DINOSAUR DREAMING 2016 FIELD REPORT

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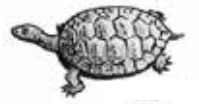

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Dinosaur Dreaming would like to extend special thanks to Robert Huntley, our volunteer webmaster, who updates our website each month.

VISIT OUR WEBSITE:

www.dinosaurdreaming.net

AND OUR BLOG:

www.dinodreaming.blogspot.com

FRONT COVER: The phalanx (finger) found this year with the ungual (claw) found in 2014. Image by David Pickering, Museum Victoria.

BACK COVER: A reconstruction of the lower jaw of *Teinolophos trusleri*. Illustration by Peter Trusler: Rich *et al*. (2016)

The Dinosaur Dreaming 2015 Field Report was compiled and edited by Wendy White. Special thanks to my proofreaders Alanna Maguire, Stephen Poropat, Mary Walters and Dorothy White. Uncredited images by the editor.

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Image: R Zugaro, Museum Victoria

View from the wrapping station

By Wendy White

Firstly, so that it's not looming for my whole article, an apology to the Week 2 crew. I forgot to take a crew photo. I'm going to try to think up a good excuse. It is true that the Friday (the day that everyone usually reminds me there's been no photo yet) was rained out, and I had a bit of a cold and was performing sub-optimally. Perhaps I should blame the wave that had the Week 1 photo participants leaping to safety. Or I could try to shift the blame to Cassia Paragnani who, sometime in Week 2, became my semi-professional photography assistant, but that would be completely unfair since the bottom line is that I forgot. Sorry about that.

There were a couple of interesting and useful innovations this year. I take credit for neither, even though they directly relate to spotting and transporting fossils.

The first idea came from Ali Calvey. As Ali started finding fossils, I noticed that she had drawn a couple of parallel lines on each face of the outside of the rock, crossing the break that had revealed the fossil. Ali is a long-time volunteer at the Australian Age of Dinosaurs Dig in Winton, Queensland. They regularly find large fossils in many (many) parts, and use these lines to make it possible to fit it all back together in the lab. At our site, I found the "Ali lines" useful when I was fitting the fossil back together to determine if it was complete, or if I needed to send the volunteer back to search for the final piece. I'd say it was only half-implemented, though, possibly because I'd lost my voice and so did not think of a song to reinforce the message. I will work on that this year, and find one worthy of joining the ranks of old favourites like:

- If you love it then you should have put a ring round it
- You've got the cutest little beetle bum
- Isn't it good? Cretaceous wood…
- Mud, mud, Cretaceous mud, there's nothing quite like it for cooling the blood.

The second innovation was initiated by our resident sedimentologist, Alan Tait, although surprisingly, it had nothing to do with rocks. He gave me a bottle of lens cleaner, which languished at the bottom of the Prep Kit Bucket for the first week. In that week, it was calm and sunny (with many swim o'clocks) and our equipment stayed relatively clean and clear. Towards the end of Week 2, the skies grew darker and the wind sprung up, sending a fine spray of salt water over our site. This left a salt encrustation on safety glasses and hand lenses. Cassia Paragnani became the restorer of sight, walking the lens cleaner around to the crew a couple of times a day.

This dig, I catalogued 520 probable fossils, with a quite uneven spread over days, even accounting for the two rain days (Friday 19 and Wednesday 24 February) and the crew changeover days (on Saturdays). Some days we were obviously digging in the right spot, and some days removing less fruitful rock to get to the good stuff.

Week 1 was glorious and sunny and perfect. We found a handful of rather scrappy bones on the first day (Saturday 6 February) with a small crew, as the bulk of the participants were still arriving and putting up their tents. We were accompanied to site by Robert Zugaro from Museum Victoria, who was filming a short documentary to accompany the visiting Jurassic World exhibition.

Image: R Zugaro, Museum Victoria

The crew working on the beach at Eric the Red West

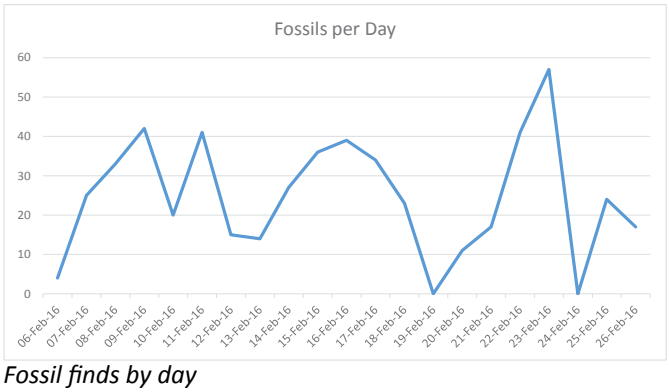
We hit the second day (Sunday 7 February) running. We were happy with our haul of 25 fossils, including a number of nice vertebrae. Alan Tait and David Pickering found something that, for a short while, we hoped was a mammal jaw. Mary Walters found something lovely and thin-walled and possibly skully. First-time diggers Robert Bender and Ali Calvey found the first "newbie" fossils of the dig.

Monday 8 February we found even more fossils (33 including one unioid), and Corrie Williams delivered to me 3 probable maxillae (upper jaws) from the excavation site. We also extracted a very thin-walled limb that we speculated (possibly wildly) might be a pterosaur.

On Tuesday 9 February, the upward trend of our fossil count (42 including one unioid) continued, and we were all predicting a record-breaking season. The crew felt invigorated after the warm-up exercises. We found a possible pelvic element, and Adele Pentland found the first unequivocal tooth.

And then we only found 20 fossils on Wednesday 10 February. Of course, it is not quantity that matters, because one of the vertebrae that we found looked far more crocodilian than dinosaurian.

On Thursday 11 February we reclaimed our fossil-finding mojo — 41 fossils including two beautiful teeth found by Amber Craig. This tally was more notable because many of the crew took a break from breaking rock to remove sand from and wash



Fossil finds by day

Image: C Paragnani

Wendy White dispensing packing materials to David Pickering

down a section of the shore platform. Alan Tait had noticed that the fossil layer was pinching out in our main excavation site, and was keen to learn if the fossil-bearing layer extended further up the beach.

Our mojo was short-lived, and Friday 12 February yielded 15 fossils. We could blame the distraction of the tide coming in over our favourite rock-breaking positions, but moving up the beach really didn't take that long. The stars of the day were a lovely ornithopod mandible (lower jaw) from the excavation site and a beautiful tooth found by Norman Gardiner that we think might be plesiosaur.

Saturday 13 February was crew change-over day, with a respectable short-day total of 14 fossils. Billy Parker found a tooth, and Kelly Gardiner was the first of the Week 2 rookies to find bone.

Sunday 14 February – 27 fossils, many of them nice. We had a mandible (lower jaw), a couple of teeth, an ungual (claw) and a large limb bone from the hole.

36 fossils (including a seed pod) on Monday 15 February. That's more like it. It rained just a little, and finding fossils makes that more bearable. Bone of the day was a large arm bone from the hole that we all hope is theropod.

39 fossils on Tuesday 16 February, and we're certain we're in the good stuff. It was cold and windy, and, unusually for Eric the Red West, the

The crew warming up on the beach at Eric the Red West

tide had invaded our hole overnight. Some larger bones came out of the hole, including one we were almost certain was an ulna. And, of course, the phalanx (finger bone) from the hole, pictured on the front cover.

34 fossils (including one unioid) on Wednesday 17 February – we've hit our rhythm. One bone comes crumbling out of the hole delivered to me in a vial that I am too scared to open.

Thursday 18 February the sun comes out again, the diggers emerge from their raincoats and we can see them smile again — only 24 fossils, including a lungfish tooth plate (I know we don't have a scientist particularly interested in them at the moment, but they sure are pretty).

Friday 19 February and it is so wet we do not attempt the beach. I do laundry and update the blog. I forget to take a crew photo.

Crew changeover day on Saturday 20 February — 11 fossils, including a large dinosaur bone from the hole.

Sunday 21 February is Friends' Day. We find 17 fossils including a beautiful big ornithopod jaw.

Monday 22 February — 41 fossils. A good day, despite a slow start. I find a tooth. I mainly wrap fossils rather than finding them so I'm very, very chuffed. Darren Bellingham finds a cone from a conifer (similar to *Araucaria*).

Tuesday 23 February delivers a whopping 57 fossils. I'm not sure how I managed to wrap them

Image: C Poropat

Wendy White and Mary Walters with packing materials

all. There is a possible plesiosaur tooth, a little ornithopod tooth, and a possible pelvis or fused scapula. Nick van Klaveren finds something that has us all puzzling for a while, until Mary Walters recalls seeing a picture of a lungfish skull that might explain it.

Wednesday 24 February is rained out. I do laundry and update the blog.

Thursday 25 February is our last full day of rock-breaking. I catalogue 24 fossils.

Friday 26 February is our last day at site, and mid-afternoon we stop breaking rock and clean up —17 fossils.

In between finding fossils we drew dinosaurs on each other, gossiped about nonexistent dig romances, listened to our palaeontologists Dr Tom Rich and Dr Stephen Poropat tell us about the latest in dinosaur (and mammal) research, did morning tea quizzes and played card games with varying skill.

A special thanks to the *chefs de cuisine* especially Corrie Williams, Pip Cleeland, Cate Cousland and Tamara Camilleri without whom the diggers would be somewhat thinner and decidedly less happy.

The crew washing rock at Eric the Red West

FROM THE LAB

BY DAVID PICKERING

Preparation Projects

The Victorian Cretaceous (Dinosaur Dreaming) Eric the Red West (ETRW) 2016 — David Pickering, Alan Tait, Paul Chedgey, Astrid Werner, Billy Parker and Geoff Thomas.

Cenozoic Marine Mammals (Australian and international) — Tim Ziegler, Erich Fitzgerald, Ben Francischelli and Astrid Werner.

Victorian Cenozoic Mammals — David Pickering, Paul Chedgey, Lisa Nink and David Thomas.

Trainee and Support Preparators — Darren Bellingham, Bridget Firth, Nathan Gregory, Jenny Monaghan, Cassia Paragnani, James Rule, Nova Taylor, David Thomas and Dean Wright.

During 2016

Museum Victoria geosciences departments (palaeontology and mineralogy) were involved in a complete relocation of all of their facilities — collections, offices, libraries, laboratories and storerooms – from the infamous and iconic basement of the Royal Exhibition Building to new premises on Level 2 West in the Melbourne Museum. We traded in our classic for the latest model — more efficient, more reliable, but with less historic appeal.

This shifting of a vertebrate palaeontology collection of more than 250,000 specimens, an invertebrate collection of a few million specimens and a mineralogy component of "lots and lots of rocks" could not help but affect our normal preparation numbers. Consequently, we have only 20 ETRW 2016 specimens finished and registered – usually, we would have triple this number by now. It also explains the fact that we have not produced a marquee specimen – no theropod claw, no mammal specimens, nothing to star in a scientific paper… yet.

Here are some statistics of the specimens from ETRW 2016:

Registered Specimens (x20) are those that are given a unique number starting in "P" (for example P252741) and whose complete data set is entered into the Museum Victoria's digital data base (KE EMu), which is a serious bit of kit. Every person who has found a specimen that has been registered has details stored in EMu. Sounds scary.

Lower Priority Specimens (x26) are ones which we hope to eventually prepare and register, but because they are not as scientifically important (for example common elements of well-known taxa or complex elements of known animals, like ornithopod vertebra which are time-consuming to prepare) they are considered lower priority. These are stored separately for one day when we have another ten preparators working for us! We have cabinets of lower priority specimens dating back to our days at Flat Rocks.

Specimens which require further checking (x22). This category is self-explanatory — work is required before we can decide which basket to put it in.

Discarded or, to be kinder and more accurate, rock to be further processed (x259). Specimens that do not make the grade for whatever reason (some are not even fossils) are not just thrown into a skip. Alan Tait has taken it upon himself to take all of the discarded rock home (his wife must hate me!) and carefully break it down. He has made a number of significant finds doing this.

Production line (x198). These specimens have all been selected for preparation with the highest priority. The smaller, more fragile ones will be prepared with the aid of hand tools only, while robust fossils on larger pieces of rock will require the use of compressed air scribes.

SEEN IN THE FIELD

BY WENDY WHITE

SEEN IN THE LAB

BY DAVID PICKERING

After the success of last year's article, we thought it might again be interesting to compare what we see in the field with what we can see in the lab. In the field, things are rushed and either sun or rain is beating down, the wind is threatening to blow away delicate fossils and a salty film is slowly covering our hand lenses. In the lab, the light is good, the microscope is expensive and skilled technicians can remove any sand grains obscuring diagnostic elements.

Here is a sample of fossils from the Field Catalogue and their lab notes, part way through initial lab analysis.

Ref #	**Field Description**	**Lab Notes**
6	David Pickering's very attractive vertebra	Neat vert processes
7	Rather more shapely bone from hole	Goes nowhere
18	Wendy White's little fish scale	Not fish scale. Mica
19	Dave's scrappy frag	Can't believe I found this!
20	Nick van Klaveren's nice vertebra	LP Vert requires much work
21	Dean Wright's pretty little vert	Neat vert. Req. much work
42	Nick's underwhelming brown blob	Beetlebum kept w BB collection
44	Mike Cleeland's crumbly XS	Too little - Too smashed - No ends
53	Ben's schmooshed limb	Death by chisel. Alan to check further
59	Corrie's poss tooth root	Not tooth. No ends
90	Jeremy Baker Smith's spongy XS shaped like a hat	Alan Tait to process
91	Schmooshed limb from hole	So schmooshed
92	Gen Cini's curved spongy XS	Crushed w no ends
125	Little vert from hole	Awful! Discard
142	Jeremy's possible vert	Not vert. Plate w no finished edges
143	Dean Wright's microscope-check	Carbonised wood. Discard
147	Ben Francischelli's schmooshed spongy one	Frags of Fish. Discard
148	Half only circular XS on outside of rock	Perfect rock for Alan to break up
157	The one James offered to carry up the hill	Alan to check
161	Outside edge on outside edge from hole	Carbonised wood. Discard
162	Mary Walter's poss croc / turtle plate	Not croc. No finished edges. Discard
166	Ornithopod jaw from hole (in 2 pieces)	Partial right maxilla w teeth. Register P252568
218	Found by Mary — bit of bone	Unworthy of you, Mary! Discard

Ref #	Field Description	Lab Notes
219	Found by Ben — small limb	Frag only. No ends. Discard
235	Little vert	Unfortunately too smashed
278	Vertebra from hole	P252582 Ornithopod. Caudal vert
279	Mary's large oval spongy XS	P252584 Ornithopod. Lacrimal (skull element) ident. by Paul Barrett June 2016. Prep by L Kool
330	Large limb bone	Theropod manual phalanx. Register P252405
343	Elaine's rib	Rib but too smashed
347	Many many pieces — poss 1 long bone	Many frags. Too smashed
350	Sharyn's little centrum / toe	Not enough there. Sorry Sharyn
354	Mary's turtle plate	Lesley Kool's call. Discard. No finished edges
356	XS of unidentified bone found by Norman G	Not bone
360	Long shaft bone found in hole	Alan to judge worthiness
363	Large dino bone found in hole — unidentified	Ornithopoda. Complete right femur. Register P252570
376	Nick's beautiful lungfish plate	Turtle plate w no finished edges
381	Beautiful big ornithischian jaw + other bones	Ornithopoda. Edent right dentary (jaw). Register P252569
383	2 limb bones (in 2 pieces)	Fraggy plate
385	Steve wanted to send this one for a micro check and he's nice so I said yes	Not Bone. Carbonised plant
389	Norman's D-shaped spongy XS	Busted blob. Alas
390	Uninspiring long bone from hole	Perfectly correct, Wendy
394	John Swinkel's first fossil	Scrap only
395	John Swinkel's second fossil	Scrap only. Worse than first fossil. Sorry John
397	Nova's pretty vert	LP, yes but will be kept for future
400	Vert from hole	Interesting piece but way too busted. Pity!
402	Mel's ornithopod tooth	Ornith tooth alright. Yay Mel!
411	Scrap from hole	Yer not wrong
412	Nova's blob	Bad Blob!
463	x2 half bones – X1 rock sawn, x1 blobby.	X1 frag plus “blobby” is coal
467	Nick's tooth	Ornithopod tooth — too badly broken to fix
485	Darren’s tooth	Mostly impression. Ornith tooth gone to God
492	Steve says poss girdle element but it looks like a vert to me	Too crumbly + incomplete
500	Joerg’s nice caudal vert (or toe)	Neat caudal — but complete centre section missing
516	Nova's thin bone — ossified tendon?	Maybe but too rooted to fix

Alan's #3 hole – where to from here?

By Alan Tait

The genesis of the Eric the Red West (ETRW) dig was the discovery of a partial articulated ornithopod skeleton in November 2005 at the western end of an exposure of sandstone between Crayfish Bay and the Eric the Red anchor, on the coast, east of the Cape Otway lighthouse. Since then, there have been excavations of some sort at ETRW every year, buoyed by the discovery of a mammal jaw in 2006 and a mammal upper jaw in 2009. Up to 2013, the ETRW dig was usually around eight days long (weather and permits permitting) and had become the training dig for the annual Flat Rocks dig. In 2014, the three-week-long Dinosaur Dreaming dig transferred from Flat Rocks to ETRW and the reward was "The Claw". A mammal tooth and a mammal jaw discovered in 2015 have helped to keep us digging at ETRW.

The excavations were centred initially around the location of the 2005 find but gradually spread out over the exposed sandstone in search of other fossil-bearing layers. For years we avoided the eastern area where the rock was overgrown with green weed until, in 2011 the first hammer blow revealed bone. Also in 2011, several fossils were discovered on the rock surface just east of the weeds, an area usually covered by beach sand. In 2012, we continued excavating under the weeds in a greenish sandstone with rounded extrabasinal clasts, then, having exhausted that layer, moved in 2013 to the area east of the weeds. We have since been progressing steadily eastward each season following a fossil-bearing unit up to half a metre thick. The area that was originally 'East of the weeds' somehow became 'Alan's #3 hole' in 2014, although it's all the same excavation, now 18 metres long. Each year, we have had to remove beach sand from the hole at the start of the dig and then, during the excavation, keep clearing sand off the rock surface east of the active face of the hole to see where the fossil layer was going. Last year, it looked as if the layer was splitting and pinching out, and this year's dig confirmed it. So now we have the problem of what to do next.

We could continue eastward along the beach, removing sand and investigating the rock beneath for a new fossil layer but, unless the sea washes the sand away, this would involve a great deal of digging sand, washing down rock and test excavation with no guarantee of finding anything. Bones have previously been found on the rock surface in this eastern area when the sand was

Image supplied by A Tait

A distorted view of the dig sandstone (above yellow line) taken in 2012

missing. However, we excavated part of this area unsuccessfully in 2011 so, unless it's all magically free of sand next February, the possibilities of this eastern area can wait until we have no other options.

Our better choice is to stay in Alan's #3 hole and try to remove more of the known fossiliferous rock which has given us, on average, three to four times as many fossils per day as earlier excavations at the west end of the sandbody.

Alan's #3 hole has a wedge-shaped cross-section because we have been working downdip to the north as well as along strike to the east, using fracture and joint surfaces to assist in removing large blocks of rock. The back of the hole is an irregular east-west vertical fracture and other vertical fractures trend northwest-southeast. This makes it easiest to work eastward removing rhomboid blocks of rock one at a time by hammering a chisel into each of the two vertical fractures behind a block and another chisel along a bedding plane under the block, thus detaching the block from the dig face. Our excavating policy is to use minimum effort to achieve maximum rock removal with minimum damage to fossils. However, the chisels have a bad habit of finding fossils in the hole, which slows down the excavation and also deprives the out-of-hole breakers of a discovery.

The suggestion is to return to the western end of the present hole, just east of the weeds, and work eastward excavating another strip of the fossiliferous rock. This will involve first removing a layer of clean sandstone overburden up to half a metre thick along the back of the hole. There should be another east-west fracture within a metre of the present back wall of the hole and this will become the new back wall. So the first days of the 2017 dig will involve removing beach sand to expose a strip of the rock surface along the back of the present hole, and then drilling holes for plugs and feathers in order to remove the overburden so that we can excavate fossiliferous rock.

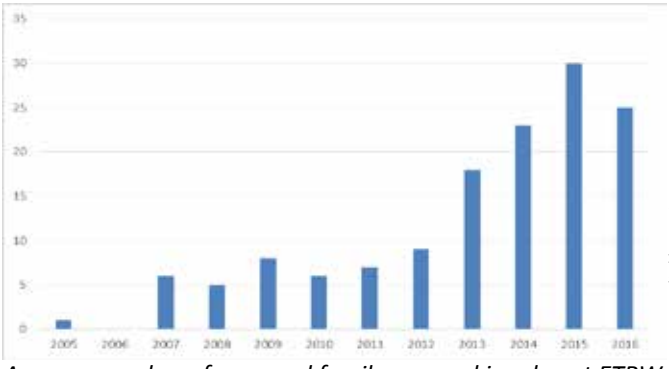


Image supplied by A Tait

Average number of wrapped fossils per working day at ETRW (no data for 2006)

This brings us to our other problem — water drainage. Because of the northward (up the beach) dip of the strata, gravitational drainage of Alan's #3 hole has often been difficult. The hole is above the normal high tide line but fills with water seeping out of the dunes. The drainage problem will get worse as we follow the fossil layers downdip and may prevent us from excavating too much farther — if our normal bailing methods become too time-consuming, we shall get out the pumps.

We do need to remember that the main purpose of the dig is to keep Wendy and her assistants busy wrapping fossils from day one. To achieve this, we should first reopen the far eastern end of Alan's #3 hole where we finished last year, and remove the remainder of the (relatively) easily accessible fossiliferous rock there to supply the breakers with something to break.

So the dig plan for 2017 is firstly to remove sand from the east end of Alan's #3 hole to allow a hole crew to remove rock for the breakers. We will then remove sand from the west end of Alan's #3 hole in order to drill holes for plugs and feathers and start to remove overburden for the second slice of the hole. Once we have a stockpile of breakable rock from the east end of the hole, those not involved with the west end opening can start breaking rock, finding fossils and taking them to Wendy for wrapping. And all the other aspects of the dig will fall into place as usual, we hope, weather permitting.


Image courtesy Museum Victoria

RESEARCH REPORT

BY TOM RICH

The annual excavations at Eric the Red West (ETRW) have moved progressively eastwards after beginning at the locality where George Casper discovered a partial skeleton of an ornithopod in 2005. A few brief field trips were held there in the immediately ensuing years, after which the yield decreased. Amongst other things, two partial mammalian specimens were found including one upper dentition — a goal that eluded all efforts at Flat Rocks where many lower mammalian jaws were found but no uppers. Since beginning the excavations at Alan's #3 hole a few years ago (at the extreme eastern end of where fossils have been systematically excavated), the yield has significantly increased.

It seems that the eastern limit of the richly fossiliferous unit that is Alan's #3 hole has now been reached. In 2017 we plan to return to the western edge of Alan's #3 hole and, beginning immediately further north, progressively move eastwards again. This will mean removing more overburden as the shore platform increases in elevation moving away from the ocean. In addition, the fossiliferous unit dips downward to the north. The excavation there will thus need to be somewhat lower. During high seas this might mean that the excavation could be flooded and filled with sand. However, based on previous experience at the ETRW locality, this will not occur with each incoming tide. This means that the daily ritual of shovelling out wet sand so familiar to those who worked at Flat Rocks will not be repeated.


Image: R Zugaro, Museum Victoria

Tom Rich talks to the crew at Eric the Red West

Limb bones of both theropods and ornithopods of all sizes (large limbs being particularly abundant) were found during the 2016 ETRW excavation. Because of the move of Museum Victoria's vertebrate palaeontology collection from the basement of the Royal Exhibition Building to Melbourne Museum in the first half of 2016, the preparation of specimens from this year's dig is far behind what would normally be expected. What can be said about the 2016 dental material prepared so far, is that all the ornithopods could well belong to *Atlascopcosaurus loadsi,* as has been the case at ETRW since work began there.

Because of George Casper's initial discovery of a partial skeleton of an ornithopod at this site, a primary motivation to keep digging there is the realistic possibility that with enough effort, a more complete skeleton of this ornithopod will be found. Such a fossil could establish once and for all that *Atlascopcosaurus loadsi* occurs at ETRW. It is quite likely that, 500 years ago, the fossil George Casper discovered was then complete or much more so than it was when found in 2005. The sea which made it possible for George to find the fossil in the first place almost certainly exacted a price: the erosion of much of the skeleton.

A phalanx that time did permit to be fully prepared could have, in life, articulated with a terminal phalanx like "The Claw" that was found in 2014 and referred to the theropod *Australovenator* (see cover photo). At this rate, in about two centuries, most of the skeleton of this dinosaur might be known from ETRW — a reason for this generation's great grandchildren to keep digging.

Teinolophos trusleri is the smallest, oldest and most primitive monotreme (egg-laying mammal) now known. Since the species was first named and described in 1999, it has been repeatedly analysed as more material has been found. Since the last

analysis in 2008 of this species near the base of the mammalian family tree, twenty-two people working together have recently published yet another analysis of *T. trusleri*. Two critical developments were the reason this was done. First was the discovery by Mary Walters in 2009 of a specimen preserving the anterior region of the lower jaw of *T. trusleri* that was previously completely unknown. Coupled with that was the discovery in China of exquisitely preserved mammalian specimens that strongly suggested modification to the reconstruction of the lower jaw of *T. trusleri*. Reptiles have a number of bones in the lower jaw whereas all living mammals have a single one. *T. trusleri* was previously thought to have had more than one bone in the lower jaw but, with these new specimens, it appears that it is intermediate between the typical reptilian condition and the situation common to all living mammals.

In order to restore what the lower jaw of *T. trusleri* looked like, Peter Trusler spent five weeks drawing a reconstruction (reproduced on the back cover). He worked closely with Pamela Gill and Jim Hopson to sort out details. This was necessary because of the crushed and distorted nature of some of the specimens. In the end, two interpretations of the anterior part of the jaw were illustrated because, after much discussion, it was agreed both were possible.

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FOSSIL CORNER

BY LESLEY KOOL

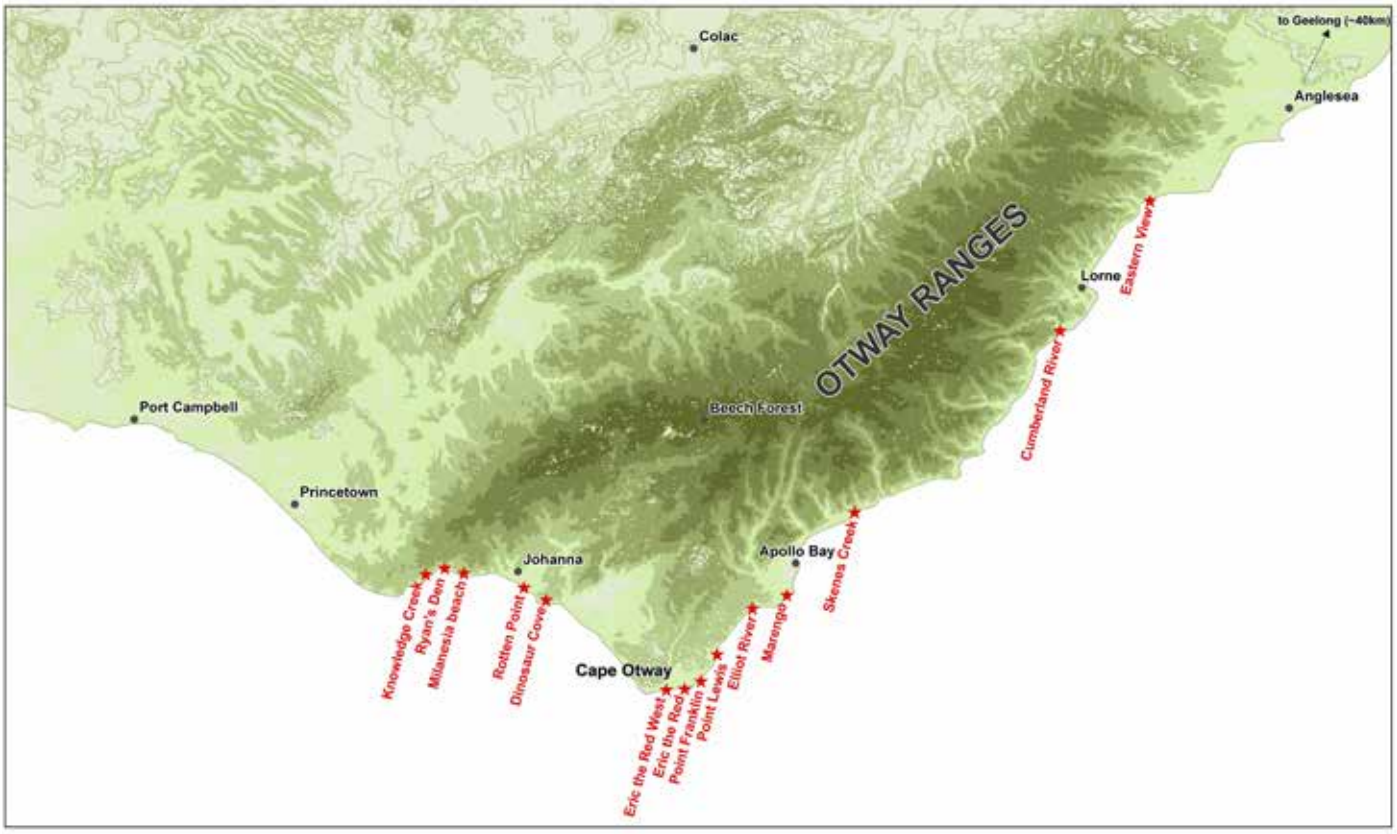
For more information on the preparation of these bones please visit Dinosaurdreaming.net.

Ornithopod tibia

Ornithopod caudal vertebra

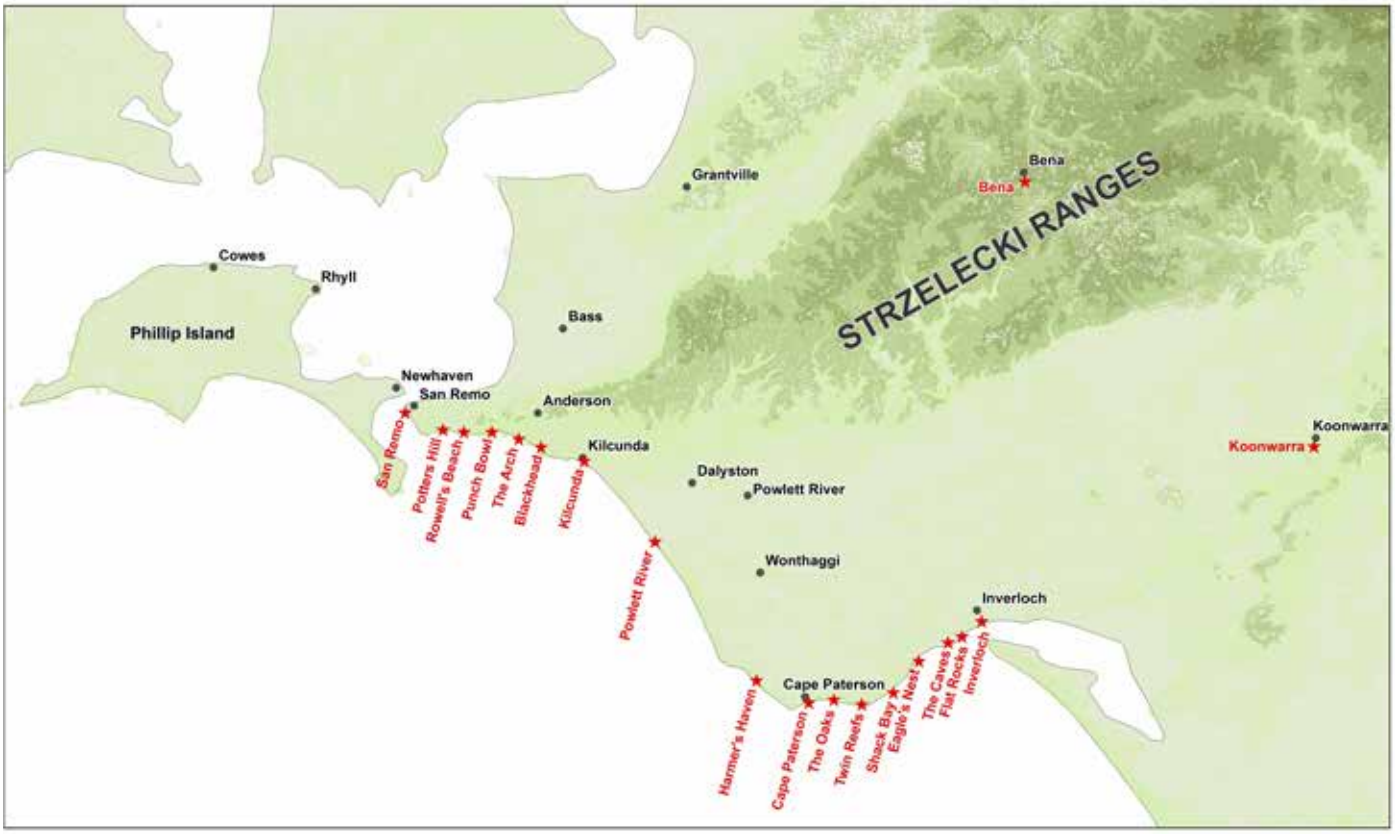
Ornithopod cervical vertebra

FOSSIL LOCALITIES IN THE OTWAYS



TAXA	Knowledge Creek	Ryan's Den	Milanesia Beach	Rotten Point	Dinosaur Cove	Eric the Red West	Eric the Red	Point Franklin	Point Lewis	Elliott River	Marengo	Skenes Creek	Cumberland River	Eastern View
Mammalia:														
Tribosphenic (Unidentified)						X								
Bishops sp.						X								
Monotremata (Unidentified)						X								
Kryoryctes cadburyi					X									
Dinosauria:														
Dinosaur (Unidentified)		X		X	X	X	X	X	X	X	X			X
Ornithopoda (Unidentified)		X		X	X	X		X	X	X	X			
Atlascopcosaurus loadsi					X				X					
Fulgurotherium australe					X									
Leaellynasaura amicagraphica					X									
Ankylosaurs/nodosaurs					X									
Neoceratopsian					X									
Theropoda (Unidentified)					X	X		X						
Spinosaurid						X								
Oviraptorasaur					X									
Ornithomimid					X									
Neovenatoridae indet.					X									
Tyrannosauroid					X									
Neovenatorid														
cf. *Australovenator*						X								
Other Vertebrates:														
Plesiosauria (aquatic reptiles)					X	X							X	
Crocodylia (crocodiles)					X									
Pterosauria (flying reptiles)					X	X								
Testudines (turtles)		X			X	X	X	X	X					
Otwayemys cunicularis					X									
Dipnoi (lungfish)					X	X			X					
Neoceratodus nargun					X				X					
Actinopterygii (ray finned fish)					X	X								
Invertebrates:														
Freshwater crustaceans														
Palaeoechinastacus australianus					X									
Bivalves (Unidentified)					X	X								
Megalovirgus flemingi					X									
Trace Fossils:														
Dinosaur footprints	X		X		X							X		
Bird footprints					X							X		
Dinosaur Burrows	X													
Crustacean Burrows: Parastacid	X				X						X	X		

FOSSIL LOCALITIES IN SOUTH GIPPSLAND



TAXA Mammalia:	San Remo	Potters Hill	Rowell's Beach	Punch Bowl	The Arch	Blackhead	Kilcunda	Powlett River	Harmer's Haven	Cape Paterson	The Oaks	Twin Reefs	Shack Bay	Eagle's Nest	The Caves	Flat Rocks	Inverloch	Bena	Koonwarra
Tribosphenic (Unidentified)																X			
Ausktribosphenos nyktos																X			
Ausktribosphenos sp.																X			
Bishops whitmorei																X			
Monotremata (Unidentified)																X			
Teinolophos trusleri																X			
Multituberculata (Unidentified)																			
Corriebaatar marywaltersae																X			
Dinosauria:																			
Dinosaur (Unidentified)	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	
Ornithopoda (Unidentified)	X	X		X	X	X	X	X						X	X	X			
Fulgurotherium australe					X									X					
Qantassaurus intrepidus																X			
Ankylosaurs/nodosaurs					X				X							X	X		
Neoceratopsidae (Unidentified)																			
Serendipaceratops arthurcclarkei					X														
Theropoda (Unidentified)	X			X	X	X	X	X					X	X		X			
Ornithomimid	X					X										X			
Megaraptora					X									X					
Ceratosaur	X																		
Other Vertebrates:																			
Plesiosauria (aquatic reptiles)	X		X					X						X		X	X		
Pterosauria (flying reptiles)														X		X			
Testudines (turtles)						X		X		X				X	X	X	X	X	
Aves (birds)																X			X
Temnospondyli (amphibians)				X													X		
Koalasuchus cleelandi	X	X	X	X															
Dipnoi (lungfish)	X			X			X	X					X	X		X	X		X
Neoceratodus nargun				X										X		X			
Archaeoceratodus avus														X					
Actinopterygii (ray finned fish)					X	X		X						X		X		X	X
Leptolepis koonwarri																			X
Koonwarria manifrons																			X
Wadeichthys oxyops																			X
Coccolepis woodwardi																			X
Psilichthys sp.																			X
Invertebrates:																			
Bivalves					X											X			
Megalovirgus flemingi					X											X			
Insecta (Insects)																			X
Trace Fossils:																			
Dinosaur footprints																X			
Crustacean Burrows: Parastacid											X	X		X	X	X			

THE MAMMALS OF VICTORIA'S CRETACEOUS

As long-time Dinosaur Dreaming diggers can attest, the tiny fragments of Cretaceous mammals that we find are celebrated and prized. But mammal jaw (and other element) finders don't always get to find out what became of their precious scrap. So here is a list of all confirmed mammal fossils from the Victorian Cretaceous, with their Museum catalogue numbers, notes and taxa.

Reg #	Taxonomy	Collector	Field Number	Year	Preparator	Notes
P208090	*Ausktribosphenos nyktos*	N. Barton	#1111	1997	L.Kool	HOLOTYPE. Right. P6, M1-3
P208094	*Kryoryctes cadburyi*		Dinosaur Cove	1993	L.Kool	HOLOTYPE. Right humerus. Slippery Rock Pillar, Dinosaur Cove
P208228	*Bishops* sp.		#329	1995	L.Kool	600my Exhibition display. Right. P4-M2
P208230	*Ausktribosphenos* ?			1995	L.Kool	Edentulous jaw fragment
P208231	*Teinolophos trusleri*		Mentors trip	Nov. 1993	L.Kool	HOLOTYPE. M3 or M4
P208383	Monotremata		Dinosaur Cove	1993	L.Kool	Premolar. Slippery Rock Pillar, Dinosaur Cove
P208482	*Ausktribosphenos nyktos*	N. Gardiner	#150	1999	L.Kool	Right. M2-3, badly crushed. Found in rock from DD1998
P208483	Ausktribosphenidae ?	N. van Klaveren	#140	1999	L.Kool	Probably Left. x1 premolar & partial tooth
P208484	*Bishops whitmorei*	K. Bacheller	#450	1999	L.Kool	Right. M2
P208526	*Teinolophos trusleri*		#560	1994	L.Kool	Right. Edentulous
P208580	Mammalia	A. Maguire	#200	2000	L.Kool	Jaw fragment. (unprepared)
P208582	Ausktribosphenidae	L. Irvine	#500	2000	L.Kool	Right. M3
P209975	*Bishops whitmorei*	R. Close ?	#387	2000	L.Kool	Right. Roots M1, worn M2. OK M3
P210030	*Teinolophos trusleri*			2000	L.Kool	Right. Edentulous
P210070	*Bishops whitmorei*		Rookies day	03.12.2000	L.Kool	Right. Badly broken M1, M2 and x6 Premolars
P210075	*Bishops whitmorei*		Rookies day	03.12.2000	L.Kool	HOLOTYPE. 600my Exhibition display. Left. P2-6, M1-3. (P1 lost since initial preparation)
P210086	Ausktribosphenidae ?	J. Wilkins	#250	2001	L.Kool	Right. Root fragment
P210087	*Ausktribosphenos* sp.	G. Kool	#620	2001	L.Kool	Right. Rear half M1, M2-3
P212785	Mammalia	M. Anderson	Rookies day	03.12.2000	L.Kool	Fragment only
P212810	*Bishops whitmorei*		#300	2002	L.Kool	Left. M2-3
P212811	*Teinolophos trusleri*	D. Sanderson	#187	2002	L.Kool	Right. Edentulous
P212925	Mammalia ?		#222	1996	D.Pickering	Edentulous
P212933	*Teinolophos trusleri*		#179	2001	L.Kool	Left. Edentulous. (Plus associated molar)
P212940	*Ausktribosphenos nyktos*	W. White	#171	2003	D.Pickering	Left. M1, M2-3
P212950	*Bishops whitmorei*	C. Ennis	#292	2003	L.Kool	Left. P6, M1-3
P216575	*Teinolophos trusleri*	N. Gardiner	#180	2004	D.Pickering	Left. x2 molars. Probably M2-3
P216576	Mammalia	A. Musser	#500	2004	L.Kool	Isolated tooth
P216578	*Bishops whitmorei*	A. Leorke	#600	2004	D.Pickering	Left. M1-3
P216579	*Teinolophos trusleri*	N.van Klaveren	#635	2004	L.Kool	Edentulous jaw
P216580	*Bishops whitmorei*	G. Kool	#800	2004	D.Pickering	Right. P6, M1-3
P216590	*Teinolophos trusleri*	J. Wilkins	#447	2004	D.Pickering	Posterior part of right edentulous jaw
P216610	*Teinolophos trusleri*		#557	2004	L.Kool	Left. Edentulous
P216655	*Corriebataar marywaltersae*	M. Walters	#142	2004	L.Kool	HOLOTYPE. Multituberculata. Left. P4
P216670	*Ausktribosphenos nyktos*		#184	1999	L.Kool	Left. M2-3
P216680	*Teinolophos trusleri*	R. Long	#132	2004	L.Kool	Right. Fragment
P216720	*Teinolophos trusleri*		#648	2002	L.Kool	Right. Edentulous
P216750	*Teinolophos trusleri*	R. Long	#162	2005	D.Pickering	Right. Edentulous
P221043	*Bishops whitmorei*	A. Leorke	#100	2005	D.Pickering	Right. M1-2?
P221044	Ausktribosphenidae	C. Ennis	#300	2005	D.Pickering	Left. M2
P221045	*Teinolophos trusleri*	J. Wilkins	#395	2005	D.Pickering	Right. Edentulous
P221046	Mammalia	H. Wilson	#480	2005	L.Kool	Isolated tooth
P221150	*Teinolophos trusleri*	J. Swinkels	#340	2006	D.Pickering	600my Exhibition display. Right. x2 molars. Probably M2-3
P221156	Ausktribosphenidae	N. van Klaveren	#360	2006	D.Pickering	Right. M2 (requires preparation to confirm)
P221157	*Bishops whitmorei*	M. Walters	#585	2006	D.Pickering	Right. Edentulous with alveolae for P6, M1-3
P221158	*Ausktribosphenos* ?	R. Close	#200	2006	D.Pickering	Right. P5-6, half M plus M2-3
P228432	Ausktribosphenidae		scrap rock	2009	L.Kool	Right. Molar talonid
P228848	*Bishops* sp.	M. Walters	ETRW, Otways	10.12.2006	D.Pickering	Left. P6, M1, partial M2
P229037	*Teinolophos trusleri*	M. Cleeland	#91	2008	D.Pickering	Right. Edentulous with alveolae for x4 molars and ultimate premolar
P229194	Mammalia	N. Barton	#770	07.03.2007	D.Pickering	Isolated upper Premolar
P229408	*Teinolophos trusleri*	M. Walters	#300	14.02.2008	D.Pickering	Left. Ultimate premolar, M1-4
P229409	Ausktribosphenidae	N. Evered	#180	07.02.2007	D.Pickering	Possibly *Bishops whitmorei* . Left. P5-6, M1-3
P229410	*Teinolophos trusleri*	C. Ennis	#90	2008	D.Pickering	Right. ?M1 plus M3
P229649	*Bishops whitmorei*	J. Tumney	#330	2009	D.Pickering	Right. P2-3,5-6, M1-3
P231328	Mammalia	A. Maguire	ETRW, Otways	29.11.2009	D.Pickering	Maxilla fragment with x2 molars
P232567	*Ausktribosphenos* sp.	M. Walters & J. Wilkins	#270	26.02.2012	D.Pickering	Right. Broken premolars. M1-3
P232892	*Bishops* sp.	Astrid Werner		16.02.2013	D.Pickering	Left. ?M 2
P252052	*Monotremata*	T. Ziegler	ETRW #626	20.02.2015	D.Pickering	Upper premolar
P252207	*Bishops* sp.	O. Campbell	ETRW #200	07.02.2015	D.Pickering	Posterior part of right mandible w x1 molar

FRIENDS OF DINOSAUR DREAMING

BY LISA NINK AND PEGGY COLE

This year, for the first time, we held our Friends' Day at the Eric the Red West site. We weren't sure how this would go as it was quite a bit further for our Friends to travel from Melbourne than to Flat Rocks at Inverloch. It would also require quite a bit of preparation on our part.

We were pleased to see several of our Friends and some new Friends arrive a day early on the Saturday to join the crew for a barbecue dinner prepared by Tamara Camilleri and to hear a special evening lecture by Dr Tom Rich. Tom updated Friends and new crew members on the Dinosaur Dreaming Project, and was keen to mention his own 2016 fossil find.

Sunday 21 February was our official Friends' Day. It was fantastic to hold it during the main dig again (something that hasn't happened since our last full dig at Flat Rocks in 2013), and it was a great opportunity to show Friends around our site. We had beautiful sunny weather (thank you Dave the Weather God!) and a wonderful turn out of Friends and visitors. Some of our Friends travelled all the way from regional New South Wales or regional Victoria.

Tom Rich, Peggy Cole and Tamara Camilleri remained at the Bimbi Park camp site to welcome those Friends who required directions to the dig site – a somewhat daunting descent with many false turnoffs along the way to the various walking tracks, the lighthouse and the beaches below.

Books and other memorabilia of the dig were on display for purchase by those eager to extend their knowledge.

Along the way Friends encountered signage and suitably attired assistants appointed at the more complicated checkpoints to direct them to the site.

There was something for everyone on the day including: tours of the dig site with David Pickering; explanations of the geology of the site with Dr Alan Tait; a display of fossils and fossil casts; and the opportunity to speak with our crew. It was also a great opportunity for us to make new Friends and tell the many passers-by on Sunday strolls about the Dinosaur Dreaming project.

A big thank you to all of the Dinosaur Dreaming Crew for making our Friends welcome and for putting on such a fun and informative day. An extra special thank you to all of our Friends and welcome to our new Friends! The dig and the research that comes out of it couldn't happen without your generous support. We really appreciate your interest in learning about Victoria's Cretaceous world and the dinosaurs, mammals, aquatic reptiles, pterosaurs and many other animals and plants that lived in it.

We hope to see you all again later in the year at our Report Day where you will hear from our research scientists about some of the wonderful things that have been uncovered from the 2016 excavation. We also look forward to seeing many of you at Friends' Day in February 2017.

Image: P Cole

Tom Rich and Tamara Camilleri talking to a Friend

I FOUND A FOSSIL!

BY WENDY WHITE

Nothing compares with the absolute excitement of finding a really good fossil. It's the one time I find that the crew is happy to stop what they are doing and strike a particularly cheesy pose. Here are some of my favourite photos of happy smiling fossil finders of 2016.

Mike Cleeland

Image: R Zugaro, Museum Victoria

Miklos Lipcsey

Astrid Werner and Warwick Foote

Callum Simpson

Image: C Roberts

Sarah Newsam

Phil Spinks

David Pickering

Billy Parker

Joerg Kluth

Phil Spinks

Ali Calvey

Wendy White and Jess Bruce

Adele Pentland

Adrienne Mallinson

Genevieve Cini

Elaine Anderson

Eve Eidelson

John Wilkins

Corrie Williams

Dean Wright

Stephen Poropat

Image: C Paragnani

Wendy White

Gerry Kool

Amber Craig


Chantelle Roberts


Christina Boundy


Image: C Paragnani
Nick van Klaveren


Cassia Paragnani


Sharyn Madder


Bridget Firth


Amber Craig


Jane Lindsay


Ben Francischelli


James Rule


Helen Phelan


Kim Douglas


Alison Dorman


Jess Bruce


Harry Osmond


Nova Taylor


Mary Walters


David Pickering, John Wilkins and Ben Francischelli


Jeremy Baker Smith


Ali Calvey


Dani Measday


Lisa Nink


Cassia Paragnani


Image: C Paragnani
Melissa Hobbs


Image: C Paragnani
John Swinkels


Giulia Cinquegrana


Darren Bellingham

Theropods in Queensland and Victoria

By Stephen Poropat

The differences in the Cretaceous theropod-bearing deposits of Victoria and Queensland: why we find what we find, and what the fossils can tell us.

I remember the first time I held the theropod claw from Eric the Red West (ETRW). I had seen it before, on the front cover of the 2014 Dinosaur Dreaming field report, but that was nothing compared to holding the real thing. This was a Mesozoic machete, a weapon from a bygone era. It was one of the best preserved theropod claws I'd ever seen. And as I pored over it, I couldn't shrug off a nagging feeling of *dejà vu*.

I had seen (and held) a claw much like it before at the Australian Age of Dinosaurs Museum in Winton (AAOD). Since opening day in July 2009, the crown jewel of the AAOD dinosaur display has been the type specimen of *Australovenator wintonensis* ("Winton's southern hunter"), the most complete Australian Mesozoic theropod known. On each hand this Cretaceous killer had three fingers, each tipped with a wickedly curved claw. The inner two claws on each hand were frighteningly large – and the one on the first finger looks just like the ETRW theropod claw.

The owner of the ETRW claw, like *Australovenator*, appears to have been from a group of theropods known as megaraptorans ("big plunderers"). The presence of these theropods in Victoria was first established in 2008 on the basis of an ulna (forearm bone). The subsequent publication of *Australovenator* in 2009 and the "Lightning Ridge ripper" in 2015, and the discovery in Victoria of several specimens (including the ETRW claw) since, have shown that these theropods were doing rather well in eastern Australia during the mid-Cretaceous.

In Victoria, theropod bones (including those of megaraptorans) are discovered fairly frequently. This is due in large part to two factors: the continual erosion of fossiliferous Cretaceous rocks along the coast; and the annual Dinosaur Dreaming digs which target these rocks. To date, theropod bones have only been found as isolated specimens in Victoria. Clearly, the bones were transported by flowing water some distance from where their owners died. Roger Benson and others have done an admirable job of working out what types of theropods are represented by these isolated specimens, although many remain unstudied and new bones are found each year.

In contrast, theropod bones are exceptionally rare in Queensland. Aside from the type specimen of *Australovenator*, there are perhaps a dozen specimens, most of which are isolated megaraptoran teeth. Very rarely, remains of much smaller theropods are found, as are the limb bones of a primitive bird (that is, a derived theropod)

Image supplied by S Poropat

Australovenator *reconstruction at AAOD*

Image: D Bellingham

Theropod claw found at Eric the Red West in 2014

called *Nanantius*. Excluding *Nanantius*, all of Queensland's Mesozoic theropod bones come from the Winton Shire, and all of these were only discovered because they were associated with sauropods.

Sauropod bones are like beacons in the Winton area – their presence at the surface of the blacksoil (the eroded form of the Cretaceous rocks beneath) heralds the existence of a fossil site. Because sauropod bones are big, they are able to resist erosion far longer than the remains of any other Cretaceous animals. Consider this: the humerus (upper arm bone) of the big sauropod *Diamantinasaurus* is almost 1.1 metres long, whereas that of *Australovenator* is only 30 centimetres long. If both bones were exposed at the surface at the same time, the *Australovenator* bone would probably turn to dust before it was spotted. The sauropod bone would survive at the surface longer, increasing the likelihood of it being discovered.

The intermingled bones of *Diamantinasaurus* and *Australovenator* were found on a property west of Winton, in an area less than half the size of a tennis court. When keen-eyed property owners discovered the site in 2005, all that was exposed at the surface was the top end of *Diamantinasaurus*' upper arm bone. Over five dig seasons (2006–2010), the site was excavated, and the presence of a theropod alongside the sauropod was established. None of the theropod bones of the theropod (since named *Australovenator*) were found in articulation, but they were found in close association.

Associated skeletons like *Australovenator*'s are important comparative tools for palaeontologists. When isolated theropod bones (like those from Victoria) are compared with the bones of *Australovenator* and other theropods from around the world, palaeontologists have a good chance of working out the position of each specimen on the theropod family tree. Last year, in the AAOD Annual, Tom Rich tentatively referred the ETRW theropod claw to *Australovenator*. I am inclined to agree, although I hope that more bones will come to light in future. Only then will we be able to determine just how similar the ETRW theropod was to *Australovenator wintonensis*. Was it the same species? The same genus? Or was it completely different? Time, and more fossils, will tell.

Image supplied by S Poropat

Site map of Diamantinasaurus *site west of Winton*

You might now be wondering how isolated theropod bones from Victoria can help us to better understand Queensland's theropods. In a way, the most important piece of information they provide lies in the bones with which they are associated.

In Queensland, theropod teeth are often found with sauropod bones. You might be tempted to conclude that these theropods hunted and killed these sauropods, but that is not necessarily true. As far as we can tell, Queensland's theropods were far too small to have tackled adult sauropods — either alone or in groups. They might have hunted young sauropods, but it is more likely that theropods like *Australovenator* waited for decrepit adult sauropods to kick the bucket, then fed on their carcasses. Regardless, Queensland's theropods would have had to eat other animals too.

It is my feeling that theropods like *Australovenator* usually hunted smaller game – perhaps ornithopods like *Leaellynasaura* or *Atlascopcosaurus*. However, in Queensland, evidence for small ornithopods is scarce — only one tooth, and the footprints preserved at the Lark Quarry Dinosaur Stampede have been described to date. Like theropods, small ornithopods had small bones which would not have survived long when exposed to erosive processes. Given that ornithopods probably didn't lose teeth as easily as theropods did, and that they probably did not scavenge sauropod carcasses, the chances of finding their bones diminish still further.

Image supplied by S Poropat

Australovenator *composite hand*

Victoria's dinosaur fauna is, in contrast, characterised by abundant small ornithopods – many of which have been found in the same beds as bones of megaraptoran theropods. The concurrence of megaraptorans and ornithopods in the Cretaceous of both Queensland and Victoria might indicate a predator-prey relationship. Perhaps one day we will find an *Atlascopcosaurus* with a healed theropod-inflicted wound, or a *Leaellynasaura* within the gut of a megaraptoran! However, it is only by continuing to search for dinosaur fossils, both in Victoria and Queensland, that we will ever have a hope of finding fossils such as these, or of finding out whether or not Australia's megaraptorans enjoyed ornithopod *hors d'oeuvres*.

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ROB GLENIE, GENTLEMAN GEOLOGIST

BY LESLEY KOOL

7th December 1928 – 11th January 2016

Rob (Robin) Glenie's connection with Dinosaur Dreaming began when he and his family became Friends of Dinosaur Dreaming shortly after its creation in 1997. Since that time he rarely missed attending the annual Friends Day at the Flat Rocks site near Inverloch, and it was only after the project moved to the Otways in 2014 that he found it too difficult to attend. Quietly spoken and modest in his achievements, he was a true gentleman geologist. But those who knew Rob were aware of the huge impact that he had made on Victorian palaeontology in particular. His love of historical maps and literature made him instrumental in tracking down where fossil material had been collected in the 1840s by E.C. Hobson at Lancefield, Victoria. Along with Tom Rich, he was part of the first major 20th century excavation at Lancefield Swamp in 1974, which resulted in the discovery of a large collection of Pleistocene megafauna, including the extinct giant marsupial, *Diprotodon*. The Lancefield site is still regularly visited by palaeontologists to this day.

Image supplied by L Kool

Rob Glenie with Tim Flannery whilst filming Coast in 2015

Image supplied by K Glenie

Rob Glenie in Lancefield in 1973

If it had not been for Rob's offer to take a couple of Monash University students (Tim Flannery and John Long) to visit the original site of Australia's first dinosaur bone in 1978, there would have been no Dinosaur Cove and no Dinosaur Dreaming. Rob possessed a copy of field geologist William Ferguson's original map of Eagle's Nest, near Cape Paterson on the Bass Coast of Victoria. The map indicated where Ferguson found what turned out to be a small theropod dinosaur claw in 1903 and this is what led Rob, Tim and John back to the area. Almost as soon as they reached the beach, John found a single bone in a pebble. That was the start of the ongoing programme to find the polar dinosaurs of this state. Rob was able to do this because of his extensive familiarity with the geological literature of Victoria and his unbridled enthusiasm. In April 2015, Rob was recognised for his contribution to palaeontology when he appeared on an episode of *Coast Australia* (History Channel TV series) with Tim Flannery and Tom Rich. The episode was filmed at Eagle's Nest, the home of the first Australian dinosaur bone and where Rob had been instrumental in the future discoveries of Victoria's dinosaurs.

Dinosaur Dreaming sends its condolences to Rob's wife Pauline and their family. We owe a big debt to Rob Glenie and we miss his gentle smile and staunch support.

Image supplied by P Gill

SCANNING OUR MAMMALS' LIFESPANS

BY PAM GILL

I want to tell you about a new project with the Flat Rocks mammals that is only possible because of two things: one is the dedicated hard work by all the people involved in the dig, which has made a good sample of specimens available; and the other is the excellent internal preservation of the specimens themselves. The project aims to estimate the lifespan of the mammals from Flat Rocks, and hopefully gain insights into other aspects of their life histories.

The story started a few years ago, when a colleague mentioned that she'd had a tooth extracted, and kept it for a CT scan to look at the cementum tissue surrounding the roots. Cementum is involved in anchoring the root within the socket and it grows throughout life, forming annular layers, rather like tree rings. So counting the rings can reveal the lifespan of an individual — this process is sometimes used in forensics to aid identification.

My research is mainly on older mammals than those found at Flat Rocks — the Early Jurassic basal mammals, *Morganucodon* and *Kuehneotherium*, from the fissure fill deposits of South Wales. The cementum idea got me thinking about whether we could apply this technique to discover the lifespan of early mammals. However, unlike that recent human tooth, the teeth of tiny *Morganucodon* are the size of a pin head and 200 million years old!

Still it was certainly worth a try, and I discussed it with my colleague, Ian Corfe. We decided that only very high resolution synchrotron CT scanning was likely to yield results. A synchrotron is an extremely powerful source of X-rays which are produced by highly energetic electrons moving

Images supplied by P Gill

Figure 1. The Swiss Light Source (SLS) synchrotron ring from the air. The experimental hutch at the TOMCAT beamline, SLS. The X-ray beam comes from the right, and the specimen is mounted on the small vertical rod, with the detector to the left of it.

around a large ring (Figure 1). We managed to get some pilot scans at the European Synchrotron Radiation Facility (ESRF), specialised for high resolution tomography, and the results were very encouraging indeed. This led to further applications for synchrotron beamtime. Many hours of scanning later, with help from our PhD student Elis Newham, we have results for a large sample of *Morganucodon* and *Kuehneotherium* tooth roots. With clues from other growth lines in the jaws and the size of the animal, it is also possible to estimate hibernation patterns and even the metabolic rate of the animals.

I was fortunate to meet Tom and Pat and work on the recent *Teinolophos* paper in *Alcheringa*, and so had access to the CT scans of the Flat Rocks mammal specimens which were taken to the Japanese synchrotron SPring 8 in 2011. I noted at the time, that although the jaws have suffered distortion and cracking during burial, the detailed

preservation of the tissue looked potentially very good. So it seemed to me that it would be especially interesting to try scanning the roots in the Flat Rocks mammal jaws to see if we could count cementum rings. What was their lifespan and were there any obvious differences between that of an early monotreme such as *Teinolophos* and the australosphenidans *Bishops* and *Ausktribosphenos*? Could we get any clues about how they were adapted to life at high latitudes and discover whether they went into torpor or hibernation in less favourable conditions?

We needed higher resolution than was provided by the earlier Japanese synchrotron scans. The Australian synchrotron has different specialisations which would not give us the particular results we needed. However, Tom and Pat were very supportive of my request for pilot specimens to take on a synchrotron visit to Switzerland, and, on a trip to the UK, Pat brought over tiny jaw specimens of both *Bishops* and *Teinolophos*.

We scanned a tooth root from the *Bishops* specimen (Figure 2) and confirmed that cementum rings are preserved. Keep in mind how small the teeth are (less than 2 millimetres), so that the cementum rings are only a few microns apart! We also scanned part of the jaw of *Teinolophos* and were astonished by the detail of the preserved bone cells (Figure 3). There was an audible gasp when the scan reconstruction came up on the computer screen.

I then asked Tom and Pat if we could use additional specimens to follow up the pilot with a more detailed study of the root cementum and the internal jaw histology. Once again they were very interested and supportive and their daughter Leaellyn Rich agreed to transport the specimens when she returned to the UK after a visit home. We have synchrotron scanning time in November in Switzerland and February in France, and now have a total of nine specimens, with tooth roots in the jaw.

So wish us luck for some interesting results. In the next Field Report I hope to have more to tell you about the lives of the Flat Rocks mammals.

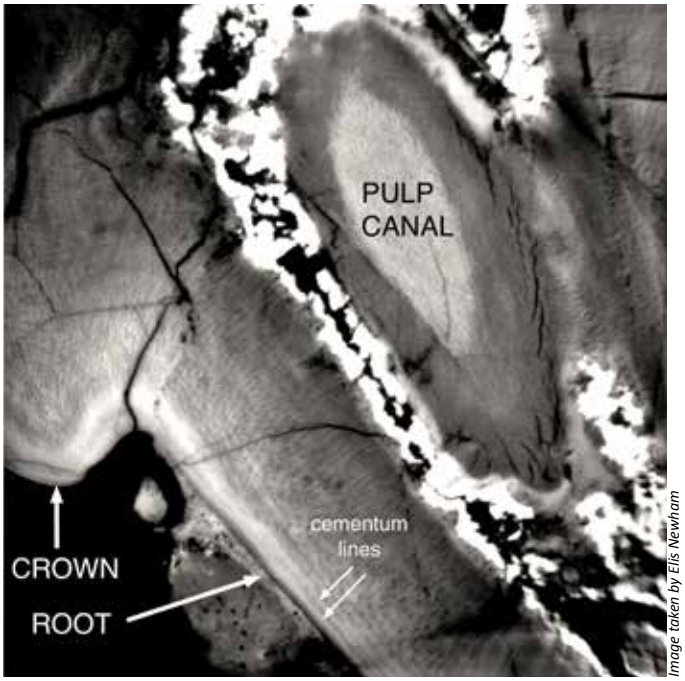


Image taken by Elis Newham

Figure 2. A section of a root of a tooth of Bishops whitmorei*, showing the cementum annuli. The tooth is still enclosed within the socket in the mandible, which has helped to preserve the cementum. Scanning at TOMCAT beamline, SLS.*

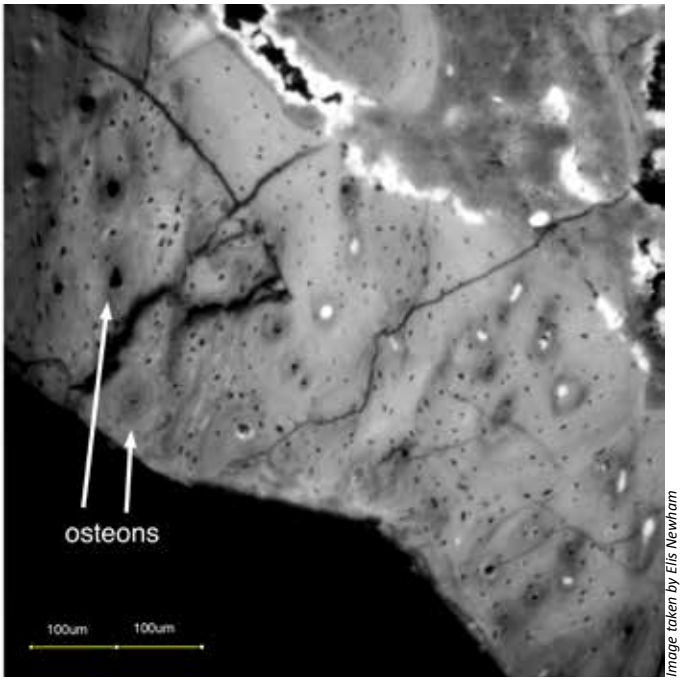


Image taken by Elis Newham

Figure 3. A section through a mandible of Teinolophos trusleri*. The outer layer of compact bone within the mandible clearly shows the cylindrical structure of the osteons. Scanning at TOMCAT beamline, SLS.*

Image courtesy Museum Victoria

I FOUND A FOSSIL... SORT OF

BY TOM RICH

It is a maxim of vertebrate palaeontological folklore that the best fossil hunting is done in museum basements. The second best option is to delve into the palaeontological literature.

While the visually well-endowed crew was excavating at Eric the Red West in February, with less such ability I was back at Bimbi Park abstracting the contents of numerous papers on my favourite topic: Mesozoic mammals. One such paper focused on a single tooth from Early Cretaceous deposits at Lightning Ridge characterised in the title as "enigmatic". When I examined the illustration, immediately I knew what it was. This was because, in 2007, almost to the hour of the tenth anniversary of her discovery of the holotype jaw of *Ausktribosphenos nyktos*, Nicola Sanderson (*née* Barton) did it again. She found an incredibly tiny upper premolar of a mammal, a specimen barely 1 millimetre across.

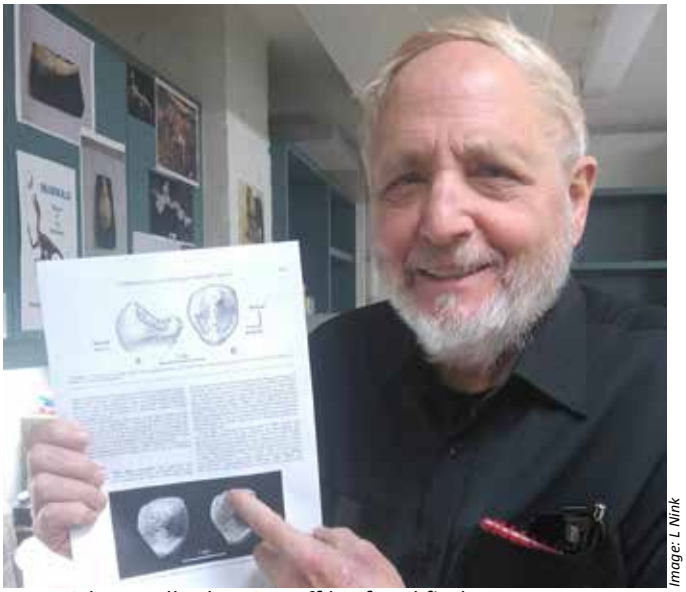


Image: L Nink

Tom Rich proudly showing off his fossil find

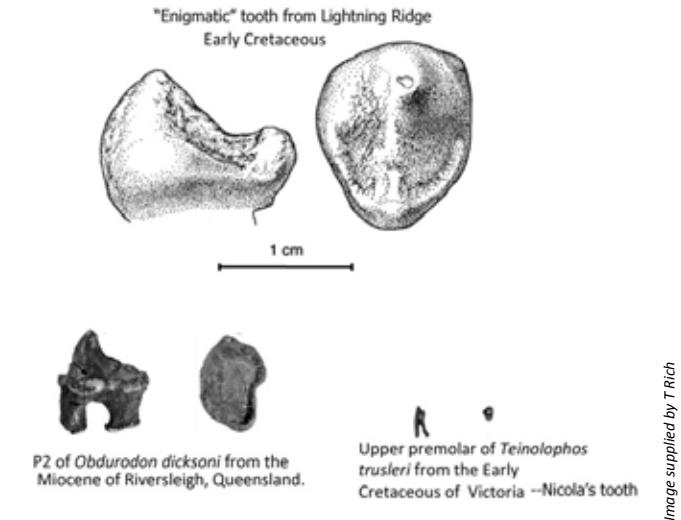


Image supplied by T Rich

The Lightning Ridge tooth

Years passed while I futilely struggled to identify this tantalizing but enigmatic tooth.

Finally, two colleagues, completely unbeknownst to one another, suggested it be compared to the upper premolars of the monotreme *Obdurodon dicksoni*. How they made that connection amazed me because the existing published illustration of those teeth was not of high definition. I found that they were both spot on because, upon examination of a cast of *Obdurodon*'s teeth, I found Nicola's tooth resembled the most posterior upper premolar.

Thus, when seeing the illustration of the enigmatic tooth from Lightning Ridge, the image of Nicola's specimen immediately sprang to mind.

While Nicola's tooth is minuscule, the Lightning Ridge specimen is much larger than the tooth of both it and *Obdurodon*, the only other toothed monotreme for which the upper premolar is known. Thus, a new Australian Mesozoic mammal was "discovered" at Lightning Ridge as part of the 2016 dig at Eric the Red West.

Reference:

Clemens WA, Wilson GP and Molnar RE (2003) An enigmatic (synapsid?) tooth from the Early Cretaceous of New South Wales, Australia. Journal of Vertebrate Palaeontology. 23(1): 232–237

Image courtesy Museum Victoria

John Herman, The Mayor of Dinoville

By Tom Rich

23 July 1929 – 15 February 2016

John had two aspects to his character that benefited many people, including the diggers at Dinosaur Cove. Firstly, he enjoyed helping people. Secondly, nothing gave him greater joy than to first conceive of something that needed to be constructed, and then to build it. When asked once how he got involved in constructing the structures and equipment that made the work at Dinosaur Cove possible, his reply was quite in character: "I talk too much." He would observe an aspect of the work at Dinosaur Cove then make a suggestion of a way to facilitate accomplishment of the task. The crowning glory of these numerous projects came about when he said, "Tom, you need a flying fox to lift rock and gear out of Dinosaur Cove and send gear down." My reply was simple: "John, you build it." Many people make obvious suggestions like this one. However, most often they stop there. It is seldom that the person making an obvious suggestion carries it out. John was different. Together with William Loads, who had been instrumental in getting Atlas Copco to supply the air tools necessary to cut the tunnels in Dinosaur Cove, he came up with a design for a flying fox that combined numerous pieces of equipment that John had in his several warehouses, and an Atlas Copco winch and compressor to drive it. John then assembled the flying fox with the aid of a number of other volunteers including Ray Blandford who helped every year the flying fox was utilized by playing the vital role of setting it up again.

Image supplied by T Rich

John and Morna Herman

Other gear that John provided included a water cart consisting of three 200 litre drums on a trailer frame and a portable kitchen and serving area. When it was decided that we build a warehouse to store gear over the winter, John scoured his various warehouses for the timber and corrugated iron to build it.

Because of all that he had done which was so vital for the success at Dinosaur Cove, when the occasion arose to recognize a new dinosaur from there, the new species was named in his honour: *Timimus hermani*.

Image supplied by T Rich

John Herman working on the flying fox at Dinosaur Cove

A LETTER FROM NATIONAL GEOGRAPHIC

NATIONAL GEOGRAPHIC

Mr. David Pickering
Museum Victoria
PO Box 666
Melbourne, Victoria 3001
Australia

Dear Mr. Pickering,

For 125 years, the National Geographic Society has been supporting researchers, conservationists, and explorers around the world to increase our knowledge of this planet, and then telling their stories to the public in the hopes of preserving it. Many of these scholars and explorers are today household names – Jacques-Yves Cousteau, Jane Goodall, Bob Ballard – but behind every great expedition, there were always hundreds of people working behind the scenes. It is rare that we have an opportunity to thank these unnamed heroes, but whenever possible, we aim to do so!

Dr. Tom Rich and Dr. Patricia Vickers-Rich have been supported by the National Geographic Society for over four decades for their ground-breaking paleontological work around the globe. However, it is their research in Australia for which they are best known to us, most especially because of the wonderful publications that are frequently sent to our offices from Down Under. Of these many publications, the "Dinosaur Dreaming" report is greatly enjoyed for its approachable writing and fun, quirky stories.

What is most wonderful about this annual report is that we get to see the hard-working volunteers like you, who make the world-renowned research of Drs. Rich and Vickers-Rich possible and affordable. We salute you for your long and distinguished service to our celebrated grantees, and wish you continued success in your work on "Noddy" and other great discoveries.

With Our Deep Appreciation,

Peter Raven

Dr. Peter Raven
Chairman; Committee for Research and Exploration

John Francis

Dr. John Francis
Vice-President of Research, Conservation, and Exploration

Ridiculous Rookie Shenanigans

By Jess Bruce

'Twas a regular day in first year geology, my books and pen at the ready to 'rock', when Marion Anderson began to talk of Dinosaur Dreaming digs. My heart raced and my stomach flipped — a real-life dinosaur dig! Before I knew it, applications were sent (and blissfully, they were accepted) and I was on the floor of my best buddy's house sewing dinosaurs onto our gear before leaving for the dig the next morning. We ventured along the Great Ocean Road, the lovely view a trade-off against the quease-inducing roads, and carefully selected a site to pitch our tent — a nice spot under the shade of a pine tree and seemingly free of bull ant nests (or was it…?). After setting up all our dinosaur plush toys to guard our new home for the week, the time had come to head for the coast and begin our long lasting friendships and respect for the wind, the sand, our tools, and the amazing people we were about to meet. All but the last proved difficult, the wind and the sand teaming together at times, and our trusty chisels burying themselves in the beach and within hunks of mudstone as we got to grips with the art of splitting rocks into sugar-cube sized chunks. Despite this, our intense work under the sun became therapeutic and serene, and disappeared all too fast, though not without many an exciting 105 million year old exception.

Here are some tips to get you through a wily week as a rookie volunteer palaeontologist:

- While you're snug in your sleeping bag don't wait till the bull ant is directly above your head to agree that it really is inside the fly, and make sure to have emergency bug catching containers on hand to avoid the mad scramble with the Tiny Teddies box.
- Have some favourite songs on hand, because if you don't bring new musical material on site, you'll hear the same tunes sung enthusiastically and repeatedly for a week — "If I Were a Rich Man" is still stuck in my head.
- It's surprising, but horses sure do love chips. We found ourselves the pied piper of horses, with more than 20 hungry white equids mobbing us through the paddocks and almost all the way up the phone service hill.
- Even though every night there is incredible food, don't go back for thirdsies, because it will be the one night of the most nostalgic dish and you are struggling with that extra bit, when the most heavenly sweet surprise is revealed. So keep the incredible food possibilities of the lovely members of the dig in mind: you never know what you might need to save room for.
- Just accept the fact that you and the sand are now one, the sand making a home in places you never thought it could live, and popping up as a clasty reminder for weeks after.
- Every brown smudge has potential, and though it's unbearably suspenseful, should be checked out. Sure, most of the time its mud, and when it's not mud its coal. But that amazing experience when you split a rock, and it's bone, no matter how scrappy, is truly magical. Don't lose heart, because in a week of rock splitting, you will know this joy.
- But when you do find something, 8 times out of 10 it's a little fossil seed called a beetlebum — yes, like a beetle's bum; not beetlebutt, beetlething, beetleguy, beetledude… or other varieties as, and I quote from Wendy, "You can say bum y'know".

Overall, this was the best experience of my little life so far, and it could only be topped by future digs. The amazing people, with so many stories and so much experience, who are incredibly inspirational, will stay in my mind as some of the coolest people that I have ever met. Chris and I are already making plans to increase the nerd level at next year's dig, and can't wait to share it with the next fleet of the keenest rookies around.

PROSPECTING REPORT

BY MIKE CLEELAND

Several sites were visited last year with mixed results.

During the February dig season an isolated ornithopod tooth was found several hundred metres west of Von Mueller Creek, east of Apollo Bay. Another bone fragment was found on a return visit in May. This result was interesting for two reasons. Firstly, it's uncommon for Cretaceous vertebrate remains of any kind to be found in the Otways east of Apollo Bay, there being only a handful known in total. Secondly, it's hitherto unknown for the first specimen found at a new site to be a tooth. The site therefore remains deserving of further monitoring.

An interesting discovery was made in May 2016 when Andrew Giles found a vertebra at San Remo while on a field trip with Monash University students. Isolated vertebrae are of course not unknown in these parts but this one was several hundred metres from any other known specimen, in the cliff at Griffiths Point in the area where students have for years been taken to see the outstanding sedimentary structures. The discovery highlights the possibility of finding bones such as these in areas that had otherwise been more or less written off as unproductive.

Scheduled Prospecting
During 2016 several dates were advertised where crew members were invited to join in group prospecting at selected sites.

On the first of these, a party explored the north shore in the vicinity of Sorrento without finding any trace of the megafauna that had emerged from nearby localities.

A second trip to Harmers Haven was washed out with bad weather.

Grampians
Going back into the Palaeozoic for a moment, in April we travelled to the Grampians with a group of friends looking at interesting rock formations. One of the objectives of the trip was to learn more about the Glen Isla Trackway, one of the oldest tetrapod trackways in the world. We hoped it may be possible to find a counterpart, or more trackways. The original specimen was first recognised in a paving stone in the courtyard of Glen Isla homestead, and is now on display in the Council office in Hamilton. Our party was able to discover that the stone was obtained from the nearby Mt Bepcha quarry, and an attempt was made to visit the site. The quarry unfortunately was found to be closed and disused, but should any future prospectors wish to explore the site further, the quarry is owned by Layton Stone.

French Island
The south coast of French Island in Western Port was searched in the 1990s, revealing two relatively nondescript bones from the shore platform adjacent to Elizabeth Bluff. In 2015 and 2016 further exploration, with the assistance of the Perseverance Primary School students, resulted in the confirmation of two known plant fossil sites, east of The Anchorage and east of Elizabeth Bluff, but no more bones.

Image: M Cleeland

Vertebra found by Andrew Giles at San Remo

FOSSIL CORNER

BY DARREN BELLINGHAM

Footprints

During March, Dr Jack Horner visited Australia from his home in the US, as part of his involvement with the Jurassic World exhibition in Melbourne. On a visit to the Inverloch area with Tom and Pat Rich, Dr Horner took the opportunity to peruse the shore platform near the dig site. He returned to announce that he had identified a three toed footprint, similar to the known specimen at the dig, raised and similarly aligned. His recollection was that it was not far from the prominent dolerite dyke that crosses the shore platform to the north of the dig site. The print he saw has not yet been relocated despite a relatively systematic search.

During the year, anecdotal evidence was also obtained that supports the historical report of a trackway near Kilcunda. Several previous searches targeting the west end of Shelly Beach had been undertaken without success, but the recent report gives encouragement to believe that such a trackway may indeed exist.

Palynology

The last 12 months also saw two field trips dedicated to collecting pollen samples for analysis by Dr Barbara Wagstaff. These trips concentrated on known bone sites in the Otways and Strzeleckis where samples were collected from organic-rich mudstone layers above and below the known bone layers. Barbara's research intends to shed more light on the way plant communities changed over time during the Lower Cretaceous in Victoria.

Occasionally, bones were recovered from known sites at Point Franklin, San Remo and Eagles Nest during this collection period, showing again that continuing erosion reveals new fossils at old sites.

Prospecting in the Victorian Cretaceous is carried out under a National Parks Permit held by Professor Pat Rich, who is responsible for approvals.

P252584: Anterior and lateral view of ornithopod lacrimal

P252405: Dorsal and side view of theropod manual phalanx

FESTSCHRIFT MEMOIRS MV 74

BY TIM ZIEGLER

In the 42 years since Dr Thomas H Rich began his career at Museum Victoria, he has headed a search for this continent's Mesozoic mammals, engaging colleagues, students and non-specialists. This pursuit, and decades of diversions, derivatives and serendipitous discoveries, inspire Volume 74 of the Memoirs of Museum Victoria. This is a festschrift (special issue) that specifically honours Tom's continuing influence and service. The 408-page volume, edited by Erich Fitzgerald, comprises work from dozens of contributors. The authors have studied under Tom's direction, laboured alongside him in the field or been inspired by his insights. Their 27 articles in the 408-page volume share hitherto undescribed specimens, new analyses and intriguing theories.

Dinosaurs, dolphins, nautiluses and marsupial moles are only a few of the animals canvassed in this volume. The diversity of topics reflects Tom's broad influence, and the multitude of research paths in palaeontology. Tom and Pat Vickers-Rich also receive the unique honour of Michael Archer's creative taxonomy: Vol 74 welcomes *Wholleydooleya tomnpatrichorum*, a hypercarnivorous rainforest marsupial from a new site near Riversleigh in Queensland.

Several articles are relevant to Tom's Cretaceous tetrapod research, now driven by our excavations at Eric the Red West. Diggers captivated by the curving six-inch claw found in 2014 might recognise its cousins among the review by Fernando Novas *et al*. of manual anatomy in the Gondwanan theropod genus *Megaraptor*. Recurrent digger and trace fossil specialist Anthony Martin offers detailed accounts of Otway Coast dinosaur tracks, confirming them as ornithopod footprints — the first described in Victoria. Benjamin Kear catalogues the plesiosaurs, ichthyosaurs, mosasaurs and marine turtles that swam Australia's Cretaceous inland seas. Doris Seegets-Villiers and Barbara Wagstaff's study of fossil fern spores confirms their value for dating rocks in the Gippsland Basin, and infers a genetic adaptation to the unpredictable floodplains on which they grew.

Surely to Tom's relief, Mesozoic mammals also find a niche in Vol 74. Alistair Evans reflects on the terminology and meaning of mammal teeth, while Rebecca Pian *et al*. publish new images of the bizarre teeth of the platypus ancestor *Kollikodon* from Lightning Ridge. As opalised fossils, the teeth of *Kollikodon* are essentially glass casts of the original material. Were such remains preserved at ETRW as bone, enamel and dentine, they would help clarify this ancient monotreme's enigmatic lifestyle. Looking to the future is a geochemical analysis of the Koonwarra Cretaceous lakebeds by Tuite *et al*. The authors confirm these lakes were fed by sediment-laden streams that flowed from the surrounding forests. The prospect of exceptionally preserved tetrapod body fossils at Koonwarra, akin to the Jehol and Liaoning biota of China, is further supported by such findings.

Reference:

https://museumvictoria.com.au/about/books-and-journals/journals/memoirs-of-museum-victoria/2010-2019/2016-vol-74-special-issue-in-honour-of-dr-thomas-h-rich/

Image: A Evans

Tim Flannery, Tom Rich and Erich Fitzgerald read the journal

Image courtesy Museum Victoria

BOB HODGE, ENTHUSIASTIC ROCK BREAKER

BY TOM RICH

Deceased 2 January 2016.

Bob Hodge was in the first group of nine Earthwatch volunteers that arrived in 1986 to work at Dinosaur Cove. He returned there three more times and then, with his wife Lois, participated in the first major dig at Flat Rocks in 1994.

Many are the volunteers who are quite enthusiastic and return year after year. But none were more enthusiastic than Bob. Because the digs he participated in lasted for quite some time, the routine was to take Wednesdays off and half of Saturdays. While the rest of the crew would spend those days typically sight-seeing or doing essential shopping and laundry, Bob would be down in the cove breaking up rock in search of fossils.

His jovial nature was infectious and he made many long time friends who continued to correspond with him after he returned home to Virginia.

There he was both an inspiring biology teacher and a local historian. One thing he very much enjoyed doing was going to the United States

Image supplied by T Rich

Bob Hodge at home in Kansas

Image: P Schokman

Bob Hodge at Dinosaur Cove in 1989

National Archives in nearby Washington, D.C. to do research. One of the projects he took up after a conversation with me was tracking down available information about my great grandfather's service in the Union Army during the American Civil War. We knew he had been captured by the Confederate forces in 1862, but a misconception in my family over three generations about what happened to him as a prisoner of war was corrected because of Bob's efforts. Bob really enjoyed doing this as he did everything he did in life. And that enthusiasm for everything was infectious and inspiring to all who had the privilege to come to know him.

And he was an expert fossil finder, too!

Image: L Kool

Bob and Lois Hodge at Flat Rocks in 1994

FROM MONASH TO WINTON

BY ADELE PENTLAND

After having spent months sorting through thousands of fossils at the palaeontology lab at Monash University, I found myself some time later sitting on a shore platform in early February. Hammer in hand, I sat with many others breaking rocks apart in search of Cretaceous fossils. Just days earlier, I had accepted an offer to work as a Museum Tour Guide at the Australian Age of Dinosaurs Museum (AAOD). During the course of my undergraduate degree, I had become familiar with the fossil material discovered throughout the Winton Formation. But the reality of moving to western Queensland had not yet hit me, and I remained blissfully unaware of the blistering summer temperatures and recent insect plagues. Instead I remained focused on the task at hand, scrutinising anything which may have resembled a fossil and contemplating the differences between the faunal and floral assemblages observed in Victoria compared with Winton.

What enticed me to move half way across the country was not the opportunity to empty fly traps or scrub toilets, but the opportunity to spend some time working in a fossil preparation laboratory and attending another dinosaur dig. Staff were given the opportunity to visit the dig on rostered days off, and naturally I was eager to provide what little assistance I could to the diggers. More importantly, I wanted to learn from more experienced staff members as well as visiting palaeontologists. The dinosaur dig sites in Winton are worlds apart from those in Victoria. Although both areas are remote in nature, it's possible to operate heavy machinery at the Winton dig site, expediting the removal of the overlying soil layer.

Image: R Zugaro, Museum Victoria

Adele Pentland works with Alan Tait at Eric the Red West

One obvious difference between the two sites is the black soil observed in western Queensland, compared with the sandstone at ETRW. The black soil is a mixed blessing — without it, our understanding of the fossil record within this area would not be as extensive, and although the rotational soil brings bones to the surface, it disarticulates skeletons and compromises the preservation of bone. Below the black soil lies Cretaceous siltstone deposits, described by David Elliott (Founder of AAOD) as the remains of ancient muddy waterholes. Unlike the Victorian dig sites, the deposits investigated during the 2016 field season seem to lack bedding and sedimentary structures such as ripple marks. This makes targeting deposits and documenting the geology of the area incredibly difficult and, at times frustrating.

Like previous years, participant diggers and staff stayed at Elderslie Station. Each morning diggers and staff alike settled down to a hearty breakfast and then travelled to site, located on the neighbouring property, Lovelle Downs. Within the first week of digging, a team of approximately 20 people (assisted by a loader and mini-digger) made two gaping holes in the ground, roughly 20 metres apart. Each hole was christened, the first and most promising dubbed 'Mikey' and the latter, with initially very scrappy material, 'Moggsey'. Both were named in honour of the landowner, Mikey Elliott. Eventually the material from the Mikey site petered out and the Moggsey site became our sole focus.

Image supplied by A Pentland

Adele Pentland with two volunteers at the AAOD dig

Moggsey contained sauropod material within the transition zone between the black soil and the underlying Cretaceous deposits. Although this site contained many bones, their preservation varied. Whilst the discovery of small bits of bone identified as those belonging to turtles was exciting, it did slow down the extraction of our dinosaur bones (that we wrapped in plaster jackets). Participating in the dig was an extremely rewarding experience. By the end of three weeks of digging, over 100 specimens were catalogued and waiting for transport back to the lab. Currently, the AAOD dinosaur lab is preoccupied with the material from the Matilda site, and the next dig sites in line are the Pete and Dixie sites, containing more sauropod material. It will take many years before the spoils of the 2016 field season are finally processed. For the diggers, I'm sure it's well worth the wait and they will stay up to date with the museum's expansion and development.

Last year, I completed my Bachelor of Science (Honours) supervised by Associate Professor Jeff Stillwell and Dr Chris Mays on a palaeontology project. It still comes as a surprise today that I now work at a dinosaur museum in the middle of western Queensland, doing something that some can only dream of. Although I had volunteered for Dr Rolf Schmidt (Museum Victoria's curator of invertebrate palaeontology), and studied palaeontology and biology during my undergraduate degree, I left university with no practical knowledge of vertebrate biology or palaeontology. This is slowly being remedied. During my short time at the museum, I have already learned so much (and heard whisperings of incredible and as yet undescribed material) whilst remaining extremely passionate about science communication.

If you haven't paid a visit to the museum, I would highly recommend it. On the tour, visitors are able to experience first hand the *Australovenator wintonensis* and *Diamantinasaurus matildae* holotypes, and walk through the only collection room open to the public anywhere in the world. The lab tour includes a description of the process of digging for dinosaurs and a demonstration of the tools used to remove the rock which surrounds our bones. At one point, visitors have an opportunity to touch real dinosaur bone. Words can only go so far to convey my excitement for Australian palaeontology.

While Victoria will always be my home, I feel there is still so much to learn and contribute at AAOD. Acting as a tour guide for the visitors (who are in effect, keeping the museum alive and viable) I am, in some small capacity, helping to preserve Cretaceous fossils. It's no secret that I one day dream of becoming an academic, and it is my hope that soon I will pluck up the courage to write my own paper. Perhaps I'll be the first to describe some of the invertebrate material housed at AAOD, but, for now, seeing some of the most spectacular sunsets and enjoying the view from the Jump-Up is enough to keep me happy.

Image supplied by A Pentland

The AAOD dig site

Image supplied by R Bender

Fossil rainforest leaves at Anglesea

By Robert Bender

From 11 to 25 January 1988, I joined a team of ten Earthwatch volunteers (four Australians and six Americans) to share two rented holiday houses and extract Eocene leaf fossils from clay rock taken from the overburden above the Alcoa coal mine at Anglesea. David Christophel and his students had been working this site for a few years and had identified several species from about 50 million years ago (early Tertiary) that closely resembled plant species currently found at Noah Creek in the Queensland Daintree rainforest. They wanted more evidence of a far wider extent of rainforest than the tiny pockets remaining on the Queensland coast. His postgraduate student Leonie was trying to identify *Casuarina* fossils and match them with a current species found in New Caledonia.

The Alcoa staff were strongly committed to mine safety and we had to work within their behavioural guidelines. Our first task was to descend the 55 degree slope to a stratum about 15 metres down into the clay, where the narrow band of fossil-bearing rock was located. An Alcoa backhoe was used to break large chunks of rock from the solid wall, for us to carry back up the slope. As our ages ranged from early 30s to late 70s, some of us found that a real challenge.

Image supplied by R Bender

Removing rock from the wall

Image supplied by R Bender

Macerating rocks

David had set up two Wreckair sheds for different tasks — a dirty lab and a clean lab. The dirty lab held macerating tanks in which rocks were softened with a peroxide solution until leaves could be floated off (preferably intact). The clean lab was used for cleaning the extracted leaves, mounting them on glass slides, and using binocular microscopes to examine tiny flowers and fruits.

Image supplied by R Bender

Examining leaves under the microscope

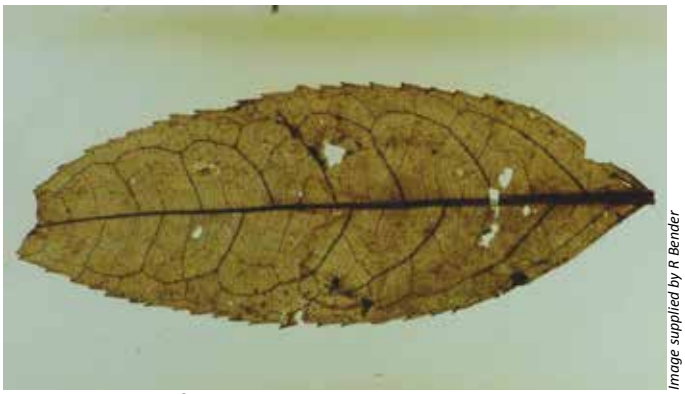


Image supplied by R Bender

An Anglesea leaf on a light-box

None of the Earthwatch team had any background in palaeobotany, so David's challenge was to give us some basic understanding of the field, and develop our skills at extracting and cleaning leaves so at the end of a fortnight we had added substantially to his collection of rainforest evidence and strengthened his case for claiming that Eocene Anglesea held a Daintree-like rainforest.

The first two or three days we all tried everything, but, as expected, people soon discovered that they were good at some tasks and not at others. So some devoted their time to macerating rocks, experimenting with different techniques, while others stuck to leaf-cleaning.

A New York pharmacist and his psychologist wife, a Connecticut banker and his insurance assessor wife, and two 79-year-old retirees made up the American contingent. The Australians comprised two young conservationists, an Adelaide divorcée and me. We all had a great deal to learn. David gave us several slide lectures about palaeobotany and the evolution of plants, the other sites around Australia that he and his students had worked and the process of developing a case for the presence of rainforest at Anglesea.

The first rocks that we macerated were not very productive, but within three days we got a couple of very rich ones. By then, our techniques had improved and the leaves started floating out of the rocks (100 to 150 a day) which kept the "cleaning ladies" busy around the sunny picnic table. Paul, the US banker, was a keen amateur photographer so David tasked him with making slides of the cleaned leaves set on a light-box – some were transparent so their venation showed up beautifully, while others were just opaque black.

Leonie's project involved examining slender stems of *Gymnostoma*, looking for dentation patterns. Sue (David's other assistant) taught us about the delicate process of preparing cuticle, which proved to be our greatest challenge.

By 1988, David had matched 13 species of tree with others from the same families growing at Noah Creek, many in the Lauraceae. That was enough to clinch the argument about the extent of Eocene rainforest beyond Queensland.

There is an excellent display of David's work at Melbourne Museum including a filmed interview in which he explains his project and what it achieved.

Reference:

Museum Victoria film: https://museumvictoria.com.au/melbournemuseum/discoverycentre/600-million-years/videos/victoria-covered-in-rainforest

Image supplied by R Bender

A display of Anglesea leaves at Melbourne Museum

DR HORNER AND JURASSIC WORLD

BY JAMES RULE

Earlier this year, Museum Victoria launched Jurassic World: The Exhibition, containing robotic dinosaurs created by Creature Technology, the company responsible for the Walking with Dinosaurs arena shows. The dinosaurs within the exhibition were made to resemble the creatures portrayed in the Jurassic World movie, and recreate the experience of visiting the actual fictional park.

The museum also had the pleasure of hosting Dr Jack Horner, renowned dinosaur palaeontologist known for his work on *Maiasaura* and juvenile dinosaurs, and as an advisor to the four Jurassic Park films. I had the opportunity to meet with him and he told us all about his fieldwork in Montana, and his experience at the Museum of the Rockies. It was great to meet such an interesting palaeontologist whose name and work appeared in many of the dinosaur books and magazines I grew up reading.

Image: C Paragnani

Tyrannosaurus rex *and that car*

Image: C Paragnani

Indominus rex

Dr Horner gave a lecture at Melbourne Museum as part of the launch of Jurassic World: The Exhibition. He spoke about the “chickenosaurus” project that he has recently been working on. The idea that dinosaurs could be cloned from ancient DNA was presented in the novel Jurassic Park, and the 1993 film of the same name. It has previously been demonstrated to be impossible to do this for animals like dinosaurs as DNA has a half-life of roughly 520 years. So, instead Dr Horner turned his attention to birds, the closest relatives of extinct dinosaurs, and how they can be used to reverse engineer extinct theropod dinosaurs. Essentially, his research team has been diving into the genome of chickens — “switching off” genes responsible for traits such as beaks, and “switching on” genes for traits such as teeth and long bony tails. By doing this, they expect to eventually end up with something that resembles a non-avian theropod (but ultimately would never be the real deal). There have already been several papers published on this, including chickens with dinosaur-like snouts and legs. With development in the area of reverse engineering animals, we might one day see the creation of glow-in-the-dark pink unicorns.

The lecture was followed by a viewing of the exhibition…

After a short introduction "the park" is opened. At the beginning you are greeted by a *Brachiosaurus*. Unfortunately, you only see the neck and head (it would have been amazing if they could have fitted the whole animal in there). The next room takes you to an adult and juvenile *Pachyrhinosaurus* in a cage. Seeing the full sized animals right in front of you is amazing (my inner child was barely contained when I saw this heavily built ceratopsid dinosaur).

Leading on from this you enter the genetics lab, which is filled with lots of infographics, but essentially acts as a waiting room for the main attraction. You are then ushered through to wait outside some electrified fencing as the King of the Tyrant Reptiles (*Tyrannosaurus rex*) marches out and harasses a car. (It was a fairly impressive spectacle and an obvious homage to the original film).

After this you are greeted by a *Stegosaurus* which, while still exciting to see another childhood favourite come to life, doesn't really do much. That is until it is attacked by the (completely fictional) star of Jurassic World, *Indominus rex*. The two bicker for a bit, and then the commotion dies down again. This is the last you see of the animatronic dinosaurs, and following on from this is a room full of casts of fossils. Ending the exhibit is a small display about our very own Dinosaur Dreaming program. The final attractions before the gift shop are the famous claw discovered by John Wilkins in 2014 (cf. *Australovenator*), and a little video montage of the Eric the Red West digs.

The success of Jurassic World: The Exhibition demonstrated just how popular dinosaurs are with the public. By the time this report is published, the exhibition will have moved on. But it provided a unique opportunity to see these animatronic creations up close, and reminded us of just how amazing these long dead animals were.

FOSSIL CORNER

BY DARREN BELLINGHAM

Ornithopod ischium (part of the pelvis)

Ornithopod fibula (calf bone)

P252569: Ornithopod dentary (lower jaw)

LESSONS FROM OUR POLAR DINOSAURS

BY PEGGY COLE

In May 2016, Emerita Professor Patricia Vickers-Rich, with PrimeSCI! president Lydia Low, delivered a workshop on promoting earth science in Kenyan schools. She had been invited as Honorary Director of PrimeSCI!, by the Kenyan Government and UNESCO. PrimeSCI! was launched in early 2013, the offspring of the Monash Science Centre, which operated for 19 years at Monash University.

They presented a lecture as a working example of how to take research to schools and the public in a language they can understand. The dinosaurs introduced in this workshop come from rocks in southeastern Australia that are more than 105 million years old, from a time when Australia lay near the south pole and was attached to Antarctica. A short documentary of the collection of these dinosaurs was shown in the workshop as well as a time lapse film demonstrating how, after collection in the field, the material was prepared.

Following the lecture and the screening of the two films, participants were shown the teaching modules that had resulted from cooperation between teachers, scientists and industry, and crafted by PrimeSCI! and Dinosaur Dreaming.

Image supplied by P Vickers Rich

Workshop introduction

Image supplied by P Vickers Rich

Dennis Njagi and Prof Daniel Ichang'I making casts

One of the workshops involved making casts of the dinosaur footprint from Knowledge Creek. This dinosaur was a little herbivore that had lived more than 105 million years ago in Australia and had left its track in the muds of the time. Some of the participants, including the Head of the Geology Department at the University of Nairobi, dug into the wet plaster and made their own cast.

The materials used were unique, supplied by the local children's hospital and normally used to repair broken bones. The demonstration showed how local materials could be substituted for the usual plaster of paris when not in supply.

Graduate student Dennis Njagi and Professor Daniel Ichang'I both tried their hand at making casts of dinosaur footprints, and both went away with new knowledge of casting techniques.

This was one of the many outreach activities that PrimeSCI! and the Dinosaur Dreaming team carries out in Australia and around the planet each year to highlight the research of the Early Cretaceous polar dinosaurs of southern Victoria.

Monash Earth Sciences Garden

By Cassia Paragnani

Enjoyable and available practical material can be hard to find for a geoscience student. Large scale to small scale geological events are often spread over large distances and can be difficult to access. Monash University is overcoming these trials in order to educate students in a creative and innovative manner. They have incorporated knowledge about the formation of Victoria in establishment of an earth sciences garden. This is an Australian first for practical learning. Unveiled in September 2015, the garden includes units of rock depicting volcanic events, common sedimentary packages and metamorphic structures. Among the structures that reflect Victoria's geology and geomorphology are an ephemeral marsh and cracking clay pan, intrusive igneous and volcanic rocks (with associated metamorphic contacts), folded sedimentary sequences, sedimentary rocks of the Gippsland and Otway coasts, Buchan Limestone and much, much more. The rock collection is thorough, including 20 different types of rock and approximately 500 rock specimens. The design of the Monash Earth Sciences Garden represents a range of geographic locations across Victoria. Found amidst the outcrops are regionally associated flora, which demonstrate the link between biota and geology. The spectacular arrangement of rocky outcrops and associated flora are thoughtfully orientated so that small regional representative areas are pulled together and integrated into a larger scale fold.

Image: C Paragnani

The Monash Earth Sciences Garden

So… how is this outdoor structure utilised by Monash? An interactive learning program integrated across first and third year courses has been implemented. First years are able to practise the incredibly useful strike and dip techniques used in mapping outcrops. This is a highly valued skill that relates directly to second and third year courses (especially the renowned Broken Hill mapping course). Third year geophysics students are able to practise taking magnetic readings in order to generate a magnetic survey map of the area. Third years studying ore geology use the pyrite near igneous intrusions to determine where gold might have been deposited.

This is a garden, a class room, a fantastic network of outcrops and a sanctuary, complete with barbecue area and power points. The beautiful scenery of native flora alongside a diversity of rock types is unlike any locality in Melbourne (or Victoria for that matter). This unique amalgamation of rock, flora and bustling new fauna is a testament to the never ending poem of earth, wind and fire.

Images: C Paragnani

Jess Bruce, Elaine Anderson and Cassia Paragnani enjoy the garden

FIELD CREWS

ERIC THE RED WEST DIG FIELD CREW
6 - 27 FEBRUARY 2016

Elaine Anderson
Olivia Arnold
Jeremy Baker Smith
Margaret Baldassa
Darren Bellingham
Robert Bender
Christina Boundy
Jess Bruce
Ali Calvey
Tamara Camilleri
Genevieve Cini
Giulia Cinquegrana
Mike Cleeland
Pip Cleeland
Peggy Cole
Cate Cousland
Amber Craig
Kim Douglas
Alison Dorman
Eve Eidelson
Bridget Firth
Ben Francischelli
Kelly Gardiner
Norman Gardiner
Mike Greenwood
Melissa Hobbs
Caitlin Jay
Joerg Kluth
Jane Lindsay
Miklos Lipcsey
Sharyn Madder
Adrienne Mallinson
Dani Measday
Sarah Newsam
Lisa Nink
Harry Osmond
Cassia Paragnani
Billy Parker
Adele Pentland
Helen Phelan
David Pickering
Stephen Poropat
Tom Rich
Chantelle Roberts
James Rule
Callum Simpson
Philip Spinks
John Swinkels
Alan Tait
Nova Taylor
Nick van Klaveren
Mary Walters
Wendy White
John Wilkins
Corrie Williams
Dean Wright

ERIC THE RED WEST WEEK 1 CREW

Image: R Zugaro, Museum Victoria

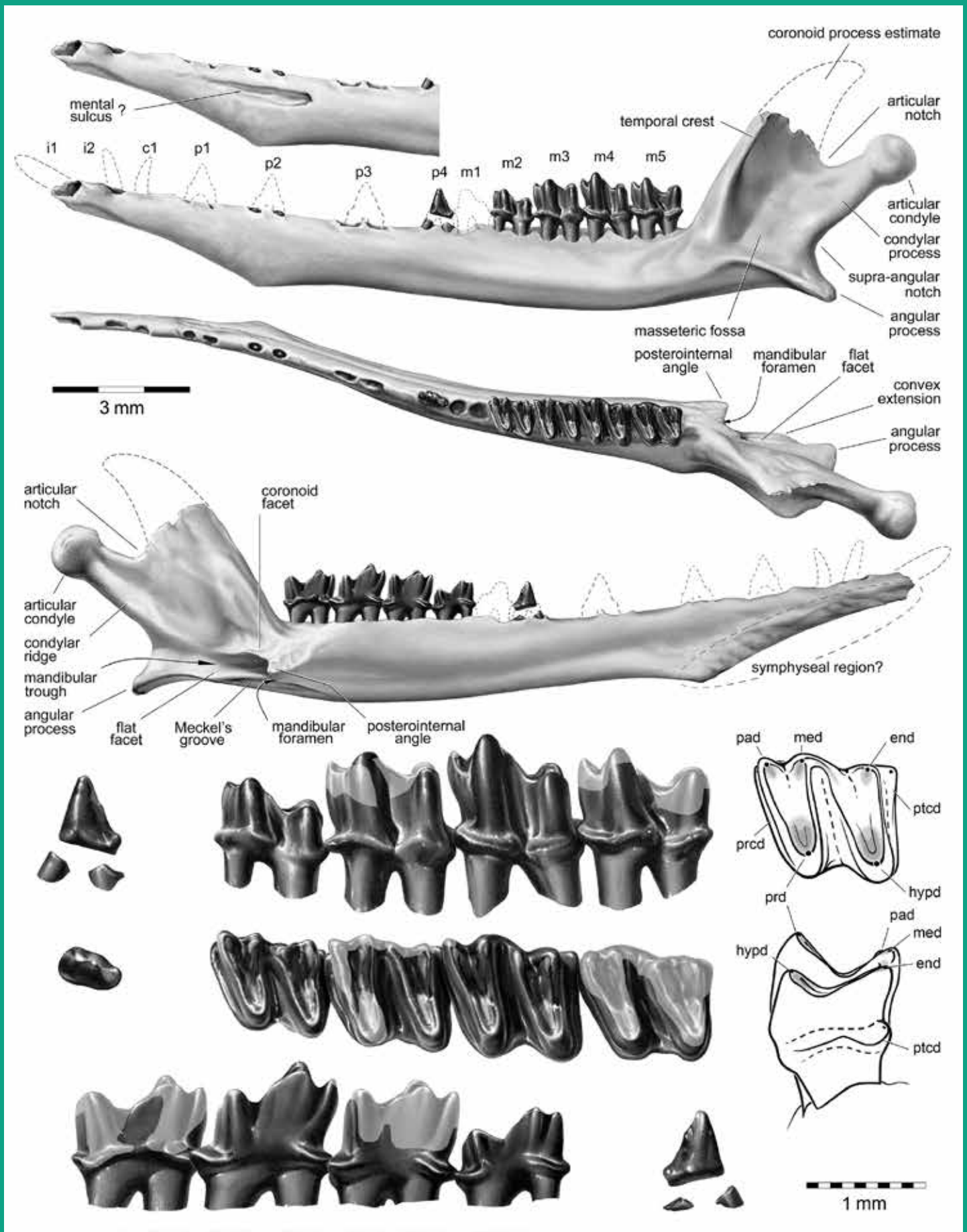
L-R Standing: David Pickering, Ben Francischelli, Lisa Nink, Jeremy Baker Smith, Dean Wright, Chantelle Roberts, Eve Eidelson, Mary Walters, Norman Gardiner, Wendy White, Miklos Lipcsey, Helen Phelan, James Rule, Ali Calvey, Adele Pentland, Robert Bender, Mike Cleeland, Nick van Klaveren
Seated: Jane Lindsay, Caitlyn Jay, Amber Craig, Genevieve Cini, Adrienne Mallinson, Corrie Williams, Alan Tait

ERIC THE RED WEST WEEK 3 CREW

L-R Standing: Margaret Baldassa, Joerg Kluth, Norman Gardiner, Nick van Klaveren, Melissa Hobbs, Darren Bellingham, Alison Dorman, Olivia Arnold, Phil Spinks, Dani Measday, David Pickering, John Wilkins
Seated: Nova Taylor, Mary Walters, Cassia Paragnani, Giulia Cinquegrana, Kim Douglas, John Swinkels, Callum Simpson, Mike Greenwood, Sarah Newsam, Stephen Poropat, Alan Tait

ROOKIES' DAY CREW

L-R Standing: John Wilkins, Ben Francischelli, Callum Simpson, Sarah Newsam, Mike Cleeland, Melissa Hobbs, Eve Eidelson, Olivia Arnold, Jeremy Baker Smith, Chantelle Roberts, Harry Osmond, James Rule, Mary Walters, Corrie Williams, Wendy White, Livvi Campbell, Christina Boundy, Jess Bruce, Nova Taylor, Shannon Brown, Hannah Carle, Astrid Werner, Adele Pentland, Robert Bender
Kneeling: Wendy Turner, Gerry Kool, Elaine Anderson, Cassia Paragnani, Genevieve Cini, Lesley Kool, David Pickering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