BEER'N'BONES

Volume 3, Number 1. June, 2008

FLINDERS UNIVERSITY PALAEONTOLOGY SOCIETY

MESSAGE FROM THE PRESIDENT

Hi, everyone. I've been compelled through threats of torture and enforced vegetarianism to write a "letter from the president" for the new Flinders University Palaeontology Society publication. Hopefully you will enjoy reading the newsletter while you are waiting for the bus, avoiding writing assignments, not listening to your insanely boring chemistry lecture, or sitting on the toilet. We endeavour to supply you with the very best of time-wasting material. In fact, you can even supply some of that material yourself, just email Sam with your submissions. Send him some chain mail and Facebook invitations while you're at it (trust me, he loves it!!).

Thankyou to everyone who helped set up the club by turning up to the first meeting, and who helped out with events such as the sausage sizzle, field trips, and Palaeontology Week open day at the lab. The committee have been enthusiastic and helped set up society services such as this newsletter, and several non-committee members have been great in offering their time. In particular, Rob Clements, Alex Tonkin and Sarah Keiller deserve special mention for their contributions as non-committee members.

There's a rundown of the recent field trips featured further on in the newsletter to give you an idea of what you can get out of the society. Incidentally, we would like to know numbers for the July 6-12 trip to Naracoorte, so email Jess or myself if you're going to come down. As an added incentive, there will a cheap (or free, depending on how many of you pay your membership fees…) barbeque on the Friday. Also, thanks to a refit of the accommodation at Wirreanda, there will be new beds and mattresses. They even have springs. What more could you ask for? Except extermination of the creepy little buzzing invertebrates like mosquitos that seem to wait until you're nearly asleep to start their coordinated attacks (I don't have a grudge against bugs at all).

As a club, we'll also be trying to organise seminars on interesting topics that are in some way connected to palaeontology. If you have ideas for these seminars, let the committee know and we'll try to find a willing academic to give a presentation. We're also happy to try out most fundraising suggestions (we tend to exclude illegal activities from our list of money-making ideas), so if you have a reasonable idea, contact us. Well, that's all I have at the moment, except to say that the Society would not be here without you as members, and your contributions in ideas and time will make the club a success. So until the next edition, enjoy your bones. And remember, front to back.

Lesley Moore
-El Presidente

F.U.P.S. NEWS

DIG

The next trip to the Naracoorte Caves is planned for July 6-12. The only costs will be accommodation ($10.50 per night for less than 3 nights, or $9 per night for more than 3), as well as food, petrol and or course, beer. If you're interested please contact Lesley or Jess.

MEETING
The next meeting will be held on Thursday the 18th of June at 1pm at the tav. All welcome. (Pints for schooners!)

WEBSITE.
The website is currently under construction, with plans to online somewhere in the next geological era. It will feature all previous editions of 'BEER'N'BONES' as well as a photo gallery and, well were not sure what else, so if you've any ideas or photos from previous trips, email Sam.

IN SITU

NARACOORTE FIELD TRIP

The April field trip to Naracoorte was extremely productive. The first few days were spent in the lab, and specimens from three years of the Vertebrate Palaeontology topic were finally put into some semblance of order. We also sorted through wet sieving, and imagine our delight when we found shitloads of, you guessed it, rodent jaws.
We spent the rest of the week digging, and managed to bring out some finds that were slightly more exciting that bucketloads of *Rattus* and *Muridae*. Among the large amount of long bones from various species, we each managed to find *Thylacoleo* premolars and incisors. James uncovered a humerus and part of a pelvis belonging to a *Diprotodon*. Despite being

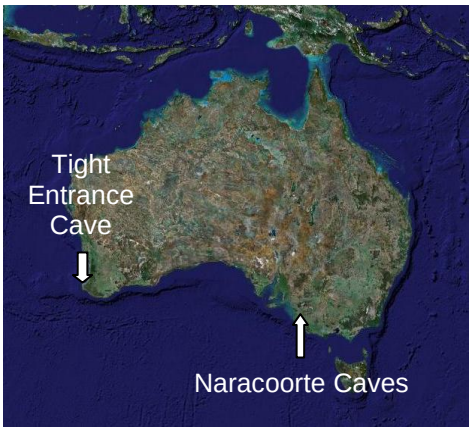
large, *Diprotodon* bone is usually quite *Lagorchestes sp.*

deteriorated when taken out of the ground, although we managed to excavate the humerus in relatively good condition. This may be due to the slightly hazardous amounts of mowital/acetone mix we poured over it before pulling it out (palaeo tip - we have discovered that confined spaces such as caves don't leave many places for noxious fumes to go).
My contributions were on a smaller scale, and included a good taphonomic sample of a wallaby skull (cf. *Lagorchestes* sp.) with termite damage (pictured).

The juvenile Thylacoleo shown next to an adult for comparison.

I also found a thylacine jaw with all teeth except the last molar still attached, as well as some sthenurine cranial material.
But by far the biggest kudos go to Jess, who at the last moment pulled out a skull from the youngest *Thylacoleo* ever found (pictured).
It was in very good condition, and because it only broke into three smaller pieces due to the youth of the animal and the sutures not being properly closed, Jess still managed to score a bottle of wine for the find. And not just any bottle of wine, one with a *label*!

Lesley Moore



TIGHT ENTRANCE CAVE,
A Beer by Beer Guide.

Tight Entrance Cave (TEC) is situated in the very southwest of Western Australia on the Cape Leeuwin Naturaliste Ridge. It currently presides over the most extensive Pleistocene fossil assemblage west of the Nullarbor. Previously the most extensive knowledge of Pleistocene faunas from the west came from the Mammoth Cave fossils collected by Ludwig Glauert in the very early 1900's. Unfortunately scant regard was paid to little else

except collecting the fossils themselves, and what may have been several well stratified, datable layers were cleaned out almost to the grain of sand. With this in mind Gavin set out in '96 to investigate the cave and I came on board on the next trip and we have been digging (on and off) and having one or two beers (after knock off) ever since.

This trip was my 7th trip to the cave, and it was in style as Gav, Carey, Sam and myself flew, rather than drove. I was pleased that Qantas now serve a complimentary James Squires Golden Ale, and it did indeed serve as a pleasant aperitif to the trips other beers.

Before embarking to Margaret River we spent a day or two at the Western Australian Museum looking for past post cranial material in the TEC bulk collection from our old trips that we may have missed (now that we are better at recognising this material), and made good evening use of the Little Creatures Brewery, downing plenty of the American styled aromatically hopped Pale Ale, whilst catching up with Mike Bunce, an ancient DNA specialist who has extracted DNA segments from Moa amongst other animals.

Down to business in TEC, we continued digging in some of the quadrats that we started last trip to extend our sample size of the upper layers of sediment. These layers are proving much more

As a matter of fact I've got it now. Grant emerges from the depths.

fossiliferous, and are providing a valuable insight into the community structure of the assemblage prior to the megafaunal extinction 50,000-40,000 years ago.

These early days saw a couple of obligatory Coopers Pale Ale cartons whilst work started up (with a documentary film crew making a brief visit early on). To say we shifted a bit of dirt on this trip would be an understatement, with Sam and Carey being the primary sievers and sorters, especially early on (due to a backlog from last trip).

For the remainder of the trip, Tasmania's best were the order of the day in the form of various Cascades and James Boags. We rounded off the trip with a carton of the local Jarrah Jacks Pemberton Ale. Amazingly, we packed the collected fossils and gear with half a day to spare and decided to venture to a local microbrewery (Colonial). The beer was good, although they hadn't filtered the IPA yet. Nice but very cloudy. These days, I can't get past bitter hops in ales, so I drank it anyway. Whilst the beer may have featured in this article, there was a lot of progress made in the dig, and this will be expanded on when we can reveal more specifics, but suffice to say we have really nailed some issues we were having with some of the overall cave stratigraphy (and gladly some of the future dating that is associated with this). We have also seriously increased our sample size from the more prolific megafaunal layers prior to their extinction, including such (extinct) finds as thylacines, *Zygomaturus*, *Thylacoleo*, *Protemnodon* and plenty of sthenurine kangaroos. Tight Entrance Cave will be a very important component in our understanding of the megafaunal extinction, and specifically what happened in the little known south west of Australia. Cheers.

Grant Gully

OLD NEWS

FOSSIL TREE-KANGAROOS FROM THE TREELESS PLAIN

The 10 living species of tree-kangaroos (genus *Dendrolagus*) are restricted to the wetter forests of far northeastern Queensland and New Guinea. For this reason, they are often viewed as ecological relics from an era when the continent was less arid. Based on molecular phylogenetic analyses of modern macropods (kangaroos and wallabies), researchers have suggested that tree-kangaroos evolved from hopping, ground-dwelling, rock-wallaby-like ancestors 4–5 million years ago. The accepted view, based largely on their current distribution, was that this transition to the trees occurred in the wet forests of northeastern Australia (Martin 2005).

Lumholtz's Tree-kangaroo Dendrolagus lumholtzi.

Tree-kangaroos are rare in the fossil record and typically represented only by fragments. Until recently, the only extinct species described were from eastern Australia. The first fossil species, *Bohra paulae* from the Wellington Caves on the western slopes of the Great Dividing Range in central eastern New South Wales, represents the only extinct Australian marsupial described solely from leg bones rather than teeth and jaws (Flannery & Szalay 1982). The second, *Bohra wilkinsonorum*, was described on the basis of one small piece of jaw from a 3.4 million-year-old site near Chinchilla in south-eastern Queensland (Dawson 2004). Perhaps when these animals were living in these areas wet forests were far more widespread than they are now, since tree-kangaroos have always been quintessential rainforest dwellers, right? Not quite.

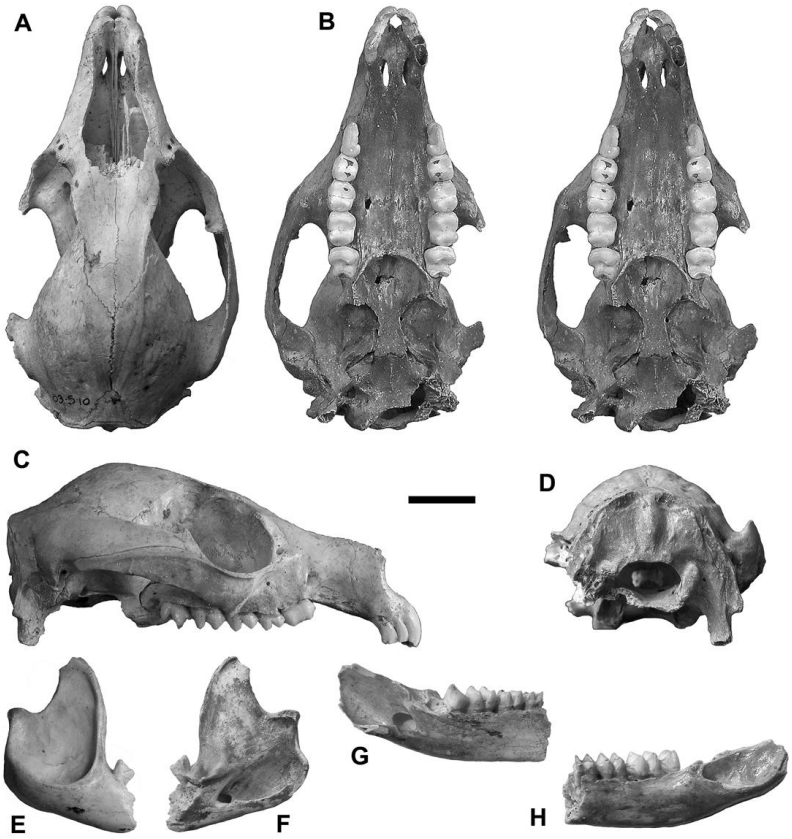
In April 2002, a small team of cavers using an ultralight aircraft to spot openings on the treeless, arid Nullarbor Plain of south-central Australia discovered three large caves with narrow solution pipe openings. Collectively named the Thylacoleo Caves, after complete skeletons of the marsupial 'lion', *Thylacoleo carnifex*, which were collected from each site, the caves preserve a diverse assemblage of Pleistocene vertebrates (Prideaux et al. 2007). The fossils are better preserved than in any other Australian Pleistocene site, with several new and previously incompletely known species represented by whole skeletons. The diverse herbivore assemblage, which includes 23 macropod species, implies much greater plant diversity than that of the modern plain, even though stable-isotope data indicate that the climate was just as dry as today (Prideaux et al. 2007). Today, the Nullarbor (Latin for 'treeless') is dominated by low, hardy shrubs and grasses. It is about the last place one would expect to find tree-kangaroos, so it was with an initial sense of disbelief that we identified the fossilised remains of two distinct tree-kangaroo species within collections made from the Thylacoleo Caves during the 2002 and 2003 expeditions.

The first species is represented by a near-complete adult skeleton and a partial pouch-young skeleton. Natalie Warburton and I named it *Bohra illuminata*, because of the light it sheds on the overall body form of this extinct genus (Prideaux & Warburton 2008). It also confirms the leap-of-faith made by Lyndall Dawson when she placed *B. wilkinsonorum*, known only from a jaw fragment, within the same genus as *B. paulae*, represented only by a few leg bones from a site hundreds of kilometres to the south. The description of *B. illuminata*

will appear in the June 2008 issue of the *Journal of Vertebrate Paleontology*.

Analyses show that *B. illuminata* had a very similar level of limb mobility and strength as living species of *Dendrolagus*. Even though they may have weighed up to twice as much (~20 kg) as their extant relatives, the species of *Bohra* were obviously well adapted for climbing trees. *Bohra* differed from *Dendrolagus* in overall build, possessing a larger body relative to the size of the head, and longer hind limbs relative to both forelimb length and body size (Prideaux & Warburton 2008). So while species of *Bohra* were taxonomically and functionally tree-kangaroos, their body proportions were not quite as derived relative to their terrestrial ancestor, modern *Dendrolagus*.

Within the scleromorphic woodland/shrubland mosaic inferred for the middle Pleistocene environment of the Nullarbor Plain (Prideaux et al. 2007), the two species of *Bohra* may have utilised a range of small tree species now largely restricted in this region to remnant stands on the periphery of the plain. These include *Myoporum platycarpum* (sugarwood), *Pittosporum phylliraeoides* (native apricot), *Santalum acuminatum* (sweet quandong), *S. spicatum* (sandalwood), *Alectryon oleifolius* (bullock bush) and *Acacia papyrocarpa* (western myall), plants with palatable leaves and/or fleshy fruit now highly sought after by introduced ungulates and



Skull and jaws of Bohra illuminata.

rabbits (Mitchell & Wilcox 1998). Although adapted to dry environments, all of these plants are united by their sensitivity to fire, and it may have been an increase in bushfires rather than climate change that led to the disappearance of trees and thence tree-kangaroos from the Nullarbor Plain (Prideaux et al. 2007).

The presence of these Pleistocene species on the Nullarbor Plain clearly indicates that tree-kangaroos must have had far broader geographic and climatic ranges than we have previously imagined. Tree-kangaroos were not always restricted to forested habitats, and may represent the hitherto 'missing' arboreal folivores (primate equivalents) of the semiarid woodlands of late Cenozoic Australia. Interestingly, we are now starting to recognise more tree-kangaroo fossils within collections previously made from the Lake Eyre Basin in central Australia, Yorke Peninsula and southeastern Queensland. This serves to remind us of just how little we still understand about the Australian vertebrate fossil record.

Gavin Prideaux,
Australian Research Fellow, Biological Sciences, Flinders University

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AMPHIBIAN FOSSIL REVIEWS PHYLOGENY

Palaeontologists from Texas, USA are reporting the discovery of an Early Permian fossil that claims to be able to resolve another 'missing link' in the fossil record. The link is between frogs and salamanders, over which there has been considerable debate on whether the relationship between them is monophyletic or polyphyletic. The fossil discovered has been named *Gerobatrachus hottoni* or 'aged frog'. This may be a misnomer however, as the specimen was deemed to be a juvenile.
The specimen is approximately 110mm long and was preserved fully articulated with only a small number of bones missing. The importance of this fossil lies in its features, which

G. hottoni in situ.

place it firmly between the 2 lineages, with characters present from each. Among these are a broad skull with large palatial vacuities, as is seen in Palaeozoic frogs, and tarsal elements consistent with salamanders. The intermediate characteristics are also telling, such as the number of vertebrae; 17, as compared to frogs, ~21, and salamanders, 14. The holotype was deemed to fall as an immediate sister taxon to Batriachians, supporting a monophyletic origin for extant frogs and salamanders but separate to caecilians (fossil worm-like amphibians). This also lowers the separation of frogs and salamanders, to now have occurred at least after the Early Permian (269-270)±0.7 mya. This is significantly later than molecular clocks have established of 308±20 mya, and 357±40 mya.

Sam Arman

Anderson, Jason S., Reisz, Robert R., Scott, Diane, Fröbisch, & Sumida, Stuart S., A stem batrachian from the Early Permian of Texas and the origin of frogs and salamanders, *Nature*, Vol453, 22 May 2008

PLATYPUS: STILL WEIRD

Naturalists first encountered the platypus in 1798, when a sketch and pelt of one was sent by the Governor of New South Wales to the UK. Upon viewing this specimen, George Shaw pronounced that the creature must be a hoax, made from a duck and a beaver. This view was later curtailed for the more accurate description of 'real' and was furthered over time by palaeontologists, tracing the monotremes to ancestors predating both eutherian and marsupial mammals. This view has been furthered by the recent sequencing of the platypus genome. The full results of the 52 chromosomal, 2.3 gigabase analysis has also solidified a genetic basis for some of the other peculiar characteristics of the 20 cent figurehead. The relationship of platypus to mammals and sauropsids (birds and reptiles) has always been of particular interest. This is because the

platypus displays traits characteristic to both groups. Platypuses lay eggs, and produce venom, like sauropsids, but their young are fed on milk and they are covered in fur like mammals. Even on the chromosomal level the platypus has five X and five Y chromosomes, analogous to bird sex chromosomes.
When the genome was compared to these groups, this homology was confirmed. MicroRNA sequences were compared to mouse, human and chicken genomes, and while 137 were found to be conserved over all vertebrates, there were also 10 found only in monotremes and eutherian mammals, and 4 found only in monotremes and sauropsids. It also found 183 novel microRNA found only in platypus to date. The analysis also found 2 ZPAX genes, seen previously only in birds and fish.
The previously mentioned sex genes were also found to be avian like, and appear to have been evolved from 'a bird like ancestral reptilian system'. From the statistical analysis, the study confirmed the view that 'marsupials and eutherians are more closely related to each other than either is to monotremes'.
Mean microsatellite coverage also show the platypus to be more similar to birds than to other mammals. Using molecular dating the last common ancestor of the Platypus and echidna was also estimated to have been approximately 21.2mya. So the original scepticism of the first scientific encounters with the platypus appears to be well founded; the platypus really is like nothing else on earth.

Sam Arman

A John Gould Platypus Print from 1863.

Genome analysis of the platypus reveals unique signature of evolution, *Nature*, Volume 453, 8 May 2008
http://en.wikipedia.org/wiki/Platypus

INTERVIEW
LINDSAY HATCHER

How did you first become interested in palaeontology?
I was bored, working a job as a teacher in 1975. We went out to Jurassic hills outside Geraldton and started looking to see what was out there.

What did you find?
Ammonites, seashells; it was a seashell deposit.

And how did you move on from there?
In 1977 a friend and fellow teacher was into caving and offered a trip down south to go caving so I went with him. I said 'what's that bone, what's that bone?' And no-one could tell me. So I started to collect a reference collection over time and started to learn as much as we could about the bones. Soon we could identify most of them and we saved a lot of the fossils off the cave floor which would have otherwise been destroyed.

How are palaeontology and caving connected?
Caving is just a small part of palaeontology. Significant deposits have been found in caves because they're great deposits, because everything's fairly stable in caves. Caves just happen to be really good repositories of fossils. And they're covered in calcium carbonate so they last forever.

What is the story behind Tight Entrance Cave?
It was a training cave back in the seventies for one of the caving clubs in Perth.
A 'life be in it' cave because it was squeezy and tight to get in. I was taken into it in the early nineties and spotted lots of bones lying on the surface that people had been trampling over. We collected the surface material but no-one seemed to be interested from the museum. So we made a bit [sic] of a sample pit and collected a huge menagerie of specimens. It just happened by chance in 95-96 Gavin Prideaux came over and was interested in kangaroos and I showed him what we had found. It just led on from there.

What has this process taught you about palaeontology in practice?
The early people who gutted mammoth cave didn't have any processes at all.
They removed thirty cubic meters of material and didn't leave any sediments or materials behind. So we don't know anything about them in terms of dating and stratigraphy. This is a great window here because we can

get all the sediments and stratigraphic layers and date them and find out all sorts of information. Find out lots of information on past climates and the animals and whether it was climate or humans that caused the extinctions.

H. Ringy at work.

You also help run the caves in the Leewin-Naturaliste region through Caveworks, which has a significant portion of palaeontology in its attractions. How do you see the link between palaeontology and tourism?
Down the track we would love to turn mammoth cave into a megafaunal site, because it was the first megafauna cave found in Western Australia back in the early 1900's. We'd like to utilize that because not enough of our children and even adults know a lot about our past creatures, especially like the marsupial lion and *Zygomaturus*, which have both been found here. We'd like to educate them as well as encouraging them to come see the caves. So it could be an expanding of product. We don't have a lot of megafauna but if we expand it, it might increase sales, as well as educate them.

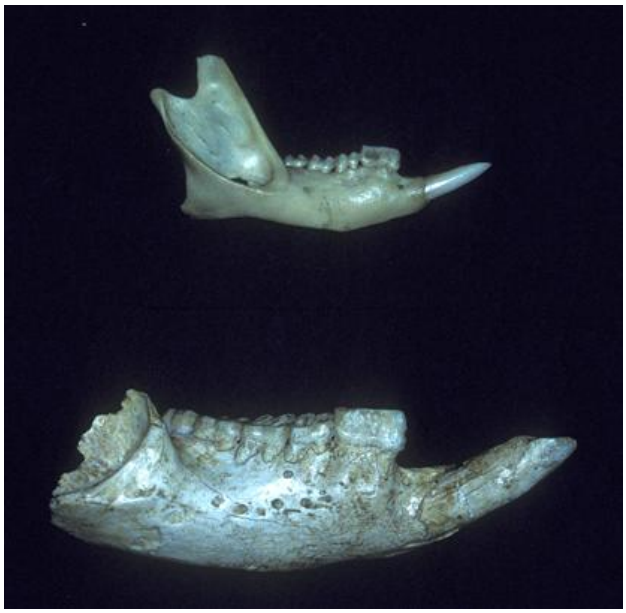
You've worked with a number of palaeontologists over the years. How would you describe these experiences?
It's always just been downhill. Palaeontologists just want to take all the best specimens (laugh). It's been great working with Gavin [Prideaux]. The rewards are finding out all the details of the caves, especially the dating, and also his research out in the Nullarbor. Probably the most rewarding was finding the *Thylacoleo* out in the Nullarbor.

Your contribution to palaeontology was recognised in the species name of the giant bettong *Borungaboodie hatcheri* How did this come about and what effect has it had on you personally?
Well I wasn't actually there when they found it. Gavin found it, and he named it after me in recognition of what I had led him to, which I was really chuffed about. I don't think it had a huge profound effect on me. It's just nice to have something named after you I suppose. I don't know. It's not important.

How would you encourage young people who are considering becoming involved in palaeontology?
If I was a realist I wouldn't encourage them. There's no jobs in it. But it's a rewarding experience and you can learn a lot about history. Especially the history of Australia and its past climates and the animals that used to live here, and maybe fore tell what's going to happen down the track. If we know what happened in the past we may be able to manage what's going to happen in the future. Personally I'd encourage them, but if you were a realist you wouldn't. Take lots of field trips. Find something unique. But it's really hard; hard yet rewarding. I was just extremely lucky.

Upon thinking the recorder was off, Lindsey went on to add.
The bastards stole all my fossils. Promised to give me casts but never have. They con me out of the fossils and they still haven't come good with the casts.

Interview by Sam Arman

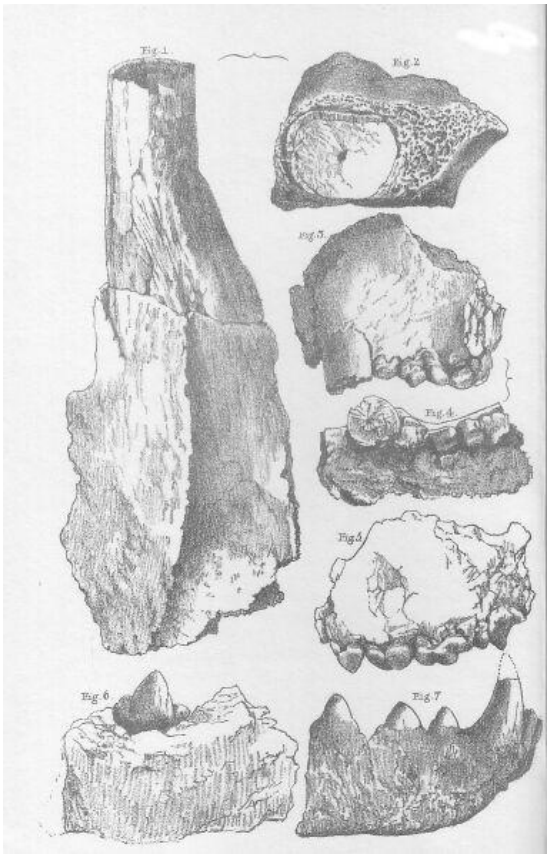


The Holotype and only known specimen of Borungaboodie hatcheri (bottom) compared with a regular Bettong (top).

FEATURE FOSSIL

A facet of the format of this feverish publication in future will be the Feature Fossil; a frivolous yet functional footnote into the facts of fortuitous fossilisation. As the first of a few to follow, this foetal following, has the features of foundation familiar to this issue itself.

Diprotodon opatum
In 1836, surveyor general Sir Thomas Mitchell ventured into a series of caves near Wellington in what was then the colony of New South Wales. As their team ventured into a pitfall formation, one of their members was, 'fixing a rope to what seemed like a projecting portion of rock, he let himself down to another stage, where he discovered, on the fragment giving way, that the rope had been fastened to a very large bone, and thus these fossils were discovered.'
And so began Australia's great story of marsupial palaeontology. Within this cave was discovered the first fossil mammals to be described from Australia. Among them were a number of extinct kangaroos, a Wombat, Brush Tailed Possums, a Potoroo, and the star of the show, the Diprotodon.
Diprotodon, (Greek *Di* 'two' *proto* 'front' *don* 'tooth') was originally named by a lone right lower jaw fragment with incisor. Conjectured to belong to the Dugong family, it was described by Sir Richard Owen to have a greater affinity to living wombats due to the position and structure of the tooth and corresponding pattern of enamel as shown on the original lithograph below.



The original lithograph. The Diprotodon incisor is the two top pictures. The others are dasyurids.

Now known from many complete specimens, the Diprotodon lived throughout the Pleistocene, becoming extinct in the megafaunal extinction around 30 000 years ago. It was the largest of all the Australian megafauna, growing approximately two metres tall and three metres long. They ranged throughout mainland Australia, from the tropical north, through the arid interior and into the temperate south. They inhabited open forest, woodlands, and grasslands, possibly staying close to water, and eating leaves, shrubs and some grasses.The taxonomic status of Diprotodonts is not entirely clear, but there are at least two species recognised; Diprotodon opatum, and Diprotodon minor.
As well as the enormous Diprotodons, there are also a number of distinct genera that fall into its family, such as Pitikantia; a sheep sized Diprotodontine, and Euryzygoma, whose broad cheek arches have led some to propose that they may have stored food in cheek pouches. The origin of Diprotodonts and their relatives is largely unknown, due to Australia's lack of fossils from the Pliocene to Oligocene eras, where the marsupial radiation is believed to have happened.

Sam Arman

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