DINOSAUR DREAMING 2024 FIELD REPORT

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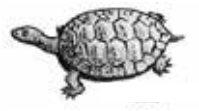

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Dinosaur Dreaming acknowledges the Bunurong and Eastern Maar peoples, the Traditional Owners of our Victorian Cretaceous dig sites, and pays respect to their Elders past and present. We extend that respect to indigenous peoples throughout Australia.

FRONT COVER: Dinosaur Dreaming at Twin Reefs by Marlonique Wolmarans.
INSIDE FRONT COVER: Cretaceous animals by Peter Trusler.
BACK COVER: Dinosaur Dreaming 2024 logo by Zev Landes.

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The Dinosaur Dreaming 2024 Field Report was compiled and edited by Wendy White. The editor would like to thank Mary Walters for proofreading and Tom and Pat for battling the tech.

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Image: L Nink

THE HOUSE AND THE WRAPPING ROCK

BY WENDY WHITE

Dinosaur Dreaming's February 2024 dig was full of surprises which kept us on our toes and necessitated constant adjustments.

The Plan

Melissa Lowery had found associated bones at Eagles Nest, so we decided to dig at that site. It had 127 stairs, and the crew was looking forward to all of them. It was in a very public area, so we had decided before the dig started to minimise how much work we would do there. We would send a small crew to site each day, who would only remove large chunks of rock. We would not have rock-breakers on site, to discourage the public from deciding that they could do this themselves without a permit. We would add a couple of people to talk to passers-by and other interested members of the public, and to make sure that we kept them safe from our excavations. On weekends, we planned for this to be a dedicated role — not that any of our diggers who love to hit things with a hammer were clamouring to take it on. John Wilkins devised a clever system of buckets and poles that would create a very obvious physical barrier to entering our site.

Some of the more physical crew would go down to the site a couple of times throughout the day to retrieve the buckets of excavated rock and deliver them to the house.

We also decided that we needed more taphonomic information than we had previously been collecting. We devised a scheme of numbered buckets (for example, 16-1 was the first bucket extracted on the 16th) with a photogrammetric (3D photographic model) record between filling buckets to trace back precisely where in the shore platform that they came from.

We had purchased a new electric rock saw (a circular saw with a diamond-tipped blade) which, whilst not being able to cut quite as deep as the old petrol-powered one, was much lighter and much easier to control. We were confident that this would allow us to expand the number of people trained to use the rock saw to a larger number of crew. A special call-out to Amber Craig and Fotini Karakitsos who embraced the new tool with relish.

Instead of wrapping and labelling the fossils at site, we decided that we would bandage them only. We would use no newspaper, just tape to hold the toilet paper to the fossil — also (of course) putting chips of rocks with fossils on them into vials. Instead of labels, we would write bucket numbers and a fossil-half identifier on the rock (for example, 16-1A for the first broken fossil face found in bucket 16-1). Then back at the house, we would unwrap all fossils, match all of the pieces, trim where appropriate, wrap, label and catalogue them. And because we would have the rest of the bucket available, we could easily(!) find any missing halves.

We had deliberately chosen the dig dates so the best weekend for tides was the middle weekend (17th and 18th February). This was so we could do set-up and tear-down activities at the beginning and end of the dig without sacrificing a lot of site time. It also meant that we would have time towards the end of the dig to process all of the 2024 rock that the team had carried up the stairs.

Once again, Zev Landes would be joining us as an embedded artist, to sketch dig moments. He also generously provided not only the original design for our dinosaur T-shirt (in collaboration with some of our PhD students), but also the fancy fabric printing press to transfer the design to vests, T-shirts and polo shirts. Our artist digger Sharyn Madder returned from a hiatus last year. One of our rookies, Marlonique Wolmarans, was an aspiring artist. You can enjoy their wor in this Field Report.

Happy with our plan, we sat back and waited for the dig dates to arrive.


Image: J Koekoe

The crew with Alan Evered's 90th birthday balloons

Preparing The House

We rented our usual Dig House at Cape Paterson, with a few diggers renting the Blue House a few properties down the street. Some of the core crew arrived a day early on Friday 9th February.

We assessed the back lawn to see if it needed mowing (it didn't) and looked for jumping jack nests to see if they needed eradicating (they didn't). We set up the rock-breaking tarp in the back yard, a welcome return of the tap-tap-tapping to Cape Paterson from Lesley Kool's house where we had banished it in our return-from-Covid caution the previous year.

John Swinkels retrieved a ute-load of Old Rock to break down until we extracted enough 2024 Rock for the whole crew. The Old Rock was mainly rock that had once been wrapped and catalogued, but had undiagnostic fossils on the surface. It needed to be hit with a hammer to determine if there was better stuff inside.

As in previous years, we transformed the garage and downstairs space from a living room for a single family to a food service area for 20 people. We determined how much we could plug into the one lonely little power point in the garage, prioritising the urn for our much-anticipated cups of tea, and piling our new microwave and toaster on top of the bar fridge. We ran an extension cord along the ceiling so we could power work lights on both sides of the room.

Image: W White

Adam Dellal and the crew sweep rock

Image: W White

Astrid O'Connor designed the new dig house white board

Once again, we stored John Wilkin's portable freezer at one of the satellite houses, to protect the dig house garage power points, and because that house gets very full and very busy. A few diggers brought pre-cooked frozen meals. Big thanks to Doris Seegets-Villiers with her trays and trays of zucchini slice, Marion Anderson with her big pot of sauce that became spag bol and chili, and John Wilkins with the always-beloved lasagne. I experimented with a Moroccan tangine-inspired stew.

We packed away most of the stuff already in the house, replacing it with our own dig things. We unloaded great big pots and pans and serving tools upstairs and lots of plates and mugs and cutlery downstairs.

We were ready. We ordered our usual pre-dig fish-'n'-chips (Cape Paterson is not known for its range of takeaway dinner options), opened the chocolates and waited for the next day when the new crew would arrive.

Eagles Nest

On Saturday the 10th February, we welcomed our first week dig crew, a mix of seasoned crew and rookies. We filled up the bedrooms and put up a couple of tents in the back yard. We put the rookies through their paces, as they spotted fossils on the training rocks and received instruction on how to hit rocks with a hammer and cold chisel.

On Saturday 10th and Sunday 11th we only sent a few people down to Eagles Nest to plan our attack and take some initial photographs of the area we planned to excavate. The rest broke rock at the house. We found unimpressive fossils in the Old Rock, but we all wanted to get our hands on new 2024 Rock. We were expecting a lot from this new site.

Image: Z Landes

Twin Reef turtles by Zev Landes

Zev dropped off his fabric printer and the decals, and we started the process of printing the vests and shirts we had ordered. Zev had filled the space between the official images with extra dinosaurs and other animals found in the Bass Coast Cretaceous, so the crew happily chose extra images to personalise their shirts.

On Monday 12th, bright and early, we sent a small excavating crew down to site. Those of us not at site were experiencing uncontrolled FOMO (Fear of Missing Out) but got on with the job of backyard processing.

The crew on site reported very few bones, a handful of plants and many public onlookers. Back at the house we also found few bones and a handful of plants but continued to work assiduously, interrupted only by the occasional “hello” from the landlord’s parents over the back fence.

Then everything changed.

The Power Outage

We had an overnight storm on Tuesday 13th February. We lost power and most internet connectivity at Cape Paterson. Dinner plans changed at the last minute — Tom Rich and Pat Vickers-Rich came to the rescue with roast chickens from the Inverloch supermarket that had a generator. We deferred or cancelled diggers’ planned research presentations. We retrieved flashlights and head lamps. We all went to bed when it got dark (heat and wind before the storm meant that it was a Total Fire Ban day and we could not even light a campfire) and waited to see what the morning would bring.

In the morning Corrie Williams braved Bunnings where she was escorted through the dark warehouse by a staff member with a big flashlight, and bought a portable camping stove for making essential cups of tea. It took about 15 minutes to boil enough water for the crew but that was much better than nothing.

We did not send anyone to site on Wednesday 14th because we had planned to take photogrammetry records of the rock we were removing from site. Our phones were not charged enough to take videos and we had no internet to send them back to be processed. We broke the 2024 Rock retrieved on Monday in the back yard. We did not love the new rock. There were not many fossils in it. The find of the day from this was a small collection of fish scales. Those who have been associated with the project for a while will know that this did not thrill us.

We ran a pool to guess when power would be restored.

Image: W White

Ruairidh Duncan and Jake Kotevski removing turtle fossils

(The prize? The first hot shower!)

Late on Wednesday we got power back for a short time, so on Thursday 15th February we sent the small crew back to Eagles Nest (for the first time that crew included me so I was happy). We found more bones than on previous days, partly because we were working closer to Melissa Lowery's initial find. However, it was decided that we would not continue excavating this site and would move to our alternate location.

By the evening of Thursday 15th February, we had bought or borrowed three gas rings (including one that could actually boil a dig-sized pot of water fairly quickly) and had borrowed Lesley's generator to charge phones and power our fridge for a part of each day (by running a long extension cord over the back balcony). We had established a new workable power-outage normal. We learnt to like lukewarm showers, and wondered how long that stored heat would last.

We found a few vertebrae, including a rather attractive one found by Amber.

Then everything changed.

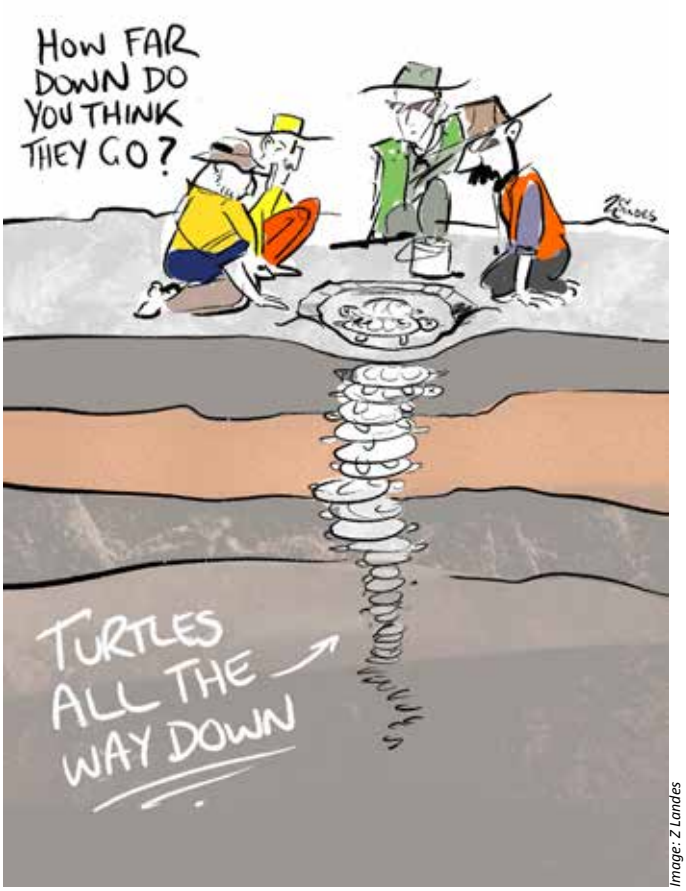

Image: Z Landes

Turtles by Zev Landes

Twin Reefs

On Friday 16th February two exciting things happened — we moved our base of operations to Twin Reefs (which had only about 90 stairs but they were obviously built by a very tall person who did not know that some people have short legs — they were about 10 cm too high and 10 cm too deep), and our power came back on permanently. Twin Reefs was a much less popular tourist destination than Eagles Nest, so we decided we could send most of the crew and process the rock on the beach, and dispense with building the tall barricade. That's one way to cure everyone's FOMO!

Twin Reefs was stunningly beautiful and had a few boulders that were at excellent sitting height, including one near the dig hole that I claimed for myself, designating it Prep Rock, and upon which I spread out my fossil wrapping materials. I devised an improvised table of gold pans resting on buckets to store exposed fossils as they dried. We found lots of fossils, and lots of turtle fossils. Marlonique found a nice little vertebra, we found a very attractive ornithopod claw (pedal ungual) near an isolated ornithopod tooth, and a beautiful really big (for ours) ornithopod lower jaw (dentary). This was starting to work really well.

There was one noticeable issue with the Twin Reefs rock. There were small fractures in the rock that were in-filled with calcite. Sometimes a fossil would be split by the small fracture, which generally meant that one half of it was hidden behind this largely opaque calcite layer. It took us several days to notice this — we had assumed that the fossils terminated at the calcite. That meant that we then had to undertake a broad search for the other half. We did not come up with a solution for this during the dig, but have some ideas that we might try in 2025.

Image: J Koekoe

Corrie Williams and Alan Tait make coffee on the gas burner.

Crew changeover on Saturday 17th February saw me waving goodbye to the first week crew and staying at the house to induct the second week crew, watching Alan Evered train the Rookies, and helping Lesley Kool catalogue the fossils we had previously found. We needed to clear table space at the house for the anticipated new finds. I discovered that when you find a big turtle shell, it tends to be retrieved in many fragments that require time and patience to piece back together. That day I was definitely not understanding how Lesley could love turtles so much.

Down at site Doris and Melissa Lowery found a small articulated tail. It split along the length so was particularly beautiful. I look forward to learning more about it.

After dinner we celebrated the 90th birthday of Alan Evered, our most long-lived digger. We threw balloons off the balcony and gave him 90 individually wrapped presents, which he did not finish unwrapping until August.

Sunday 18th February I was back at site, soaking up the view, numbering buckets and bandaging fossils to be examined at the house. We found more nice stuff, including a small vertebra by Doris. The crew was happy.

Monday 19th February, after carrying the big rock saw to site for this purpose, the crew decided to extract a turtle that Melissa found about 2 metres from the main hole, in parallel with continuing to excavate the main hole. This is where things got a bit stressful for me, the fossil wrapper, since the turtle being excavated was big and fragile and emerged in many pieces, and other bones were found whilst removing it. This happened at a time when the main hole was yielding some nice fossils. So we needed to halt work on the main hole so that we could focus on the turtle hole and keep all of the fossil buckets and fossil halves controlled. At the debrief that evening, we decided that we would no longer attempt to opportunistically extract Melissa's finds, but work systematically along the layer, extracting surface fossils when we get to them.

Image: F Karakitsos

The crew working at Twin Reefs

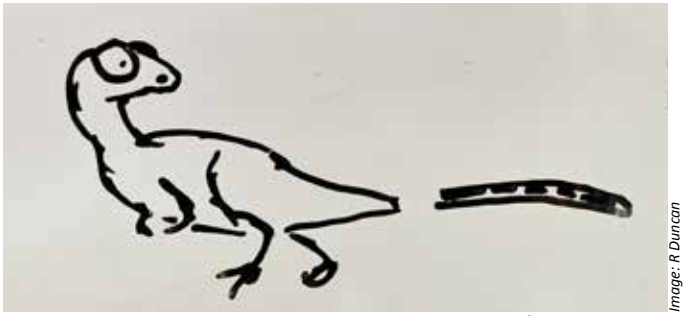

Image: R Duncan

This drawing appeared on the dig white board after the tail was found. I suspect the artist is Ruairidh Duncan, who is very fond of ornithopods. I don't know for certain that it is an ornithopod tail, but there's hope!

Fossils extracted included a little vertebra found by Astrid O'Connor, a metatarsal, and a huge crumbly turtle shell that we catalogued as a whole tray.

On Tuesday 20th February, I stayed back at the dig house to help Lesley identify, sort and match all parts of the fossils that we had extracted the previous day, including all the fractured pieces of turtle shell. This is a fun part of my job, but I also wished I could be on site with the rest of the crew... until they told me that, although they had taken down the hot water and cups, they had forgotten the tea and coffee! Those from the Blue House who had brought hot chocolate sachets were much happier than the rest of the crew down at Twin Reefs. No fossils were found on site on 20th February, which did not help the crew's mood.

Wednesday 21st February, I was back at Twin Reefs, although the tides were starting to drive us off the beach in time to work at the house in the afternoon. We had a very successful fossil-finding day. Corrie Williams extracted a large crumbly turtle plastron and a close-by turtle humerus. Mary Walters, Astrid O'Connor and Alan Tait found more vertebrae. We still had problems with the tea and coffee — the crew in charge of afternoon tea had decided that the day was too hot to worry about such things. I tried to be subtle drinking from the sneaky one-cup thermos I had been taking down with me, but I think everyone noticed.

Thursday 22nd February was spent mainly at the dig house. Because of the tides, we had planned the morning at the house, and for a clean-up crew to go to site in the afternoon. But it was really hot and really windy, so the house crew knocked off early and most of us went for a swim. A small crew of four did go to site, but were there less than an hour taking some final photographs and making sure that the beach bore little trace of our passing. We found a few more

fossils. Highlights included a turtle plastron and more vertebrae, including one by rookie Ash Hateley.

Friday 23rd February we broke up the rest of the Twin Reefs rock and started packing up the dig house. Mary found an ornithopod tooth in the Twin Reefs material, a promising sign.

Our landlord's mother, who lived over the back fence, surprised the crew with a home-made Victoria sponge with lashings of jam and beautiful fresh cream. We love it when the community embraces and supports the dig.

Pack Up

Each dig season, we end up with some food left over. Mostly it is flour and sugar and pasta and rice — things that we have bought cheaply in big bags. Although there was slightly more than usual this year — I think we'd overlooked that we had a smaller crew and lots of pre-cooked meals. Most years we have a surprise leftover ingredient. Those who were there on the last day of the 2015 dig remember me trying very hard to give away large jars of cream cheese spread. This year it was bread wraps. Possibly because quite a few packets had ended up upstairs hidden during lunch prep. At least they freeze well.

Wrap Up

The dig was over for another year.

We had:

- Determined that the Eagles Nest site is not a deep rich vein and is better suited to prospecting than quarrying;
- Discovered that Twin Reefs is a great new site with enough good rock to dig for a few more years (a special call-out to Melissa for finding it!);
- Catalogued 114 bones/teeth, 1 set of fish scales and 5 plants;
- Uncovered several vertebra in association, something that did not happen at Flat Rocks.

Image: W White

Fossils found at Eagles Nest (blue) and Twin Reefs (orange)

Image: W White

DEBUTANTE DREAMER

BY MARLONIQUE WOLMARANS

After touching down in Melbourne from New Zealand, diving straight into the Dinosaur Dreaming team excavation felt like jumping headfirst into Aussie culture. It was like my initiation into all things Down Under happened right there at the dig site.

A storm hit, knocking out power and service for days. But despite the challenges, those days became some of the most memorable moments of the dig. I have to admit, it turned out to be one heck of a wild ride.

Meeting the crew and getting to know their quirks was like stepping into a sitcom — each person brought their own unique flair to the dig, from the seasoned pros dropping knowledge to the rookies like me stumbling over our tools. I soaked up every bit of insight.

It was a whole new world compared to the crab and whale fossils I was used to back in New Zealand. It was truly a dig to remember.

Image: J Koekoe

Marlonique carries buckets of water to wash rock

Image: W White

EAGLES NEST AND TWIN REEFS

BY LESLEY KOOL

Fossil collecting along the Bass Coast of Victoria in 2024 began with a bang! In January, local fossil prospector Melissa Lowery discovered a new fossil site at Twin Reefs, less than one kilometre west of Eagles Nest. Her discovery followed some impressive finds she made the previous year at the same locality, including a large theropod tibia and a number of articulated vertebrae in sandstone erratics.

Previously, very few fossil bones had been discovered at Twin Reefs, but Melissa had a gut feeling that there was more to be found and her gut did not let her down when she returned in January 2024. Melissa found 13 bones exposed in a discrete mudstone layer on the shore platform within an area of 7 m by 1.5 m. Interestingly, the bones belonged to just two taxa. There were three vertebrae, one toe bone, one humerus and an odd bone, which after preparation, was thought to be a pterygoid, all belonging to ornithopod dinosaurs. The second taxon was the ubiquitous turtle, represented by an almost complete carapace and plastron, a partial articulated tail and two shell fragments. Initial preparation of the almost complete carapace suggests that it could be a new genus and species as it differs in a number of characters from the more common turtle that is found along the Bass Coast.

Image: L Kool

Articulated vertebrae and jaw

The discovery of a new fossil locality sent ripples of excitement and anticipation through the Dinosaur Dreaming team, who were eager to sample more of the site. However, plans had been made to sample the Eagles Nest locality where Melissa had found a partially articulated dinosaur skeleton the previous year, so Twin Reefs had to wait.

Two weeks were set aside to sample the Eagles Nest fossil layer in February, but after five days of finding practically nothing, it was decided that the second week of the field trip could be used to explore Twin Reefs. Although not much was found at Eagles Nest in the first week of the field season, one specimen caused quite a stir. Found by Amber Craig, the specimen appeared to be the dorsal processes of a gracile vertebra. Currently its identification is unknown.

As well as processing the rock excavated from the Eagles Nest locality, the team also has access to

Image: L Kool

Humerus


Image: L Kool

Mary's jaw


Image: L Kool

New jaw with Qantassaurus intrepidus *and vertebra*

an amount of Old Rock from previous field seasons at the Flat Rocks dig site that needed to be broken up. Mary Walters, one of the founders of the Dinosaur Dreaming project and ace discoverer of five mammal jaws, cracked open an Old Rock and found a beautiful ornithopod dinosaur dentary, with ten teeth preserved in the jaw. It proves that the Flat Rocks site still has a few secrets up its sleeve.

The second week of the field season was far more successful. Within hours of commencing excavations at the site where Melissa found the first 13 fossil bones on the surface, more bones were recovered. Over the second week the team collected more than 100 bones, again mostly ornithopods and turtles. I was particularly interested in the fossil turtles as I was hoping to find more evidence of the new genus and species.

The general size of the ornithopod bones was interesting. They were mostly vertebrae; some were articulated and others found close enough together to assume that they were associated. They were also larger than the average ornithopod bones found at the major fossil locality at Flat Rocks, particularly the humerus that was one of the original 13 that Melissa found. One large ornithopod pedal claw was collected, again larger than any other ornithopod claw found along the Bass Coast. This size disparity also applied to an ornithopod dentary, which bore a general similarity to the holotype *Qantassaurus intrepidus* dentary but was considerably larger. There is a possibility that all the ornithopod bones may originate from one individual. This theory will be tested when the team returns to Twin Reefs next February for a three-week field season.


Image: L Kool

Mystery bone

One specimen that went against the trend was a small articulated tail. Made up of more than 20 vertebrae, each only about 1 cm long, it appeared to be the end of the tail. Unfortunately, the rest of the animal had not been preserved.

Dr Matthew Carrano from the Smithsonian Institution in Washington, USA, arrived in May to research the Museum's dinosaur collection, which prompted me to prepare as many of the dinosaur fossils collected from Twin Reefs as possible so that he could examine them during his three month visit to Museums Victoria. His report on the dinosaur material in the Museum's Collection is eagerly anticipated.


Image: L Kool

Odd vertebra from Eagles Nest

Image: W White

VICTORIAN THEROPODS

BY JAKE KOTEVSKI

The curse of the academic is to always be looking to the future — what project is next? Ironic because, as a Palaeontologist, I should be looking into the past. In February 2022, I began my PhD with the goal of revising the record of theropod fossils from the Cretaceous coasts of Victoria. With hundreds of registered fossils collected over four decades by more than 700 volunteers (and counting!), we hoped to discover what was missing from the record of Australian carnivorous dinosaurs.

The past two decades have delivered a treasure trove of theropod dinosaur fossils. In the Cretaceous of Victoria, palaeontologists have identified noasaurs (Birch et al., 2020), elaphrosaurs (Poropat et al., 2020), tyrannosauroids (Agnolín et al., 2010; Benson et al., 2012), megaraptorids (Poropat et al., 2018; Poropat et al., 2019; Smith et al., 2008) and probable unenlagiines (Benson et al., 2012), as well as other more-inclusive groups, closely tying the Australian Cretaceous to that of South America. However, despite their taxonomic variation, the fossils remained the same. They were usually tiny teeth or small, isolated and often fragmentary body fossils.

In the first six months of my PhD, as I scoured the collections of Museums Victoria to establish the foundations of my research, I was approached by Senior Curator of Vertebrate Palaeontology, Dr Erich Fitzgerald. Erich was particularly interested in an isolated fossil from Shack Bay of the Bass Coast, found by Mike Cleeland in 2007, which had already been identified as a theropod frontal bone — an element which forms the back part of the skull. My colleagues and I published this research in February (Kotevski et al., 2024), and identified this specimen as a megaraptorid, being only the 3rd (and geologically oldest!) example of a megaraptorid frontal in the world, and the first upper-skull bone of a theropod ever described from Australia. But, even before that research had been published, I'd already begun planning the next paper.

In 1988, Pat Vickers-Rich collected a fragmentary distal end of a tibia (lower leg bone) from what is now known as Lesley's Lair at Eagles Nest. This poor bone sat in the dark drawers of the MV collections for decades, having never been formally described. Then, in December 2022, Melissa Lowery found three new specimens, a tibia and a pair of articulated vertebrae, from the now-lauded Twin Reefs locale, and another tibia from Eagles Nest. I began to form a plan for a new paper — New theropod tibiae from the Lower Cretaceous of Victoria, southeastern Australia. I spent two weeks going through all limb material of theropods at Museums Victoria, and found only one other tibia worth describing, found in 2007 by Mike Cleeland at Point Lewis on the Otway Coast. And then, in July of last year, Collections Manager Tim Ziegler suggested that those two articulated vertebrae from Twin Reefs were also theropod, and into the mix they went. Recent Dinosaur Dreaming Field Reports have included reports of quite a few firsts — in the 2020 edition, Steve Poropat's Elegant and Enigmatic Elaphrosaurines discusses the first Australian elaphrosaur; in 2023, Adele Pentland's Pterosaurs in Victoria discusses the first juvenile pterosaur from Australia. In this research, my colleagues and I have identified multiple firsts, all in one. This paper is currently in review, so keep an eye out!

The Eagles Nest raptor

Although NMV P257601 appears to be another unassuming theropod limb bone from Victoria, it's actually quite important. This near-complete tibia belongs to an unenlagiine, which are a southern radiation of the dromaeosaurs, commonly known as raptors. While their northern cousins, such as *Deinonychus* or *Velociraptor*, are known to prey on other dinosaurs, the unenlagiines are thought to be piscivorous (Brum et al., 2021), or may have exploited small-mammals, of which Victoria had no short supply. While a possible unenlagiine was known from the Otways, specimen NMV P257601 is the first unenlagiine identified from the Bass Coast.

Image: A Tait

NMV P257415, large megaraptorid tibia, before preparation.

Big shoes to fill

The Lesley's Lair tibia (NMV P186143) that kickstarted this project, and its counterpart from Point Lewis (NMV P221042), are arguably the most exciting specimens included in this research. Having trawled through hundreds of papers containing theropod tibiae, we were only able to identify one theropod that shared an almost exact morphology with these specimens – *Siamraptor*, a carcharodontosaurian from Cretaceous Thailand. The carcharodontosaurs are a lineage of large theropods that achieved apex status in North America (such as *Acrocanthosaurus*), Africa (such as *Carcharodontosaurus*) and South America (for example, *Mapusaurus*). Other famous examples include *Giganotosaurus* from Jurassic World: Dominion, or *Tyrannotitan* that features in the travelling exhibit Dinosaurs of Patagonia. Several species are known from the Gondwanan continents of South America and Africa, but had yet to be identified in Australia. Although very small compared to their cousins around the world, these two specimens are the first robust evidence that the carcharodontosaurs made it to the land down under.

More megaraptorids than we can manage

The Twin Reefs vertebrae (NMV P257414) and tibia (NMV P257415) are spectacular. Melissa found both of these specimens on the same day, from two different boulders that had eroded from the cliff face. These fossils were immediately striking, and are easily the largest theropod body fossils found in all of Victoria. Unfortunately, we cannot say for certain whether these specimens belong to the same, or two different, individuals. However, they both represent evidence of a large megaraptorid in Victoria, throwing both specimens into contention to be one of Australia's largest theropods. The tibia approaches a 5-10% size increase compared to the same element in Queensland's *Australovenator*, placing it in a similar size range as New South Wales's Lightning Claw (LRF 100-106). While the Punchbowl Claw outshines them all (around 25% larger than *Australovenator*: Poropat et al., 2019), these fossils give us a glimpse into the larger sizes theropods were able to achieve in Victoria.

Cretaceous Victoria undoubtedly holds more secrets, but the addition of another unenlagiine, the first carcharodontosaurs and large-bodied megaraptorids substantially improve the Australian theropod record. I now look forward to the 2025 Dinosaur Dreaming dig, and Melissa's next find. Perhaps a theropod jaw is out there, after all.

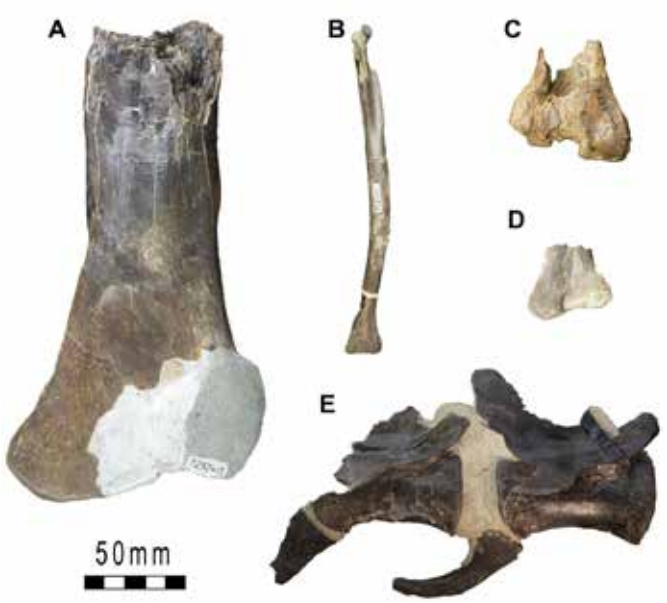

Image: J Kotevski

Victoria's newest theropod fossils. A. NMV P257415, the large megaraptorid tibia in anterior view; B. NMV P257601, the unenlagiine tibia in anterior view; C. NMV P186143, the Bass Coast carcharodontosaurian tibia in anterior view; D. NMV P221042, the Otway carcharodontosaurian tibia in anterior view; and, E. NMV P257414, the large megaraptorid vertebrae in right lateral view.

Image: A Tait

NMV P257415 after preparation by Alan Tait

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Image: J Metzger

Reconstruction of the upper Strzelecki Group environment, displaying a carcharodontosaurian drinking, unenlagiine fishing, and the apex megaraptorid prowling the shoreline. Artwork by Jonathan Metzger, courtesy of Museums Victoria,

North to South or South to North: The Dispersal Direction of Some Major Mammal Groups?

Thomas H. Rich[1,2], Michael Hall[2], Lesley Kool[2], Sally Rogers-Davidson[1], Patricia Vickers-Rich[1,2,3],

1. Museums Victoria, Melbourne, Australia, 2. Monash University, Clayton, Victoria, Australia, 3. Curtin University, Perth, Western Australia

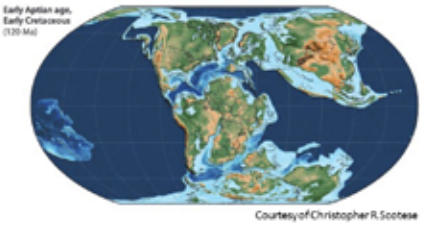
The Traditional, Well Established view

Beginning at least in 1876 when Alfred Russel Wallace speculated on the biogeography of major mammalian groups in his seminal work, "The Distribution of Animals, with a Study of the Earth's Surface", the view has been consistent among biogeographers that the major groups of terrestrial mammals originated in the Northern Hemisphere and dispersed to the Southern. These dispersals are thought to have occurred in the Mesozoic. Given the preponderance of relevant fossils in the Northern Hemisphere during that era and the few from the Gondwana continents of that time, this hypothesis has been seen to be further strengthened during the past century and a half with the collection of additional specimens.

Coupled with this was the arrangement of the continents in a stabilist world. Workers such as Charles Darwin considered that the Eurasian land mass was the heartland of evolution because it was so much larger than the continents outside of it. This view has been given the name the Sherwin-Williams effect. This is because the logo of that paint company shows paint spreading from the north to the periphery on the south.

Plate Tectonics and a Few Fossils Challenge Tracitional view

With the widespread acceptance of Plate Tectonics, it was no longer obvious that the Sherwin-Williams effect applied in the Mesozoic when the major terrestrial mammalian groups evolved.

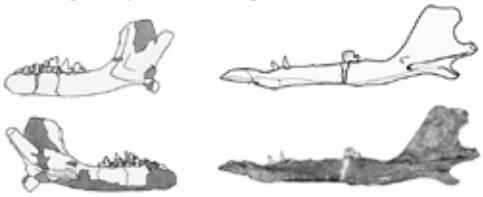


Courtesy of Christopher R. Scotese

In addition to the Plate Tectonic Revolution, a handful of fossils all discovered in the Southern Hemisphere during the past 35 years, suggest that caution may be warranted in the conventional view.

In the Early Jurassic of Argentina fossils of stem therians (four lower jaws plus possibly one upper premolar) occur 15 million years earlier than undoubted therians (marsupials and placentals) in the Northern Hemisphere. The oldest therian in the Northern Hemisphere is either Late Jurassic or Early Cretaceouss in age.

Stem therian *Juramaia sinensis*, Late Jurassic or Early Cretaceous, 15 million years minimum or as much as 50 million years younger than *Asfaltomylos* and *Henosferus*, China.



The single known specimen of the stem therian *Asfaltomylos patagonicus*, Early Jurassic, Argentina.

One of four or five known specimens of the stem therian *Henosferus molus*, Early Jurassic, Argentina

Cimolodontan Multituberculata

The Multituberculata are the longest-lived mammalian order, appearing in the Early Jurassic and becoming extinct in the Early Oligocene. Rodent-like, it may have been the appearance of that group that led to their extinction.
Two major groups of multituberculates have been recognised, differing primarily in the number of lower premolars.

Plagiaulacoid multituberculate characterized by more than one premolar in lower jaw. This group appears in the Early Jurassic.

Cimolodontan multituberculate, characterized by a single enlarged, blade-like lower premolar. In the Northern Hemisphere, they appear in the early Late Cretaceous.

One of two known specimens of *Corriebaatar marywaltersae* from the late Early Cretaceous of Australia, the oldest known cimolodontan by at least 15 million years.

Conclusion

So, do these few specimens of therians and cimolodontans provide sufficient evidence that these groups originated in the Southern Hemisphere and then dispersed northward?

Image: W White

LOGO? VEST? WE GO TO THE BEST!

BY ASTRID O'CONNOR

The 2023 Flat Rocks dig crew were delighted to meet Zev Landes, a local artist engaged for the Bass Coast Dinosaur Trail proposal. A Phillip Island local with a diverse background across education, entrepreneurship and creativity, Zev's art has been featured by many conservation, environmental and governmental groups globally.

When thoughts turned to the planned DD 2024 dig in late 2023, there was an idea to create a dig logo representing Eagles Nest (Figure 1) to adorn swanky new high-visibility vests for everyone. Zev's incredible talent and skill placed him at the top of our list of candidates and he graciously offered to create one for us!

The initial brief was for a nonstandard high-vis vest colour… we tried blue but remembered sand flies were attracted to that so green won out. — Corrie Williams

The initial brief involved trying to highlight the local theropod finds. Hence, our initial logo brainstorm tried to draw a connection between those theropods and their avian descendants, particularly the sea eagles of Eagles Nest notoriety. A composition idea that we really liked involved the eagle looking down upon a megaraptor from its elevated nest.

Whenever a cartoon is created, the hardest part of the work goes into coming up with the idea… — Zev Landes

Wanting to capture the pride in the dig site, whilst still honouring the fonts and styles of past Dinosaur Dreaming logos, Zev sent through a few sketch ideas (Figure 2). Jake Kotevski was consulted to ensure that the megaraptor had its key anatomical details correct whilst still falling within the cartoon style.

Image: A O'Connor

Figure 1. Eagles Nest Landscape

I was also consulted, but if I'm honest, my main contribution was to suggest that the eagle be given Sea Eagle colours!

Starting by drawing with pencils and paper, the rough concept was refined as Zev iterated ideas. Compositions were then developed further on the iPad with the Procreate app, an Apple Pencil 2, and a brush called Dry Ink. Working digitally at this stage allows for changes to easily be made to the art based on feedback. One key piece of feedback was the suggestion that a mammal be added (Figure 3)!

One of the most challenging aspects involved attempting to cartoon-ify the natural Eagles Nest rock tower whilst still having enough detail to be recognisable.

The colour scheme for the megaraptor was also discussed, and it was decided to keep it in line with the colour scheme Zev had already created for the megaraptor hero animal in the Bass Coast Dinosaur Trail proposal branding and posters.

With the final logo design approved (see back cover)

Image: Z Landes

Figure 2. Initial DD 2024 Logo draft

Image: Z Landes

Figure 3. We love a cheeky mammal!

and screen-printed (via an amazing group effort) onto the green vests (Figure 4), the crew loved being able to wear a safety vest that was also beautifully stylish and branded (Figures 5-7)!

We are extremely thankful to Zev for lending his time and wisdom to the logo's creation. I for one will treasure this vest for years to come. If you are interested in checking out more of Zev's work, you can find it at www.zevlandes.com or @zevlandes on Instagram.

Image: J koekoe

Figure 4. Marion Anderson and Corrie Williams printing vests

Image: J koekoe

Figure 5. Amber Craig wearing the final logo

Image: W White

Figure 6. Vest models Adam Dellal and Amber Craig

Image: W White

Figure 7. Alyssa Fjeld, Adam Dellal and Amber Craig test if the vests can handle a full range of motion

Image: W White

CRETACEOUS POTATO EATERS

BY SHARYN MADDER

THE MAMMALS OF VICTORIA'S CRETACEOUS

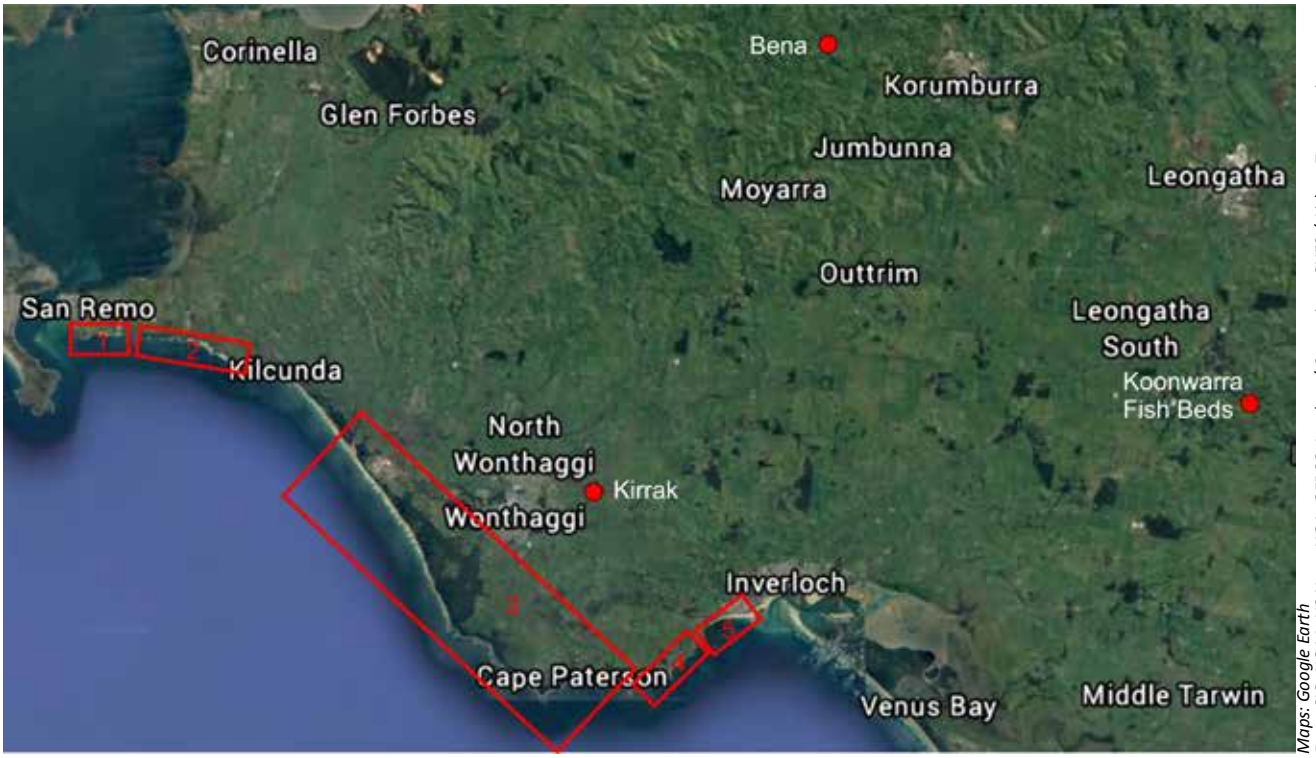
NMV Reg #	Taxonomy	Finder	Location / Field Catalog #	Date Found	Preparator	Notes
P208090	*Ausktribosphenos nyktos*	N. Barton	Flat Rocks #1111	1997	L. Kool	HOLOTYPE. Right. P6, M1-3
P208094	*Kryoryctes cadburyi*		Dinosaur Cove	1993	L. Kool	HOLOTYPE. Right humerus. Slippery Rock Pillar
P208228	*Bishops* sp.		Flat Rocks #329	1995	L. Kool	600my Exhibition display. Right. P4-M2
P208230	*Ausktribosphenos* ?		Flat Rocks	1995	L. Kool	Edentulous jaw fragment
P208231	*Teinolophos trusleri*		Flat Rocks	Nov. 1993	L. Kool	HOLOTYPE. M3 or M4. Mentor's trip
P208383	Monotremata		Dinosaur Cove	1993	L. Kool	Premolar. Slippery Rock Pillar
P208482	*Ausktribosphenos nyktos*	N. Gardiner	Flat Rocks #150	1999	L. Kool	Right. M2-3, badly crushed. From DD1998 rock
P208483	Ausktribosphenidae ?	N. van Klaveren	Flat Rocks #140	1999	L. Kool	Probably Left. x1 premolar & partial tooth
P208484	*Bishops whitmorei*	K. Bacheller	Flat Rocks #450	1999	L. Kool	Right. M2
P208526	*Teinolophos trusleri*		Flat Rocks #560	1994	L. Kool	Right. Edentulous
P208580	Mammalia	A. Maguire	Flat Rocks #200	2000	L. Kool	Jaw fragment. (unprepared)
P208582	Ausktribosphenidae	L. Irvine	Flat Rocks #500	2000	L. Kool	Right. M3
P209975	*Bishops whitmorei*	R. Close ?	Flat Rocks #387	2000	L. Kool	Right. Roots M1, worn M2. OK M3
P210030	*Teinolophos trusleri*			2000	L. Kool	Right. Edentulous
P210070	*Bishops whitmorei*		Flat Rocks	03 Dec 2000	L. Kool	Right. Badly broken M1, M2 and x6 Premolars. Rookies Day
P210075	*Bishops whitmorei*		Flat Rocks	03 Dec 2000	L. Kool	HOLOTYPE. 600my Exhibition display. Left. P2-6, M1-3. (P1 lost since initial preparation). Rookies Day
P210086	Ausktribosphenidae ?	J. Wilkins	Flat Rocks #250	2001	L. Kool	Right. Root fragment
P210087	*Kryoparvus gerritti*	G. Kool	Flat Rocks #620	2001	L. Kool	HOLOTYPE. Right. Rear half M1, M2-3
P212785	Mammalia	M. Anderson	Flat Rocks	03 Dec 2000	L. Kool	Fragment only. Rookies Day
P212810	*Bishops whitmorei*		Flat Rocks #300	2002	L. Kool	Left. M2-3
P212811	*Teinolophos trusleri*	D. Sanderson	Flat Rocks #187	2002	L. Kool	Right. Edentulous
P212925	Mammalia ?		Flat Rocks #222	1996	D. Pickering	Edentulous
P212933	*Teinolophos trusleri*		Flat Rocks #179	2001	L. Kool	Left. Edentulous. (Plus associated molar)
P212940	*Kryoparvus gerritti*	W. White	Flat Rocks #171	2003	D. Pickering	Referred specimen. Left. M1, M2-3
P212950	*Bishops whitmorei*	C. Ennis	Flat Rocks #292	2003	L. Kool	Left. P6, M1-3
P216575	*Teinolophos trusleri*	N. Gardiner	Flat Rocks #180	2004	D. Pickering	Left. x2 molars. Probably M2-3
P216576	Mammalia	A. Musser	Flat Rocks #500	2004	L. Kool	Isolated tooth
P216578	*Bishops whitmorei*	A. Leorke	Flat Rocks #600	2004	D. Pickering	Left. M1-3
P216579	*Teinolophos trusleri*	N.van Klaveren	Flat Rocks #635	2004	L. Kool	Edentulous jaw
P216580	*Bishops whitmorei*	G. Kool	Flat Rocks #800	2004	D. Pickering	Right. P6, M1-3
P216590	*Teinolophos trusleri*	J. Wilkins	Flat Rocks #447	2004	D. Pickering	Posterior part of right edentulous jaw
P216610	*Teinolophos trusleri*		Flat Rocks #557	2004	L. Kool	Left. Edentulous
P216655	*Corriebaatar marywaltersae*	M. Walters	Flat Rocks #142	2004	L. Kool	HOLOTYPE. Multituberculata. Left. P4
P216670	*Ausktribosphenos nyktos*		Flat Rocks #184	1999	L. Kool	Left. M2-3
P216680	*Teinolophos trusleri*	R. Long	Flat Rocks #132	2004	L. Kool	Right. Fragment
P216720	*Teinolophos trusleri*		Flat Rocks #648	2002	L. Kool	Right. Edentulous
P216750	*Teinolophos trusleri*	R. Long	Flat Rocks #162	2005	D. Pickering	Right. Edentulous
P221043	*Bishops whitmorei*	A. Leorke	Flat Rocks #100	2005	D. Pickering	Right. M1-2?
P221044	Ausktribosphenidae	C. Ennis	Flat Rocks #300	2005	D. Pickering	Left. M2
P221045	*Teinolophos trusleri*	J. Wilkins	Flat Rocks #395	2005	D. Pickering	Right. Edentulous
P221046	Mammalia	H. Wilson	Flat Rocks #480	2005	L. Kool	Isolated tooth
P221150	*Teinolophos trusleri*	J. Swinkels	Flat Rocks #340	2006	D. Pickering	600my Exhibition display. Right. x2 molars. Probably M2-3
P221156	Ausktribosphenidae	N. van Klaveren	Flat Rocks #360	2006	D. Pickering	Right. M2 (requires preparation to confirm)
P221157	*Bishops whitmorei*	M. Walters	Flat Rocks #585	2006	D. Pickering	Right. Edentulous with alveolae for P6, M1-3
P221158	*Bishops whitmorei*	R. Close	Flat Rocks #200	2006	D. Pickering	Right. P5-6, half M plus M2-3
P228432	Ausktribosphenidae		Flat Rocks	2009	L. Kool	Right. Molar talonid. From scrap rock
P228848	*Bishops* sp.	M. Walters	ETRW	10 Dec 2006	D. Pickering	Left. P6, M1, partial M2
P229037	*Teinolophos trusleri*	M. Cleeland	Flat Rocks #91	2008	D. Pickering	Right. Edentulous with alveolae for x4 molars and ultimate premolar
P229194	Mammalia	N. Barton	Flat Rocks #770	07 Mar 2007	D. Pickering	Isolated upper Premolar
P229408	*Teinolophos trusleri*	M. Walters	Flat Rocks #300	14 Feb 2008	D. Pickering	Left. Ultimate premolar, M1-4
P229409	Ausktribosphenidae	N. Evered	Flat Rocks #180	07 Feb 2007	D. Pickering	Possible new species. Left. P5-6, M1-3
P229410	*Teinolophos trusleri*	C. Ennis	Flat Rocks #90	2008	D. Pickering	Right. ?M1 plus M3
P229649	*Bishops whitmorei*	J. Tumney	Flat Rocks #330	2009	D. Pickering	Right. P2-3,5-6, M1-3
P231328	*Bishops* ?	A. Maguire	ETRW	29 Nov 2009	D. Pickering	Maxilla fragment with x2 molars
P232567	*Ausktribosphenos* sp.	M. Walters & J. Wilkins	Flat Rocks #270	26 Feb 2012	D. Pickering	Right. Broken premolars. M1-3
P232892	*Bishops* sp.	A. Werner	Flat Rocks	16 Feb 2013	D. Pickering	Left. ?M2
P252052	*Sundrius ziegleri*	T. Ziegler	ETRW #626	20 Feb 2015	D. Pickering	HOLOTYPE. Upper premolar
P252207	*Bishops* sp.	O. Campbell	ETRW #200	07 Feb 2015	D. Pickering	Posterior part of right mandible w x1 molar
P252730	*Corriebaatar marywaltersae*	W. White	Flat Rocks	11 Nov 2017	L. Kool	Refered specimen. Left. P4. Tragics Day.
P256479	Mammalia	M. Walters	Flat Rocks	15 Dec 2019	L. Kool	Fragment with single tooth. Tragics Day.
P257142	*Ausktribosphenos* sp.	M. Lowrey	Honey Locality	21 May 2021	L. Kool	Left. M2
P257716	Mammalia	M. Lowrey	E of Mary Anning	16 Dec 2022	L. Kool	Highly ferruginised. uCT scanned at Monash in May 2023

CRETACEOUS VERTEBRATE LOCALITIES IN GIPPSLAND

BY LESLEY KOOL AND MELISSA LOWERY

TAXA	San Remo Back Beach	Potters Hill	Rowell's Beach	Skull Cove	Punch Bowl	The Haybaler	Andrew's Beach	Orbital site	Tree Trunk Point	The Arch	Black Head	Kilcunda	Powlett River	Harmer's Haven	Wreck Beach	F Break	Cape Paterson	The Oaks	Twin Reefs	Shack Bay	Lesley's Lair	Tom's Layer	Ferguson's Layer	Eagles Nest	Halfway Headland	The Honey Locality	The Caves	Flat Rocks	Swim O'clock Rock	Ankylosaur Point	Noddyland	RACV Point	Mary Anning	Kirrak	Melissa's Mine	Bena	Koonwarra
Mammalia:																																					
Australosphenidae (Unidentified)																												■					■				
Ausktribosphenos nyktos																												■									
Ausktribosphenos sp.																										■		■									
Bishops whitmorei																												■									
Kryoparvus gerritti																												■									
Monotremata (Unidentified)																												■									
Teinolophos trusleri																												■									
Multituberculata (Unidentified)																																					
Corriebaatar marywaltersae																												■									
Dinosauria:																																					
Dinosauria (Unidentified)	■	■	■		■			■	■	■	■	■	■	■	■	■		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Ornithopoda (Unidentified)	■	■			■					■	■	■	■	■	■			■	■	■		■	■	■		■	■	■	■	■	■	■	■				
Fulgurotherium cf.										■														■													
Galleonosaurus dorisae																						□					■	■		■							
Qantassaurus intrepidus																												■									
Ankylosauria										■				■														■		■			■				
Neoceratopsidae (Unidentified)																																					
Serendipaceratops arthurcclarkei										■																											
Theropoda (Unidentified)	■				■					■	■	■	■						■	■	□			■	■			■									■
Noasauridae	■																																				
Carcharodontosauria																								■													
Megaraptora										■													■	■													
Megaraptoridae																			■	■								■									
Unenlagiinae																					■																
Aves (birds+B28:AF39)																												■									■
Other Vertebrates:																																					
Plesiosauria (aquatic reptiles)	■		■										■										□	■				■				■					
Pterosauria (flying reptiles)																						□		■	□			■			■						
Testudines (turtles)											■		■				■		■		■	■		■	■	■	■	■	■		■	■	■		■	■	
Temnospondyli (amphibians)	■	■	■	■	■	■	■	■	■							■	■																				
Koolasuchus cleelandi	■	■	■		■																																
Dipnoi (lungfish)	■				■							■	■							■				■	■			■		■	■			■			■
Neoceratodus nargun					■																			■				■									
Archaeoceratodus avus																								■													
Actinopterygii (ray finned fish)										■	■		■									■	■	■	■		■	■	■	■	■	■	■	■		■	■
Coccolepis' woodwardi																																					■
Koonwarria manifrons																																					■
Psilichthys sp.																																					■
Wadeichthys oxyops																																					■
Waldmanichthys koonwarri																																					■
Trace Fossils:																																					
Dinosaur footprints																			■					■		■		■	■			■					

Key: ■ *fossil from locality identified;* □ *fossil from locality tentatively identified*



Maps: Google Earth
Data: SIO, NOAA, US Navy, NGA, GEBCO, Landsat / Copernicus, CNES / Airbus, Terrametrics


Image: R Schowalter

FOOTPRINTS

BY TONY MARTIN

From March 2020 to May 2022, the COVID-19 pandemic imposed a mixed situation for the documentation of Wonthaggi Formation trace fossils. On the one hand, prospecting of Bass Coast marine platforms for trace fossils, ably done by Melissa Lowery and others, was a great success, resulting in some of the most significant ichnological discoveries known thus far for the Wonthaggi Formation. On the other hand, the proper documentation and diagnosis of these trace fossils was delayed until 2022 and will still continue into the next few years. So I am pleased to report that we are now finally sharing these discoveries with both the scientific and wider communities, generating much wonder among both my colleagues and the general public.

First, let's talk about the vertebrate tracks. During 2020-2022, Melissa and others (but mostly Melissa) found more than a hundred tracks in the marine platforms along the Bass Coast, a massive improvement over the three tracks found before then. (I found the first two at the Dinosaur Dreaming site during my first visit there in February 2006, before a third was found in 2007.) From 2020-2021, Pat Vickers-Rich and others started a database of the tracks' locations and preliminary measurements, while also sending me many photographs. Pat even had Peter Swinkels cast and mould three bedding plane surfaces and mailed them to the U.S. so I could study a few of the trace fossils at home during the pandemic. Based on this preliminary evidence, I reckoned the tracks were mostly those of large theropods with maybe a few ornithopods, but I couldn't be sure without seeing them in person.

This far-removed stagnation ended in April 2022, when Australia lifted its pandemic-era tourist ban, which enabled my wife and field partner Ruth Schowalter and me to travel from Atlanta, Georgia (USA) to Victoria, Australia in May 2022. Over the course of 10 days that May, we did field work on the Bass Coast with Melissa and Aidan Lowery, Pat Vickers-Rich, Tom Rich, Mike Hall, Peter Swinkels, and Doris Seegets-Villiers, with "guest star" appearances by Lesley and Gerry Kool and Mike Cleeland. During those 10 days, we photographed, measured, and described vertebrate tracks just east of the Dinosaur Dreaming dig site near Inverloch (dubbed Footprint Flats), Eagles Nest, Honey Bay, and Harmers Haven.

On Day 2 of this 2022 field work with Melissa, Pat, and others, a magical moment happened. I realized that the smaller tracks were more likely those of birds, not non-avian theropods. In my estimation, this was the most important of the trace fossil finds from 2020-2022, with worldwide implications in our understanding of bird evolution and dispersal during the Early Cretaceous (more on that later).

Because these bird tracks were (in my opinion) so scientifically significant, I decided these would be the topic of the first of five planned research articles about palaeontologically important trace fossils of the Wonthaggi Formation. The five articles are on:

1. Bird tracks;
2. Non-avian dinosaur tracks;
3. Termite coprolites and a probable nest structure in a petrified log;
4. Arthropod tracks; and
5. A probable synapsid burrow.

Since May 2022, we've published two of these articles, with the bird-track paper in PLOS ONE (published November 15, 2023) and the dinosaur-track paper in Alcheringa (published September 8, 2024). The bird track article made international news for more than a week, and with good reason, as these were not just the oldest bird tracks in Australia, but also the rest of the Southern Hemisphere. They also indicated a remarkable variety of birds (including some that were heron-sized!) living near the South Pole about 120 million years ago. Their presence further implied that these "early birds" may have already undertaken seasonal migrations, flying to high-latitude places during their springs and summers. As for the non-bird dinosaur tracks, most of these were from large predatory theropods, with one (47 cm long!) the largest dinosaur track in southern Australia,


Image: R Schowalter

Melissa Lowery and Tony Martin examine bird footprints

with most theropods ranging from 30 to 44 cm long, corresponding to *Australovenator*-sized theropods. Another significant find was of the first known small ornithopod tracks from the Wonthaggi Formation, which verify that these dinosaurs were on walkabouts in the same places where their skeletal remains were buried and much later excavated by generations of Dinosaur Dreaming dig crews.

The third article, on the possible termite nest, is currently under review in Palaeogeography, Palaeoclimatology, Palaeoecology, which hopefully will be published by the time you read this. The primary author of this article is Jonathan Edwards, who originally studied the possible termite nest and its petrified-log host as an undergraduate honours thesis under the direction of Pat in 2022. Jon and I then developed this study after his graduation, aided by many time-zone-challenged Zoom meetings and email exchanges. Without revealing too much now (toes and thumbs crossed), this paper will rewrite what we know about the early evolution and palaeoecology of these social insects.

As for the last two articles? They're in various states of disarray now, but should come together later in 2025. Nevertheless, I presented on the already-completed trace fossil studies and initial findings of the others while representing Australia in another part of Gondwana (Brazil), which was at the International Ichnological Congress meeting in April 2024. This presentation was well received by my international ichnological colleagues, who were awed by what we've found so far, and what's to come. All in all, I can confidently state that the last few years have proved these trace fossil discoveries are the most palaeontologically significant in the history of the Bass Coast, resulting in new insights on the Early Cretaceous palaeoecosystems of this area and well-deserved international recognition.

Images: A Martin and M Lowery

Bird footprints from the Bass Coast

Image: L Nink

NEW DINOSAUR DREAMING WEBSITE

BY WENDY WHITE

This year I spent way more time than I thought it would take replatforming our website (www.dinosaurdreaming.net). Building on the great work done by Rob Huntley over more than a decade, I ported the website to the Wix platform.

This platform ensures that the website can be easily edited by non-coders. We have four crew trained and with access to make updates. It incorporates a mobile-friendly version.

Fans will be pleased to know we kept a lot of the original content including:

- The great cover artwork by Andrew Plant;
- A full catalogue of Dinosaur Dreaming and Dinosaur Cove Field Reports;
- Fun activities for kids; and
- A list of all research publications related to the material that we have found.

I introduced some new material such as:

- Links to selected media;
- Gallery views of fossils and dig sites; and
- Contact forms for volunteering and other queries.

As at end of October, we have had over 4000 page views and 600 unique visitors since we launched in late June.

Image: W White

The new website home page. Artwork by Andrew Plant.

Image: W White

TWIN REEFS: AN INTERVIEW WITH MELISSA LOWERY

BY FOTINI KARAKITSOS

The latest of the Dinosaur Dreaming sites, Twin Reefs, has become another area of interest to fossil hunters. Over the past three decades, Dinosaur Dreaming has confirmed the presence of dinosaur, fish and turtle fossils, through observing and sampling the Bass Coast rocky shore platforms at low tide and mapping significant geological sequences.

In addition, the Dinosaur Dreaming crews continue to undertake vigorous physical extractions, such as rock breaking and chiselling out large, small and fragile bone fragments, to assist in the preservation, identification and research of Australian palaeo fauna.

Twin Reefs as a fossil-bearing site was discovered by Melissa Lowrey, a local avid fossil prospector and dinosaur dreaming volunteer. She discovered the first bone fragment at this locality in late 2023. Melissa's findings led the Dinosaur Dreaming crew to excavate this new fossiliferous site during February 2024.

The Interview with Melissa Lowery

What inspired you to go to Twin Reefs?

Prospecting the Bass Coast has given me a huge insight into seeing that dinosaur fossils and the like are scattered and not restricted to one area. The day I decided to take a good look at Twin Reefs was driven by gut feeling. So I decided to prospect that part of the coastline. Sometimes you get these feelings and so you just go ahead with it.

What was your first telling discovery that Twin Reefs could be a Fossil Hot Spot?

I happened to have walked over a sedimentary layer and yelped with excitement "wooooa! That's a bone!". It was right between my feet where I was standing. This was no ordinary bone to say the least. In fact, it was the vertebrate part of a centrum!

Apart from this finding did you find more fossils?

Yes, I walked across the many sedimentary layers and saw that the exposed mudstone had bones embedded in it. There were lots of bones, and I believe in the future of this site. I can't wait to see what else comes out of Twin Reefs.

What would you like to find in the future along the Bass Coast?

Ultimately, a theropod skeleton and of course a mammal skeleton or maxilla, especially for Tom Rich and for the wider dinosaur-involved community. This would be epic!

What do you believe helps you to find fossils?

Having the ability to understand pattern recognition is one of my strengths and I believe that this assists me to find bones in situ in rock formations. Understanding the nature of the sediments is another important factor which I observe whilst prospecting.

Do you have a favourite Dinosaur?

Yes I do! Have always loved Tyrannosaurus rex*. This species fascinated me as a child and still does as an adult. The best part is that my childhood dreams have come true — I actually get to search for dinosaurs in the real world.*

In conclusion, Melissa is a remarkable fossil prospector who continues to enrich the Dinosaur Dreaming project's findings as she dedicates much of her time to exploring coastal sites and challenging the notion of where bones can be found.

The Bass Coast, particularly the coastal platforms proximal to Inverloch, certainly harbours a mélange of bones scattered beneath the subsurface which (like always) awaits further discoveries.

Image: J Koekoe

Melissa Lowery at Twin Reefs during the 2024 dig

Image supplied by M Carrano

Four Months with Victoria's Dinosaurs

By Matthew Carrano
Smithsonian Institution, USA

For me, this all began back in 2019, at the annual Society of Vertebrate Paleontology conference in Brisbane. I figured that I should make the most of the long (and expensive) trip, so I made a short visit to Melbourne as well. Aside from touring the Yarra Valley wineries, I spent most of my time in the Melbourne Museum collections, where I studied some of the Early Cretaceous vertebrate fossils from the south coast of Victoria.

I was struck by the scale of the collection and the variety of species present — and those that perhaps weren't present. I've spent almost 30 years collecting and studying vertebrate microfossil bonebeds from the Jurassic and Cretaceous of the United States, with an interest in the broad composition of dinosaur ecosystems. It occurred to me that looking at polar dinosaur ecosystems in the same way could be revealing, and perhaps only possible with that collection.

It took a few years for that seed to germinate. Eventually I proposed to look at every single fossil in these assemblages and compare them with non-polar ecosystems elsewhere. I contacted Tom Rich and Erich Fitzgerald, who were very supportive, and then applied for a Fulbright grant. This grant supported a four-month visit to Melbourne with my family — an essential detail, as I have 6- and 2.5-year-old boys. We had an absolutely fantastic time living and working (and eating) in Melbourne and found many things to love about life in Victoria (yes, even in the austral winter!).

But, back to the Cretaceous. I spent most of my time entrenched in the Melbourne Museum collections, with Tim Ziegler as a very knowledgeable guide. I also got the chance to see some of the original outcrops, including Flat Rocks and Twin Reefs (where we failed to find more theropods for Jake Kotevski's Ph.D. thesis). I met new colleagues, got to reconnect with older ones, and learned a lot from all of them.

Some pleasant surprises awaited me as well. The many unprepared blocks from Eric the Red West, which I wasn't able to visit, gave me some insights into

Image supplied by M Carrano

Hope springs eternal at the Twin Reefs locality.

the sediments of that locality. Tim Ziegler invited me to help collect Pleistocene fossils for the museum at Cocoroc. And I got the chance to talk with Lesley Kool, Mike Cleeland, and Alan Tait, whose long experiences bridged gaps that studying the collections alone never could have. (Though I knew about their important contributions thanks to the Dinosaur Dreaming reports, I hadn't expected to meet them.)

In the end, I was able to work through the entire collection three times over. I collected size and shape data, parsed detailed locality information, and refined many taxonomic identifications. I am now aggregating the data to identify and interpret larger-scale patterns. One preliminary find is that the Otways assemblage seems to reflect slightly higher-energy deposition than that from the Strzeleckis. Another is that, with a few exceptions, taxonomic composition is remarkably consistent across localities. I'm also expecting to make some new taxonomic insights.

But for now, I want to offer my great thanks to everyone for their help and hospitality during my visit. It was a privilege to spend time studying this collection — unique in many ways, scientifically invaluable, and a hard-won point of pride for all involved.

Image supplied by M Carrano

One final pass through the collections to examine some of the newly prepared specimens.

Image: W White

WHAT'S IN A BONE?

BY LESLEY KOOL

All volunteers are trained in how to recognize fossil bone in cross-section, but not necessarily what animal that particular bone came from. To try to alleviate the mystery behind that question I have put together a collection of different fossil bones, found along the Bass Coast of Victoria, and their identifying characteristics.

Image: L Kool

Let us start with the most common bones found in the Victorian Early Cretaceous rocks: fish. No complete fish skeletons have been found along the Bass Coast, unlike the beautifully preserved specimens from the Koonwarra Fish Beds. No fish vertebrae have been found, only fish scales, fish jaws and the occasional isolated fish tooth. Cross-sections through a fish jaw expose a striated bony texture, sometimes infilled with kaolinite — a degraded clay mineral resembling white wax.

Image: A O'Connor

Unbroken fish teeth typically possess an apical cap — an opaque conical cap at the tip of the tooth. The teeth are small, usually no more than 2-3 mm in length and as they grow out of the top of the fish jaw, they have no root.

Image: M Lowery

Apart from the common teleost fish, another taxon of fish is found in the Victorian Early Cretaceous—lungfish. At least two lungfish taxa have been identified by their diagnostic tooth plates. Totally different from the teleost jaws, their characteristic fused dental plates are easily spotted.

Image: L Kool

The next most common fossil is the turtle. Turtle shell fragments, isolated limbs and vertebrae are frequently recovered when prospecting and excavating. Unlike dinosaur limbs, that have internal cavities, turtle limbs are solid with no cavities.

Image: L Kool

The vertebrae are smaller than most dinosaur vertebrae and look like small aeroplanes.

Image: L Kool

Fragments of broken turtle shell are very common and are easily identified by their flat smooth outer surface and spongiose internal texture.

Image: A O'Connor

Of course, we all hope to find dinosaur bones and the most common dinosaurs discovered along the Bass and Otway Coasts are the ornithopods. There are now five named ornithopod dinosaurs from Victoria. They are mostly identified by their teeth and jaws. Ornithopod teeth are fan shaped with deep grooves and are typically dark brown in colour.

Image: L Kool

The dentine is solid in cross-section and the enamel is usually well-preserved. You may be lucky enough to find a dinosaur jaw with teeth that gleam in the sunshine.

Image: D Seegets-Villiers

Ornithopod dinosaur bones are quite robust, compared to theropod bones and possess an internal cavity, which originally would have been filled with marrow.

Image: D Seegets-Villiers

The bone along the shaft of the limb is compact and dense, whereas the ends of the limb are spongy and often infilled with kaolinite.

Ornithopod vertebrae, in particular the centrum, are solid and spongiose in cross-section. The centrum is cylindrical in shape with parallel edges and becomes more elongate in the tail.

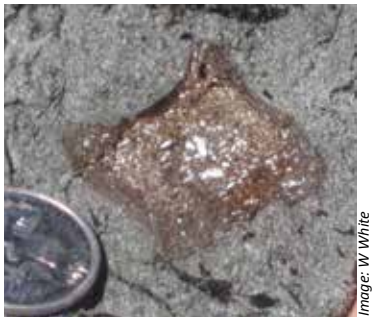


Image: W White

Image: A O'Connor

Theropod teeth are always nice to find. More than 100 isolated theropod teeth were recovered from the Flat Rocks Dig Site over the 20 plus years of excavations. More often than not the rock would break around the tooth, possibly because the enamel surface of the tooth was smooth with no ridges and grooves found in the ornithopod teeth. . The teeth vary in colour from light brown to almost black, depending on the prevailing minerals that were in solution in the sediments. Only two theropod teeth were found with a root attached. The rest of the teeth were "shed" teeth that had fallen out of the mouths of the theropods while they were still alive. The back edge of the tooth possesses a row of serrations, which can be diagnostic, but unfortunately researchers have been unable to name a theropod dinosaur to date.

Image: L Kool

Theropod bones are hollow and thin walled, similar to birds and their vertebrae also possess large air pockets and cavities.

Image: S Morton, Monash University

Ankylosaur dinosaur bones and teeth have also been found, particularly at the Flat Rocks dig site. Their teeth are similar in size to ornithopod dinosaur teeth but they possess more well defined ridges and grooves along the edge of the crown.

Image: A O'Connor

The most common evidence of ankylosaurs at the site are tiny bony balls, approximately 3 mm in diameter, called dermal ossicles. They were part of the dermal armour in the skin of the ankylosaurs. Each ankylosaur would have had thousands embedded in their skin and when they died and their skin rotted away the ossicles were swept down the river, to be found 126 million years later. In cross-section the tiny ossicles are made up of solid bone, not spongiose and are semi-circular in shape.

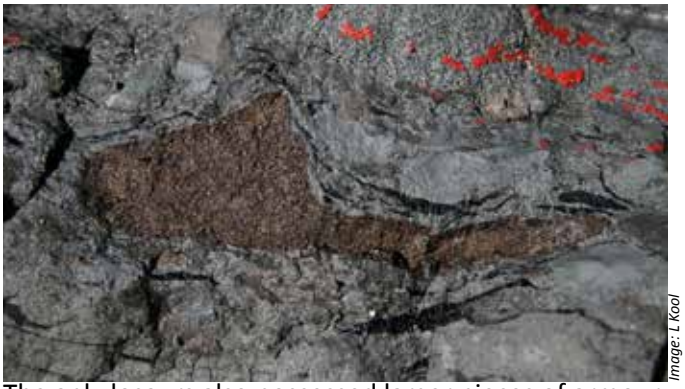


Image: L Kool

The ankylosaurs also possessed larger pieces of armour in the form of osteoderms that were irregular in shape, measuring up to 10 cm and spongiose in cross-section.

Image: L Kool

Plesiosaurs are rare in the palaeofauna and are mainly represented by teeth, which are easily identified by parallel ridges and grooves that run down the length of the outer surface of the tooth .

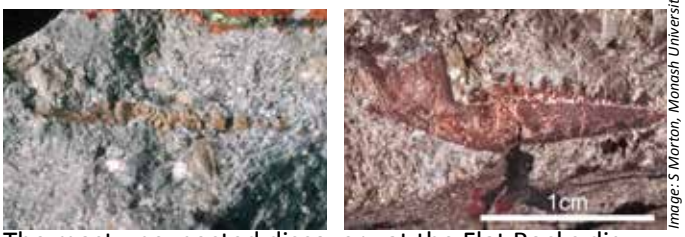


Image: S Morton, Monash University

The most unexpected discovery at the Flat Rocks dig site was, of course, the mammals. After the discovery of *Ausktribosphenos nyktos* in 1997 the entire volunteer training program changed to increase the chances of finding more of these tiny critters. At approximately 20 mm long the jaws were not easy to spot but breaking the rock down to the size of sugar cubes improved our chances and by 2013 more than 50 mammal jaws had been found. Like any fossil bone, it all depended on what was exposed in the cross-section, which made it a challenge. Sometimes it was the jaw exposed without the teeth and on one occasion it was just a row of teeth. Occasionally a complete specimen is found, which makes Tom Rich very happy.

Image: L Kool

Evidence of pterosaurs is restricted almost entirely to teeth. A number of small dagger-shaped teeth have been found at the Flat Rocks dig site over the years and it wasn't until 2000 when a visiting researcher identified them that we found out that they were pterosaur teeth.

Image: S Morton, Museums Victoria

Fossilised bird bones are relatively small and rare. A furcula (wish bone) was discovered in 1997 and it took many years of painstaking research to finally identify it as bird. Apart from that bone and a possible ulna, the only other evidence of birds has come from Koonwarra in the form of feather impressions. So they were here but their bones were so fragile and small that they did not preserve well.

Image: D Pickering, Museums Victoria

One group of discoveries at the Flat Rocks dig site were described as “beetle-bums” for many years (and still are unofficially). These small (2-3 mm), often metallic looking crinkly blobs turned up with regularity but no-one knew what they were, until Dave Pickering and Alan Tait took the time to analyse them and discovered that they were in fact the outer husks of seed pods. They come in an assortment of colours and they can have a smooth or wrinkly surface texture, depending on where they were deposited.

Image: L Kool

The remains of giant temnospondyls, like *Koolasuchus cleelandi*, are mostly found around San Remo but one specimen, a maxilla, was found north of the Flat Rocks dig site, so they were more wide spread than previously thought. The temnospondyl bone is very dense, not particularly spongiose, and heavier than equivalent dinosaur bone.

Image: S Morton, Monash University

Cranial bones and pectoral bones are ornamented resulting in deep grooves and ridges.

Hopefully, these descriptions will assist in the identification of your next bone.

I FOUND A FOSSIL!

BY WENDY WHITE

Image: L Nink

Image: W White

Wade Oliver

Image: W White

Amber Craig

Image: W White

Alyssa Fjeld

Image: W White

Leo Prezant

Image: W White

Alan Evered and Fotini Karakitsos

Image: W White

Ash Hateley

Image: A O'Connor

Wendy White

Image: W White

Marlonique Wolmarans

Image: W White

Astrid O'Connor

Image: W White

Fotini Karakitsos

Image: W White

Astrid O'Connor

Image: W White

Adam Dellal

Image: W White

Mary Walters


Image: W White

Sharyn Madder


Image: W White

Amber Green


Image: W White

Adam Dellal


Image: W White

Corrie Williams


Image: W White

Jake Kotevski


Image: W White

Alan Tait


Image: W White

John Swinkels


Image: W White

Ruairidh Duncan

Image: Z Landes

Image: W White

IN-CHANNEL MUDSTONES AND CHANNELS IN MUDSTONES: EAGLES NEST AND TWIN REEFS

BY ALAN TAIT

The 2024 dig aimed to evaluate the mudstone unit in the Eagles Nest sandbody in which Melissa Lowery had discovered a turtle, an ornithopod femur and two ornithopod postcranial specimens, one articulated and one associated. After several days' work, only a few additional parts of the associated specimen had been found so the dig was shifted to another Melissa locality at Twin Reefs which then produced two turtles and an articulated ornithopod tail (amongst other fossils). At both localities the sediment hosting the fossils is mudstone but the locations of the mudstone units within each river sandbody are very different.

A few words about the mudstones. They are called mudstones because they are greyer in colour and obviously finer grained than the sandstones, and because they weather as if they were composed mostly of clays. In fact, they are composed mostly of clays now but they were deposited as very fine-grained sand and silt by river currents, not as clay settling out of still water. That they are largely clays now is due to diagenesis. During burial, the original volcanic rock and feldspar that, with quartz, make up the sand and silt grains, have been partly or wholly altered to clays. The quartz grains have not been altered but they are in the minority and hence the original volcaniclastic sandy siltstone now behaves as a mudstone, a mixture of various clay minerals and quartz.

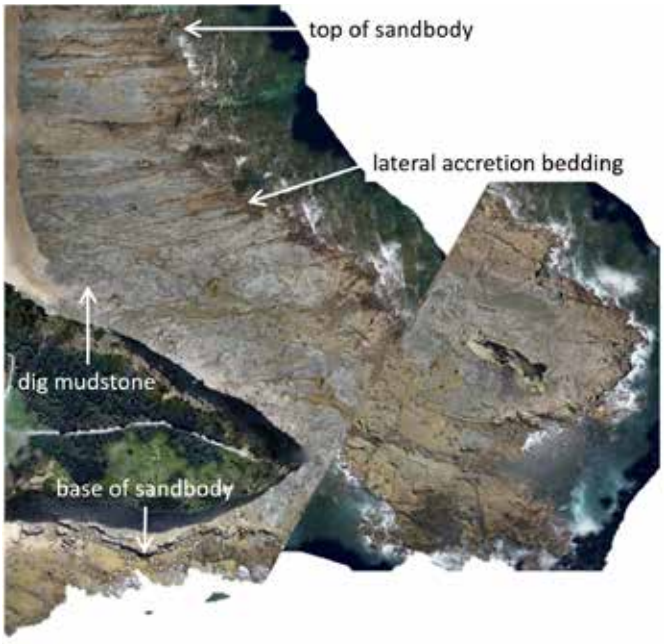


Image: A Tait

Figure 1. Aerial view of Eagles Nest sandbody with top and base indicated and fault restored. Dig mudstone is in middle of sandbody on a lateral accretion surface indicating sandbody was deposited by a meandering river.

The mudstones at Eagles Nest and Twin Reefs were deposited by flowing river water but in rather different parts of rivers.

The fossil-bearing mudstone unit at Eagles Nest is one of several mudstone units within the Eagles Nest sandstone (Figure 1), each deposited on the sloping pointbar surface as the current slowed down, perhaps in the waning stages of a river flood or when the main river flow moved laterally due to changing conditions upstream such as sand deposition, bank erosion or the development of logjams of vegetation. The successive pointbar surfaces mantled by mudstone form lateral accretion bedding, characteristic of meandering rivers. The fossil-bearing mudstone unit (Figure 2) was deposited under water half way down the pointbar slope. The unit is presently about 30 metres long but has been eroded by the overlying sandstone unit at both ends and originally was more extensive.

The fossil-bearing mudstone at Twin Reefs (Figure 3) is one of a number of stacked thin mudstone units with channelised bases lined by thin sandy layers, which form the uppermost parts of the Twin Reefs sandbody (Figure 4) and were deposited on the inner margins of a pointbar or on the adjacent floodplain. The main part of the sandbody displays interbedded sandstone and mudstone units formed by lateral migration of a pointbar as at Eagles Nest.

We have now collected articulated specimens from the base of a river, as at Eric The Red West and Dinosaur Cove, from within a river as at Noddyland and Eagles Nest, and from the top of a river as at Twin Reefs showing that they seem to occur everywhere but in low numbers.

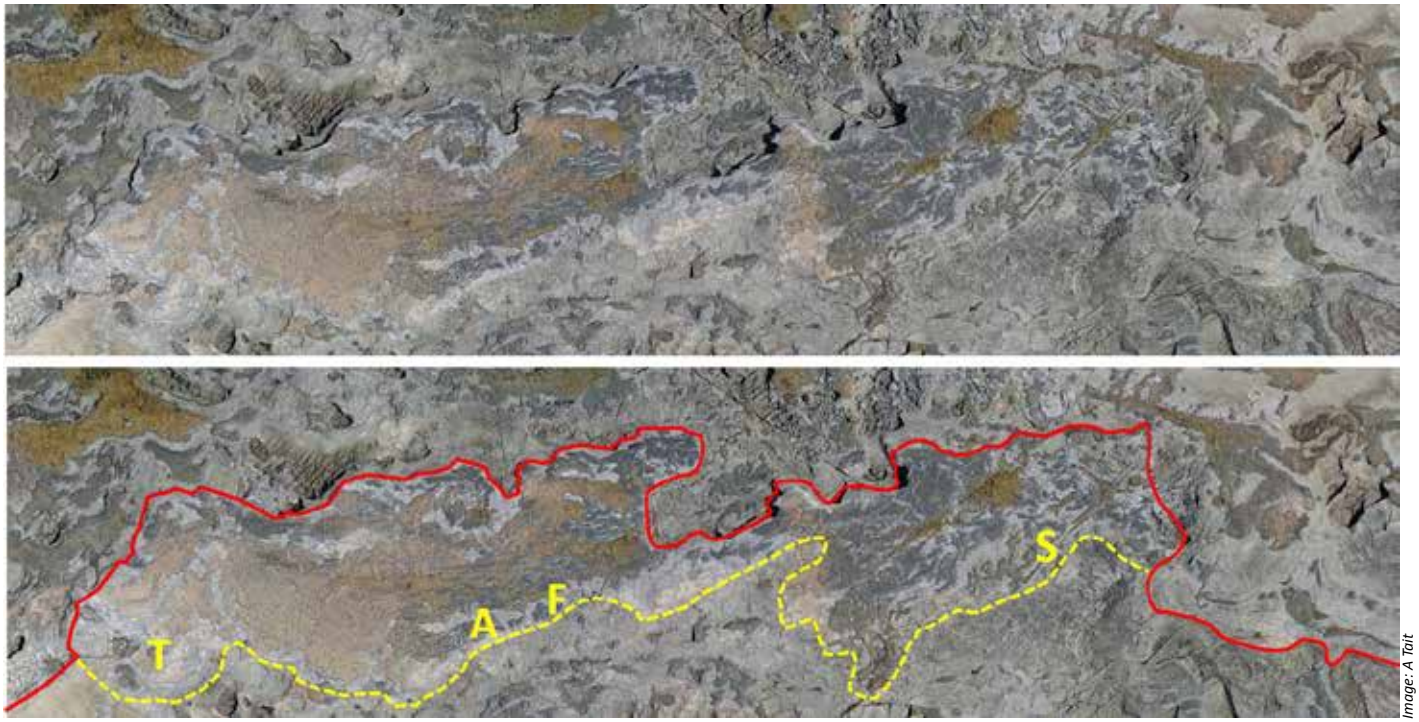


Image: A Toit

Figure 2. Aerial view of the fossil-bearing mudstone unit at Eagles Nest with dashed yellow line indicating the base of the unit and the red line its erosive top. Fossil locations are marked by T (turtle), A (articulated ornithopod) F (femur) and S (associated ornithopod). Mudstone unit about 30 metres long.

Disarticulated specimens can also be anywhere within a river but occur in low numbers except as bedload at or near the base of river channels. Concentrations of bones vary, so some localities are better than others for prospecting and quarrying. At the Flat Rocks dig site, some broken bones are filled with a finer sediment than the surrounding sandstone and similar fine sediment has been found inside carbonised seed pods, suggesting that the bones have been excavated by the river from abandoned channel sediment where the animals' articulated bodies and carbonised seed pods were originally buried. The fine sediment is similar to that at the Koonwarra site and the same buff colour. So we are still looking for an abandoned channel with a graveyard of articulated fossil animals but in the meantime we have Twin Reefs to excavate and a possible return to Eagles Nest when the articulated and associated specimens have been prepared and given up their secrets.

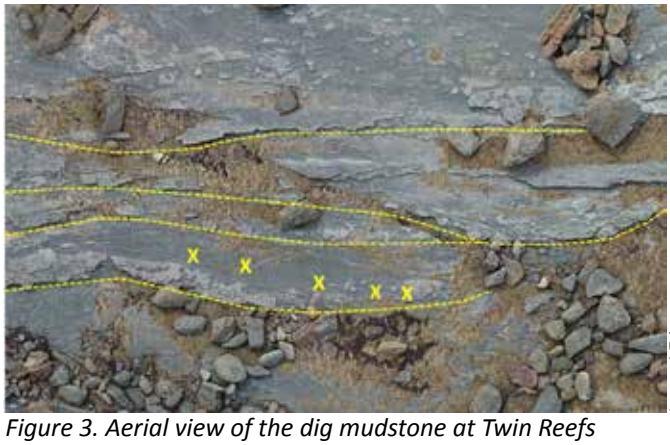


Image: A Toit

Figure 3. Aerial view of the dig mudstone at Twin Reefs showing stacked channel shapes within the mudstones near the top of the sandbody. Locations of major fossils marked by X.

Image: A Toit

Figure 4. Aerial view of Twin Reefs sandbody with top and base indicated. Dig mudstone is near the top of the sandbody.

CARTOONS
BY ZEV LANDES


HOW STRONG IS THE ROCKSAW?
VROOM
VROOM
E. LANDES 2024


HEY CAN YOU PASS ME BUCKET 18-A?


Image: Museums Victoria

RESEARCH UPDATE

BY TOM RICH

In July 2023, two Mesozoic mammal experts Drs. Jin Meng from the American Museum of Natural History, New York and Mao Fangyuan from the Institute of Vertebrate Paleontology and Paleoanthropology, Beijing, visited Melbourne Museum. Their twin purposes were to examine the collection of Early Cretaceous polar mammals from Victoria and to meet Pat and me. In our time together, one specimen in particular was discussed. This was a tiny ausktribosphenid jaw unlike the three other species previously recognised from one locality, Flat Rocks. We agreed that it was a fourth ausktribosphenid. We then invited them to be coauthors on the paper where it will be named in honour of Nicole Evered who found the fossil in 2007 and Peter Marshall of Monash University who has supported the Dinosaur Dreaming Project for many years in many ways. We extended this invitation to Drs. Mao and Meng for two reasons. Firstly, they independently recognised the significance of this fossil, thus adding confidence to our interpretation of it. Secondly, to reciprocate for their having invited us to be coauthors on two new Jurassic mammals that would later be named in 2024, *Feredocodon chowi* and *Dianoconodon youngi*.

There was an historical reason for this invitation from them. In 1982, together with Minchen Chow, the same Chow that the species name of *Feredocodon* honours, I had the privilege of describing a new Jurassic mammal from China that we recognised had a significantly different dental pattern than any fossil or recent mammal that had previously been described. While that specimen was only a lower jaw with a few teeth, *F. chowi* is known from two complete skeletons.

Feredocodon and *Dianoconodon* were published in adjoining articles in the same issue of Nature in April 2024, volume 628, pages 569–581.

A fourth ausktribosphenid from Flat Rocks (in addition to *Ausktribosphenos*, *Bishops*, and *Kryoparvus*) suggests interesting questions about the family. What is the reason that the group is so diverse there and only known from a single specimen of *Bishops* elsewhere, (from Eric the Red West)? If they seemingly flourished at Flat Rocks, what brought about their extinction? And exactly what were they?

When first proposed in 1997, it was suggested that they were possibly placental mammals. If so, they would have preceded the marsupials being present in Australia by about 70 million years. Soon after 1997, an alternative suggestion was made. The alternative was that ausktribosphenids were an entirely new higher group of mammals confined to the Southern Hemisphere, the Australosphenidia. The method of analysis used to defend this alternative hypothesis was quite different from the original one. Most of those researchers who have subsequently considered the matter favour this second interpretation. But not all.


Image: Z Chuang

Feredocodon chowi. *Artist: Zaho Chuang*


Image: Z Chuang

Dianoconodon youngi. *Artist: Zaho Chuang*

In 1957, Phillip J. Darlington, Jr. published a book entitled Zoogeography: The Geographical Distribution of Animals. In it he observed that the platypus and echidna were so different from one another that it was likely there were many intermediate species on the monotreme family tree, that would be proven if ever the appropriate fossils could be found. In the time since then, a number of both Mesozoic and Cenozoic monotremes have been found not only in Australia but also South America. The number of monotremes known from the Cretaceous of Lightning Ridge was recently doubled in a publication by Flannery et al that appeared in Alcheringa.

In the September 2024 issue of Scientific American there is a cover article entitled "What was it like to be a Dinosaur?" What the authors did was to infer behaviour based on aspects of the morphology of dinosaurs. One structure that was analysed were the optic lobes. I recalled that *Leaellynasaura* has rather large optic lobes, so made contact with Amy Balanoff of Johns Hopkins University, the senior author. Images of the skull roof were sent to her. She not only agreed that the optic lobes were large but also wrote, "….that *Leaellynasaura* had a particularly bird-like brain unlike any other ornithischian I have seen." She was so taken with the skull of *Leaellynasaura* that she expressed a wish to collaborate in a further study of the skull. The next step to do so was to have a CT scan made of the skull. This is where good luck came in big time. Asking Alistair Evans of Monash University if he would do the scan with his equipment, he replied that it had been done a decade before at the Australian Synchrotron. With that remark, digging into the nether regions of my laptop, I found clues that Karen Siu had

Image: P Schouten

Six monotremes living in the same place at the same time, 100 million years ago at Lightning Ridge, New South Wales, Australia; clockwise from lower left: Opalios splendens*;* Stirtodon elizabethae*, the largest monotreme of the time;* Kollikodon ritchiei*, with hot-cross-bun shaped molars;* Steropodon galmani*, now known from additional opalised fossils;* Parvopalus clytiei*, the smallest monotreme of the time; and* Dharragarra aurora*, the earliest known species of platypus. Reconstruction by Peter Schouten*

the synchrotron data, had given a copy of it to me on four external hard drives and that Alana Sharp had rendered the data. So, instead of having to organise a CT scan of the skull and a subsequent rendering of that data, the job was already done. Once the rendered data reaches Amy, she will be ready to go instead of waiting perhaps six months or a year for all these preliminary steps that I thought would be necessary when Amy first expressed the need for CT data.

With the passage of a decade subsequent to the scanning and seven years since the rendering of that data, I had simply forgotten that it had all been done. But by asking the right person, the right question, things fell into place with remarkable ease.

Within a few weeks of the recognition of the fact that *Leaellynasaura* had been scanned at the Australia Synchrotron, Alistair Evans did it again. This time he reminded me that the fourth ausktribosphenid mentioned above had been scanned at the SPring-8 Synchrotron in Japan in 2011. So, there was no need to scan that again, either. When scanned 13 years ago, the specimen was listed simply as "Mammalia" whereas all the other mammals from Flat Rocks that were scanned then were identified to genus. So it was easy to forget.

Having pointed out the existence of two lots of unremembered data in a few weeks, I asked Alistair if there was a third lot in the offing? None came immediately to his mind. But who knows what might occur to him in the not too distant future!

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Image courtesy of P Vickers-Rich

CURRENT EXHIBITIONS

BY PAT VICKERS-RICH

Exhibitions at the RACV Inverloch Resort and the Inverloch Information Centre continue to be upgraded and School Programs in association with the PrimeSCI! Group at Swinburne University continue.

A major exhibition called DinoQuest, centred on the polar dinosaurs from Victoria, was installed by the Dinosaur Dreaming Team in association with the Science Centre Singapore in the city of Chengdu China (with a population of 22 million!). This expo will continue there until early 2025 and hopefully move on to other venues after that. It continues to generate research funds for the Dinosaur Dreaming project, with its first venue being at the Science Centre Singapore in 2019 — and after that delayed by Covid. It is hoped that this exhibition will continue to travel after Chengdu to generate funds for further research. It was most appropriate that this expo on dinosaurs was launched in China during the Year of the Dragon.
https://www.youtube.com/watch?v=T6-J6yBkHiM

Image: P Vickers-Rich

DinoQuest images and a link to video from the launch

Image: A Fjeld

THE DAMES OF DINOSAUR DREAMING

BY ALYSSA FJELD

Marion Anderson sits, shoulders back, and double checks a new digger's freshly broken rock for bone. In the background, Mary, an octogenarian who has been with the dig team since its inception, smashes open the final rock from a five kilo pile. She's moving onto her third bucket of the day while I sit, mystified, by my first bucket, still half-finished. Another member of the team is telling us about her children, and the awe they feel about their mom's work at Inverloch. Decade-long veterans like Corrie and Doris will carry buckets of difficult rock up the hundred stairs to the cars. The sun bears down. The women sweat.

This is the palaeo I have known since arriving in Australia four years ago. Yes, there are men in our field — and they stride like giants. Names like John Long, Steve Poropat, and of course, Tom Rich (in stratigraphic sequence). But it is Lesley Kool who patiently prepares the animals we uncover, under Tom and Pat's gentle guidance. It is Wendy White who snaps us to attention, a seasoned general organizing her troops, telling us where to be and when, through wind, sleet, rolling blackouts and (worst of all) a drying well of Super Quizzes. And it is the team of dozens of women like Margaret, Jade, and Corrie who form the muscle and substance of the dig team. Together with students like Marlonique, who arrived in Australia only weeks earlier, they cut out, press, peel and add decals to the vests we will wear in the field. Amber and Fotini are the muscle behind the rock saw this year. They sweep the beach raw of sand for Melissa to examine. Her excited shouts at every new footprint, every possible well of material, keep us going when the snacks are low and the sun is high. It is by their hands, too, that the dig is moulded into a welcoming, encouraging and hard yakka community.

Image: W White

Fotini wields the rock saw

Digs like this uncover the past. The fascinating and turbulent history of the Australian Cretaceous that remains so new to science is unspooling in their hands. But in students like Marlonique, or Jade's little ones, lies the future. It is woven like flax in strong female hands. It is in the names of the mammals we find and the headlines we make.

And if that's a bit too self-important, then this at least is true: if it weren't for the Wendys of the dinosaur world, there would be worse food and fewer bones found.

Image: W White

Amber sweeps the beach

Image: W White

Videos to volumes: DD 2024 photogrammetry

By Astrid O'Connor

3D models! They're interactive, flashy, and sure to elicit an "Ooo" or two, but can they yield useful dig data? With the lack of a magical machine that can scan our dig area and locate fossils within the rock with accuracy (Geophysicists, I eagerly await this), we are left with surface scanning as the only feasible option for testing this question.

Surface scanning is the process by which an object or landscape is turned into a digital 3D model to capture its topology (shape) and texture (colours) (Figure 1). In the past, such methods were restricted only to extremely expensive specialised equipment (such as the Artec Leo or Space Spider). However, recent developments in photogrammetry algorithms, which make models from photos or videos, have made scanning much more accessible.

Because we need to dig for our fossils in an intertidal zone, it makes standard methods for collecting data on fossil distribution (for example, gridding and marking) very difficult. Hence, I suggested photogrammetry as a method for collecting more data throughout the DD 2024 Eagles Nest and Twin Reefs digs.

The photogrammetry process

With very little guiding literature to follow — photogrammetry is rarely used on active digs — we developed a method where we would clean and video the dig area (Figure 2) from as many different angles

Image: A O'Connor

Figure 1. Photogrammetry scan of a turtle block from Eagles Nest.

Image: A O'Connor

Figure 2. Doris sets a 1 m scale for the photogrammetry scan.

as possible before, after, and in intervals throughout each dig day. For each interval between two videos, we assigned a bucket number to the material collected during that time.

With a tonne of videos in my back pocket and on my hard drive, it was now time to process the data! My poor MacBook nearly died trying to process the data on its own (>1 TB of data!), so I instead booked and remote-accessed one of the Evans EvoMorph Lab's supercomputers at Monash University. Inputting the videos into a program called Agisoft Metashape (Figure 3), I extracted the video frames as images for the photogrammetry and experimented with different algorithm types to find the best balance between final model detail and processing time.

After spending three days processing the giant first scan of the entire site of interest (despite the best efforts of a power outage to scamper this), I identified our level of scan detail at 5 mm for the model texture and 25 mm for the model topology. I also ran data-checking algorithms to identify the level of topology accuracy we were able to achieve with the videos (Figure 4).

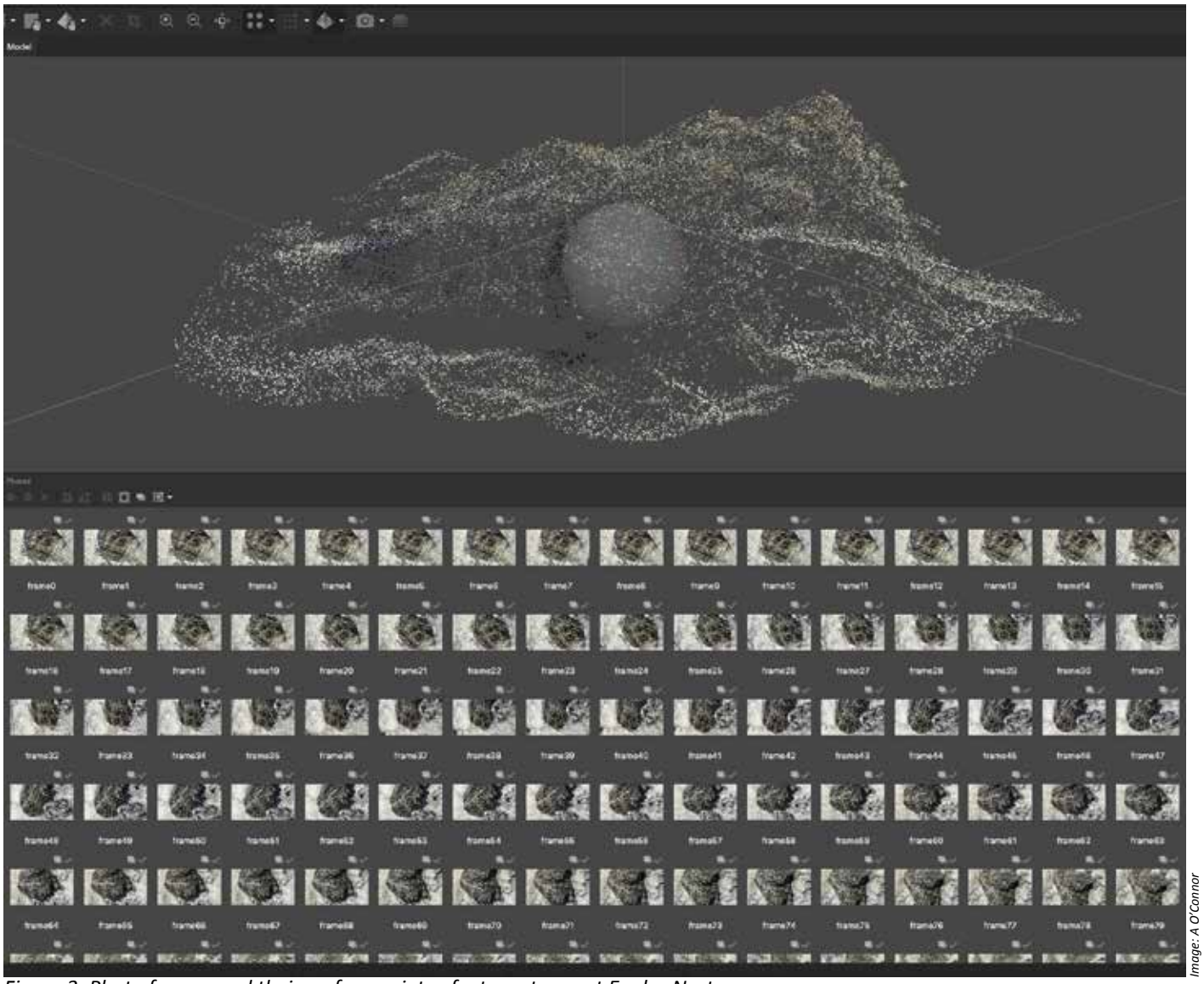


Image: A O'Connor

Figure 3. Photo frames and their surface points of a tree stump at Eagles Nest.

I'd like to discuss the advantages and disadvantages of using photogrammetry in the context of a dig like ours.

Data result #1: detailed maps

The first advantage is that these high-quality data scan models can be used to render higher quality geological maps than drones or satellites can achieve (Figure 5) as they capture data closer to the ground without warping the model perspective.

Data result #2: specimen orientation

Readers of the 2023 field report may remember my article on 'Julio', a nearly complete turtle found at Eagles Nest. Another advantage of this kind of photogrammetry is that we can take specimens that poke through the surface and re-integrate them back

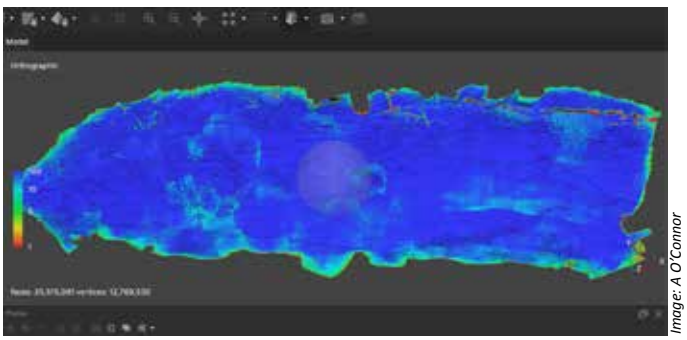


Image: A O'Connor

Figure 4. Twin Reefs scan accuracy (from blue = 100% to red = 1%).

into the ground to find the articulated specimen's exact orientation (Figure 6).

Data result #3: dig volumes & masses

Having detailed scans of a site before and after a dig allowed me to line up the two models, create a volume model of the intersection, and then use that value to discover the total volume of rock removed during the dig. In the case of Twin Reefs, this was 0.78 m^3 (Figure 7).

Photogrammetry limitations

Some of the limitations of photogrammetry include that it cannot determine specimen distribution without parts showing on the surface originally, it requires a very large amount of data, and the level of detail achieved increases only with much more time spent taking the videos and processing the models.

I hope that we can find even more ways to quantify the incredible amount of work during these yearly digs!

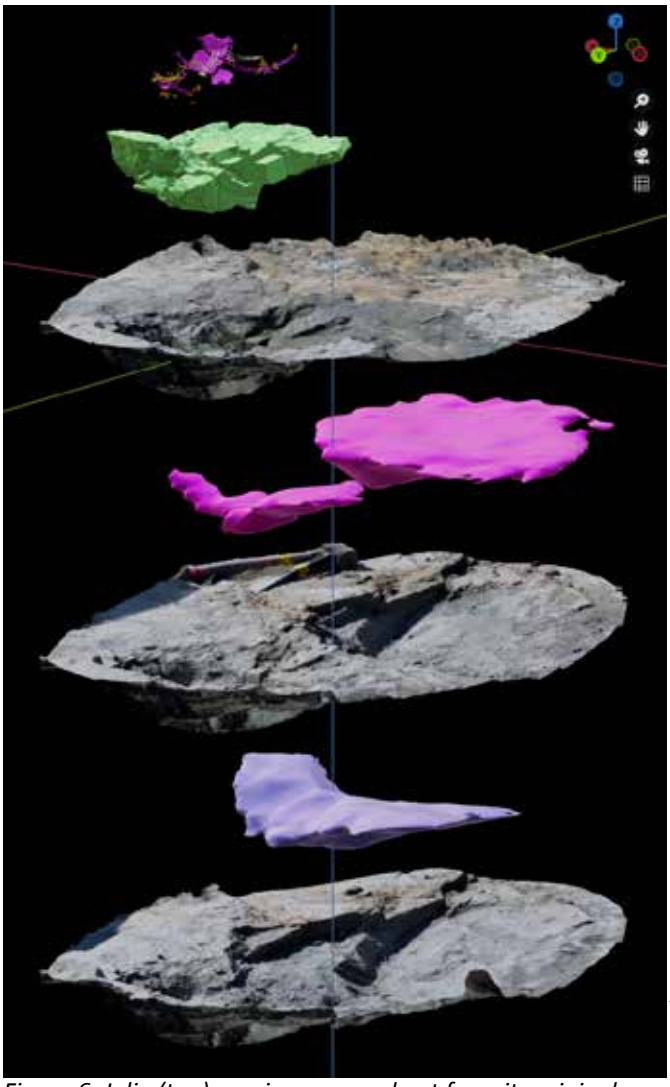


Image: A O'Connor

Figure 6. Julio (top) specimen spread out from its original blocks (green), and then further excavations conducted during the DD 2024 dig (photo models showing stages, purple and blue showing rock removed each time).

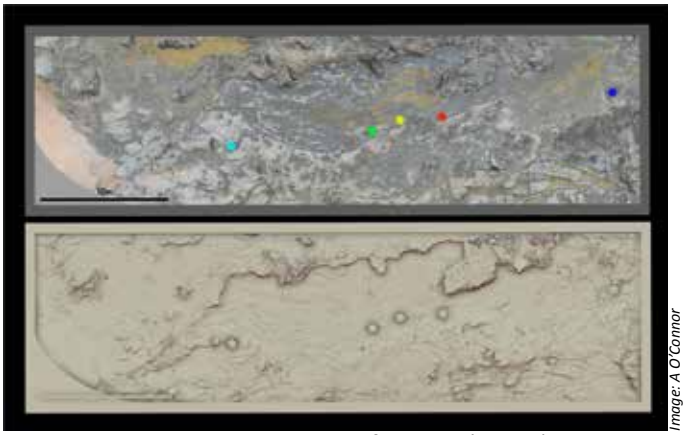


Image: A O'Connor

Figure 5. Eagles Nest scan maps of texture (above) and topology (below). Scale bar 10 m. Coloured/round markers indicate fossil finds prior to DD 2024 February dig.

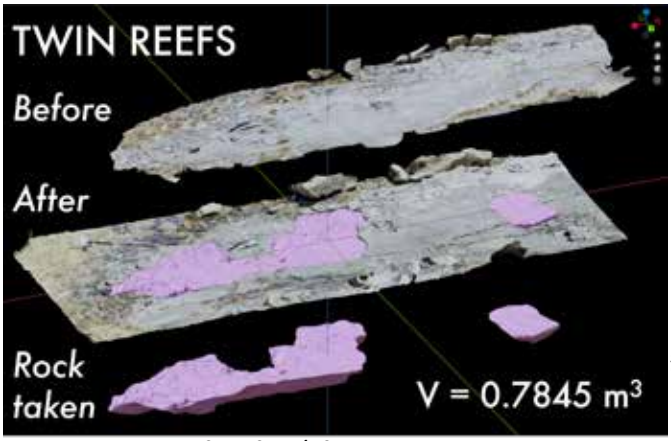
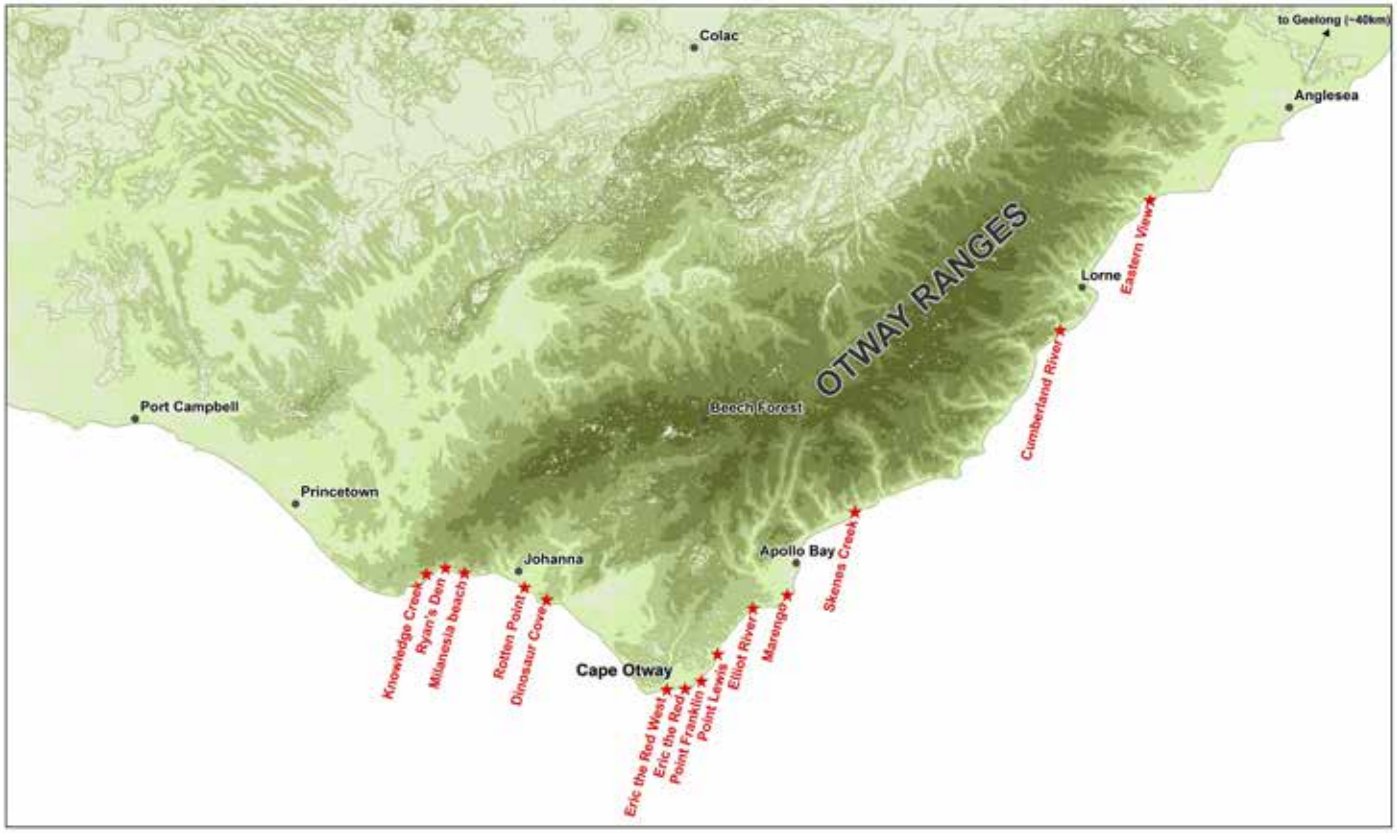


Image: A O'Connor

Figure 7. Twin Reefs before/after models showing total volume of rock removed.

CRETACEOUS VERTEBRATE 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:														
Sundrius ziegleri						X								
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					
Diluvicursor pickeringi						X								
Fulgurotherium australe					X									
Leaellynasaura amicagraphica					X									
Ankylosaurs/nodosaurs					X									
Neoceratopsian					X									
Theropoda (Unidentified)					X	X		X						
Elaphrosaurinae							X							
Carcharodontosauria									X					
Tyrannosauroidea					X									
Timimus hermani					X									
Megaraptoridae					X	X								
Unenlagiinae									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 cunicularius					X									
Dipnoi (lungfish)					X	X			X					
Neoceratodus nargun					X				X					
Actinopterygii (ray finned fish)					X	X								
Trace Fossils:														
Dinosaur footprints	X		X		X							X		
Bird footprints					X							X		
Dinosaur Burrows	X													

Image supplied by Pam Gill

LIVE LONG AND PROSPER

BY PAM GILL

Exploring the life histories of Australia's Early Cretaceous polar mammals using synchrotron X-ray cementochronology.

An abstract by Pam Gill, Elis Newham, Andre Rowe, Nuria Melisa Morales Garcia, Tahlia Pollock, Kathleen Dollman, Thomas Rich, Pat Vickers-Rich, Tim Ziegler and Emily Rayfield.

The abstract was accepted for the 84th Annual meeting (2024) of the Society of Vertebrate Paleontology (SVP) in Minneapolis, USA.

Excavations in Victoria, Australia, have produced rare Early Cretaceous mammals, predominantly dentaries of *Teinolophos*, *Bishops* and *Ausktribosphenos*, from the uppermost Barremian Flat Rocks site. Analysis of the dentition places *Teinolophos* within the Monotremata, and the other two taxa within Tribosphenida. During the Early Cretaceous, south-eastern Australia lay within the Antarctic Circle, at about 70 degrees of latitude, with three months of darkness and relatively low mean annual temperatures, so the life histories of these small Early Cretaceous mammals are of particular interest. Although the dentary specimens are often incomplete and cracked, propagation phase contrast X-ray synchrotron micro-computed tomography (PPC-SRμCT) scans reveal well preserved histological detail of the bone and tooth tissues. These tissues include dental cementum, a continuously growing dental tissue forming circum-annual annuli around the root, from which an individual's age at death can be assessed.

Our previous studies used cementum to estimate maximum longevity, growth rates and growth patterns in mammaliaform taxa across the Jurassic, in-turn allowing us to interpret aspects of their physiology. We are applying these techniques to the Early Cretaceous Victoria mammals and have SRCT scanned 27 dentary specimens for cementum data of all the individual tooth roots.

We find a lifespan of six years for *Bishops*, which is exceptionally long-lived compared to extant mammals of similar size, such as the Arctic shrew. Mass-specific cementum growth rates in *Bishops* are also significantly slower than extant small-bodied extant mammals, instead correlating with other Mesozoic crown mammals sampled. Cementum growth patterns in *Bishops* also correlate with other Mesozoic crown mammals, with a delayed point of growth rate reduction when compared to extant small-bodied mammals, which show significant growth rate reduction at the advent of somatic maturity in their first two years of life (following mammalian "determinate growth" patterns).

Examples of extended wild lifespans in extant small-bodied terrestrial mammals are often the product of hibernation and/or torpor, allowing relatively flexible metabolic output and a slower life history. Alongside a protracted, slower life history as found for earlier Mesozoic mammaliaforms, we suggest that hibernation may have played a factor in these southern polar taxa, resulting in slower growth through a portion of each year-of-life.

Funding for this work was received from UKRI/ NERC funded NE/X001504/1; European Synchrotron Radiation Facility, France, proposal ES-1447; Diamond Lig0ht Source, UK, proposal MG 31897.

IMAGES OF DINOSAUR DREAMING 2024


Image: W White

Alan Tait and Astrid O'Connor at Eagles Nest


Image: J Koekoe

Alan Evered and Astrid O'Connor watch Zev Landes draw


Image: F Karakitsos

Working in the back yard


Image: A O'Connor

Corrie Willliams and Alan Tait


Image: J Kluth

Above Twin Reefs


Image: J Koekoe

John Swinkels


Image: W White

Working Twin Reefs


Image: M Anderson

Alan Tait explains ripples


Image: W White

Twin Reefs centrum


Image: C Williams

Heading down to Eagles Nest


Image: J Koekoe

Displaying our permit


Image: W White

Alan Tait looks closely


Image: M Anderson

Margaret Baldassa


Image: M Anderson

The Shore Platform


Image: J Koekoe

The wrapping station


Image: J Koekoe

Alan Tait explains the geology


Image: F Karakitsos

Not a bad place to work!


Image: W White

Sweeping the beach


Image: W White

Eagles Nest


Image: W White

Lesley Kool puzzles turtle frags


Image: M Anderson

Sketching the action

Image: University of Melbourne

Thylacines at Melbourne University

By Rohan Long

The last known thylacine or Tasmanian tiger (*Thylacinus cynocephalus*) died in Hobart's Beaumaris Zoo on the 7th of September 1936. Questionable eyewitness reports notwithstanding, the only contemporary physical presence of these animals is in museums. Due to the obvious impossibility of obtaining new material, there has been increasing interest in documenting, analysing, and rediscovering thylacine specimens in museum collections.

Although little known to the public (and many staff and students) the University of Melbourne holds over 30 museum collections embedded within various faculties and departments. Within the collections of the Harry Brookes Allen Museum of Anatomy and Pathology, Henry Forman Atkinson Dental Museum, and Tiegs Zoology Museum, the University holds five thylacine skulls. As curator of the Harry Brookes Allen Museum and former collection manager of the Tiegs Zoology Museum, I've been able to work firsthand with these specimens. In a recent paper, I have described these skulls in detail for the first time.

The specimen from the Harry Brookes Allen Museum of Anatomy and Pathology is a half-skull sourced from anatomist Frederic Wood Jones, head of Melbourne's Anatomy Department for most of the 1930s. In 2020, during depressing months of lockdown, I was scrolling through the online catalogue of the Hunterian Museum, the collections of the Royal College of Surgeons London, when I saw a familiar looking half-skull. It slowly became clear that I had stumbled on the other half of the thylacine skull from the Harry Brookes Allen Museum, half a world away in London.

While measuring and analysing the skull from the Henry Forman Atkinson Dental Museum, I found that it came from a female thylacine, a rarity in museum collections. More than half of the thylacine specimens in museums have no sex recorded and of those that do, female specimens are a minority, representing 16% of specimens.

Looked at as a group, University of Melbourne's skulls constitute one of the top ten largest collections of thylacine specimens in Australasia. It's a significant collection and one that provides a stark reminder of the harsh realities of extinction. It's up to us to make sure that future observers will be able to study our native mammals in the wild, and not just as specimens in a museum.

Reference

Long, R, 2024. Five previously undescribed thylacine (*Thylacinus cynocephalus*) specimens held in the museums of the University of Melbourne. *Australian Zoologist* 18 April 2024; 43 (3): 455–469. doi: https://doi.org/10.7882/AZ.2024.013)

Image: Gavan Mitchell

Harry Brookes Allen Museum of Anatomy and Pathology's thylacine half-skull

Image: Lee McRae

Henry Forman Atkinson Dental Museum's female thylacine skull

Image: Bayside City Council

CURATING PREHISTORIC BAYSIDE

BY BEN FRANCISCHELLI

Over the last two years, I have had the privilege of working at Bayside City Council as the curator of Prehistoric Bayside, to create a 3-month long fossil exhibition that showcased some of the most terrifying predatory animals that ever existed. It was a huge success, smashing all attendance records for the Bayside Gallery and the council, with thousands of people from all areas of Victoria coming to visit.

Hundreds of these 5 - 6 million year old fossils were put on display from Beaumaris and Black Rock (Victoria), and included the toothy remains of *Otodus megalodon*, to the bones of the largest flying bird that ever existed, *Pelagornis*. Working with artists Zev Landes and Ruairidh Duncan, we created life-size artworks of these prehistoric creatures. I created an 8-minute documentary with Kasimir Zierl that played on repeat in the gallery, that looked at the rise and fall of the *Megalodon* and its influence in Bayside. I curated, prepared, and created stillage for all the fossils, wrote all the signage and scripted all accompanying videos, that also showcased how we found these fossils underwater. It was one hell of a slog, but as the exhibition started taking shape in the gallery, it was an incredible sight.

We held numerous public facing events that included a fossil ID event inspired by Antiques Roadshow, and even got the chance to hold a panel Q and A of other palaeontologists during Science week (in August).

It was one of the most amazing and exhausting things I've ever done. I learnt so much from so many talented people, and this show has now paved the way for the council to actively care about these fossil sites.

Image: B Francischelli. Pelagornis by Z Landes

Image: B Francischelli. Shark by R Duncan

Next year, I'll be erecting many of the materials that were created from the exhibition at the Beaumaris Motor Yacht Squadron for permanent public display.

You can find the virtual tour of Prehistoric Bayside here (and through the QR code): https://www.benfrancischelli.com/prehistoric-bayside-1

But this work is far from over. I'm planning numerous expeditions (underwater and above it) across Victoria to find megafauna, fossil whales and sharks. Anything of scientific importance will be donated directly to the state museum.

Bayside is just one of many incredible areas we have across the state, but these areas are poorly known. We have an amazing fossil heritage on our doorstop — anyone can contribute to our understanding of evolution, simply by picking something up on the beach. Citizen science is one of the most important ways of contributing to palaeontology.

If you'd like to help me out in the future with my expeditions, reach out on my website: https://www.benfrancischelli.com/

One final thing…

As I was creating this fossil exhibition, I was constantly reminded of my friend, palaeontologist and former Museums Victoria collections manager David Pickering (who passed away in 2016). He had an incredible kindness and with that I tried my best to replicate in the exhibition, and which is sorely missed. He introduced me to this amazing palaeontological world when I was a volunteer and student at Museums Victoria, and I'll never forget the impact this had on me. I hope I can inspire kids and adults alike, in much the same way that David did with me.

Image Courtesy AAoD

PRESENTING PALAEO THROUGH PODCASTING

BY ADELE PENTLAND

Countless hours and literal blood, sweat and tears go into every new scientific discovery in the field of palaeontology. From the moment the fossil is found in the field, to its transport to the lab and the time spent painstakingly preparing it from the surrounding matrix. Not to mention the weeks and months taken by the palaeontologists photographing, drawing and scanning the specimen as they study it.

For me, all these efforts are for naught unless we publish these findings and share these discoveries with a broader audience. The pathway to publication is relatively straightforward, especially when compared with the many ways we can use our creativity to share our ideas with the general public. For some, disseminating knowledge might mean painting or drawing artistic reconstructions of ancient animals in their environment. Others might spend hours animating and bringing their creatures to life using 3D models.

In some instances, newly-found fossils will spark the creation of museum displays, and it's a matter of carefully choosing which words will convey the importance of the discovery. While I am lucky to have worked with talented palaeoartists and collaborated on museum displays seen by tens of thousands of visitors across Australia, one of my favourite mediums has been podcasting.

I've loved listening to podcasts when I've felt alone and isolated, as a distraction during exercise or simply as a means of escaping boredom whilst completing household chores. And whilst there are many fantastic palaeo-themed podcasts such as Paleocast, I Know Dino and Common Descent, until recently, very few have focused on the weird and wonderful beasts found in Australia.

In May 2023 I started my own podcast, Pals in Palaeo, a family friendly show which emphasises Australian palaeontology, and highlights the work of other PhD students, Early Career researchers, museum staff and fossil preparators. Ultimately, I want to encourage kids across Australia to love the unique fossils found in their own backyard as much as *Tyrannosaurus* and *Triceratops*, and connect them with Australian palaeontologists doing phenomenal work.

Since its launch, the podcast has reached almost 20,000 downloads and covered a range of topics and fossils, including those found by members of Dinosaur Dreaming. In Episode 2 I spoke with Lesley Kool and Mike Cleeland about their shared connection to Victoria's state fossil emblem, *Koolasuchus cleelandi*. Of course, there's also been discussions about dinosaurs. I've spoken with some of my fellow PhD students, including: Jake Kotevski, and his research on the apex predators of polar Victoria, the megaraptors; and, Ruairidh Duncan about his Honours research on Victorian ornithopods from Eric the Red West.

My hope is that Pals in Palaeo continues to make science more accessible, and through sharing the research and stories of others working in palaeontology, ultimately encourages more kids to pursue careers in STEM. Engaging in conversations with my peers has been incredibly enlightening, allowing me to explore topics I'm less familiar with and deepening my understanding of the field. With more episodes to come, including a special one dedicated to Dinosaur Dreaming set for release next year, I'm excited to continue sharing my passion for Australian palaeontology and demonstrate just how diverse our community is.

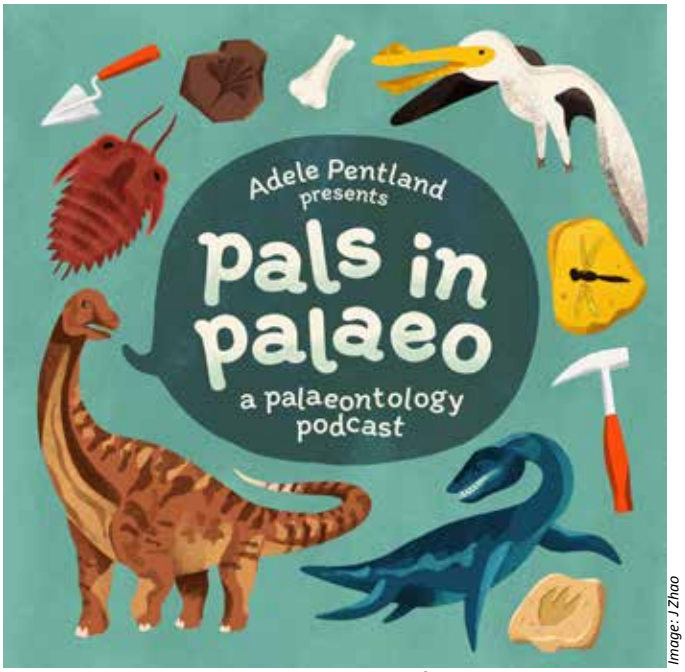


Image: JZhao

Pals in Palaeo cover art by Jenny Zhao from Crumpet Clubhouse.

Image: W White

THE DEAD WALK: BUILDING A LIBRARY OF AUSSIE MESOZOIC 3D RECONSTRUCTIONS

BY ASTRID O'CONNOR

Very few extinct animals have full and rigorous 3D skeletal reconstructions completed of them, let alone available for public view online. Hence, I have made it my personal mission to see that Australia starts leading the world in this category!

The platform? Sketchfab, an open-source 3D asset website.

The reconstruction? Using Blender, also open-source.

The goal? Create a rigorous 3D animated skeletal reconstruction of as many extinct Aussie animals as possible.

Non-Mesozoic aficionados will also be interested to know that I have made and added *Perucetus*, *Zygomaturus*, *Thylacoleo*, and a Thylacine joey.

I am inordinately pleased with how my library is taking shape. I started out with *Siderops* as a representative for temnospondyls, then moved onto *Leaellynasaura* as an example of our small-bodied ornithopods. Driven by a curiosity to understand how lungfish tooth plates work, *Neoceratodus* was next. The latest, and in some ways the most challenging, was a collaboration with Adele Pentland to reconstruct *Ferrodraco*. You can find the library at the QR code below, and stay tuned for a soon-to-be-added titanic addition…

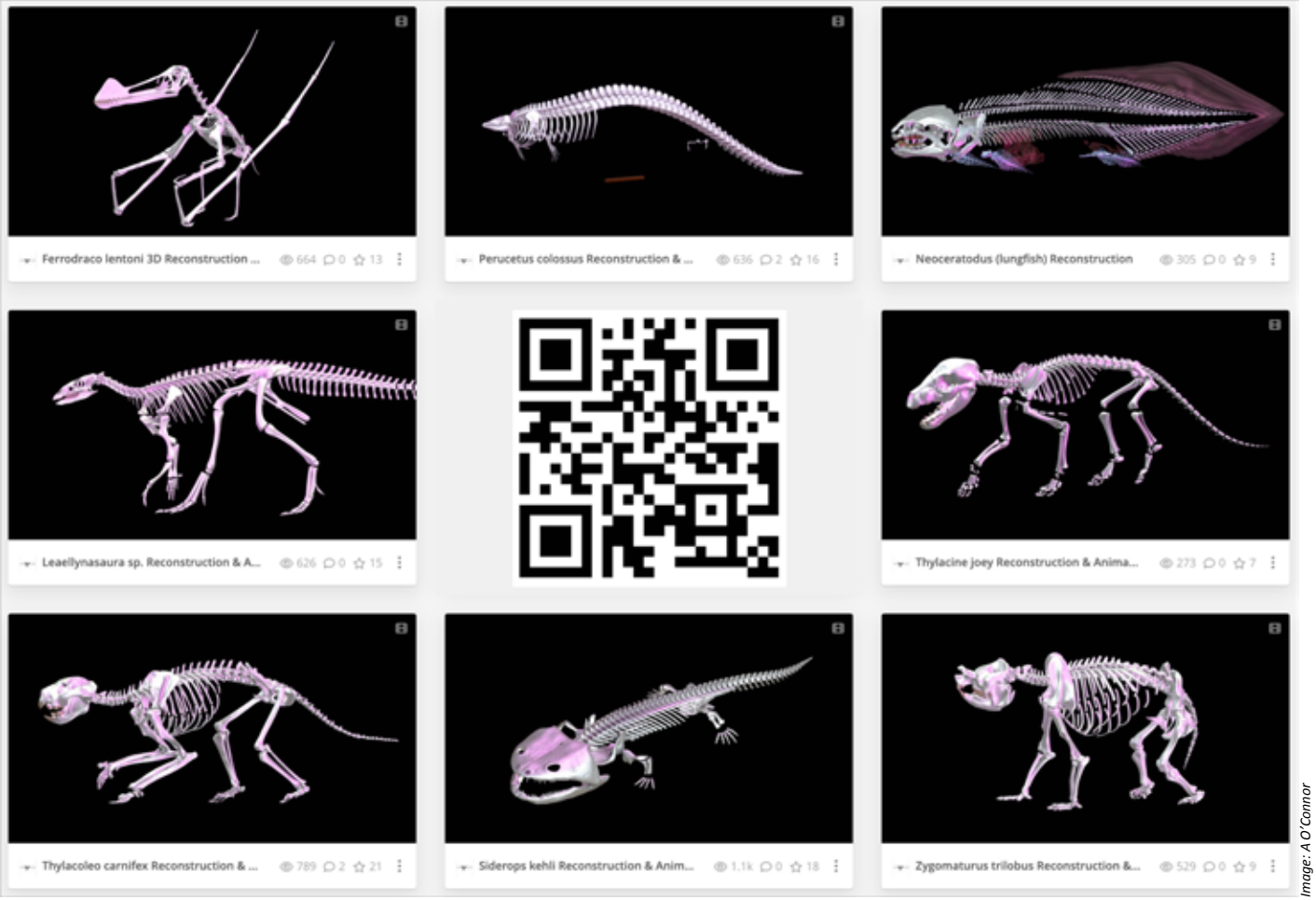


Image: A O'Connor

2024 FIELD CREW

Marion Anderson
Margaret Baldassa
Mike Cleeland
Amber Craig
Adam Dellal
Ruairidh Duncan
Eve Eidelson
Alan Evered
Alyssa Fjeld
Ash Hateley
Fotini Karakitsos
Joerg Kluth
Jade Koekoe
Lesley Kool
Jake Kotevski
Zev Landes (embedded artist)
Melissa Lowery
Sharyn Madder
Astrid O'Connor
Wade Oliver
Leo Prezant
Tom Rich
Doris Seegets-Villiers
Danielle Shean
John Swinkels
Alan Tait
Pat Vickers-Rich
Mary Walters
Wendy White
John Wilkins
Corrie Williams
Marlonique Wolmarans

WEEK ONE

Image: G Kool

Back row: Marion Anderson, Jade Koekoe, Corrie Williams, John Swinkels, Adam Dellal, Amber Craig, Alan Tait
Middle row: Sharyn Madder, Mary Walters, Alan Evered, Doris Seegets-Villiers, Wendy White, Lesley Kool
Front row: Alyssa Fjeld, Marlonique Wolmarans, Astrid O'Connor
Absent: Mike Cleeland, Melissa Lowery, Tom Rich, Pat Vickers-Rich

WEEK TWO

Image: Z Landes

Back row: Alan Tait, John Wilkins, Margaret Baldassa, Joerg Kluth, Eve Eidelson, Wade Oliver, Leo Prezant, Ash Hateley, Fotini Karakitsos, Wendy White, Marion Anderson, Mary Walters, Doris Seegets-Villiers
Front row: dinosaur, Astrid O'Connor, Jake Kotevski, Ruairidh Duncan, Corrie Williams, turtle
Absent: Mike Cleeland, Alan Evered, Lesley Kool, Melissa Lowery, Tom Rich, Danielle Shean, Pat Vickers-Rich

DINOSAUR DREAMING

EAGLES NEST

BASS COAST 2024