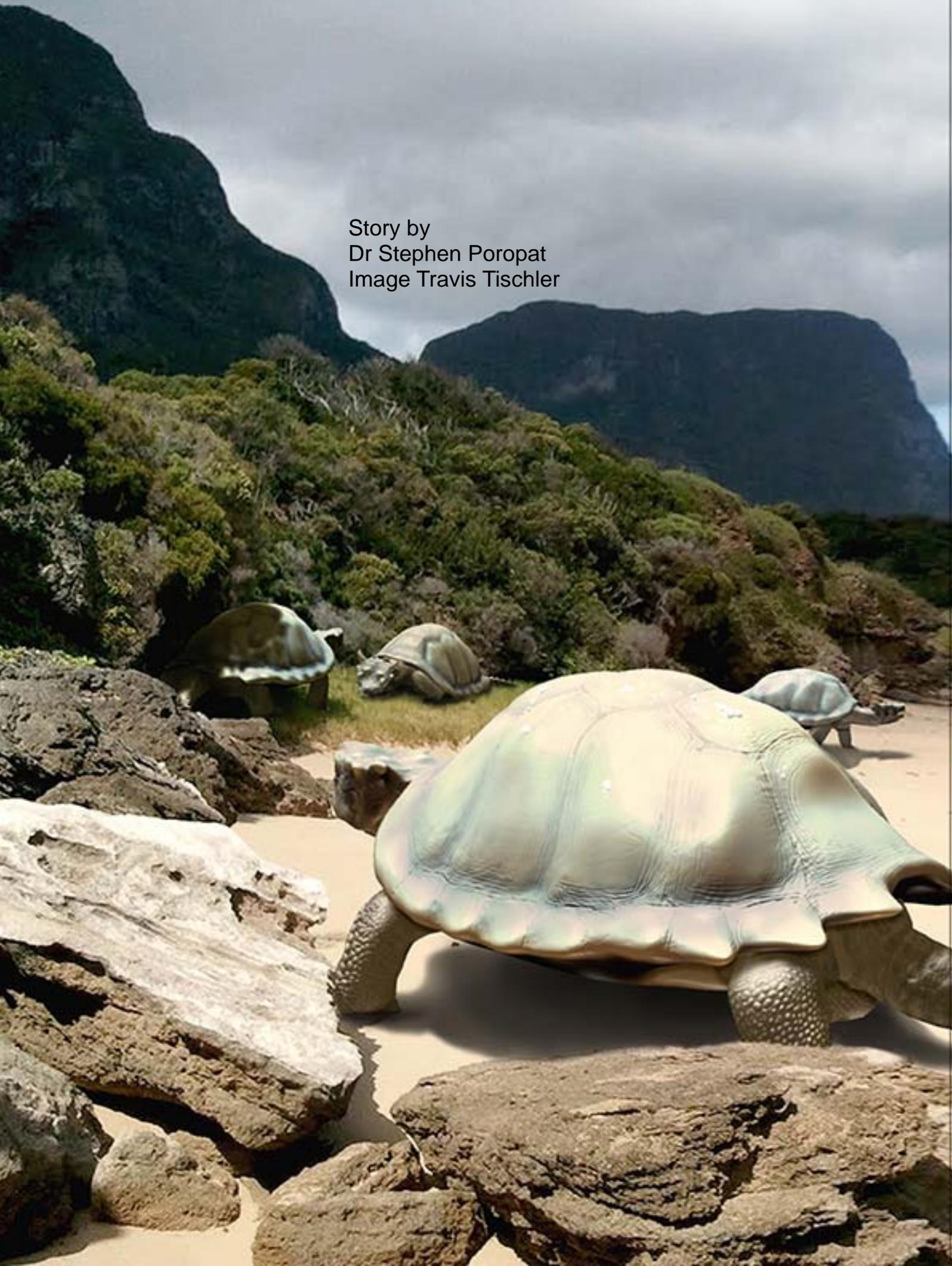


Story by  
Dr Stephen Poropat  
Image Travis Tischler



Meet the  
**MEIOLANIIDS**  
The Original  
**NINJA**  
**TURTLES!**



Oceanic volcanic islands are special places. They are hard for animals to get to unless they can swim long distances or fly, meaning that they often have similar faunas: lots of birds, a few species of reptiles, few or no mammals (seals and bats often being the only exception), no amphibians, and abundant insects, arachnids, and other arthropods. The commonalities between these island faunas can be explained fairly easily: birds, bats and insects can fly; terrestrial reptiles can survive long ocean journeys on rafts of vegetation (whereas mammals can't); amphibians die when exposed to saltwater; spiderlings can use silk as a parachute to ride on the wind over vast

expanses of ocean, and other arthropods can hitch a ride on the feathers of birds. The absence of mammalian predators on these islands gives other animals the opportunity to develop in ways they otherwise might not be able to – they may become large, or flightless, or relatively more defenceless. One of the most famous examples of an animal becoming large in island isolation is the Galapagos Tortoise, which approaches half a tonne in mass and achieves lengths close to two metres. However, despite its fame, the Galapagos Tortoise is not the only turtle to have evolved strangely and thrive in isolation...

Imagine that you are in a time boat

and transported back in time over 20,000 years to the south-western Pacific, some 640 kilometres northeast of where the city of Sydney resides today. As you sail north in your boat, the sun ripples across the surface of a gently undulating sea that extends uninterrupted as far as the eye can see. Before long you spy a dark speck on the horizon and as you approach it, you see that it is a conical island looming half a kilometre above the surface of the ocean. This rocky island (now named Ball's Pyramid) is all that remains of an ancient volcano, but its steep, basaltic sides support little vegetation and no animal life is apparent. You drift on to the northwest.



*Situated 640 kms northeast of Sydney, Lord Howe Island (below) is the eroded remnants of a volcanic seamount that formed around 7 million years ago. Due to its isolation and lack of predators, the Island was a haven for the giant horned turtle *Meiolania* that existed on several islands throughout the south-western Pacific during the Oligocene - Holocene Periods. Scientists believe that extinction of these animals may have been due to rising sea levels between ice ages which resulted in a loss of their habitat. Photo courtesy Lord Howe Island Historical Society*



Twenty three kilometres further on, you find a much larger island with gently rising, but much taller slopes that are almost entirely covered by dense forest. An occasional gap through the trees reveals that this island too was formed as a result of volcanic activity but the gentle slopes of its rocky edifices have allowed soil to form and plants to grow. You carefully navigate the coral reef at the edge of the western lagoon, landing on a beach formed from eroded volcanic rocks and shells and lined by palm trees. You have arrived at Lord Howe Island.

You take a moment to assess your surroundings. The air is tinged with the smell of salt, and palm trees sway in the breeze. The sky resonates with the calls of birds as they flit through the lush forest beyond the shore and wheel through the skies above. You spy geckos in the trees and skinks on the rocks. And yet you see no mammals. You hear no frogs. There is no evidence that humans have ever been here.

Walking inland, you are suddenly startled by the sound of something large coming through the forest. It appears to be moving slowly and as you stare in the direction of shuffling footfalls and rustling bushes, a spiked head thrusts through the undergrowth in front of you. It is unlike anything you have ever seen! Its wide and flattened jaws are sheathed in a blunt horny beak – it has no teeth. Thin nostrils protrude above wide spaced eyes set forward on either side of its broad, flattened, armoured skull. But its most distinctive feature is the spiked horns at the back of its head – thrusting out and backwards like those of a yearling bull. As the animal emerges from the bushes you see its wide, shallow-domed shell, and you realise you are looking at a large, well-armoured, land turtle. Its body is supported by robust legs with stubby toes all bearing strong, flattened claws. As it lumbers past, you stare in amazement at its tail – longer than that of any turtle you've seen before and covered in rings of bony armour with an array of spikes pointing upwards and out to each side. Clearly, you realise, this animal is not to be messed with. Following it through the undergrowth at a respectful distance, you are surprised when it leads you back to where you started. And suddenly you realise there are horned turtles everywhere, patiently devouring vegetation along the coastline and sunning themselves along the sandy, shell covered beach.

In spite of its otherworldliness, this bizarre creature is not an object of fantasy. Giant horned turtles are known to have existed on several Pacific islands until as recently as a few thousand years ago and their fossils have been found in Australia as well as South America. But no place in the world has produced as many fossils of these animals as Lord Howe Island. In isolation, they thrived there. These extinct giants are today known as meiolaniids and as is the case with so many fossil groups, the history of our early understanding of them is full of misconceptions, heated scientific debates and amazing discoveries.

### **Early Discoveries - The Great Turtle Debate!**

The recognition of *Meiolania* itself as a land-dwelling turtle is entwined with the history of another famous Australian prehistoric reptile. The story begins in 1858, when Dr George Bennett discovered three fossil vertebrae in a tributary of the Condamine River, west of Moreton Bay, Queensland. Bennett sent these vertebrae to the famous British anatomist Sir Richard Owen who, apart from naming the Dinosauria in 1842, became world renowned for his contributions to vertebrate palaeontology and staunch resistance to Darwin's theory of evolution. Owen identified the vertebrae collected by Bennett as belonging to a 6.1 metre long carnivorous monitor lizard, which he named *Megalania* - the "great roamer".

Over the next twenty years Owen continued to receive reptilian fossils from Australian sediments less than 2.5 million years old and in 1880 he described a collection of these as belonging to *Megalania*. The specimens included a vertebra sent by Dr Bennett from the Darling Downs region of south-eastern Queensland; a vertebra sent from Melbourne by F. M. Raynal; and vertebrae and the back of a skull sent by Sir Daniel Cooper from Gowrie, northwest of Toowoomba. These fossils compared favourably with the original specimens of *Megalania*, meaning that all of the evidence available pointed to *Megalania* being a large lizard. However, Owen also described an extraordinary horned skull, sent to him by Dr Bennett in 1879, which dramatically altered his view of *Megalania*. Dr Bennett, in a letter to Owen, suggested that the skull belonged to a turtle. However, because

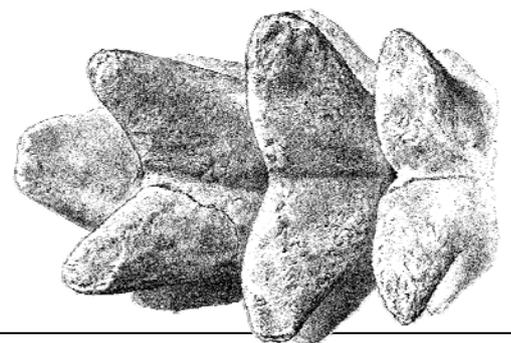
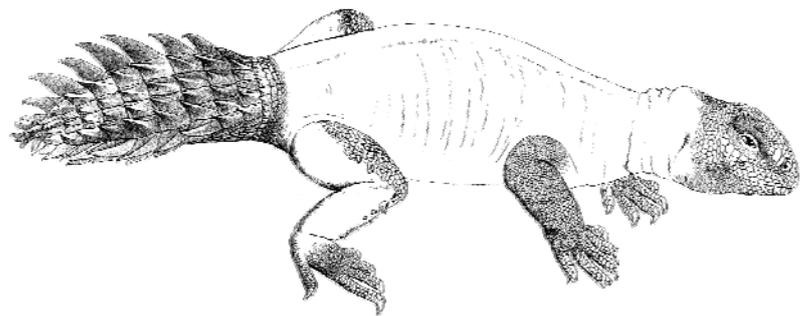
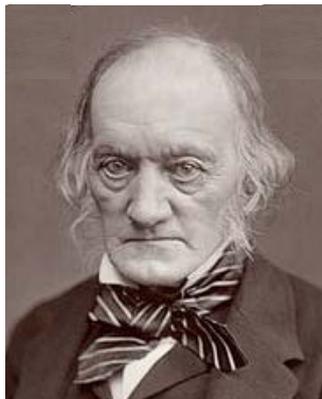


Photo Juliana Sterli courtesy NHM, London



Australian Museum Archives

*In 1858, Dr George Bennett (top right) shipped three fossil vertebrae from the Darling Downs area of Old to Sir Richard Owen (below) at the Natural History Museum in London. Owen described the fossils as belonging to a large extinct monitor lizard which he subsequently named *Megalania prisca*. In 1879, Bennett discovered further fossils from a site nearby which included a large horned skull (above) that he believed to be from an extinct turtle. Owen however disregarded the turtle like features of the skull and identified it as belonging to *Megalania* which he re-identified as a giant herbivorous lizard similar to a Thorny Devil (bottom left) rather than a carnivorous monitor lizard. His theory was strengthened further when, in 1881, an armoured section of tail (bottom right) from the same locality was sent by Bennett. In Owen's eyes, this compared favourably with the tail armour of living lizards such as the Princely Mastigure from Somalia (below right). The black and white images below are figures from Owen's papers published in 1879 and 1881.*



of the lizard-like features of the vertebrae previously described from a nearby locality, Owen disregarded the turtle-like features of the skull. Instead he proposed that, based on the skull and vertebrae together, *Megalia* was an extinct, herbivorous, over-sized Thorny Devil rather than a large carnivorous monitor lizard as he had previously thought.

Owen strengthened his view that *Megalia* was a large relative of the thorny devil still further in 1881 when an armoured section of tail was sent to him by Dr Bennett. This specimen came from the same site as the skull he had previously described and compared favourably (in his eyes) with

the tail armour of some living lizards, including the Princely Mastigure from Somalia and the Australian Thorny Devil. Finally, in 1886, Owen described a vertebra and some foot bones sent to him by Dr Bennett from Gowrie Creek, northwest of Toowoomba, as representing additional remains of *Megalia*.

In a paper published in 1886, Sir Richard Owen reported the first fossilised reptile remains recovered from Lord Howe Island. These remains, sent to him by Robert D. Fitzgerald in 1884, included a skull and tail armour very similar to those which he had referred to *Megalia* several years earlier, and as such he identified

them as belonging to a megalanian lizard which he named *Meiolania* - the "lesser roamer". Owen identified two species: *Meiolania platyceps* - the "flat-headed lesser roamer" and *Meiolania minor* - the "small lesser roamer" and was convinced that all of the remains belonged to herbivorous lizards very like the thorny devil. However, the following year, Thomas Henry Huxley, famously known as "Darwin's Bulldog" for his stout support of the theory of evolution, argued that the skulls and tails referred to *Meiolania* and *Megalia* by Owen were actually turtles. The following year, Arthur Smith Woodward sorted out the confusion. He restricted *Megalia* to

*Some of the earliest Meiolania fossils from Lord Howe Island were collected by scientists who visited the Island as part of a government expedition aboard the steamer Thetis in 1869, and again in 1882 (below). Robert D. Fitzgerald (right) attended the 1869 expedition and became so enchanted with Lord Howe Island that he returned several times over the following years. In 1884 he sent two boxes of specimens from the Island to Sir Richard Owen which included skull and tail armour fossils similar to the Old fossils that Owen had assigned to Megalia several years earlier. Again Owen was convinced the remains belonged to a large, extinct, herbivorous lizard which, based on the skull, he named Meiolania platyceps. His lizard theory however was to be short lived. In 1885 Thomas Henry Huxley (below right) argued that the specimens assigned to Megalia and Meiolania actually belonged to turtles and the following year Arthur Smith Woodward published a paper to this effect.*

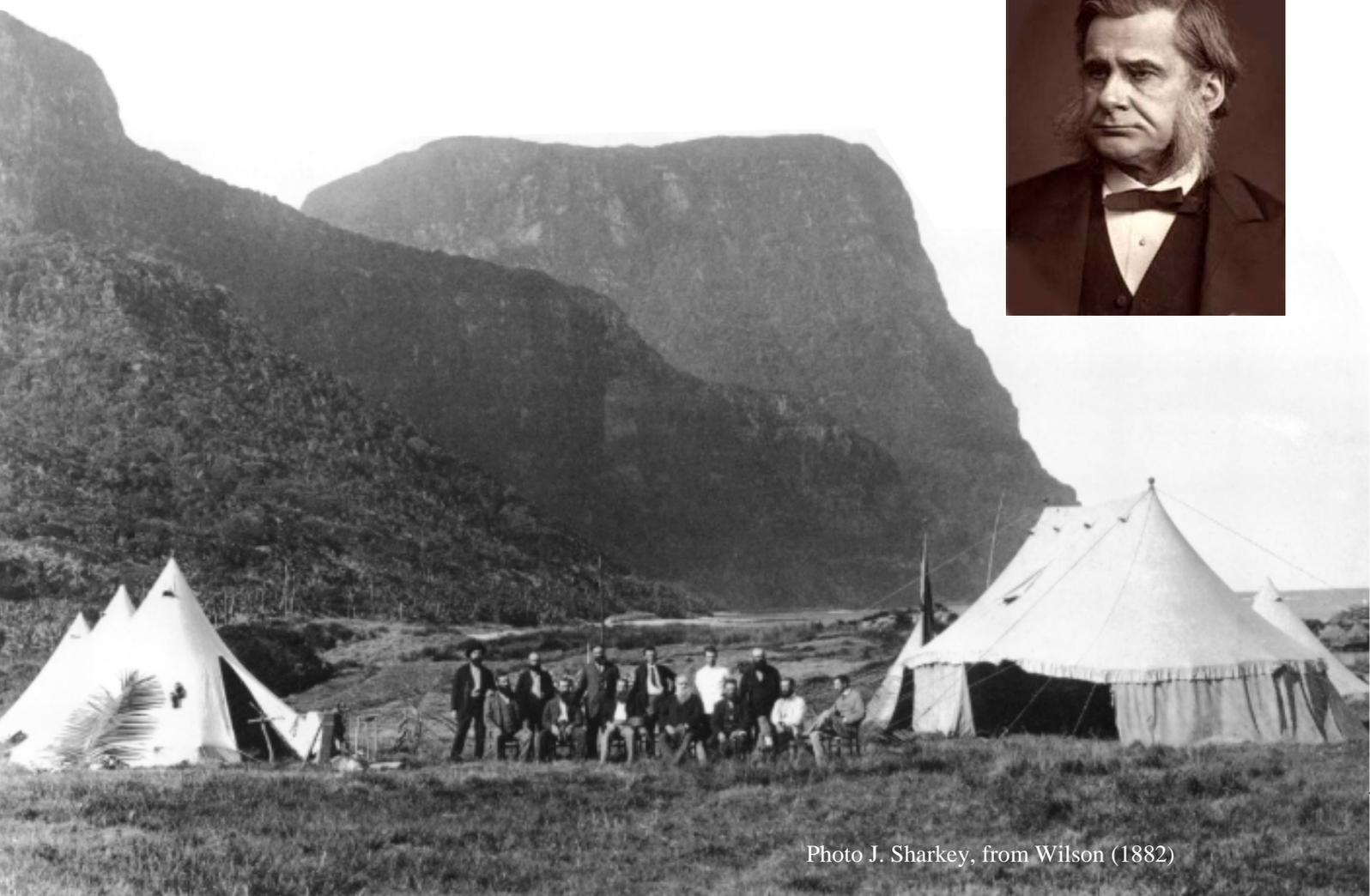
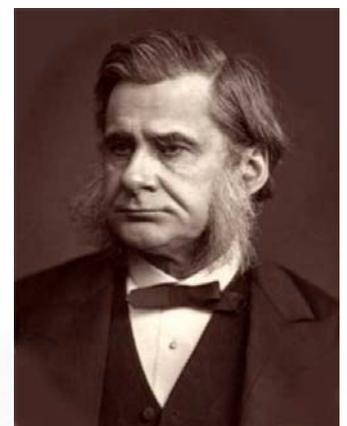
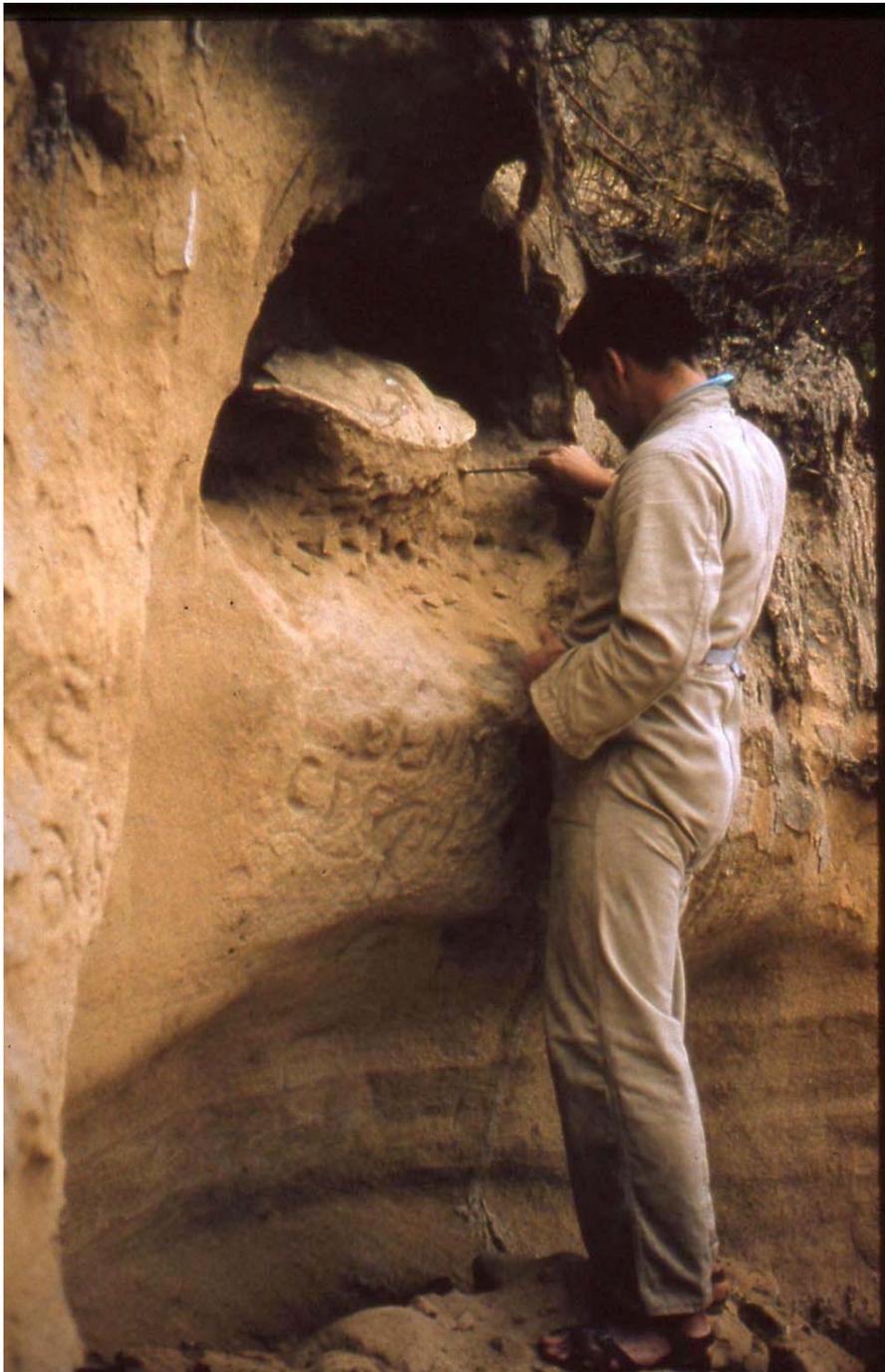


Photo J. Sharkey, from Wilson (1882)



*In 1959, Ray Missen, a resident of Lord Howe Island discovered the first complete shell of a meiolaniid high in the face of a sand cliff on the north-east end of Ned's Beach (left). The specimen was exposed over the course of a day, but was unfortunately ruined by high seas overnight before it could be safely recovered.*

*In 1971, workers digging a swimming pool for a guest house establishment owned by Alan Wilson (below right) uncovered fossil bones while jack-hammering hard, shell-rich sediment. The significance of their find was not realised until a horned skull (above right) appeared, by which time some of the bones had been badly fractured. Fortunately Wilson saved many of the blocks containing bone which he sent to the Australian Museum. Subsequent acid-preparation proved that they represented the most complete specimen of a meiolaniid found to date.*

*Photos courtesy Lord Howe Island Historical Society.*

the monitor lizard vertebrae and skull fragment; referred the Australian mainland turtle material to a new species of *Meiolania* which he named after Owen (*Meiolania oweni*); and identified the foot bones previously assigned to *Megalania* as coming from a marsupial mammal - later identified as *Diprotodon* remains!

Owen, however, was either stubborn in his resistance to Huxley and Woodward's ideas, or was not aware of them. In 1888, he described two skulls, several vertebrae, limb bones, and another tail shield of *Meiolania* that had been sent to him from Lord Howe Island by Charles Wilkinson. Owen remained adamant that *Meiolania* was closely related to *Megalania*, and even proposed that the

two belonged to a group intermediate between lizards and turtles which he called Ceratosauria. Owen was evidently unaware that the North American palaeontologist Othniel Charles Marsh (famous for his "Bone Wars" feud with Edward Drinker Cope during the late nineteenth century) had already used the name for a group of theropod dinosaurs. Regardless of this, other palaeontologists of the day accepted that *Meiolania* was a turtle, and Owen's Ceratosauria was soon forgotten.

There was some disagreement however about exactly what type of turtle *Meiolania* was. Huxley identified it as a cryptodiran - a turtle which lowers its neck vertically to retract it. The Belgian/British zoologist George

A. Boulenger disagreed: he contended that it was actually a pleurodiran, or "side-necked" turtle. American palaeontologist Georg Baur, who studied fossil turtles of the southern United States, supported Huxley's interpretation that *Meiolania* was a cryptodiran and became embroiled in a public debate with Boulenger regarding what type of turtle *Meiolania* represented. A heated exchange ensued between the pair, but it is Baur whose arguments have stood the test of time. *Meiolania* is a cryptodiran turtle!

Scientific work on *Meiolania* abated somewhat in the years following Boulenger and Baur's public tiff; however, in 1899 the famous Argentine palaeontologist Florentino Ameghino



published a preliminary report on the discovery of an impressive horned skull which he named *Niolamia argentina*. In 1901 this skull and other remains were described in detail by Arthur Smith Woodward who considered it to be a new species of *Meiolania*, but like Boulenger, thought *Meiolania* to be a side-necked turtle. Woodward cited the presence of terrestrial meiolaniids in both South America and Australia as evidence for a past land connection. In the meantime, collections on Lord

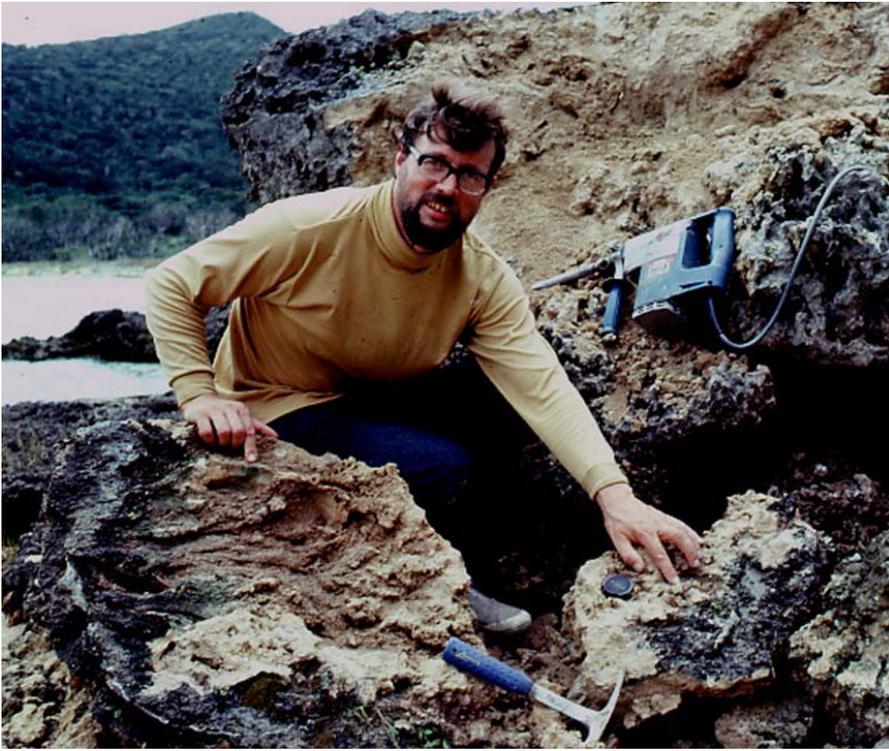
Howe Island continued, and additional *Meiolania* material was sent to the Australian Museum in Sydney. New meiolaniid fossils found on Walpole Island, 100km southeast of New Caledonia were also sent to the Australian Museum and the material from both islands was described in detail by the Museum's Director Charles Anderson in 1925 and 1930. Anderson named the Walpole Island form *Meiolania mackayi* and his study of the additional Lord Howe material provided a much fuller understanding

of the anatomy of *Meiolania* in general. In 1937, American palaeontologist George Gaylord Simpson reported the discovery of a second meiolaniid from Argentina. This specimen, which he named *Crossochelys corniger* was considerably smaller than *Niolamia* and was described in detail by Simpson the following year. Simpson further suggested that Woodward's inferred connection between South America and Australia was ill-founded and the Argentine horned turtles were much older than the Australian forms, suggesting that the range of these animals may have been greater in the past.

### Turning of the Tide - Significant New Discoveries

When people think of turtles, the first thing that comes to mind is usually their shells, since all turtles have them. The shell of a turtle comprises a carapace (the top half) and a plastron (the bottom half) but, surprisingly, the first essentially complete meiolaniid shell was not even discovered until 1959 – more than seven decades after Owen first named *Meiolania*! This discovery was made on the northeast coast of Lord Howe Island by Ray Missen, an officer at the island's Meteorological Station. By





lucky coincidence, Elizabeth Pope, Curator of Worms and Echinoderms at the Australian Museum, happened to be on the island when the discovery was made and assisted in its excavation. Over the course of one day the pair managed to expose half of the specimen but, devastatingly, an overnight storm caused higher than normal waves to undermine the exposed fossil, shattering it into many small pieces. Luckily, photographs of the shell taken during its excavation allowed the shape of *Meiolania's* carapace to be determined (relatively low and wide, not tall and domed), and several other well-preserved bones were recovered intact. It was to be a further 12 years before our understanding of the shell of *Meiolania* was to improve further.

In 1971, Alan Wilson, the proprietor of the Ocean View Apartments on the north of the island, decided to build a swimming pool for his guest house establishment. During the course of the excavation, a hard layer of shell-rich sediment was struck which had to be broken up with jackhammers. In the course of the extraction of these blocks, the workers

*The most complete meiolaniid carapace to date was discovered by Dr Alex Ritchie on Old Settlement Beach at Lord Howe Island in 1977 (above). The specimen, which included a complete skull, carapace and partial skeleton was painstakingly acid-prepared by Bob Jones at the Australian Museum (below). Photos courtesy Dr Alex Ritchie*



started noticing what looked like embedded bones. They did not recognise the significance of their discovery until they found the horned skull – a rare discovery indeed! The workers photographed the fruits of their labour and the specimens were set aside; however, word of the discovery only reached the Australian Museum after the excavation had been completed. Thankfully, Wilson saved many of the bone-bearing blocks and sent them to the Museum, where Curator of Palaeontology Dr Alex Ritchie and Museum staff acid-prepared them. The restored bones were in excellent condition and included the skull, neck, much of the carapace, a complete front foot and a complete back foot making this one of the most important discoveries made, and the most complete specimen of a meiolaniid found to date.

Six years after the discovery of the swimming pool specimen, Jim Dorman, a resident of Lord Howe Island, visited the Australian Museum and was stunned by the amount of meiolaniid material present in the collections. The purpose of his 1977 trip had been to track down information in the Australian Museum for the Lord Howe Island Historical Society, with a view to starting a museum. Intrigued by the fossils, Dorman visited all of the sites from which fossils of *Meiolania* had been recovered and discovered a new specimen on the northeast of the island at Ned's Beach. He informed Alex Ritchie of his discovery and Ritchie made his way over to Lord

Howe Island in October 1977. Unfortunately, following his arrival, Ritchie found that he was not going to be able to get his digging equipment down to the Ned's Beach site as a result of the timing of the tides. This forced Ritchie to explore beds known to have produced fossil turtles on Old Settlement Beach on the opposite (western) side of the island, which proved to be a blessing in disguise: it was here that the most complete carapace of *Meiolania* known, together with a complete skull, were found together! The carapace was beautifully prepared mechanically at the Australian Museum by Robert Jones who also acid etched the delicate skull using dilute acetic acid – vinegar! The Lord Howe Island Historical Society, who adopted *Meiolania* as their motif, opened their Museum in 1978, and Dorman's dedication to the project earned him an 'Order of Australia' in 2002. Sadly, he passed away the following year, but his story highlights the level of contribution that interested, passionate people without formal training in palaeontology can make to our understanding of the past.

#### Sorting out the Species

The glut of new *Meiolania* material did not escape the notice of one of the world's foremost experts on turtles, Dr Eugene Gaffney of the American Museum of Natural History, New York. Gaffney visited the Australian Museum and Lord Howe Island many times and published several papers on meiolaniids in the

1980s and 1990s, focussing on their skeletal anatomy and their relationships. He concluded that Huxley had been correct in his assessment that meiolaniids were hidden-necked turtles, and brought to light many features of *Meiolania*'s anatomy. In 1992, Gaffney deduced that the extinct horned turtle from Queensland, which was originally called *Meiolania oweni*, was very different from the Lord Howe Island species (*Meiolania platyceps*). This meant that a new genus was necessary, and Gaffney named it *Ninjemys* – literally the 'ninja turtle' which he justified in his manuscript as "*in allusion to that totally rad, fearsome foursome epitomizing shelled success*" – the *Teenage Mutant Ninja Turtles!*

Apart from the Queensland species which he named *Ninjemys oweni*, one other meiolaniid from mainland Australia was named by Gaffney, this time in association with Prof Mike Archer and Dr Arthur White. This turtle, *Warkalania carinaminor*, was found at the famous Riversleigh site in north-western Queensland and, at around 20 million years old, is much older than either *Ninjemys* or *Meiolania* – although still younger than the Argentine *Niolamia*. In addition to this discovery, further meiolaniid material has also been reported from near Wyandotte in Queensland, as well as from New South Wales, South Australia and the Northern Territory. The Northern Territory specimen was tentatively named *Meiolania brevicollis* by Alice Springs geologist Dirk

***In 1980 the Australian Museum and American Museum of Natural History held a joint expedition to Lord Howe Island where the excavation of a site near "Trader Nick's Store" was carried out (right). The site, which was known to have produced fossil material in the 1920's, produced numerous bird and meiolaniid bones. The team (from left to right) included Ed Wilson, Robert Jones and Alex Ritchie of the Australian Museum, and Steven Barghoorn, Paul Sereno and Eugene Gaffney (not in picture) from the American Museum of Natural History.***

*Photo Eugene Gaffney courtesy Lord Howe Island Historical Society*





Images by Eugene Gaffney

Megirian and colleagues in 1992. Interestingly, Gaffney and his colleagues also described meiolaniid specimens from New Caledonia which were found to be very young indeed (geologically speaking) – less than 100,000 years old, and possibly as young as 1,720 years old in one case!

In recent years, the South American meiolaniid turtles have been studied by Juliana Sterli who has revisited all of the *Niolamia* and *Crossochelys* material. Sterli's conclusions agree with an earlier suggestion made by Gaffney that *Crossochelys*, rather than being a separate species, was in fact a juvenile *Niolamia*. She also determined that the South American meiolaniids were Eocene in age and not Cretaceous as had been previously suspected, meaning that no known meiolaniids lived alongside the dinosaurs. Nevertheless, Sterli concluded that the ancestors of the horned turtles did coexist with dinosaurs in Australia, South America, Europe and Asia, and that one of these more primitive relatives (*Peligrochelys walshae*) even survived the end-Cretaceous extinction, as did the direct ancestor of the meiolaniids. In more recent years several small meiolaniid-like turtles have been recovered from the 110 million year old opal deposits of Lightning Ridge in western New South Wales and preliminary research on these specimens has been undertaken by Dr Elizabeth Smith of the Australian Opal Centre.

More recent research by Arthur White and colleagues has shown that meiolaniids also lived on Vanuatu, and were even eaten by humans. The remains of a meiolaniid they named *Meiolania damelipi* were found in the middens (ancient waste piles comprising discarded bone and shell remnants) of a tribe living almost 3,000 years ago. No shells or heads were found, suggesting that the villagers butchered the turtles elsewhere and carried the meat back to the village. Furthermore, the remains of these turtles were only found in the lower levels of the midden, not the upper levels, suggesting that meiolaniids went extinct after human occupation of Vanuatu. Hunting may have been a contributing factor, as may the introduction of pigs which would have competed with the turtles for food and preyed on their nesting sites. White and his colleagues suggested that the pattern of extinction of meiolaniids on Pacific Islands coincides well with the



Photo Dr Alex Ritchie

*Dr Alex Ritchie displays a drawer full of Meiolaniid bones at the Australian Museum in Sydney (above). In 1983, a reconstruction of Meiolania platyceps was made by Eugene Gaffney using specimens held at the Australian Museum. Articulation of the skeleton (left) was based on a particularly well preserved specimen (discovered during pool excavations on Lord Howe Island in 1971) which comprises 60% of the reconstruction.*



Photo Leslie Kool

*South American vertebrate palaeontologist Juliana Sterli with the horn core of a giant Australian Meiolaniid at Museum Victoria in 2012 (above). Sterli's research career is based on the fossil turtles of South America including the Eocene meiolaniid Niolamia argentina from Argentina (below).*





timing of the arrival of humans. However, this does not explain why the meiolaniids of Lord Howe Island went extinct as there is no evidence that humans ever set foot on the Island until 1788. White and colleagues suggest that increased sea level during warm periods between ice ages may have been the cause of the extinction of the Lord Howe Island horned turtles simply because if their island was submerged, they would have lost their food sources and their habitat.

Our knowledge of the horned meiolaniid turtles has come a long way from Owen's early research on the group and there are currently four "good" meiolaniids that have been named. In order of age these are *Niolamia* from Patagonia; *Warkalania* from Riversleigh in north-western Queensland; *Ninjemyx* from south-eastern Queensland; and *Meiolania*, which includes species on Lord Howe Island (*M. platyceps*), Walpole Island (*M. mackayi*) and New Caledonia (*M.*

*damelipi*) as well as one potential species from the Northern Territory (*M. brevicollis*). As far as we are aware, all of these animals had horned skulls, and all but *Warkalania* are definitely known to have armoured tails as well. Their peculiar anatomy has generated some notoriety, prompting the inclusion of a chapter on *Meiolania platyceps* in the 1985 book *Kadimakara*, and the portrayal of *Ninjemyx* on an Australian postage stamp in 1997.

All of the known meiolaniids



*The giant meiolaniid **Ninjemys oweni** as it would have looked during the Pleistocene epoch (above). Growing up to 2.5 metres long, **Ninjemys** was one of the largest terrestrial turtles to ever exist and is known from fossilised remains in Queensland. Image by Laurie Beirne*

appear to have been herbivorous and it is believed they would have likely foraged on relatively low-growing vegetation. None had teeth and their claws, though strong, were not weapons. Yet despite their non-predatory nature, meiolaniids were heavily armoured, not just with a shell, but with horned heads and armoured tails. What did they use these weapons for? One theory is that, in the absence of predators on isolated islands, males engaged in head-butting contests or tail clubbing displays and their defensive weaponry evolved for this purpose. However, most of the earlier meiolaniids lived alongside mammalian and reptilian predators on large continents meaning that their armour and weaponry were very likely to have evolved as defensive weapons against potential predators. In fact, in comparison with *Ninjemys*, *Meiolania* has relatively small horns and a less powerfully armoured tail – maybe island isolation made meiolaniids lazy! This, of course, would not have helped them when they came into contact with humans and is one of the reasons why human interference with island animals is often so devastating.

Relatives of meiolaniids seem to have lived over most of the globe during the latter stages of the Age of the Dinosaurs, though after that they were restricted to South America and Australia. They were probably able to travel unimpeded (though no doubt rather slowly) between these two continents via Antarctica prior to the detachment of Australia about 45 million years ago, although they

appear to have survived longer in Australia and the various islands of the Pacific Ocean than in South America. Meiolaniids probably reached islands like Lord Howe from Australia by rafting on vegetation or floating out to sea and, once settled in a predator-free environment, were able to thrive in isolation. Strangely, whilst the Queensland meiolaniids like *Ninjemys* were among the largest terrestrial turtles ever to exist – up to 2.5 metres long – the island meiolaniids were actually smaller, possibly because they no longer had to worry about predators like their mainland cousins did. Sadly however, no meiolaniids remain today. Despite the fact that the extinctions of some species of meiolaniids were not caused or facilitated by human interference, we do know that this was the case for one species. And now that they are gone, we can only learn so much about their behaviour, lifestyle, eating habits and appearance from their fossils. Nevertheless, it is clear that meiolaniid turtles would have been incredible to behold – not as the giant thorny devils envisaged by Owen, but as herbivorous, terrestrial turtles with horned heads and spiked tails – definitely rivalling the Teenage Mutant Ninja Turtles as the most awesome turtles ever.



#### The Author

Dr Stephen Poropat is undertaking a postdoctoral research project through a collaboration between Uppsala University in Sweden and the Australian Age of Dinosaurs Museum.



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