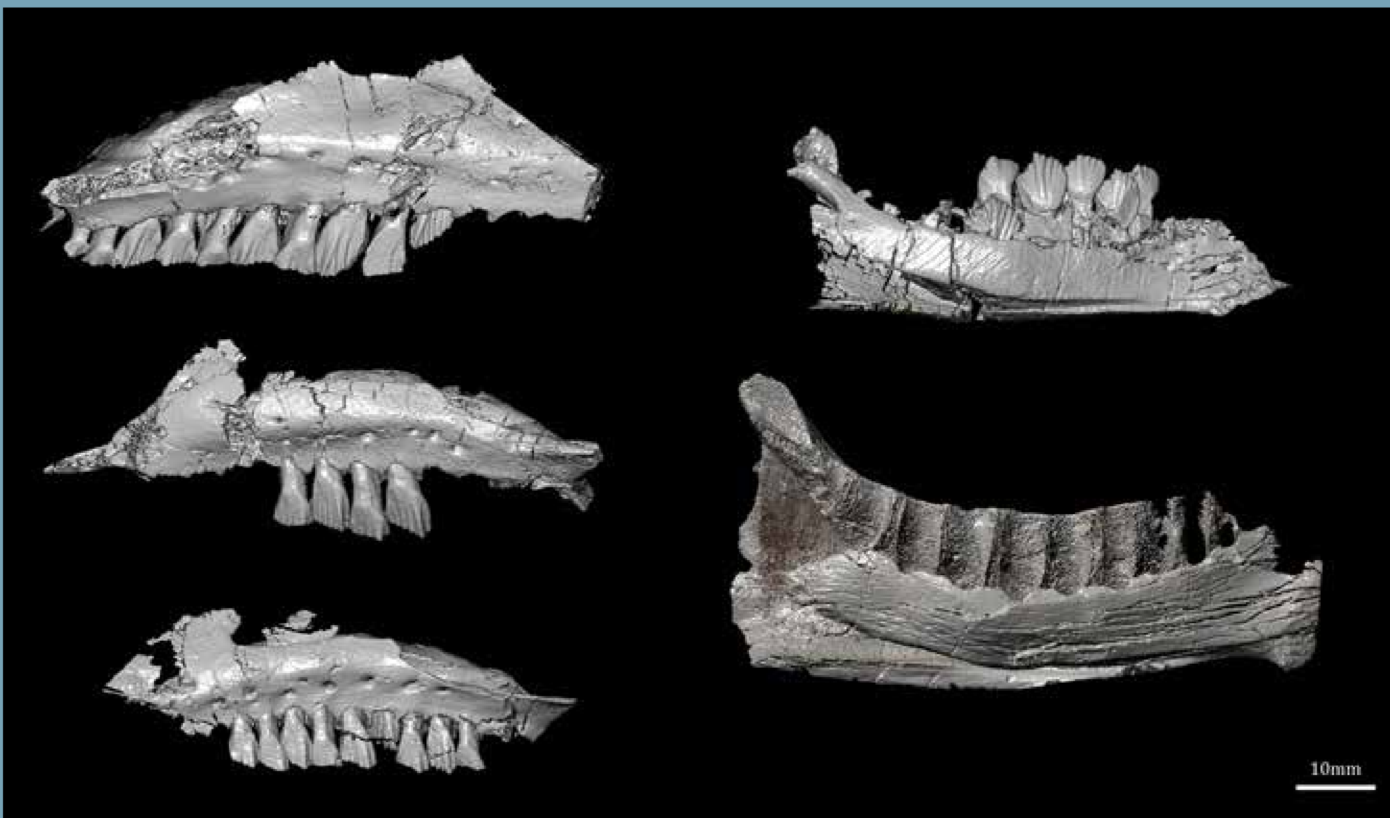
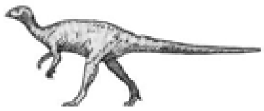
DINOSAUR DREAMING 2019 FIELD REPORT





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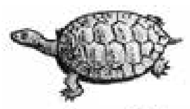

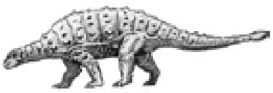

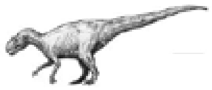

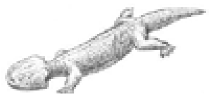

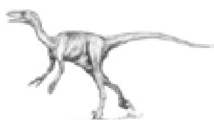

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Dinosaur Dreaming acknowledges the Bunurong and Eastern Maar peoples, the Traditional Owners of our Victorian Cretaceous dig sites, and pays respect to their Elders past and present.

Collection of Victorian Cretaceous material was completed under the Department of Environment, Land, Water and Planning, National Parks Act 1975 Research Permit No. 10008781, File No. FF383578.

FRONT COVER: Ornithopod maxillary and dentary morphotypes from the Eric the Red West site. Left: maxillary morphotypes in lateral view. Right: dentary morphotypes in medial view. Image: Ruairidh Duncan

BACK COVER: Lesley and Gerry Kool model coordinated hi-vis vests. Image: Wendy White

The Dinosaur Dreaming 2019 Field Report was compiled and edited by Wendy White. The editor would like to thank her proofreaders Alanna Maguire and Mary Walters. Uncredited images by the editor.

Contents:

Visit our website: *www.dinosaurdreaming.net*

and our blog: *www.dinodreaming.blogspot.com*

Field Report

By Lesley Kool

The 2019 Dinosaur Dreaming field season saw a welcome return to our old stamping ground at the Flat Rocks site, near Inverloch. We last excavated this site in 2013, as later that year we decided to concentrate our efforts at the Eric the Red West site in the Otways, due to the discovery of a mammal upper molar there. We continued to return to Eric the Red West until 2017 when, a one-day dig in October of that year at the Flat Rocks site, conducted by dig excavation manager Nick van Klaveren, resulted in the discovery of only the second evidence of a multituberculate mammal, (*Corriebataar marywaltersae*) in Australia. The first specimen, also found at the Flat Rocks site, consisted of a single premolar tooth in a small fragment of lower jaw. Fortunately, if you are going to find a single tooth from this group of primitive mammals, the best tooth to find is the modified premolar. The second specimen, found by Wendy White when a group of us were breaking down the rock collected by Nick and his excavators, was a much more complete lower jaw. Although it, too, only possessed a single premolar, much more of the jaw was preserved, which allowed palaeomammalogist, Tom Rich, to ascertain that it originally held a large incisor and a small molar.

We were unable to excavate in 2018 as our Parks Victoria permit had expired and there was some delay in getting it renewed. When the permit was finally

Rebekah Kurpiel and Joerg Kluth working in the hole

Digging out sand at Flat Rocks

renewed in November 2018, we quickly made plans for a return to the Flat Rocks site in the following February, in the hope of finding more evidence of *C. marywaltersae* and anything else we could find in the process.

So after a six year hiatus we returned to the Flat Rocks site for the 21st field season. On Saturday 9 February, the first week's crew assembled at the same dig house we had rented six years previously and set about making it "home" for the next three weeks. As we had been given only a short time to organise the dig, we decided to invite only experienced volunteers who needed no training, although we did accept a small number of "rookies" who came to us from various institutions.

The weather at the start of the dig was unseasonably cold and wet, but the crew used their initiative and found areas out of the rain to break rock. The weather gradually improved in the second week and became positively "toasty" in the third week, as Wendy White recalls in her report.

The focus of the three week field season was to find more evidence of *C. marywaltersae*. To that end, excavation manager, Nick van Klaveren, whose idea it was to conduct the one day dig in 2017, concentrated most of the excavations along the southern edge of the fossil layer. This area included the lowest part of the fossil layer, situated just above a sandstone layer that was wedged between the lower conglomerate and the underlying mudstone. This part of the fossil layer had been sampled in previous digs and was notorious for containing only bone fragments, isolated small dinosaur teeth, fish jaws and scales and the occasional turtle bone. It represented the edge of the original river channel where the current was much slower than the main channel current and consequently only small bones were deposited.

John Swinkels, Nick van Klaveren, Alan Tait, Ali Calvey and Fotini Karakitsos working during a rainstorm

As expected, the concentration of bones in this part of the fossil layer was quite low and consisted of many incomplete bones and small fish bones, neither of which were worth collecting. However, on the very first day, a small ornithopod dinosaur tooth was found, which buoyed the volunteers' spirits with the hope that more interesting fossils might be discovered.

The only way fossil bones are found is by breaking them. The sediments in which the fossils are found is a sandstone/mudstone conglomerate which represents the bed of an ancient river channel that flowed in the Inverloch area approximately 125 million years ago. The rock containing the fossils is carefully removed from the fossil layer and then systematically broken into smaller pieces by the experienced volunteers, who check each broken surface looking for a bony or toothy cross-section. This is not an easy task, as the conglomerate contains many other remnants other than fossil bones (hence its name). For example, being a river deposit, the rock also contains a large amount of plant debris in the form of coal. In fact, the coalified plant deposits are one of the indications that the rock may also contain fossil bones. The conglomerate also contains mud clasts ripped up from the original underlying muddy substrate. Some mud clasts can look suspiciously like a bone in cross-section and it is only with experience in identifying hundreds/thousands of fossil bones in cross-section that a volunteer can be confident of making the right decision. If still unsure, they are encouraged to ask for a second or third opinion until a consensus is reached.

Exposing the fossil layer at the Flat Rocks site is not a straightforward task as the main part of the fossil layer lies within the intertidal zone and is inundated by the high tide each day. Consequently, each day the Dinosaur Dreamers arrived as the tide was receding and commenced pumping out the water from the excavations. Once the water level had decreased sufficiently to reveal the layer of sand that had also been deposited by the previous high tide, the volunteers got to work digging out the sand to expose the underlying fossil layer. This daily process took about two hours before any excavations could be carried out Then, approximately three to four hours after low tide, the incoming high tide filled in the excavations all over again. As the field season continued, we decided to expand the excavation area to include a section of the northern edge, which contained some of the uppermost fossil layer — an area where larger bones had been found in previous field seasons. This part of the fossil layer was nicknamed "BOB" (which was short for Back Of Bridge), an area more eastward than the lower section that we were originally working. The sediments in this part of the channel contained more and larger mud clasts, suggesting faster water flow. Although some of the bones were larger, they were not as well preserved as those in the lower sections of the fossil layer.

At the end of the 2019 Dinosaur Dreaming field season, we had catalogued just over 300 fossil bones and teeth, including six ornithopod dinosaur teeth, three possible theropod dinosaur teeth and a pterosaur tooth. There were also many interesting cross-sections through small bones that will eventually be identified after preparation. Also, for the first time since excavations began at the Flat Rocks site, we stockpiled a quantity of rock that had been removed from the fossil layer but had not been processed. The reason for this was that we had only just over 12 months left on our excavation permit from Parks Victoria and we were concerned that we might run out of time to return to the Flat Rocks site. The stock piled rock will be processed over the next 12 months or so by experienced Dinosaur Dreaming volunteers during a series of rock-breaking weekends and we are confident that new discoveries will be made.

Ali Calvey and Corrie Williams at Flat Rocks

Image: C Paragnani

Excavation Report

By Nick van Klaveren

The Flat Rocks fossil locality consists of a series of stacked and graded Cretaceous fluvial pulses, each with a basal lag mudstone clast conglomerate grading to coarse sand and an upper fine sand with coalified plant remains.

The majority of bones have been recovered from within and on the upper margins of the higher two conglomerates termed upper Conglomerate (upper CG) and middle Conglomerate (middle CG). The lateral extent of the upper CG is confined to the “Main Hole” and pinched out at the “Bridge” to the east and at “Prep Rock” to the west. The middle CG persisted through the Bridge and is notably thinner at “Bridge East” where it’s truncated by a sand scour at the sandstone stack at “Far East”. Although mammalian material was recovered from all units, the greatest concentration was located at A2 (see map opposite) in a 50 millimetre thick coarse feldspathic sandstone overlying the middle CG. It was characterized by white spots formed by the weathering of feldspar grains to kaolin, had a width of 1.5 metres and persisted down-dip to the north.

The Lower Fossil Unit (LU) is a loose term for a 600 millimetre thick zone of thin coarse sandstone and gravel lenses and an upper 400 millimetre thick sandstone unit (LSS) with abundant coalified plant remains. A well-sorted basal conglomerate unit (lower CG) of gravel- to pebble-sized clasts persists almost entirely along the width of this unit with a notable thickening at A1 also known as “Norman’s Hole” where it increases to 300 millimetres. This unit is exposed at “Prep Rock” where it is easily accessed with minimal effort on one-day excavations. The lower CG usually produces turtle and fish remains with occasional isolated dinosaur teeth and rare mammal jaws. The LSS is very poorly endowed and is almost barren, only producing rare fragmentary fish and turtle bones.

A large sandstone lens known as the Basal Sandstone (BSS) extends from the central fault to the Bridge area to the east, and represents a large scour in-filled with a medium sand. I investigated its base in 2005 and it yielded a single ornithopod femur. I postulated that the upper margins of this unit may have had the effect of causing scours to form on what was the margins of a sand bank at the time of its formation.

In a one-day dig in late October 2017 at locality C1, a 30 millimetre thick conglomerate and overlying coarse sandstone were collected. Three weeks later, in a rock breaking weekend, a mammal jaw of *Corriebataar* was found by Wendy White in the overlying coarse sandstone which provided impetus for the 2019 field season.

2019 Field Season

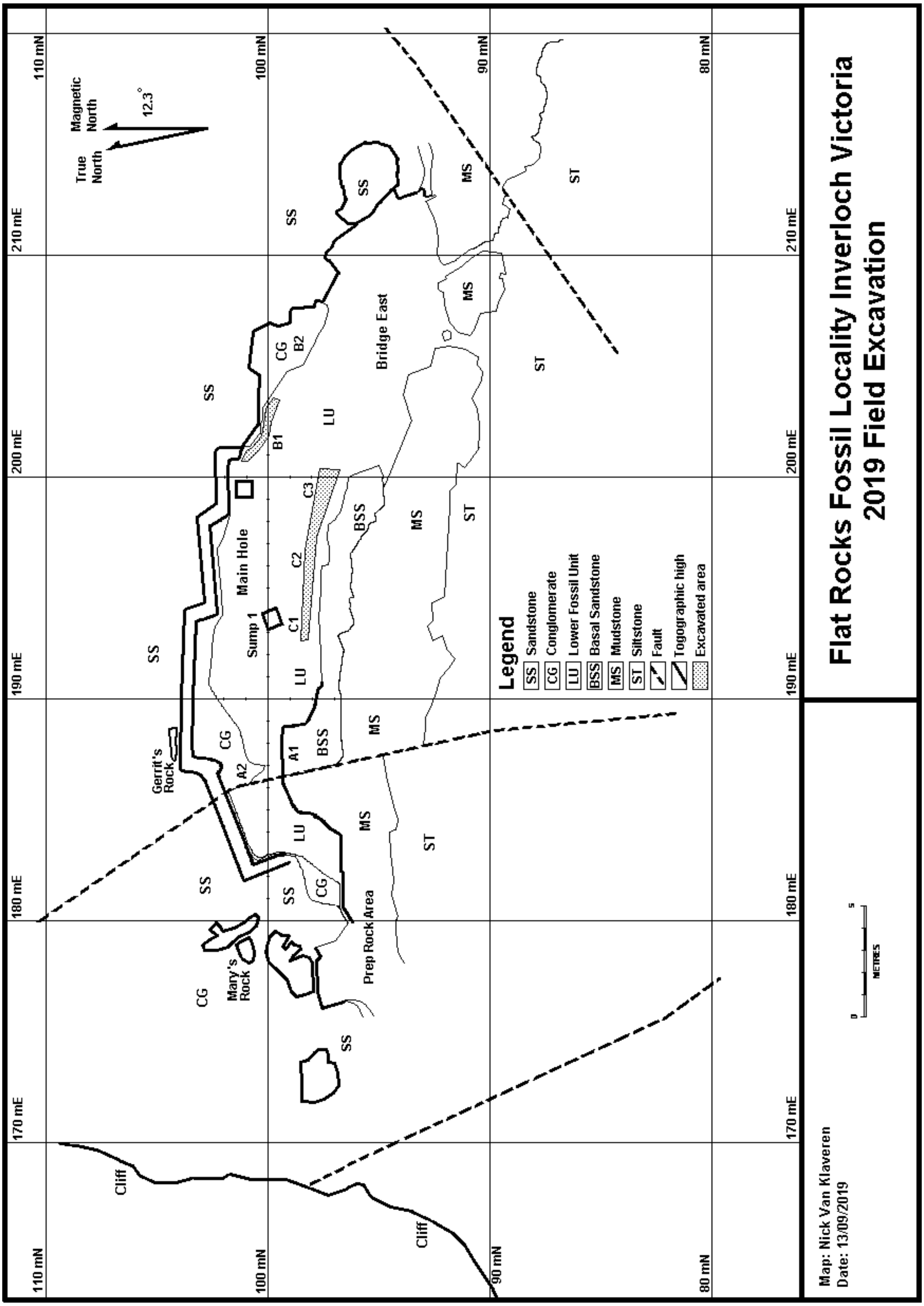
The 2019 field season at Inverloch was conducted to investigate the remnant lower CG lenses and in particular to further investigate the occurrence at C1. As the exact location of C1 was not recorded at the time, a systematic investigation of the entire 5 metre top margin of the BSS was undertaken. Three shallow, gravel sized conglomerate lenses were discovered at C1, C2 and C3, with a twenty-fold increase in local bone concentration. The original C1 site was not relocated until the last three days of the dig and was not adequately tested. These sites produced the expected fragments of fish and turtle, but no mammal bones.

The Middle Conglomerate was sampled by Alan Tait this season at the remnant of the “Bridge” and the margin to the east at the B1 site with a local name “BOB” (Back of Bridge). A number of worn (at the time of deposition) and recently weathered (due to seawater exposure) dinosaur bones were recovered in an indurated claystone conglomerate (middle CG).

Future Excavations

Two sumps were excavated in the Lower Sandstone Unit in 1998 and the western “Sump 1” yielded an unexpected concentration of bones and may represent a larger more fossiliferous unit of the lower CG. The proximity of Sump 1 to site C1 (1 metre) may indicate that C1 is the up-dip margin of this lens. Investigation of this area will require the temporary construction of low sand bag walls and will require digging out before each day’s excavation. An area of 3 metres by 3 metres would be adequate to be enclosed by the sandbag walls on three sides.

A large area at B2 has already had most of its sandstone overburden removed and could also be worked, but the inflow of draining water from the main hole would be significant, and be would likely to require a sump in the floor 3 metres to the east. A second temporary low sand bag wall at the position south of the B1 location would limit the ingress of sand into the B2 excavation area.


Flat Rocks Fossil Locality Inverloch Victoria
2019 Field Excavation
Map: Nick Van Klaveren
Date: 13/09/2019
Legend
SS Sandstone
CG Conglomerate
LU Lower Fossil Unit
BSS Basal Sandstone
MS Mudstone
ST Siltstone
Fault
Togographic high
Excavated area
True North
Magnetic North
12.3°
Main Hole
Sump 1
Bridge East
Prep Rock Area
Gerrit's Rock
Mary's Rock
Cliff
A1
A2
B1
B2
C1
C2
C3
110 mN
100 mN
90 mN
80 mN
170 mE
180 mE
190 mE
200 mE
210 mE
0
5
METRES

Crew Report

By Wendy White

In 2017, when I found a *Corriebataar* jaw breaking rock in Lesley's driveway, I didn't know what it was. I thought it was the non-fan-shaped side of an ornithopod tooth. A weird multituberculate tooth was, of course, even better, since it meant that we got to run a dig at Flat Rocks again this year.

Flat Rocks is where it all began for me in the 2001/2002 Field Season, and it feels like home. I've done the math and worked out that I've spent about 10 months looking for dinosaurson that beach. It was good to come back.

Once again, we rented the two-storey house in Cape Paterson and tried to remember all the modern conveniences that we should bring along to make so many people living there easier. Gerry Kool confirmed that the fridge that Helen Hughes gave us still worked. We had plenty of tables and some chairs. No-one could find the huge floodlights that we had downstairs that sometimes tripped the circuit breaker, so I bought some new lights. Those lights were a bit wimpy; if we come back next year I will buy a couple more.

We had planned to have only experienced crew on this dig, but we ended up with five rookies that were recommended to us – from La Trobe University, Parks Victoria, Australian Age of Dinosaurs and volunteers from Museums Victoria. It was great that we still got to have a few rookies – they bring enthusiasm, delight and a sense of wonder to the dig, but I confess it was also lovely not to have too many people to induct into the Dinosaur Dreaming way of doing things.

Talking to Inverloch Beach Kinder about dinosaurs

We arrived at the house and set up our tent city and rock-breaking stations in the back yard. Having been spoilt with plenty of room at Bimbi Park in The Otways, many of the regular crew had up-sized their tents accordingly, but we managed to Tetris everybody in.

Mary Walters had rented a house a few doors down from the main dig house, and we used that space to run some lectures in the evenings. Besides Tom Rich talking about the latest Mesozoic mammal research, I talked about Winton footprints; Adele Pentland told us about pterosaurs (did you know that more than half of the known pterosaur teeth in Australia come from our digs? — although that was pre-*Ferrodraco,* so it may need reevaluation!); Lesley Kool explained why she loves turtles so much (we have examples of pretty much every bone in a turtle body from the Victorian Cretaceous); Marion Anderson talked about Mars exploration (complete with Mars Bars); and Rohan Long told us about some of the objects that he curates in the Harry Brookes Allen Museum of Anatomy and Pathology. Once again, the irrepressible Alan Tait took our diggers on his famous sedimentology tour down at site.

This year we decided to run Field Report Day during the dig and in South Gippsland. A big thanks to Mike Cleeland and the Bunurong Environment Centre for hosting the day. We filled their room to the brim with people sitting on every chair we could find, on the floor and on tables. Having it close to the dig site meant that visitors could observe the crew at work in the morning and join us for the presentations in the afternoon. It was good to see many of our regular Friends, including Rob Huntley, our honorary webmaster, who had only recently been released from a short stint in hospital.

We had visits from school groups at opposite ends of their educational journey. John Monash Science School arrived with yellow note pads supervised by graduate geologists, including Dinosaur Dreaming alumni. Inverloch Beach Kinder arrived with sippy cups and lots of questions.

Master 4 - "Why are dinosaurs so big?"
Me - "That's a good question. Rhinos are big. Why do you think Rhinos are so big?"
Master 4 - "Because they are animals!"
Me - "Well, dinosaurs were animals too."
Master 4 - "So, why is T. rex so big?
Ruairidh Duncan - "Because they ate big animals."

Which, when you think about it, was a perfectly good way to answer that question.

One of my favourite days on the dig was the one where Corrie Williams and I got up really early to see the dawn over the Dinosaur Dreaming pool down at

Corrie Williams shovelling sand as the sun rises

site. It was stunningly beautiful and serene, and we got to potter around clearing seaweed and digging out the easy top layer of dry(ish) sand. Don't tell the rest of the crew who thought we were down there working, but we also brought a thermos of tea and sat on a rock admiring the sunrise whilst we drank it.

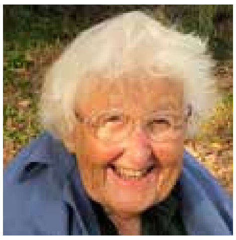
Then there was the day that it was so hot that all of the crayons melted down at site making a rainbow-coloured sticky mess, followed immediately after by the evening during which I discovered where I had sequestered spare crayons just in case I needed them. The inside of my pack looked pretty gross with a rainbow-coloured waxy coating.

This year we made sure that a few of our regular volunteers knew the ins and outs of coaxing the pumps into life. This resulted one day in Ali Calvey accidentally swimming in the Dreaming pond.

We had our normal share of wildlife checking out the dig, including a juvenile Pacific Gull that spent most of a day figuring out what we were doing.

It is always nice when we feature in the local media — the Sentinel Times published an article about us during the dig, and we all clustered around it to look for mentions of our own names and to chuckle at the odd inaccuracy.

My favourite fossil of this year's dig was probably Mary's lovely little theropod tooth, which emerged from the rock all shiny and perfect. I was also particularly fond of the little pterosaur tooth that I found, although it was not quite as pretty. Not to mention the fossil that Alan Evered found before his wife Nicole, who prides herself on being a gun, found one. You should have seen the look on her face!



Return to Flat Rocks

By Nicole Evered

Dream no longer, dear dinosaurs
Diggers have returned to your shores
Excitement is high as we dig
We know that we'll find something big
But whether finds be big or small
We've all responded to your call
We are here — may the fun begin!
We know for sure that we will win.
Digging from dawn to afternoon,
Hoping the tide won't come too soon.
Weary, we take back rocks to break
At home — if we can stay awake!

Who will reveal the very best find?
Will all my rocks be extra kind?
Bone of the Day is what we crave
If NO — we will be very brave
.... And congratulate the winner.

Dear dinosaurs, now rest and dream
Our grateful thanks from all the team.
Twenty nineteen digging ended,
Peace at The Caves has now descended.
And as we've gone our separate ways
We will recall our digging days,
And boast of finds both great and small
(Some of the tales are rather tall!).
The Caves await, we will return
To see what else there is to learn.
So, dear dinosaurs, dream and sleep
Your destiny, for now, will keep.

A juvenile pacific gull flies across the dreaming pool

Prospecting Report

By Mike Cleeland

The last 12 months have been a particularly active time for prospecting of the exposed lower Cretaceous outcrops, especially along the Bass Coast where a number of new bones have been collected. The renewal of the Parks Victoria permit and the addition of several new pairs of eyes on the ground has resulted in some interesting new discoveries.

From west to east...

San Remo Back Beach has produced a steady supply of vertebrate fossils since the late 1970s. Another interesting bone was found here in August 2019 which appears to be a possible temnospondyl mandible fragment, but identification is yet to be confirmed at the time of writing.

A number of visits to the type locality of *Koolasuchus cleelandi* at **Rowell's Beach** produced no further material, which is hardly surprising considering the particularly slow rate of erosion in that area.

A visit to **Punch Bowl** on 27 July recovered only one bone — a possible temnospondyl fragment found by Melissa Lowery. This was considered to be a somewhat poor result, given that the area had not been searched for some 14 years and that the GOK and several other bones had been recovered from the site. For readers unfamiliar with the story of the GOK, this unusual specimen was at first difficult to identify and was for several years referred to as the "God Only Knows". It was later identified as a partial Temnospondyl mandible.

Image: M. Cleeland

Limb bone found by Andrew Ruffin and relocated by Simona Grippi at The Arch

Image: M. Cleeland

Trilby Parise's limb bone from Ankylosaur Point

Tim Flannery reported that in the late 1970s he descended into the Punchbowl and exited through a cave, and discovered the GOK on the shore platform to the east. Access through this opening has since been blocked by rockfall material, but in time erosion will likely remove this collapsed rock and the sea will once again enter the Punchbowl.

A visit to **The Arch** in May produced four bones: a hollow limb in the base of the cliff (found earlier by Andrew Ruffin); two bones in erratics including a medium sized unidentified limb bone found by Simona Grippi; and a fourth on the west side of the leg of the arch.

Blackhead produced three bones in August including one relatively complete ornithopod ilium.

2019 has been something of a breakthrough year for the **Harmers Haven – Cape Paterson** area, with the collection of five bones (exceeding the total of four collected in all previous years.) Four of these were from the headland to the west of F Break at the end of Wilson's Rd, Cape Paterson. One of these four was a fragment of ornamented temnospondyl bone, only the second bone from this group found outside the San Remo – Punchbowl area. The fifth bone, and ornithopod femur, was found in the only other known fossil layer in this section, about a kilometre south of Harmer's Haven.

Another interesting development was the discovery by Simona Grippi of two bones at **Shack Bay**, west of Inverloch. This locality had been considered unproductive in recent years but the ornithopod femur and additional bone found at a new site has put this area on the map again.

Image: M. Cleeland

Melissa Lowery at her new site on the Inverloch foreshore

A highlight of the prospecting year was the quantity of material collected from near **Eagle's Nest**. A fine Plesiosaur tooth was collected from a layer at the start of the cliff line to the south of the access path in April. Three bones were found in the east wall of a cave to the east of Ferguson's original discovery site, and six were found by a prospecting party in August at or near Tom's layer further west. This is not the first time that multiple specimens have been collected from this area, and demonstrates that continuing erosion is exposing new specimens.

A headland **between Eagle's Nest and The Caves** has been searched previously without success but Melissa Lowery found the first bone, on the east side of the headland, in July and another was found nearby. Both were possibly turtle material.

Ankylosaur Point, the headland immediately to the north of the dolerite dyke near the Flat Rocks dig site, revealed a possible ornithopod skull element early in the year. Then, in April, Trilby Parise discovered a large hollow limb bone protruding from the base of the cliff. This unusual bone has yet to be identified but its discovery is consistent with a greater rate of erosion at this site than at some of the others. This continuing erosion, particularly of the cliff face, also exposed an ornithopod mandible with four teeth, which at the time of writing is awaiting identification. Melissa Lowery subsequently found several smaller bones at this site. These finds have advanced the case for this locality being considered for a test excavation in the near future.

Several additional bones were found by Melissa Lowery at the **Mary Anning** site as well as another in a nearby erratic exposed by flooding overflow from the road in winter.

Images: M. Cleeland (L) and L. Kool (R)

Plesiosaur tooth from Eagle's Nest when found and after preparation by Lesley Kool, Scale in cm

Two further bones were found on the headland immediately to the south of this site, including a prominent centrum found by a visitor from the RACV.

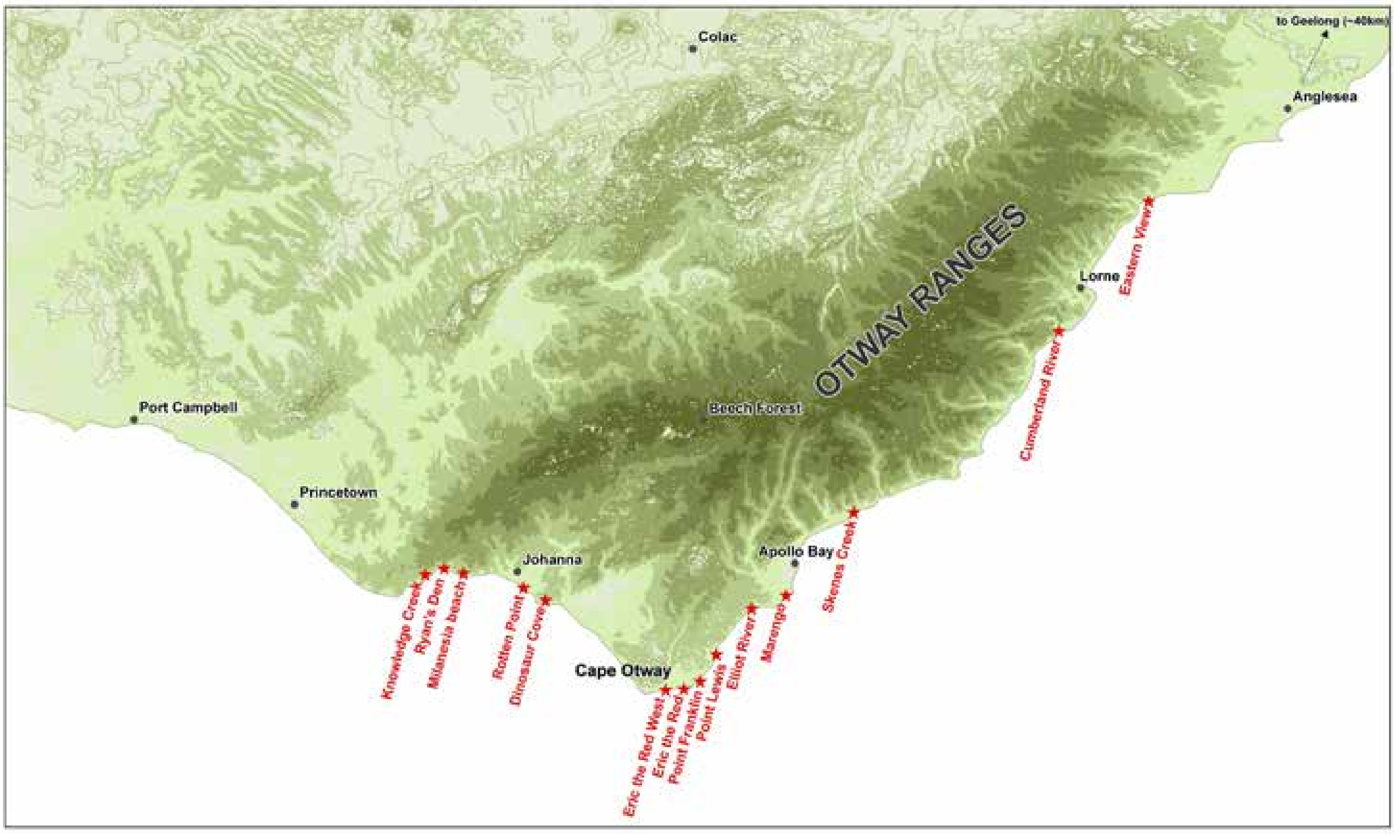
Significant sand movement along the Inverloch surf beach has caused serious concern for local residents but has also exposed a considerable area of new rock at the **eastern area of Flat Rocks**, where Melissa Lowery has discovered a new site containing eight small bones in an area of only 2 square metres. Although none of these have as yet been identified, this readily accessible site is another which appears deserving of further excavation.

Little attention was given to the Otways this year, the only result being the recovery of one eroded limb bone from **Black Beacon Point** at Marengo.

Images: M. Cleeland (L) and L. Kool (R)

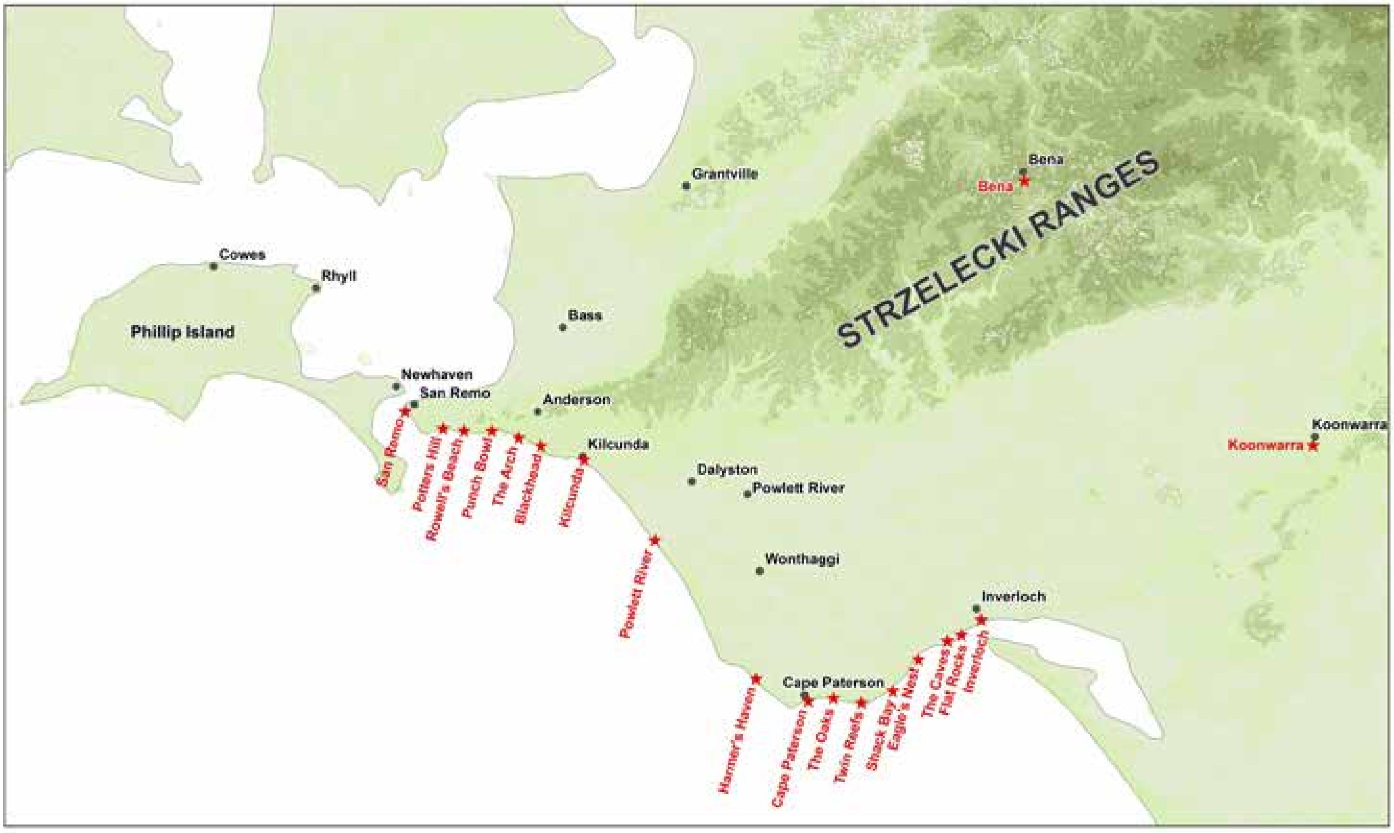
Femur found by Simona Grippi at Shack Bay when found and after preparation by Lesley Kool.

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:														
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						
Megaraptorid					X	X								
Oviraptorosaur					X									
Tyrannosauroid					X									
Timimus hermani					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													

Cretaceous Vertebrate Localities in South Gippsland



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

The Bass Coast Prep Group

By Lesley Kool

On a recent trip to Queensland, Gerry and I called in at the Australian Age of Dinosaurs Museum of Natural History (AAOD) on The Jump-Up just outside Winton. After marvelling at the new Dinosaur Canyon they had constructed since we were there four years ago, we visited the preparation laboratory, which is situated close to the reception centre. We were welcomed by lab manager George Sinapius and shown some of the fossils that he and his volunteers were currently working on. Talking to the volunteer preparators, I was interested to hear that some of them had travelled thousands of kilometres just for the experience of exposing the dinosaur bones that had been recovered around Winton. Their enthusiasm for, and the satisfaction they achieved from, uncovering those ancient bones was something that resonated with me as a fossil preparator of more than 35 years' experience.

After leaving Winton, we headed south towards Eromanga, the town which proudly boasts that it is the furthest town from the sea. It is also the home of the newly built Eromanga Natural History Museum, which houses Cooper, Australia's largest sauropod dinosaur, and some amazing megafauna from nearby Eulo. We were fortunate to catch up with the Museum's curator Robyn Mackenzie, who kindly showed us around the establishment and allowed us to see some of their prize specimens in the Type Room.

Robyn explained that the bones they collected were prepared by a team of volunteer preparators and

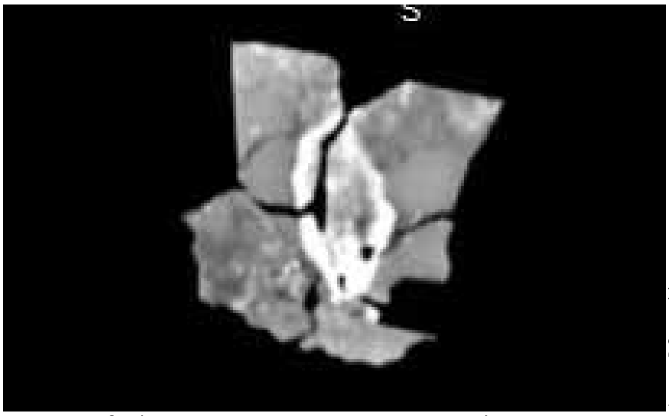


Image: R Comanici

CT scan of a bone in Victorian Cretaceous rock

Image: AAOD

AAOD Prep Lab

showed us their work area. It was a similar setup to the lab at the AAOD, with a similarly dedicated group of volunteers — which got me thinking...

I began as a volunteer preparator at Museum Victoria after the first Victorian Dinosaur Dig at the then-recently named Dinosaur Cove in 1984. We returned from that two week dig with around 80 fossil bones but there was no-one to prepare them, so I volunteered. Two years later, I was offered a research assistant position by Dr Pat Vickers-Rich at Monash University, where I worked for the following 20 years. During that time I was fortunate to learn aspects of preparation at the Royal Tyrrell Museum in Drumheller, Alberta, Canada as well as at the Museo Paleontologico Egidio Feruglio in Trelew, Patagonia. I also picked up many valuable tips from visiting preparators, which all added to my repertoire of knowledge.

I was not the only preparator working on the Victorian Early Cretaceous fossils. Former Museum Victoria Vertebrate Palaeontology Collections Manager, David Pickering had a small group of volunteer preparators who worked on some of the bones in the Preparation Laboratory. However, when David sadly passed away in 2016, the number of volunteers gradually dwindled.

Having been involved with the preparation of the Victorian Early Cretaceous fossils almost from the beginning, I was well aware of the large backlog of unprepared fossils that patiently awaited someone to lovingly uncover them. In addition, my friend and colleague Mike Cleeland had been emailing me during our trip to Queensland with images of bones that he had found and removed from the rocky shore platform along the Bass Coast. The thought of the enormous task of preparing all those bones was overwhelming... until I began to think about the volunteer preparators in Winton and Eromanga.


Some of the Prep Group sorting fossils in the garage

Living in the Gippsland town of Wonthaggi, the thought of travelling regularly to Melbourne – a round trip of 250 km – to supervise the volunteers was rather daunting. As most of the unprepared fossil bones from the Flat Rocks site are housed in a shed on my property, it suddenly made sense to set up a volunteer preparation group at my home, reflecting the situation in Winton and Eromanga where the local fossils were prepared. I sent out a few feelers to see if there were people who were interested in fossil preparation and were willing to travel to Wonthaggi for regular meetings. To my surprise and delight, I quickly had around 12 potential volunteers, some local and some from Melbourne.

The inaugural meeting of the Bass Coast Prep Group took place on 27 July where I explained the basic preparation procedure to a group of enthusiastic volunteers. My plan was to equip the members with a basic preparation kit that they could set up at home and work on their allotted specimen in their own time, even if only for one hour a week. As a preparator working from home, I have missed the interaction with fellow preparators. The lack of having someone to discuss the best method or direction of preparation was very isolating. My hope for this prep group was that they would have support from me and other members of the group.

At the second meeting in August, I showed the group the boxes of fossils housed in my shed and explained that the mission, if they chose to accept it, was to make serious inroads into those boxes. To my surprise no one ran away. Instead most of the group had large grins on their faces with the anticipation of future discovery.

One of the volunteer prospectors accompanying Mike Cleeland on his regular forays on the Bass Coast is Raluca Comanici, who is studying to be a radiologist. When Mike explained that we often can't identify a fossil from what is exposed on the surface of the rock she generously offered to scan a few mystery bones in a Computerized Tomography (CT) scanner where she works. We jumped at the opportunity, giving her a selection of specimens and eagerly awaiting the results. The results were very interesting in that two of the specimens showed up as bright white outlines inside the rock, but the third sample was too ambiguous to make out. We also gave her a test rock with no bones exposed on the surface, which when scanned, suggested that there could be a small bone inside. When the rock was broken open there was no bone but there was a small calcite inclusion, which Raluca suggested may have given us a false reading. Fortunately, Raluca is willing to keep scanning any rocks of interest, which will assist us when it comes to preparing the specimen.

Over time, I intend to impart as much of my accumulated knowledge as I can to the group so that when I can no longer wield an engraving tool or focus through a microscope there will be someone to take up the baton and continue to add to Victoria's amazing fossil record.

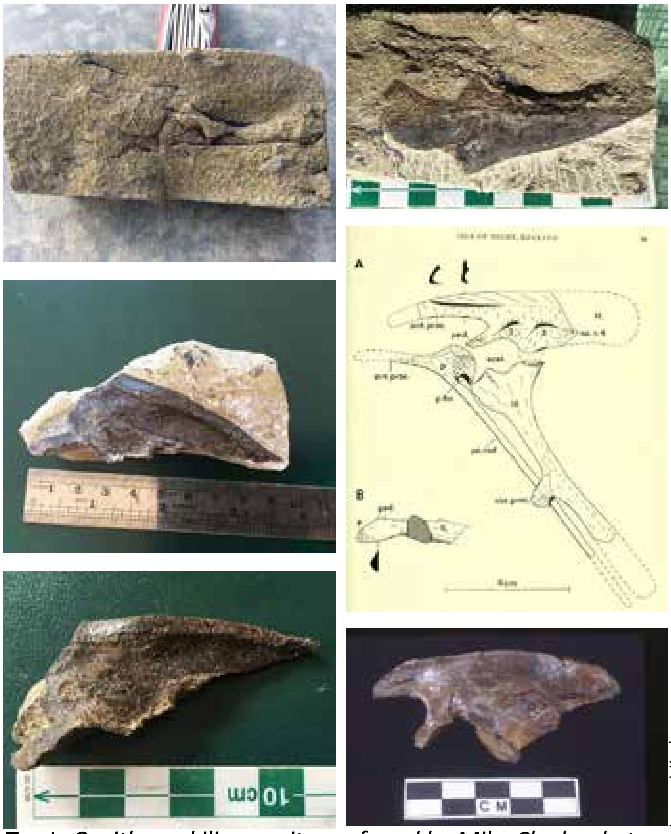


Image: L Kool

Top L: Ornithopod ilium as it was found by Mike Cleeland at Black Head, Kilcunda in June 2019; R: One side of the ilium exposed; mid L: 2nd side exposed, bone still in carbowax; R: Illustration of Hypsilophodon foxii *hip region from Galton 1974. lower L: Partial ornithopod ilium fully prepared; R: A more complete ornithopod ilium from the Flat Rocks site*

Image courtesy of Museums Victoria

We Will Return to ETRW

By Tom Rich

A core group of Dinosaur Dreamers recently completed a test excavation at Eric the Red West (ETRW). Our objective was to determine whether the high concentration of dinosaur and turtle bones found on the second-to-last day of the previous major excavation at the same site continued. Never in the last forty years in southeastern Australia had so many fossil dinosaur bones been found in such a small volume of rock. This discovery has been christened "The Block". Was it worth continuing to dig there? Or was this concentration a fluke that signified nothing?

Despite inclement weather and unusually high sand levels, in three days we were able to establish that about 106 million years ago, an extensive log jam had occurred in a river flowing through the area at that time. That log jam had acted as a trap for bones that had been swept along by the river, accounting for the accumulation of them at this location. The flow of water was clearly chaotic, for the bones are oriented at different angles rather than being parallel to one another.

Plans are now being laid for a more prolonged excavation at ETRW next summer.

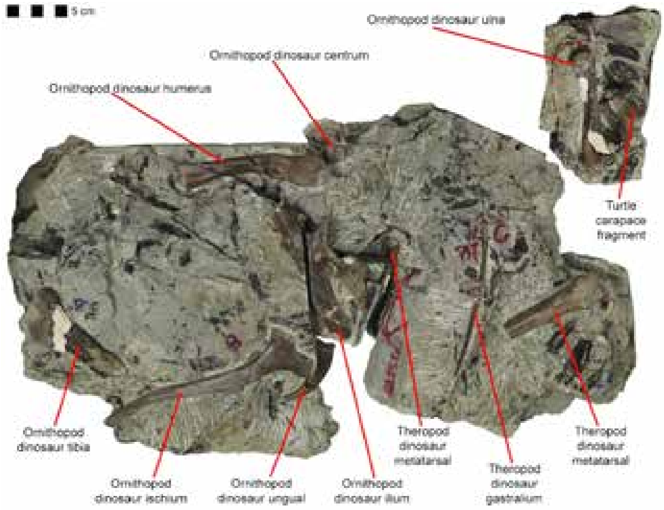


Image: L. Kool

The Block uncovered at ETRW in 2017

Had The Block not been discovered on the last major dig at the site, no further work would have been carried out at ETRW, after a dozen previous excavations there. But now, in light of what has been learned during this recent test dig, work there may well continue for a number of additional years.

Given the evident differences in the way the fossils accumulated where The Block was found compared with elsewhere at the site, it may be that we will find dinosaurs not yet discovered at this locality.

The next step: logistics. The people must be found, the equipment organised and the financial support obtained to carry out the intended dig next summer.

Dinosaur Dreaming is a joint project of Monash University, Museums Victoria, and Swinburne University of Science and Technology.

Nick van Klaveren, Alan Tait, John Wilkins and Corrie Williams digging out the hole in warm hats and waterproof jackets

Image: P. Vickers-Rich

Alan Tait, Corrie Williams and John Wilkins in the deep hole

Cartoon

By Sharyn Madder


Image courtesy of Museums Victoria

Mammal Update

By Tom Rich

While more than fifty lower jaws of mammals are known from the Cretaceous of Victoria, only two specimens of mammalian upper molars have been found. The first was found by Alanna Maguire in 2009 and the second by Tim Ziegler in 2015. Much effort has been spent analysing these two fossils. Both are quite enigmatic. As a consequence, more than one plausible hypothesis has been proposed as to what each is.

Both were collected from Eric the Red West (ETRW), which has only yielded a total of four mammalian specimens, but these include the only Victorian Cretaceous mammalian upper molars. Although more than fifty mammalian lower dentitions are known from the Flat Rocks locality, no upper mammalian molars have been found there (this bias in the Flat Rocks sample is termed the “Samson Effect” — recounted in The Bible, Samson chose to slay the thousand Philistines with the jaw bone of an ass because is the toughest bone in the mammalian skeleton). For this reason, if more mammalian upper molars are to be found in the Victorian Cretaceous, the most likely place is ETRW despite the low frequency of fossil mammals of any kind at that site. But, after the passage of several years with no additional specimens turning up at ETRW, we will now publish what can be said about these two specimens, rather than delay any further in the hope that additional and better preserved specimens will be found.

The approach to be taken in writing this paper is the Method of Multiple Working Hypotheses, coined by the geologist Thomas Chamberlin in 1890, who wrote of it, “With this method the dangers of parental affection for a favourite theory can be circumvented”. What Chamberlin suggested was when one cannot decide between two or more hypotheses, propose all of them.

The reason for a particular interest in these two specimens is that they extend the range of morphological information known about the Victorian Cretaceous mammals. This is particularly true of Alanna’s fossil.

With the publication in 1997 of Nicola Sanderson’s (nee Barton) specimen of *Ausktribosphenos nyktos*, a controversy began. Was it a placental mammal, or the first representative of a group of mammals confined to the Southern Hemisphere, the Australiasphenida, distinct from both placentals and marsupials but having some resemblance to placentals? In the years immediately following that publication, more of this possible group of Southern Hemisphere mammals were found, not only in Victoria, but in the Jurassic of South America and Madagascar. Like Nicola’s fossil, all the specimens subsequently found were lower jaws.

Alanna’s fossil is a mammalian upper molar that might be the upper molar of an ausktribosphenid. Therefore, possibly significantly, it extends the debate about what those mammals were.

However, Alanna’s specimen only hints at this. The individual that had these teeth in life lived to a very old age for the teeth are heavily worn. Nice for that individual, but this obscures the features that could potentially reveal what it was related to. On top of that, in being discovered, the specimen was badly broken. Much effort by Peter Trusler and others was spent reconstructing this important fossil. Peter’s efforts included hypothetical lower molars based on the locations of features on the known upper molars. Using computer graphic techniques, Alistair Evans did much the same thing. The results were that Alanna’s upper molars could be those of the ausktribosphenid *Bishops*, a lower jaw of which was found at ETRW.

Alternatively, Alanna’s specimen might be a marsupial. If there is one thing that everyone agrees that an ausktribosphenid is not, it is a marspial. The number of molars, nature of the most posterior premolar and confirmation of the jaw itself all place the ausktribosphenids, whatever they are, outside of the marsupials.

If Alanna’s specimen is the otherwise unknown upper molar of an ausktribosphenid, with its resemblance to a marsupial, it strengthens the case that it belongs to the Australosphenida (the Southern Hemisphere group hypothesized to accommodate our specimens).

Tim Ziegler’s specimen could be either just a part of a single upper molar with possible affinities to (the monotreme?) *Kollikodon* from Lightning Ridge, or a partial molar and three premolars of a mammal more likely to have something to do with ausktribosphenids than montremes.

THE MAMMALS OF VICTORIA'S CRETACEOUS

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

Reg #	Taxonomy	Collector	Field Number	Year	Preparator	Notes
P208090	*Ausktribosphenos nyktos*	N. Barton	#1111	1997	L. Kool	HOLOTYPE. Right. P6, M1-3
P208094	*Kryoryctes cadburyi*		Dinosaur Cove	1993	L. Kool	HOLOTYPE. Right humerus. Slippery Rock Pillar, Dinosaur Cove
P208228	*Bishops* sp.		#329	1995	L. Kool	600my Exhibition display. Right. P4-M2
P208230	*Ausktribosphenos* ?			1995	L. Kool	Edentulous jaw fragment
P208231	*Teinolophos trusleri*		Mentors trip	Nov. 1993	L. Kool	HOLOTYPE. M3 or M4
P208383	Monotremata		Dinosaur Cove	1993	L. Kool	Premolar. Slippery Rock Pillar, Dinosaur Cove
P208482	*Ausktribosphenos nyktos*	N. Gardiner	#150	1999	L. Kool	Right. M2-3, badly crushed. Found in rock from DD1998
P208483	Ausktribosphenidae ?	N. van Klaveren	#140	1999	L. Kool	Probably Left. x1 premolar & partial tooth
P208484	*Bishops whitmorei*	K. Bacheller	#450	1999	L. Kool	Right. M2
P208526	*Teinolophos trusleri*		#560	1994	L. Kool	Right. Edentulous
P208580	Mammalia	A. Maguire	#200	2000	L. Kool	Jaw fragment. (unprepared)
P208582	Ausktribosphenidae	L. Irvine	#500	2000	L. Kool	Right. M3
P209975	*Bishops whitmorei*	R. Close ?	#387	2000	L. Kool	Right. Roots M1, worn M2. OK M3
P210030	*Teinolophos trusleri*			2000	L. Kool	Right. Edentulous
P210070	*Bishops whitmorei*		Rookies day	03.12.2000	L. Kool	Right. Badly broken M1, M2 and x6 Premolars
P210075	*Bishops whitmorei*		Rookies day	03.12.2000	L. Kool	HOLOTYPE. 600my Exhibition display. Left. P2-6, M1-3. (P1 lost since initial preparation)
P210086	Ausktribosphenidae ?	J. Wilkins	#250	2001	L. Kool	Right. Root fragment
P210087	"Gerry's jaw"	G. Kool	#620	2001	L. Kool	Right. Rear half M1, M2-3
P212785	Mammalia	M. Anderson	Rookies day	03.12.2000	L. Kool	Fragment only
P212810	*Bishops whitmorei*		#300	2002	L. Kool	Left. M2-3
P212811	*Teinolophos trusleri*	D. Sanderson	#187	2002	L. Kool	Right. Edentulous
P212925	Mammalia ?		#222	1996	D. Pickering	Edentulous
P212933	*Teinolophos trusleri*		#179	2001	L. Kool	Left. Edentulous. (Plus associated molar)
P212940	"Gerry's jaw"	W. White	#171	2003	D. Pickering	Left. M1, M2-3
P212950	*Bishops whitmorei*	C. Ennis	#292	2003	L. Kool	Left. P6, M1-3
P216575	*Teinolophos trusleri*	N. Gardiner	#180	2004	D. Pickering	Left. x2 molars. Probably M2-3
P216576	Mammalia	A. Musser	#500	2004	L. Kool	Isolated tooth
P216578	*Bishops whitmorei*	A. Leorke	#600	2004	D. Pickering	Left. M1-3
P216579	*Teinolophos trusleri*	N.van Klaveren	#635	2004	L. Kool	Edentulous jaw
P216580	*Bishops whitmorei*	G. Kool	#800	2004	D. Pickering	Right. P6, M1-3
P216590	*Teinolophos trusleri*	J. Wilkins	#447	2004	D. Pickering	Posterior part of right edentulous jaw
P216610	*Teinolophos trusleri*		#557	2004	L. Kool	Left. Edentulous
P216655	*Corriebaatar marywaltersae*	M. Walters	#142	2004	L. Kool	HOLOTYPE. Multituberculata. Left. P4
P216670	*Ausktribosphenos nyktos*		#184	1999	L. Kool	Left. M2-3
P216680	*Teinolophos trusleri*	R. Long	#132	2004	L. Kool	Right. Fragment
P216720	*Teinolophos trusleri*		#648	2002	L. Kool	Right. Edentulous
P216750	*Teinolophos trusleri*	R. Long	#162	2005	D. Pickering	Right. Edentulous
P221043	*Bishops whitmorei*	A. Leorke	#100	2005	D. Pickering	Right. M1-2?
P221044	Ausktribosphenidae	C. Ennis	#300	2005	D. Pickering	Left. M2
P221045	*Teinolophos trusleri*	J. Wilkins	#395	2005	D. Pickering	Right. Edentulous
P221046	Mammalia	H. Wilson	#480	2005	L. Kool	Isolated tooth
P221150	*Teinolophos trusleri*	J. Swinkels	#340	2006	D. Pickering	600my Exhibition display. Right. x2 molars. Probably M2-3
P221156	Ausktribosphenidae	N. van Klaveren	#360	2006	D. Pickering	Right. M2 (requires preparation to confirm)
P221157	*Bishops whitmorei*	M. Walters	#585	2006	D. Pickering	Right. Edentulous with alveolae for P6, M1-3
P221158	*Bishops whitmorei*	R. Close	#200	2006	D. Pickering	Right. P5-6, half M plus M2-3
P228432	Ausktribosphenidae		scrap rock	2009	L. Kool	Right. Molar talonid
P228848	*Bishops* sp.	M. Walters	ETRW, Otways	10.12.2006	D. Pickering	Left. P6, M1, partial M2
P229037	*Teinolophos trusleri*	M. Cleeland	#91	2008	D. Pickering	Right. Edentulous with alveolae for x4 molars and ultimate premolar
P229194	Mammalia	N. Barton	#770	07.03.2007	D. Pickering	Isolated upper Premolar
P229408	*Teinolophos trusleri*	M. Walters	#300	14.02.2008	D. Pickering	Left. Ultimate premolar, M1-4
P229409	Ausktribosphenidae	N. Evered	#180	07.02.2007	D. Pickering	Possibly *Bishops whitmorei* . Left. P5-6, M1-3
P229410	*Teinolophos*	C. Ennis	#90	2008	D. Pickering	Right. ?M1 plus M3
P229649	*Bishops whitmorei*	J. Tumney	#330	2009	D. Pickering	Right. P2-3,5-6, M1-3
P231328	Mammalia	A. Maguire	ETRW, Otways	29.11.2009	D. Pickering	Maxilla fragment with x2 molars
P232567	*Ausktribosphenos* sp.	M. Walters & J. Wilkins	#270	26.02.2012	D. Pickering	Right. Broken premolars. M1-3
P232892	*Bishops* sp.	A. Werner		16.02.2013	D. Pickering	Left. ?M2
P252052	Mammalia	T. Ziegler	ETRW #626	20.02.2015	D. Pickering	Upper premolar
P252207	*Bishops* sp.	O. Campbell	ETRW #200	07.02.2015	D. Pickering	Posterior part of right mandible w x1 molar
P252730	*Corriebaatar*	W. White	Tragics day	11.11.2017	L. Kool	Multituberculata. Left. P4

Galleonosaurus: A Flat Rocks Dinosaur

By Stephen Poropat

In the three years since 2016, when I and several colleagues named the sauropod *Savannasaurus elliottorum*, four new Australian Mesozoic dinosaurs have been named on the basis of skeletal remains. All are ornithopods, and two are from Victoria. One of these, *Diluvicursor pickeringi*, graced the cover of last year's field report in the form of a beautiful restoration by Peter Trusler. The other, named in January 2019, is *Galleonosaurus dorisae*.

Gerry Kool has been a mainstay of Victorian dinosaur digs for decades. On the 2008 dig at Flat Rocks, while splitting rock, Gerry struck the palaeontological equivalent of gold: a beautiful ornithopod jaw, with four erupted teeth. Amazingly, the rock broke around the specimen rather than through it: an unusual occurrence on the Victorian coast! In next to no time, David Pickering (*Diluvicursor*'s namesake) had the specimen prepared and registered at Melbourne Museum, and shortly after it was studied by Matt Herne, then a PhD candidate at The University of Queensland (UQ).

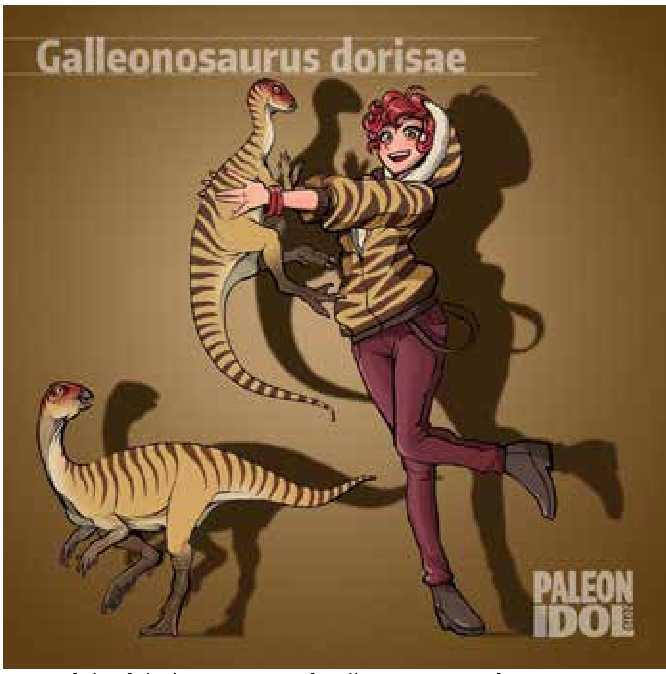


Image: The Amazing Spino (https://instagram.com/theamazingspino)

One of the fabulous pieces of Galleonosaurus *fan art*

In 2019, slightly more than a decade after its discovery, Gerry's jaw was designated the holotype specimen of a new ornithopod species by Matt Herne, Jay Nair (also from UQ), Alistair Evans (Monash University), and long-time Dinosaur Dreamer and sedimentologist Alan Tait. They dubbed Gerry's jaw *Galleonosaurus dorisae*, and assigned an additional three maxillae (two from Flat Rocks, one from The Caves) and two teeth to the new species. The genus name *Galleonosaurus* alludes to the overall shape of the maxilla, which in side view looks like an upside-down ship's hull, and the species name honours stalwart Dinosaur Dreamer Doris Seegets-Villiers, whose PhD research enabled the palaeoenvironmental setting of the Flat Rocks site to be understood.

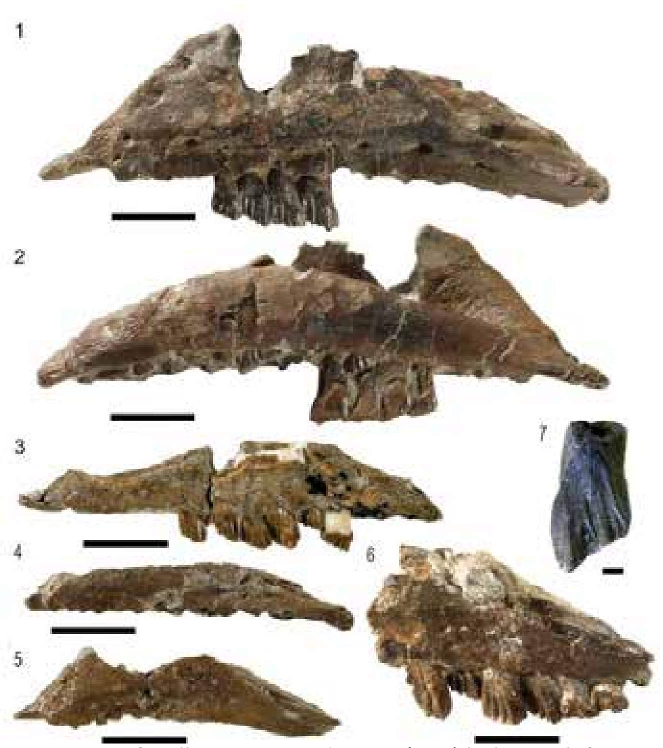


Image: Matt Herne, Herne et al (2019) Fig 4

Specimens of Galleonosaurus dorisae (1–2) holotype left maxilla (NMV P229196); (3-6) left maxillae (NMV P208178, P212845, P209977 and P186440), left maxilla in lateral view; (7) right maxillary tooth (208113)
Scale = 10 mm (1–6); 1 mm (7).

Prior to the naming of *Galleonosaurus*, only one dinosaur had been named from Flat Rocks: *Qantassaurus intrepidus*, based on three dentaries, named by Tom Rich and Pat Vickers-Rich in 1999. In their scientific paper naming *Galleonosaurus*, Matt Herne *et al* thoroughly reviewed *Qantassaurus*. They restricted it to the holotype dentary (found by Nicole Evered in 1996), and designated the other two dentaries *Qantassaurus ?intrepidus*. This indicates that they

Image: James Kuether

A reconstruction of Galleonosaurus dorisae *and its Cretaceous environment by James Kuether*

belong to the genus *Qantassaurus*, but are somewhat different from Nicole's jaw. They might represent a different species of *Qantassaurus*, or be jaws from the opposite sex of the same species as Nicole's jaw.

Intriguingly, Matt Herne *et al* also described an unusual ornithopod maxilla from Flat Rocks. This was quite different from the maxillae of *Galleonosaurus*, but very similar to those of *Atlascopcosaurus*, which were found at Point Lewis in rocks that are at least ten million years younger than those at Flat Rocks. It is possible that this maxilla belongs to *Qantassaurus intrepidus* (the teeth of which are similar to those of *Atlascopcosaurus*), but this is impossible to prove.

Finally, Matt Herne *et al* described several dentaries from Flat Rocks that are clearly different from those of *Qantassaurus*. The dentary of *Qantassaurus* is short, robust and has only ten tooth sockets, whereas the new dentaries have up to thirteen tooth sockets and are much more gracile (elongate and more lightly constructed). It is possible that these dentaries belong to *Galleonosaurus*, but again this cannot be demonstrated beyond doubt.

Unfortunately, *Galleonosaurus* and *Qantassaurus* cannot be directly compared against one another: one is named from a maxilla, the other from a dentary. Although it is unlikely that they belong to the same species, naming *Galleonosaurus* for one of the new dentaries might have allowed this comparison.

A strange coincidence occurred to me as I was writing this: the two ornithopods from the Flat Rocks site are named for a ship and an airline. Perhaps the next ornithopod should be named after Puffing Billy or Thomas the Tank Engine to complete the mass transport set!

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The Galleonosaurus dorisae *holotype the day it was found by Gerry Kool*

Image: L Nink

Victoria's diverse ornitho-squad

By Ruairidh Duncan

Growing up, I was the exuberant dinosaur kid we all know, or perhaps, if you're reading this, are. I could roll off every fun fact that my tattered, heavily taped books could furnish me with, and I made my parents take me to London's Natural History Museum every chance I could get. One year, I even brought a rock along that I had recovered from my Gloucestershire back garden and (as enthusiastic seven-year olds are wont to do) had convinced myself contained a dinosaur skull (it didn't). My favourite dinosaur, incidentally, was the omnipresent, ornithopodan star of stage and screen that is *Iguanodon*. Something about an animal that had a shiv for a thumb just really stuck with me at that age, I guess. I even wrote a story about a juvenile *Iguanodon* by the name of Injigo-go: a cheerful little scamp who spent his days meeting other zany characters instead of advancing the nonexistent plot in any way, shape or form. It is, then, perhaps, fated that I was permitted to study the southern polar relatives of this magnificent beast for my honours project this year. It was, in a word, surreal when I first laid eyes on the holotype of *Leaellynasaura*, Victoria's first named dinosaur and star of the Antarctic Walking with Dinosaurs episode. Which is to say that the opportunity of expanding the literature around these cute, fleet-footed ghosts of the Gondwanan supercontinent is a daunting one, but it's one I'm eternally grateful to have been given.

There are two sedimentary units that have produced Cretaceous ornithopod material in Victoria — the Eumeralla Formation, which crops out along the southern coast of the Otway Ranges, and the Upper Strzelecki Group, which crops out along the southern coast of the Gippsland region. These are separated by 12–17 million years (Korasidis *et al* 2016) and are home to five ornithopod taxa. This diversity is uncommonly high and some work, such as that of Woodward *et al* (2018), indicate this might be exaggerated. This, however, is difficult to prove when so much of Victoria's fossil material is incomplete, comprising single bones or even parts of bones. For this reason, the more diagnostic these elements can be, the more valuable they are to us. Elements of the skull, and particularly those with teeth, are of special significance in this case — the postcranial skeleton of an animal might change little at the same time as its teeth or jaws change markedly to enable it to take advantage of different foodstuffs. It is for this reason that four of the five ornithopod taxa from Victoria — *Leaellynasaura amicagraphica*, *Atlascopcosaurus loadsi*, *Qantassaurus intrepidus* and *Galleonosaurus dorisae* — are named from maxillary or dentary material (bones of the upper and lower jaw) (Rich and Rich 1989, Rich and Vickers-Rich 1999, Herne *et al* 2019). The exception to this is *Diluvicursor pickeringi*, named from a postcranial skeleton comprising a left hindlimb and a tail recovered from the Eric the Red West (ETRW) bonebed in the Eumeralla Formation (Herne *et al* 2018). *Diluvicursor* was named as its postcranial skeleton differs substantially from two other skeletons attributed by some authors to *Leaellynasaura* (NMV P185992–3 and NMV P186047) (Rich *et al* 2010, Herne 2014), but it is not able to be definitively associated with another taxon from the Victorian Cretaceous because there is no overlap with the skull-based holotype specimens of those taxa.

Working under the direction of my tremendous supervisor, Stephen Poropat, I described the first ornithopod cranial material from the ETRW locality — material which, due to its locality, has the potential to shed light on the true diversity of Victorian ornithopods. I also made use of micro-CT data in order to reconstruct broken fossil elements, digitally prepare specimens still entombed in matrix, and identify internal characteristics that are used for

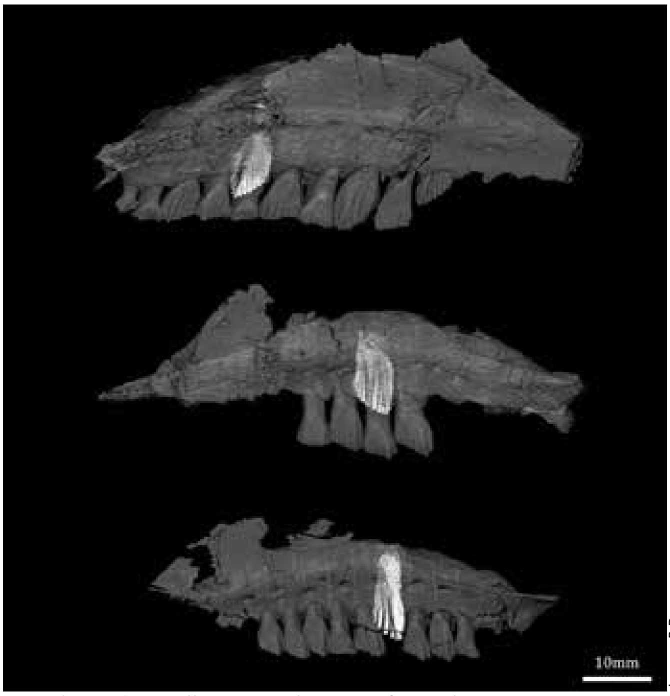

Image: R Duncan

Ornithopod maxillary morphotypes from the ETRW site in lateral view with internal replacement teeth highlighted the identification of the holotypes of *Atlascopcosaurus* and *Galleonosaurus*. I also included two specimens from elsewhere in the Eumeralla Formation in my study, as these are geographically and stratigraphically proximal to the ETRW site and show morphological features that enabled me to expand my descriptions.

In my preliminary results, I found that a minimum of six morphotypes (three maxillary, two dentary, and one premaxillary) might be present at ETRW. All of these appear compatible with existing specimens and morphotypes. The maxillary morphotypes might have the potential to extend the range of three existing Victorian genera: *Atlascopcosaurus*, *Leaellynasaura* and, most surprisingly of all, *Galleonosaurus*, which has, so far, only been described from the much older Upper Strzelecki Group. If this material is indeed comparable with *Galleonosaurus*, despite the marked geographic and temporal disparity between the ETRW and Flat Rocks sites, it is a significant example of morphological consistency in Victorian ornithopods. This idea is lent

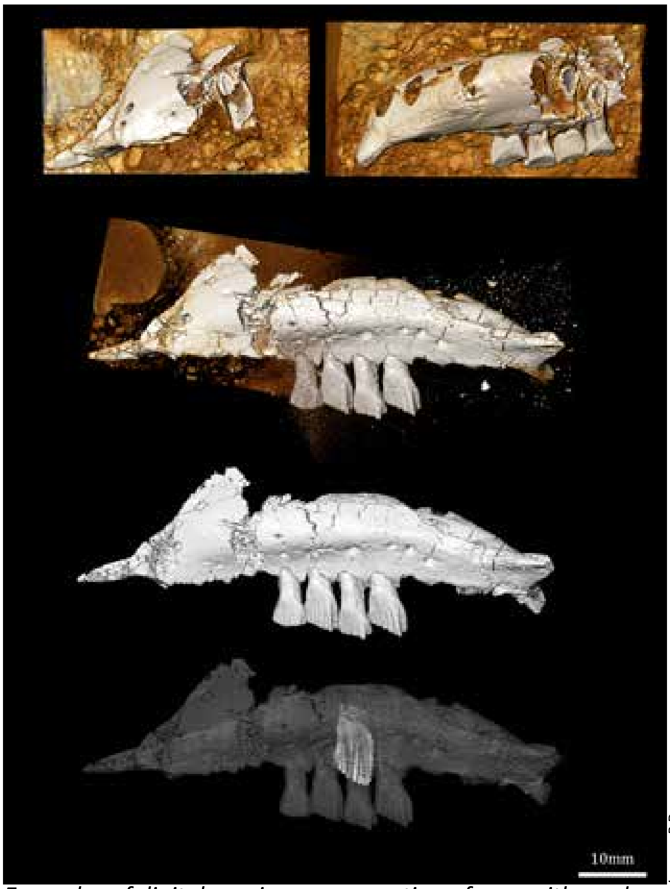

Image: R Duncan

Examples of digital specimen preparation of an ornithopod maxilla. From top to bottom: Original data before articulation; data articulated and thresholded in order to show external morphology; data after preparation and removal of surrounding matrix digitally; isolation of internal replacement tooth within prepared specimen.

support by Herne *et al* (2019), who suggested that his VOM3 (Victorian Ornithopod Maxilla Morphotype 3) from the Upper Strzelecki Group was possibly a forerunner of *Atlascopcosaurus*. The same publication also suggested an inverse referral, assigning a Eumeralla Formation tooth (NMV P186426) to cf. *Qantassaurus intrepidus*, a taxon (like *Galleonosaurus*) that has only so far been described from the Upper Strzelecki Group. If these referrals are accurate then it may be the case that three taxa are present on both sides of the Victorian Cretaceous stratigraphic divide. Our ornithopod fauna might, in fact, have been rather continuous and stable across the Eumeralla Formation and Upper Strzelecki Group, with very few environmental or ecological pressures forcing dramatic evolutionary change. A similar situation appears to be seen in theropods (Poropat *et al* 2019).

As to the reason for this lack of variability across a span of geologic time comprising as much as 26 million years (Woodward *et al* 2011), the Early Cretaceous environmental setting of Victoria might have been critical. The formation of the Australian-Antarctic rift valley meant that Victoria was separated from the Antarctic continental landmass to the south. By contrast, it was bordered to the north by the Eromanga Sea, to the east by volcanic peaks, and to the west by the growing Southern Ocean (Gallagher and Lambeck 1989, Tosolini *et al* 1999). It is possible that Victoria might have been effectively isolated from the rest of Australia (and the world) by a combination of these factors, heightened further by the extreme topography that a rift valley of this size would surely have had. This possible isolation might have played a role in the endurance and abundance of our unusual fauna, such as the survival of the gargantuan temnospondyl *Koolasuchus cleelandi* (Warren *et al* 1997), the higher than usual diversity of small-bodied ornithopods, and the complete lack of large-bodied ornithopods and sauropods seen in other Australian fossil sites (Poropat *et al* 2018).

As with so much in palaeontology, we will always need more specimens to better assess this claim, and an associated skull and postcranial skeleton is, and will for now remain, at the top of my personal wish list. With it, we might be able to better clarify the relationships between the taxa named from the, as yet, incomparable material from the Victorian Cretaceous.

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The Diluvicursor Site Then and Now

By Mike Cleeland

We started digging at Eric the Red West (ETRW) in 2016 after George Caspar found the articulated fossil that became *Diluvicursor pickeringi*. Here are two views of the *Diluvicursor pickeringi* site at ETRW separated in time by the 14 years that we have been visiting it.

Image: M. Cleeland

George Caspar and Malcolm Carkeek excavating what became the holotype of Diluvicursor pickeringi *on 18 November 2015*

Image: M. Cleeland

The same site in June 2019 after a number of years of excavation

Vlogging the Dig

By Jade Koekoe

As someone interested in sharing information and inspiring others to do the same, I had an interesting thought when I signed up for Dinosaur Dreaming's 2019 dig. I thought, as more and more people are watching video online everyday, why not add a volunteer's perspective to the mix? It's always a thrill to see Dinosaur Dreaming activities on the news, but it is often easier for the general public to relate to a "homemade video".

With that thought, I set out planning my story. You have to understand that when you make a video, it is easier to do so if you can guide the people watching through a clear story. And as with anything worthwhile, it helps to plan (and research) your story first, before shooting any footage. I ummed and aahed about creating a video where I focused on my perspective of the dig, or letting others speak for themselves. Then I realised, my friends who hadn't been on a dig of any sort, kept asking me in the weeks leading up to the Dinosaur Dreaming Dig, "But what do you do on a dig?" So there was my angle.

After all this work, I had to pause because I thought it was probably prudent that I ask permission to film before I got too excited about it. Thankfully Tom Rich, Pat Vickers-Rich and Parks Victoria were quite happy for me to do so. I let out many sighs of relief when I got the go ahead because by this point I REALLY wanted to vlog the week I was at the dig.

Image supplied by J Koekoe

Fotini Karakitsos, Tom Rich and Jade Koekoe

Image: J Koekoe

Alan Tait and John Wilkins working in the hole

Vlogging is a video (b)log. It's a format that has a more homemade feel to it than traditional video, as it's mostly a person talking directly to the camera sharing their perspective of something, or filming what they see so you can SEE things from their point of view.

During Week One I asked many diggers if I could film them explaining what they were doing. My goal was to create a time line of events — from getting the fossil layer out of the ground to preparing the fossils and giving them a final identification. This way, not only would I have a story told by Dinosaur Dreamers, but I would also have a visual record of exactly what I did on a dig to share with my friends.

There were some technical difficulties filming on site. I didn't have much in the way of protective covering for my gear and I became very conscious of all the sand at the beach that I DIDN'T want in it. Diggers will also recall how windy it can get, which was not at all helpful for capturing good audio. Then, of course, there was the occasional loud buzzing from a saw, manned by Alan Tait, John Wilkins or Nick van Klaveren, which also messed up my audio. Still, I managed to put together a pretty cohesive story that briefly shows what we Dinosaur Dreamers do when we go digging.

If you would like to view the video for yourself to see if I did a good job of telling our story you can use this link: https://youtu.be/F7N4cnp-OkA

Or search for Dinosaur Dreaming Vlog on YouTube by Jade Koekoe and it will be one of the first results.

Mega-raptorids in Victoria

By Stephen Poropat

Long-time readers of the Dinosaur Dreaming Field Report will we be aware that several beautifully-preserved theropod bones have been found at Eric the Red West (ETRW). Two of the bones in question have even been the poster children for the Field Report: “The Claw” made the cover of the 2014 edition, whereas The Claw and friend (a manual phalanx or finger bone) decorated that of the 2016 issue. Since its discovery, The Claw has been aligned with a group of theropods known as megaraptorids. Although these theropods are abundant in Argentina, they are seemingly far rarer in Australia. Outside Victoria, Australian megaraptorids are known from Lightning Ridge in New South Wales (the “Lightning Ridge Ripper”) and from near Winton, Queensland (“Banjo”, the exceptional type specimen of *Australovenator wintonensis*). Within Victoria, they are known from Flat Rocks (many teeth) Eagle’s Nest (the astragalus formerly known as Australia’s dwarf “*Allosaurus*”), Dinosaur Cove (an ulna) and ETRW.

In December 2017, while putting the finishing touches on the Victorian Cretaceous review paper, I started writing a paper describing The Claw. In the process, I also studied several other theropod remains from ETRW, including the manual phalanx that accompanied it on the 2016 Field Report cover. My aim was to work out which, if any, of the other theropod bones from ETRW were referable to Megaraptoridae, and whether or not they could all conceivably belong to a single megaraptorid individual. In addition to The Claw and the phalanx, the specimens I worked on were:

1. Two teeth;
2. A cervical (neck) rib;
3. A caudal (tail) vertebra;
4. The small manual ungual (hand claw) preserved on “The Block” found in 2017; and
5. An astragalus (anklebone).

In order to work out what type of theropod each bone represented, I compared each with published descriptions and images of comparable theropod bones from around the world. I quickly worked out that the teeth, both claws and the astragalus were compatible with Megaraptoridae, and that the astragalus was far too small to be from the same animal as the other bones. However, I also found that I could not place the cervical rib or caudal vertebra any more precisely on the theropod family tree than Tetanurae: few megaraptorids preserve cervical ribs, and few important features are found on tail vertebrae that are closer to the tip than the base. I was also unsure of what to make of the manual phalanx — it seemed to articulate perfectly with The Claw, which would make it the only other bone in the first finger, but it did not match the shape of that bone in megaraptorids well at all.

In order to improve the quality of my comparisons, Tim Ziegler and I arranged to get all of the specimens CT scanned at St Vincent’s Hospital. I then sent the CT scan data to Dr Matt White (University of New England, Armidale NSW), who used it to generate 3D digital models of each specimen, which he then 3D printed life-size. Matt brought these 3D prints to Winton in May 2018 to enable us to make direct comparisons with *Australovenator*, and this validated my interpretation of the teeth, claws and astragalus. However, it cast further doubt on the affinities of the manual phalanx — it did not seem to match any of *Australovenator*’s phalanges, on either the hand or foot!

In October 2018, I felt confident enough to submit a manuscript on these theropod remains to the Journal of Vertebrate Paleontology (JVP). A few weeks later, I embarked on a Winston Churchill Memorial Trust-funded trip to South America, during which I was able to observe several Argentinian megaraptorid specimens firsthand. While in Argentina, I received a notification from JVP that my manuscript had been reviewed by two other palaeontologists, and that they wanted me to make substantial changes to it before it would be acceptable for publication. I utilised their comments and the observations I had made of several Argentinian megaraptorids to further improve my interpretations.

Image: S Poropat

Tooth NMV P252264. Scale in mm

Image: S Poropat

The Claw NMV P239464

I resubmitted in May 2019, and after further reviews, my paper was accepted in July, and published on 10 October.

As mentioned above, the cervical rib and caudal vertebra were unable to be identified beyond Tetanurae. The same was true of the manual phalanx — we worked out that it was actually from the second finger, closest to the base, but that it was completely different from the same bone in the hand of *Australovenator*, or any other megaraptorid for which that bone was known. All of the undoubted megaraptorid bones from ETRW were found to be almost indistinguishable from the same bones in *Australovenator*, and they were consequently designated as "Megaraptoridae cf. *Australovenator wintonensis*". This means that they were clearly referable to the group Megaraptoridae, and that within that group it was nigh on impossible to differentiate them from *Australovenator wintonensis* (cf. or confer means "compare with").

However, there was one bone from ETRW, identified by us as a megaraptorid, that we could not compare with *Australovenator*…

During the course of the reviews and revisions of my manuscript, I decided that it might be a good idea to take a fresh look at the only other theropod bone that had been reported from ETRW: the cervical (neck) vertebra, found by George Caspar in November 2005, which in 2011 was interpreted as a spinosaurid by Paul Barrett and others. As I had done with all of the other ETRW theropod specimens, I looked at the vertebra under the microscope… and was stunned to see a feature that no-one had ever reported before! On each side of the vertebra, a feature known as a pneumatic foramen is present. In many theropods, only one foramen is present on each side; however, in some megaraptorids — notably a juvenile specimen of *Megaraptor*, from which an almost complete neck is known — two were reportedly present. When I looked at the "spinosaurid" cervical, I realised that the right side hosted one foramen, but the left side hosted two. I went through my notes and photos from Argentina, and soon realised that the juvenile *Megaraptor* showed the same condition: some neck vertebrae hosted one foramen on one side, but two on the other. This observation, a few other anatomical features, and the realisation that many of the features of the ETRW cervical vertebra that were used to support its referral to Spinosauridae were not exclusive to that theropod group, led me to assign it to Megaraptoridae as well. However, unlike all the other undoubted ETRW megaraptorid bones, it could not be directly compared with *Australovenator*; consequently, I had to designate it as "Megaraptoridae genus and species indeterminate", even though it is probably from the same species as the other megaraptorid bones from ETRW.

The long and the short of this research is that megaraptorid theropods, almost identical in shape to but slightly smaller than *Australovenator*, were probably running riot in Victoria during the late Early Cretaceous (~107 million years ago), as they did in the early Late Cretaceous of New South Wales, Queensland, and southern Argentina. Almost all of the theropod bones from ETRW could conceivably belong to megaraptorids — even those that at present cannot be unequivocally shown to be so. Critically, however, our research has shown that there is at least one other theropod bone from ETRW that is definitively not from a megaraptorid — future research with my PhD student Adele Pentland should reveal its identity in due course. In addition, Matt White and I were able to determine that the large claw from west of the Punchbowl, originally identified as a neovenatorid, is also a megaraptorid — and that it is from a megaraptorid larger than *Australovenator*! Could more, possibly larger, megaraptorid remains be awaiting discovery at ETRW? Perhaps! Hopefully, we'll be able to dig there again soon to work this out…

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Thirty-five years of palynology

By Barbara Wagstaff

A few weeks ago, I submitted a paper to *Alcheringa* entitled "Palynological-age determination of Early Cretaceous vertebrate-bearing beds along the south Victorian coast of Australia and implications for the spore-pollen biostratigraphy." Exactly thirty years ago, in 1989, a paper with a similar name "Palynological dating of Lower Cretaceous coastal vertebrate localities, Victoria, Australia." was published. The earlier paper provided the time control on the vertebrate sites that were known up until that time, and resulted from five years of collecting samples. In between 1989 and now, there have been a few extra sites examined and their palynological age determined, but not in any consistent or organised way. Therefore, with the attainment of a National Geographic grant and the help of numerous people, as much of the coast as was accessible was visited, and now over 50 sites have been sampled for palynology. So, has the more methodical collection of samples for palynological dating resulted in the provision of age of all the Early Cretaceous rocks that crop out along the Victorian coast? Well, yes — and no.

In the Otway Basin, palynology determines the age of all the currently known vertebrate fossil localities and any future coastal discovery. In this basin, the structural control of the outcrop has resulted in the sites proceeding from oldest (Early Albian) to youngest (Late Albian) as you move westward. So all along the eastern side of Cape Otway and as far as Rotten Point is Early Albian, Johanna to Milanesia is Middle Albian and from Wreck Beach to Devils Kitchen is Late Albian. In the Gippsland Basin the situation is more complicated. There are two main Early Cretaceous blocks along the coast — one from San Remo to the mouth of the Powlett River and a second one from Harmers Haven to Inverloch. The work done by Monash PhD student Hamed Aghaei between Harmers Haven and Inverloch has been a considerable help in understanding my results. Palynological sample sites were in either of two spore-pollen zones, with large sections of the coast falling in one or the other. Hamed had proposed that the area he studied was composed of lots of repeated sections, the pattern only disrupted by major faults. This fitted in with my spore-pollen results and led me to conclude that in fact we are not seeing as much time as had been previously thought, but have outcrops that lie at either the top of the Barremian (for example Flat Rocks) or the base of the Aptian (for example, the Eagles Nest area). However, no one has done a similar assessment of the structural geology from San Remo to the mouth of the Powlett River. Even though some sites have had multiple samples collected I am not confident in giving the age without some understanding of the structural control. Although, again, the same two ages apply to the area — that is, top of Barremian or the base of the Aptian.

So, what does this all mean for the current collections and identified vertebrate remains? Making use of Wendy White's compiled data of localities and fossils recovered, I created the two following figures (Figure 1 and 2) with the new age determination on them. I think for me (as a non-vertebrate person) it shows that the sites are very restricted time-wise. The Gippsland Basin coastal localities, no matter where you sample, are either just below or just above the Barremian-Aptian boundary and, as such, on current knowledge, are either slightly older or younger than 126.3 Ma. All the younger (Early Aptian sites) have the earliest occurrence of the pollen of flowering plants. This happening at the base of the Aptian in Victoria is the same time that the primitive angiosperm pollen type *Clavatipollenites hughesii* appears in northern Australia basins. This implies that, although Victoria is at a higher palaeolatitude, the conditions were still suitable for these earliest flowering plants. In the Otway Basin, except for the footprints recovered from Milanesia (Middle Albian), all the sites (and therefore fossils) are Early Albian in age recovered from the large palaeo channels that dominate this part of the overall section (with very rare muds and more usually intra-channel mud clasts for palynology).

So, when plotting known ranges of the Early Cretaceous vertebrate fossils in Victoria (Figure 2). there are, and always will be, gaps in the knowledge due to the nature of the outcrop. I hope, nevertheless, I have provided some food for thought in planning future exploration for vertebrate remains.

I would like to thank the following people and organisations (in alphabetical order) who have been involved in this thirty-five-year journey. I apologise to anyone I have not mentioned but it has been a very long time:

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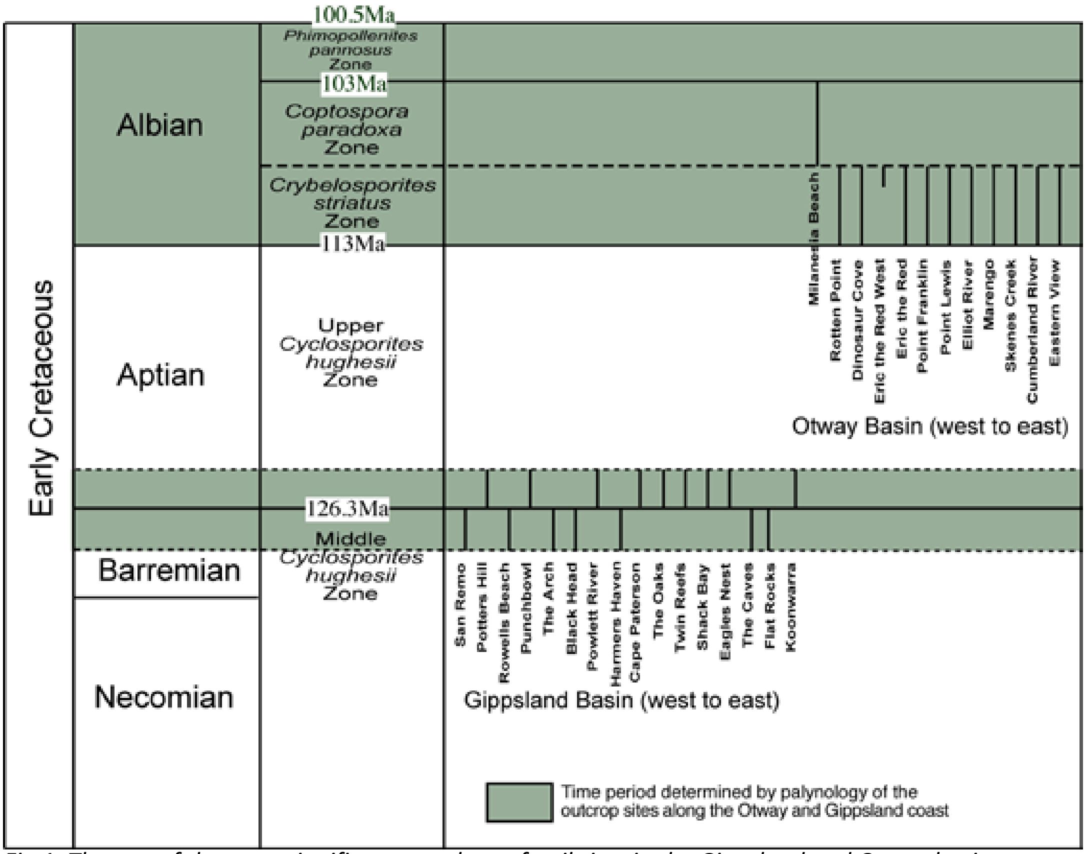


Fig 1: The age of the most significant vertebrate fossil sites in the Gippsland and Otway basins determined by palynology. Wagstaff et al *2019 (submitted to Alcheringa).*

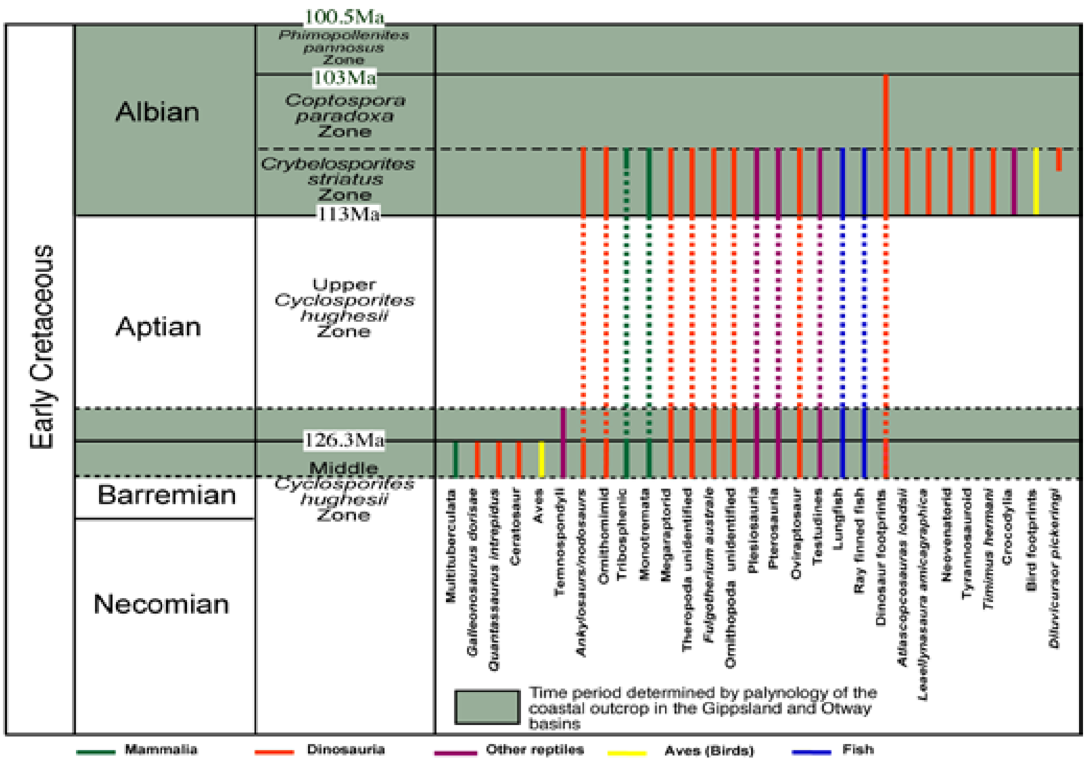


Fig 2: The ranges of vertebrate fossils recovered from the Gippsland and Otway basin coastal outcrop sites. Wagstaff et al *2019 (submitted to Alcheringa).*

The Underlying Relief of a Good Dig

By Alan Tait

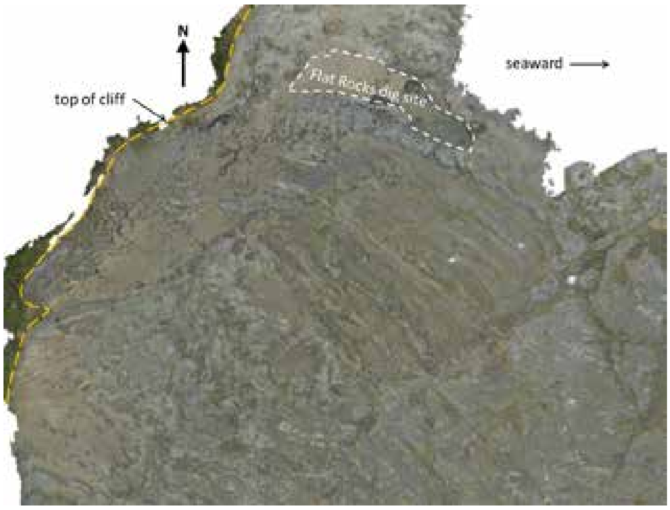


Fig 1: Aerial view of the Flat Rocks site and surrounds

The fossil-bearing unit at the Flat Rocks dig is within the basal metre of a thick (about 25 metres) river channel sandstone. The seaward side of the channel sandstone is cut off by a fault, and the sandstone extends to the west into the cliff. The river was probably around 1 kilometre wide so it's not surprising that we can't see a channel edge. However, the pattern of erosional relief on the exposed base of the channel sandstone ties in with directional indicators in the sandstone to assist in reconstructing the geometry of the fossil-bearing unit.

The river channel has eroded into the overbank / floodplain deposits of previous rivers, which consist of mudstone with thin sandstones, partly modified to soils by the action of plants growing on the floodplains. Thin layers of coal (originally peat) overlying the soils mark the successive land surfaces on which the vegetation grew, and act as datums to show the amount of relief on the base of the dig sandstone.

Across much of the dig excavation (Figures 1 and 3), the base of the sandstone overlies a thin coal but cuts down towards the datum coal at the western and eastern ends of the excavation. Farther southeast on the shore platform, the base of the dig sandstone is slightly faulted but cuts down through the datum coal towards the contorted layer. To the southwest in the cliff (Figure 2), the base of the dig sandstone also cuts down towards the contorted layer. Two main faults cut the sandstone and the underlying overbank sediments, fault B cutting fault A (see Figure 3). When the strike-slip motion on fault B is restored to line up the two segments of fault A (as in Figure 4), the cutdown edges in the cliff and on the rock platform line up approximately parallel to the log orientation at the eastern end of the dig and the plant fragment and long bone orientations within the dig measured by Doris Seegets-Villiers in her thesis. This now gives us some idea of the likely orientation of the productive fossil layer.

Crossbedding at the western end of the dig site indicates current flow to the west-southwest and data from Doris Seegets-Villiers' thesis also suggests that the fossil-bearing unit was prograding in this direction. Thus, the river was flowing to the west-southwest at the Flat Rocks location.

As excavation proceeded within the eastern end of the dig, the base of the channel sandstone was found to rise to the northeast through a mudstone layer overlying

Fig 2: Cliff to southwest of the Flat Rocks dig site

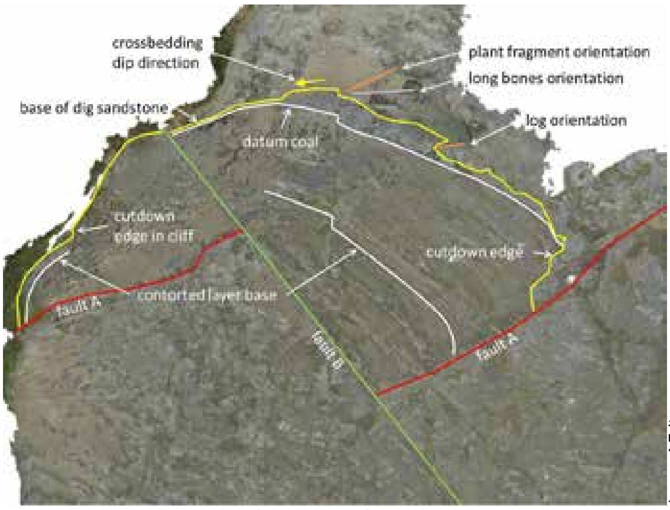


Image: A Tait

Fig 3: Faults and other features of the Flat Rocks site

the coal that floors much of the rest of the excavation. If this rise were to continue to the northeast, the fossil-bearing layer would become thinner and pinch out upstream against the rising floor of the river channel. This suggests that the fossil-bearing layer formed as a sandbar in the lee of an elevation in the base of the river. At such locations, the river current expanded and slowed, and thus deposited the sediment (sand, mud clasts, bones and plants) that it was carrying. The sandbar built downstream as additional layers of sediment were deposited, sandier layers alternating with conglomeratic layers as the speed of the current fluctuated. The possible original outline of the fossil-bearing sandbar is shown in Figure 4.

From the above analysis, the fossil-bearing unit should extend northeast farther than we can easily extract it, though the eastern edge is already becoming thinner. As for the downstream end, it is well into the cliff, close to or under the main road.

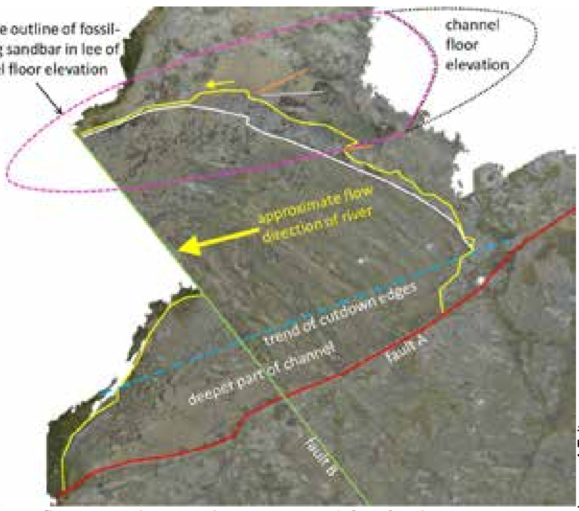


Image: A Tait

Fig 4: River flow on Flat Rocks corrected for faults

Recently Prepared Fossils

Photos by Lesley Kool

Small dinosaur metatarsal from Flat Rocks

Partial limb found by Trilby Parise

Simona's Harmers Haven bone "The eyelash"

I FOUND A FOSSIL!

Nothing compares with the absolute excitement of finding a really good fossil. It's the one time that the crew is happy to stop what they are doing and strike a particularly cheesy pose. Here are some of my favourite photos of happy smiling fossil finders of 2019.

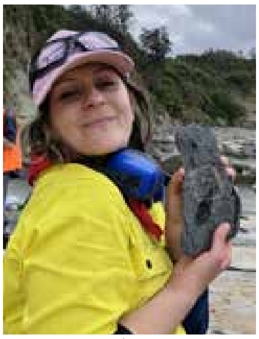
BY WENDY WHITE

Tanya Mellar

Asti Fletcher

Image: R Zugaro, Museums Victoria

Marcus Killerby



Fotini Karakitsos

Image: E Eidelson

Melissa Lowrey

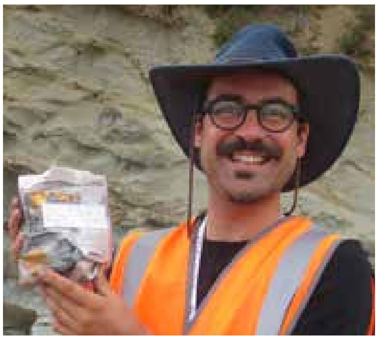
Pat Vickers-Rich

George Smith

Amber Craig

Mary Walters

Mary Walters

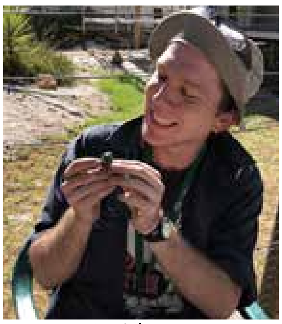


Rohan Long

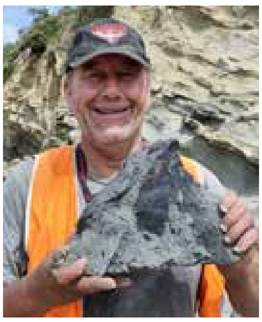
Ali Calvey

Corrie Williams

Marion Anderson



George Smith



John Swinkels

Simona Grippi

Eve Eidelson


Image: L Kool

Wendy Turner, Nick van Klaveren and Wendy White


Alan Evered


Nick van Klaveren and Dale Sanderson


Ben Woodford and Ali Calvey


Marcus Killerby


Eve Eidelson


Cassia Paragnani


Corrie Williams


Joerg Kluth


Wendy White


Mike and Pip Cleeland


Nicole Evered


Tim Ziegler


Alan Tait


Sharyn Madder


Darren Bellingham


Ali Calvey


Sharyn Madder

MONASH University
SWINBURNE UNIVERSITY OF TECHNOLOGY
MUSEUMS VICTORIA

Long Time Dreaming

By Rohan Long

My first Flat Rocks dig was in the summer of 2000. I had been to the Monash University open day the previous year, as a fresh-faced 18 year old, halfway through Year 12 at Ballarat High. I headed straight to the Earth Sciences building and told them I wanted to be a palaeontologist. I was introduced to a woman named Lesley Kool, who asked if I'd like to volunteer on a dinosaur dig. I enthusiastically replied in the positive, and then returned for almost every dig season for the next fifteen years.

I managed to get in a good four days on the dig in the 2019 season, a far cry from the early 2000s when I would stay down at Flat Rocks for weeks at a time. But I have two children and a full-time job now, whereas back then my main responsibilities were – well, I'm not entirely sure I had any. Living in Ballarat, I was supposed to get the train to Inverloch via Melbourne. However, I was so naïve to the ways of Melbourne public transport that I got on the wrong train and ended up in Dandenong. I was picked up the next day by a nice young man named Dean, who kindly drove me the rest of the way to Inverloch.

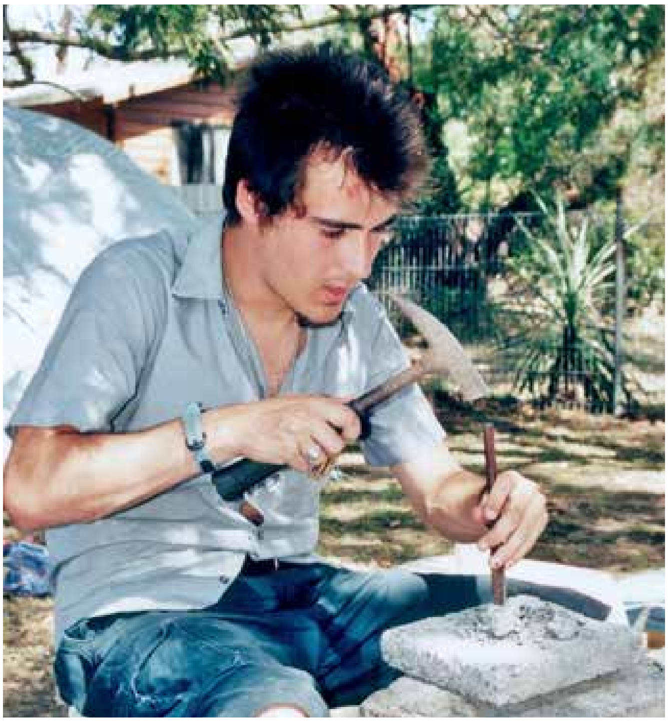


Image: R Close

Rohan Long breaking rock at the Laverton St house circa 2000, before the times of mandatory safety glasses.

Image: L Kool

Nick van Klaveren assembling The System circa 2000

To set the historic/cultural scene: there was no phone coverage whatsoever on the site in 2000 and by that, I mean you couldn't make or receive phone calls. Forget about mobile data! There were no smart phones in 2000 and many (most?) of us didn't have mobile phones at the time. If you needed to use the internet, you would have to book a session on an old PC with a dial up connection at the Inverloch library.

The main excavation hole was a lot deeper in 2000 and required extra ingenuity to manage. By 1998, the downward-dipping fossil layer had been followed to a considerable depth, and every day at high tide the hole filled with enormous quantities of sand, seaweed and water. Digging it out was taking hours and wasting valuable fossil-finding time. Nick van Klaveren engineered an ingenious set-up of tubular beams, rock bolts, metal mesh, tarps and heaps of 20 litre plastic drums. It was known only as "The System". On the whole, The System did a good job keeping the sand and water out. Each morning the team would dismantle and remove it, then dig out the small amount of sand that would invariably get through, with plenty of time to process rock. Incredibly rough storms in 2005 proved too much for The System and we arrived on site one morning to see the whole thing twisted beyond recognition with 20 litre drums strewn along the beach. In 2013 I assisted Gerry Kool with the bittersweet task of removing the rusted old remnants of The System from his shed and hurling them into the Wonthaggi tip. It was a cathartic experience, albeit tinged with sadness for this once great structure.

There have been huge strides in our understanding of the fossil animals from Flat Rocks in the last twenty years. Recent associates of the dig might be surprised to read in the 2000 field report that *Qantassaurus*, *Atlascopcosaurus*, and *Leaellynasaura et al* were unreservedly considered to be *bona fide* Hypsilophodonts. Ongoing research found that they shouldn't be classified as such, and that 'Hypsilophodonts' are a paraphyletic group anyway. Our small herbivores are now considered basal ornithopods and, in cladistic studies, find themselves aligned with small South American herbivores such as *Anabisetia* and *Gasparinisaura*.

Our early Cretaceous mammals, too, have undergone shifts in interpretation over the last two decades. When I arrived at the dig in 2000, *Ausktribosphenos* was being hailed as a paradigm-smashing discovery. The favoured interpretation at the time was that "Ausky" was a representative of placental mammals and its age would have made it a candidate for the earliest representative of that group. This was a claim to scientific fame in itself, but it also inevitably suggested that placental mammals originated in Australia – a biogeographical coup with international

Image: R Close

Mary Walters, Rohan Long, Lesley Kool and Sara Jakica at Flat Rocks circa 2000

Rohan Long and Mary Walters at Flat Rocks in 2019

implications. In the succeeding decades, the prevailing view that has emerged in the scientific literature is that *Ausktribosphenos* is, alas, not a placental mammal, but a primitive and unique taxon not far removed from monotremes. But even now, we can't say with absolutely certainty where Flat Rock's placental-like mammals fit on the family tree. As one palaeo said, in the issue of Science where *Ausktribosphenos* was first announced in 1997, "It's extremely important, whatever it is".

It's hard to conceive that my first Flat Rocks dig was almost twenty years ago. I now work as the curator of the Anatomy and Pathology Museum at Melbourne University. Although my work focuses on human anatomy, I still often see things through the lens of early Cretaceous dinosaur bones. I remember in one of my first weeks on the job, contemplating a human femur and unconsciously wondering — "Where's the fourth trochanter?"

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Image D Hocking

Pleistocene Megafauna found on Tati Tati Country

By Tim Ziegler

This tale began with a fossil preserved in Museum Victoria's collection for nearly 100 years, of the extinct giant marsupial *Palorchestes*. One of the first Australian megafauna to be described scientifically, *Palorchestes* was considered by Richard Owen on the basis of its jaw to be "the largest form of kangaroo hitherto found" (1873: 387). Thanks to the recovery of more complete fossil remains, we now recognise *Palorchestes* as a narrow-bodied quadrupedal marsupial, with hulking forelimbs and deep, curving claws (Richards *et al* 2019). The largest species, *Palorchestes azael*, may have weighed over 1000 kilograms, but its fossil remains are rarely found, and are never abundant. One of the more complete examples of *Palorchestes* at the Museum is a splintered lower jaw and postcranial bones, cemented in a grey-green clay matrix (NMV P165897). This jaw was presented to the museum in April 1924, by one "W. D. Chapman" and has an unusually thorough locality record for its vintage. The fossil's donor had provided a neat map, showing the fossil was found upstream from Euston, a small town in New South Wales, 140 km north of Swan Hill. Strangely, field notes described the site as in the Murray River, but the map had an unambiguous "X marks the spot" — the centre of a meander cutoff, south of the Murray proper. This occasional channel was noted as the "Bumbang Cut". I hadn't come across a locality like this before. Fossils are found further west along the Murray, but usually in eroding terraces, away from the river.

I'll admit that my motivations were also a bit parochial: the NSW boundary on the Murray extends from the end of the Victorian bank, meaning none of the watercourse is actually in Victoria. But the town of Robinvale adjoins Euston by bridge from the Murray's southern bank, and had also provided a large *Diprotodon* tooth in comparable matrix to the *Palorchestes* jaw. Upstream of Euston-Robinvale at the Cut, the Murray border follows the older, northern meander. This placed the Cut, and thereby the fossil jaw, in Victoria, rather than New South Wales.

Following this petty victory, I wanted to investigate just how the fossil was ever found. Satellite photographs showed an active, inundated Murray flowing through the Cut, so at first I guessed that the Cut might be a European modification. Perhaps workers had uncovered the fossil while cutting a channel to circumvent an inconvenient meander. After all, the Museum purchased fossils of starfish, brachiopods and nautiloids from labourers who uncovered them during the turn-of-the-century Yarra Improvement Works in metropolitan Melbourne. Studying catchment maps for the Bumbang area quickly proved me wrong on this — the Cut was a natural feature. Nonetheless, a lead emerged; in 1924-1926, there had been works at Euston, to build a railway bridge across the Murray. Moreover, listed as engineer on the Euston Bridge, was the man who had presented the *Palorchestes* specimen to the museum — Wilfrid Dinsey Chapman.

The care with which Chapman documented these fossils endears him to me, but is not surprising: he had a good example in his father, Frederick Chapman, Palaeontologist to the then National Museum (now Museums Victoria) from 1902 to 1927, and inaugural Australian Commonwealth Palaeontologist. He took an interest in Chapman Sr's business: "still youthful Wilfred [sic] Chapman" was profiled in 1928 as a promising engineering prospect who, when not building bridges, "follows his father's footsteps and gloats over fossils" (Smith's Weekly, 1928). At Euston, he made hundreds of silver nitrate photographs, now at State Library Victoria, of buried pilings, workers climbing skeletal girders, and rail tracks creeping over the river. In quieter times, he rowed the Murray in a characterful three-piece suit and hat, visiting

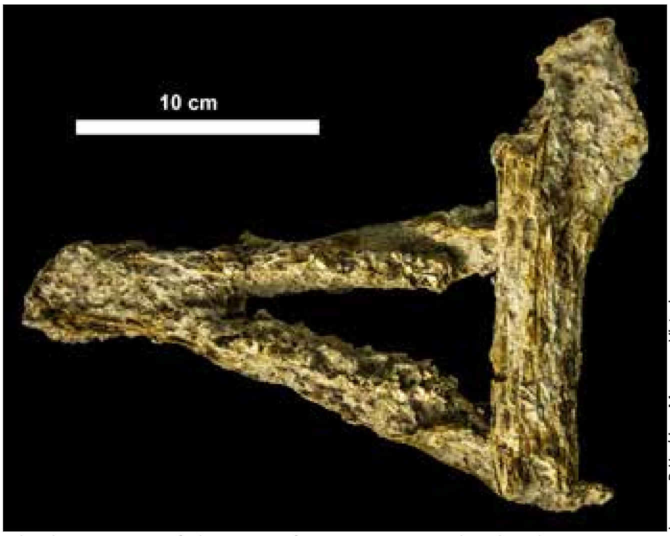

Image: D Hocking, Museums Victoria

The lower jaw of the megafauna marsupial Palorchestes, found at the Bumbang Cut, Victoria (NMV P165897)

"The Cut where fossil mammal bones were found" taken by Wilfred Chapman in 1924 (SLV H2001.308 2626)

canoe-scar red gums along its banks. Of the many pictures, Chapman took just four at the Bumbang Cut. The first two were titled "The Bumbang Cut in flood", and "Bumbang Cut just beginning to flow". In the latter, the Cut no longer flooded its banks – huge tracts of the riverbed were exposed, in a channel 15 feet deep. Chapman had revealed that the Cut's base could indeed be a prospect for finding fossils. Then, the next photograph: a silhouetted man stood in the channel, dwarfed by river debris, stooping to peer closely at the ground. I was excited to see the title of the photograph was "The Cut where fossil mammal bones were found".

I imagined surveys upriver by Chapman's party, weighing possible sites for his bridge. He would have walked the Cut, scuffing against its bed of jagged, grey-green clay. Perhaps he sighted a glint of amber enamel, or was drawn to the symmetry of paired jaws. I read the title of the final image: "J French finds a *Macropus gigans*". The original notes on the *Palorchestes* specimen described it as "lower jaws [and fragmentary limb-bones] of giant kangaroo"—pictured here was the site marked "X" on Chapman's map. I saw French, leaning on his Marsh pick, shovels beside him, standing in the base of the Cut. The look on his face suggested a man who had just found buried treasure. This was the moment French discovered the fossil *Palorchestes* in the Cut, 95 years ago.

Geologists later defined the grey-green matrix in which French found the *Palorchestes* fossil that day as the bottom of an enormous inland lake known as Bungunnia, which spanned New South Wales, South Australia and the north of Victoria. At its peak it covered more than 50,000 square kilometres, comparable to the largest lakes in the world today. Sustaining a lake of this size suggests annual rainfall around 1000 millimetres per year — five times the modern average. This megalake, Bungunnia, began to fill around 2.4 million years ago (Ma), and persisted at varying depths until it eventually drained around 1.2 Ma (McLaren *et al* 2012). The mixture of lake bed and riverine sediments deposited during this time are now defined as the Blanchetown Clay — the likely host matrix for the Bumbang *Palorchestes*. Vertebrate fossil faunas of this age are scarce in Australia, and most have poorly defined date ranges. The best-known example in southern Australia is the Nelson Bay Local Fauna (1.77-0.78 Ma), which includes relict Pliocene taxa such as the "giant ringtail possum" *Pseudokoala* and enigmatic ektopodontid *Darcius duggani* (Piper 2007). This fauna may have survived in a wet-forest refuge at the southern coast of Victoria, which would be distinct from the inland, aridifying landscape in which Bungunnia was located. Absolute dating of river terraces has been carried out along the Murray to characterise Pleistocene climate in the region, but not at Robinvale, and never with such well-preserved vertebrate fossils. Well-dated, well-preserved fossils at Robinvale would provide a critical advance for Early Pleistocene vertebrate palaeontology in Australia.

So far, this has mainly been a story of palaeontological history, discovery, and the possibilities emerging from Robinvale's past. Nevertheless, the landscape at Bumbang has manifold layers of context, and is richly productive for people of the Tati Tati tribal lands and language groups. One of them is Uncle Brendan Kennedy, a traditional land and water owner, cultural artist and language researcher. He was born on his Country at Robinvale and descends from Tati Tati, Wadi Wadi and Mutti Mutti people. We were first introduced in 2018, during conversations at the museum about megafauna and Pleistocene Australia. Brendan related his perspective on how the landscape at Bumbang provides food and materials for survival, and is deeply important to Tati Tati culture. The Bumbang Cut falls within the northern limits of Tati Tati Country: people cut canoes and shields from trees on Bumbang Island, and buried family at Lake Benanee and Knight's Bend.

"J French finds a Macropus gigans": this silver nitrate photograph, taken by Wilfrid Chapman, records the 1924 discovery of the Palorchestes jaw found at the Bumbang Cut. (SLV H2001.308 2627)

When Europeans claimed their first pastoral leases, colonial diseases borne upriver had already decimated the people who were there. Later, European authorities forced many survivors off their Country, to live on Christian missions.

It was later in 2019 that I connected Wilfrid Chapman's photographs of Bumbang to the *Palorchestes* fossil. At that time, Brendan was painting and writing a mural, "River of Language", for the Bunjilaka Aboriginal Cultural Centre at Melbourne Museum. As we caught up over paint pots, I shared what I had learned of the Bumbang *Palorchestes*, and showed to him and his family the fossils collected on his Country. He confidently associated the familiar edged grey-green clay on the *Palorchestes* jaw with the hardened base of the Cut—as a child, he had cut his feet walking barefoot on it.

In one way, this investigation was triggered because Chapman removed the fossil from its Country. However, by preserving it in the State Collection, he left behind the opportunity for us to renew and sustain that link. How do we make it count? I would like to revisit Robinvale with the Bumbang *Palorchestes*, to share this recovered perspective. I wonder what we might see if we walked the base of the Cut again. A lock and weir now controls the Murray's flow at Euston, and the Cut is inundated most of the year. Red gums die on the banks where floods no longer reach. To walk the Cut with Tati Tati elders would allow the return of knowledge to Country, and further pave the way for renewed discovery. If I can encourage new sets of eyes in the Robinvale community to search where Chapman did, we can together build our shared fossil heritage.

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Recently Prepared Fossils

Photos by Lesley Kool

Ornithopod femur from ETRW 2017

Ornithopod femur from Harmers Haven

Mystery bone from near San Remo

Matilda Site Sand Sorting

By Kylie McGenniskin

Here at Dinosaur Dreaming, we have unlimited enthusiasm for fossils — anything to do with fossils. Even tiny fossils. Fossils so small we cannot detect them without a magnifying glass, and even then, it's a stretch!

Some marvellously ingenious human (otherwise known as Tom Rich) arranged for 10 kilograms of sand to be brought to Victoria all the way from the Matilda site (in Winton, named after the dinosaur that was discovered there, *Diamantinasaurus matildae*) on the off-chance it might contain a small mammal tooth, or some other wondrous thing. A scientist's worst nightmare is that we may, god forbid, miss some vital discovery! It was decided that, with the help of some volunteers, we would carefully examine our sand sample. The crew at Australian Age of Dinosaurs had samples of their own to deal with. So a number of us put our hands up, took some sand and selected our weapons of choice to deal with this new challenge.

So far, my toolkit consists of: a white casserole tray (liberated from my mother's cupboard without permission); a range of elegant tweezers from my entomology kit; a number of jars to toss grains into (categories of interesting, not interesting, and flipping gypsum); a large magnifying glass with light; and a digital dissecting microscope for inspecting interesting anomalies. Each of us has our own unique kit with the same basic premise behind it. Find anything that might be a fossil, so that the experts have significantly less sand grains to examine.

Bone fragment found by Wendy White

Image: M. Cleeland

Plaster pretending to be bone found by Mike Cleeland

So far, thanks to Wendy White, I have managed to escape the time-consuming sand-washing. But her methods are worth mentioning here. Put 500-800 grams of sand into a container, add water, swirl the sand, tip off most of the dirty water and floating organic matter. Repeat until water is clear. Which takes roughly half an hour. Sun-dry before sorting.

We have spent hours of our time washing sand, drying sand and (especially) picking grains of sand out of the sand. At a rough estimate, it is at least 70% gypsum. It has an especially bad habit of looking like interesting stuff, especially teeth. Don't even get me started on the plaster — that stuff is even more tricksy. In spite of these difficulties, we have managed to find some interesting stuff, not exactly the stuff we were looking for but we have certainly found "fossily" things, mostly what appears to be fossil plant matter and fragmentary bone. Anyone else dreaming about gypsum? I might need to see a therapist.

Our thanks to all our sand-sorters, many hands (and pairs of eyes) make light work.

Image: K McGenniskin

Bone fragment found by Kylie McGenniskin. Scale in mm

Ferrodraco lentoni: A new pterosaur

By Adele Pentland

There are plenty of people who think that interesting things don't happen outside major cities. In some respects, they're absolutely right— however, when it comes to finding some of Australia's most important fossil material, there's no place like Winton. Within the last two decades, excavations lead by the Australian Age of Dinosaurs Museum of Natural History (AAOD) have resulted in the discovery of several sauropods, as well as megaraptoran material. More recently, a partial skeleton of an ornithocheirid pterosaur was discovered by local grazier Bob Elliott on Belmont station, located northeast of Winton. He identified, from the surface, parts of the lower jaw and associated limb bones, including the left ulna and part of the shoulder girdle; based on surface material alone, Bob had discovered the most complete Australian pterosaur.

Within a matter of weeks we had a team of excited volunteers searching for more of this incredible fossil specimen as part of the AAOD annual field season. It was unlike any dig I've ever experienced — the site was located in the banks of a dry, silty creek and some of the surface material had been kicked into position by travelling livestock. We recovered the majority of the remaining material within the first two days onsite, which would seem to suggest that this fossil had been exposed at the surface for several years. Or, at the very least, long enough for a troublesome grass tussock to fragment the thin, blade-like premaxillary crest with its roots. I can still vividly remember the moment a staff member eagerly grabbed hold of the weed and yanked it into the air, sending several small shards of bone flying. Thankfully, we had already agreed to load whatever matrix we could from the site into the back of the utes, to wash and sort later. More to the point, AAOD co-founder Judy Elliott was able to expertly piece together all of the broken fragments of the crest, and just about every fragmented limb bone we found during the dig.

After five weeks in the field and several months of sorting through washed matrix, we had recovered approximately 13% of the skeleton, including a partial skull comprising the anterior portions of the upper and lower jaws, as well as the frontal and back part of the lower jaw and several elements from the left and right wing. Most of the wing elements are from the left side, but we also recovered the partial right scapulocoracoid (part of the shoulder girdle) as well as the proximal end of the right metacarpal IV. Other elements include: the distal ends of the left ulna and radius; the syncarpus (preserving the majority of the wrist bones); partial non-wing manual phalanges; the crushed and distorted metacarpal IV; and the proximal and distal ends of the first wing phalanx. We also recovered approximately 40 teeth and tooth fragments, with complete teeth varying between 7–29 millimetres in height. Preserved three-dimensionally, it's one of the most breathtaking fossils within the AAOD collection.

Based on fusion of several elements, the individual was osteologically mature. During the initial excavation of the specimen we speculated that this pterosaur might have had a wingspan between 4–6 metres; however, based on comparisons with other pterosaurs in this clade, it's more likely this pterosaur had a wingspan closer to 4 metres.

Sadly, months after excavation of the pterosaur, we received news that the mayor of Winton, Graham "Butch" Lenton, one of AAOD's greatest supporters,

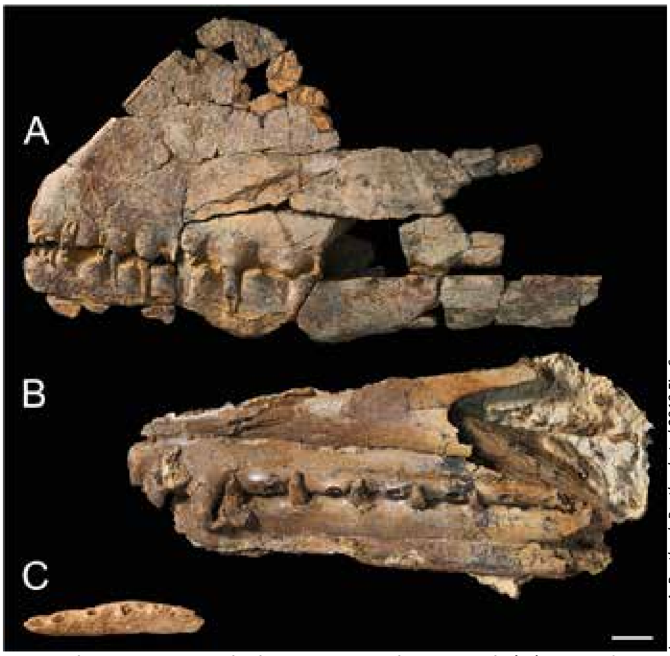

Image: A. Pentland, Pentland et al 2019 Fig 6

Australian pterosaur holotype cranial material. (A) Ferrodraco lentoni *holotype skull and mandible (AODF 876); (B)* Mythunga camara *holotype skull and mandible (QM F18896); and (C)* Aussiedraco molnari *holotype mandible (QM F10613). Scale bar = 20 mm.*

Image: T. Tischler, Pentland et al 2019 Fig 8

Life restoration of Ferrodraco lentoni *as an ornithocheirid pterosaur*

had passed away. Given that each holotype specimen at AAOD is given a nickname, it seemed fitting to name the pterosaur Butch in his honour, and give the specimen the scientific name *Ferrodraco lentoni*. It was a massive privilege to name a new species of pterosaur, and I can't wait for it to be on permanent public display at AAOD.

Butch is, without a shadow of a doubt, the most significant Australian pterosaur to date, with less than 20 pterosaur fossils reported from Australia — all comprising isolated and fragmentary remains. Until the discovery of this specimen, there were just two Australian pterosaur taxa: *Mythunga camara* (QM F18896; Molnar and Thulborn 2007) and *Aussiedraco molnari* (QM F10613; Kellner *et al* 2011). Both taxa were established on the basis of incomplete material, with *Mythunga* established based on the mid-section of a partial skull, and *Aussiedraco* represented by the anterior portion of a mandibular symphysis (the tip of the lower jaw). It's been incredibly difficult to relate one isolated pterosaur bone to another without any overlapping material, but now with this metaphorical Rosetta Stone we'll have a better sense of how much variation there is within the Australian pterosaurs.

This pterosaur is not only the most complete example we have from Australia, but it has allowed us to assess the paleobiogeography of the Australian pterosaur taxa. When included in two phylogenetic analyses, *Ferrodraco lentoni* was resolved within the clade Anhangueria as the sister taxon to *Mythunga camara*. We already had strong suspicions that Butch was anhanguerian, based on the premaxillary crest, which is a synapomorphy of this particular clade. What came as a surprise was that *Ornithocheirus simus* (Cambridge Greensand, England), *Coloborhynchus clavirostris* (Hastings Sands, England), and *Tropeognathus mesembrinus* (Romualdo Formation, Brazil) were resolved as successive sister taxa. Initially, I hypothesised that the Australian pterosaurs were more closely related to the anhanguerids of South America, which would then mirror the Gondwanan provincialism of several non-volant terrestrial vertebrates during this period. We now know that these pterosaurs were capable of dispersing across oceanic barriers, as previously suggested by several authors.

Never in my wildest dreams could I have imagined working on a fossil as beautifully preserved and scientifically important as this pterosaur. Hopefully it's the first of several exciting pterosaur finds from the Winton area but, if not, I can always travel a few hours to neighbouring Richmond where even more pterosaur material awaits.

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Molnar R.E and Thulborn R.A. 2007. An incomplete pterosaur skull from the Cretaceous of north-central Queensland, Australia. *Arquivos do Museu Nacional, Rio de Janeiro* 65, 461-470.

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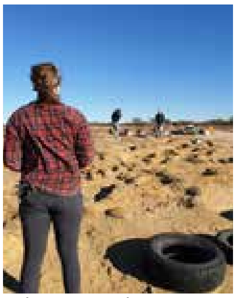
Image: A. Pentland, Pentland et al 2019 Fig 2

Ferrodraco lentoni *holotype specimen AODF 876. All preserved elements were photographed and scaled to the same size, then articulated where possible. These were then used as the basis for the scaling of the skeletal reconstruction, the missing parts of which were based on the skeletal reconstruction of* Tropeognathus mesembrinus. *Scale bar = 50 mm.*

Winton Trackway Impressions

This year, a few intrepid Dinosaur Dreamers headed up to Winton to help move the sauropod trackway. I asked them to share a photo or two with their impressions of the experience.






Wendy White, Eve Eidelson, Amber Craig and Adele Pentland in the trackway at the AAOD

By Hugh Calvey

Dave, you're going to need a bigger digger to lift that trackway slab!

Don't be ridiculous, nobody would try to move that slab by hanging it off a crowbar propped on a barrow!

Now that's more Winton style. Gentle nudge with that bucket and she'll just drop in place!

Images: H Calvey

By Eve Eidelson



Images: E Eidelson

Despite being obsessed with fossils all my life, I never imagined I'd be walking around on the top of a museum exhibit and solving 95 million-year-old puzzles with crowbars. I kept imagining a 30 ton sauropod ambling by, accompanied by the scampering of titchy little theropods scouting for their next meal. And the scale of the thing! Who even considers moving thousands of tons of rock from one location to another piece by piece and reassembling it with infinite care like an enormous 3D jigsaw? Incredibly hard yakka but it's going to be AMAZING! Scratch that, it IS amazing.

By Wendy White



Having been blown away by the trackway last year, this year I lost myself, entranced by and immersed in the beauty of the huge, harsh landscape

By Adele Pentland

It's one thing to see dinosaur footprints at Lark Quarry, but having the chance to get up close and personal with these theropod footprints was absolutely unforgettable

It's somewhat reassuring to know that since Judy's working on the trackways, David can't possibly do too much damage on his own… well, she'll know how to fix it anyway

Images: H Calvey

Imagine how many bones we'd find if David ever joined a Dinosaur Dreaming Dig (they might be in lots of little pieces but that doesn't matter, right?)

By Cassia Paragnani


If a simple 2D picture can say 1000 words then these imprints could probably fill the pages of well loved books.
The largest terrestrial animal on earth could leave behind less than a scrappy old shoulder bone and can still blow my mind.
I will follow in the footsteps of that which I must look up to and also die.

DinoQuest: A Success

Image courtesy of P Vickers-Rich

Image supplied by P Vickers-Rich

DinoQuest RFID Card

By Jade Koekoe and Pat Vickers-Rich

In last year's Field Report we got a sneak peek into the making of *DinoQuest - An Exhibition* hosted by the Singapore Science Centre with teams from the Singapore Science Centre, Digimagic, dezignformat and PrimeSCI! working together to bring our Australian polar dinosaurs to the world.

This year, we can walk you through the exhibition and tell you that, of course, it has been a thundering success! So much so, that the exhibition in Singapore was extended to October 2019, after which it will become a travelling exhibition.

The exhibition itself is very reminiscent of being on one of our digs. First you have to express your intent to dig this year (get your RFID ID card complete with a bone for you to identify in the exhibition) and travel to beaches where dinosaurs rest (go through the Time Tunnel).

Of course, nothing quite captures the imagination like giant and tiny beasts (which were reconstructed with meticulous skill by Peter Trusler working with the researchers — with visitors able to digitally take part in the process). Then the pièce de résistance — finding a fossil, presenting it to Lesley (in the exhibition she is represented by one of the explainers) and getting that big thrill when she makes her "that's interesting" sound (watch as 3D holographic mapping brings fossils found to life). The teams working on this exhibition went all out to make sure that people visiting DinoQuest got a clear understanding of the scientific process and a very similar experience to our digs on the coast of Victoria.

In fact, the entire exhibition had many interactive elements, including 3D props that people could touch, animatronics, and an actual dig site where people could see into a pit or walk into a reconstruction of the entry to the tunnels at Dinosaur Cove and try out the dig jackhammer (the Atlas Copco Cobra) for themselves. Within the Laboratory, visitors could go to the Bone Station where they could drill into rocks from Dinosaur Cove to discover actual fossils!

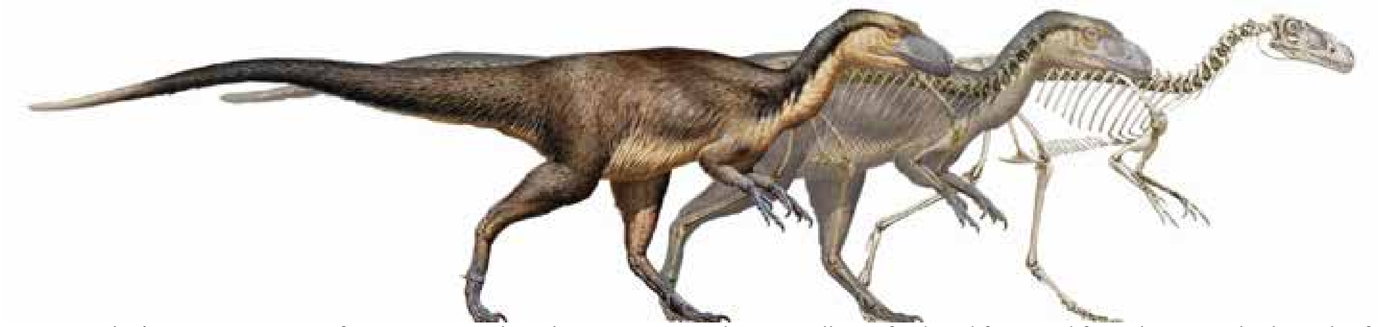


Image supplied by P Vickers-Rich

Peter Trusler's reconstruction of Timimus *as a basal tyrannosauroid – specially crafted and financed for release at the launch of DinoQuest*

Image supplied by P Vickers-Rich

Peter Trusler's studio at DinoQuest

A favourite of the kids was the finale of the exhibition. There they were able to identify the unknown bone given to them at the start on their RFID ID card, scan it in along with all the data they had collected at the many info stations, and get a printed reconstruction of unknown fossils they had been assigned. They could then colour this printout of the reconstruction, scan the finished product and see it up on screen as a moving image. Their ancient critter came to life before their very eyes, and those of all the other visitors near them.

It was really inspiring to see families getting into the interactive elements that taught them how current science is done, how important it is to be as accurate as possible in palaeo-reconstructions, and learning why most of the dinosaurs, even the polar ones, went extinct. Most importantly, it taught them how we might use our super-brains to live sustainably on the planet we call home and not go the same way as most of our polar dinosaurs — except perhaps the small tyrannosaurids and their relatives that now fly.

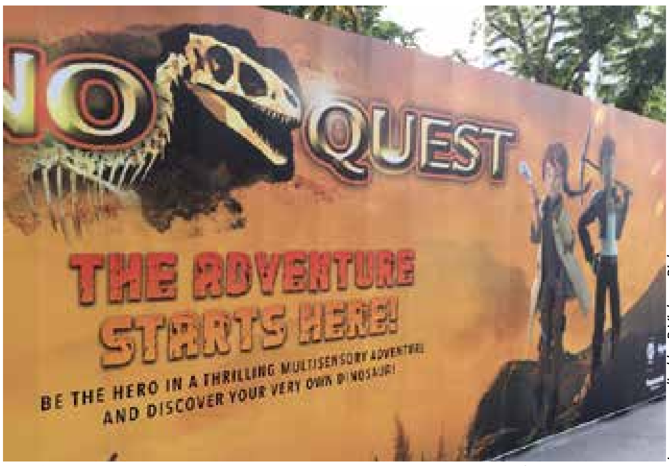


Image supplied by P Vickers-Rich

Welcoming sign to the Singapore Science Centre's DinoQuest, with Prof V and T. Rex, her assistant (do they look familiar? — add about 40 years).

Recently Prepared Fossils

Photos by Lesley Kool

Theropod tooth from Flat Rocks

Pterosaur tooth from Flat Rocks

Dinosaur caudal vertebra from ETRW 2017 prepared by Alison Dorman

Ornithopod premaxillary tooth

Pterosaur tooth from Flat Rocks

Field Crews

Flat Rocks Field Crew
9 February – 2 March 2019

Marion Anderson
Elaine Anderson
Darren Bellingham
Ali Calvey
Mike Cleeland
Pip Cleeland
Amber Craig
Kim Davis
Ruairidh Duncan
Eve Eidelson
Alan Evered
Nicole Evered
Asti Fletcher
Tim Hain
Fotini Karakitsos
Marcus Killerby
Joerg Kluth
Jade Koekoe
Gerry Kool
Lesley Kool
Rebekah Kurpiel
Miklos Lipcsey
Rohan Long
Sharyn Madder
Tanya Mellar
Cassia Paragnani
Adele Pentland
Kat Rajchl
Tom Rich
Dale Sanderson
Nicola Sanderson
George Smith
John Swinkels
Alan Tait
Wendy Turner
Nick van Klaveren
Mary Walters
Astrid Werner
Wendy White
John Wilkins
Corrie Williams
Ben Woodford
Tim Ziegler

ETRW Field Crew
9 – 12 November 2019

Mike Cleeland
Pip Cleeland
Simona Grippi
Tom Rich
John Swinkels
Alan Tait
Nick van Klaveren
Pat Vickers-Rich
Andrew von-Strokirch
Mary Walters
Wendy White
John Wilkins
Corrie Williams

Week 1 Crew

Image: C Williams

L-R Standing:
Kat Rajchl
Wendy White
George Smith
Kim Douglas
Amber Craig
Marion Anderson
Lesley Kool
Tom Rich
Gerry Kool
L-R Seated:
John Swinkels
Mary Walters
Fotini Karakitsos
Jade Koekoe
Nick van Klaveren

Week 2 Crew

Image: H Calvey

L-R Standing:
Rebekah Kurpiel
Eve Eidelson
Asti Fletcher
Tanya Mellar
Rohan Long
Miklos Lipcsey
Corrie Williams
Mary Walters
Wendy Turner
Lesley Kool
Nick van Klaveren
Wendy White
Joerg Kluth
Astrid Werner
L-R Kneeling:
Ali Calvey
Ben Woodford

Week 3 Crew

Image: R Zugaro, Museums Victoria

L-R Standing:
Tim Hain
Marcus Killerby
Tom Rich
Ruairidh Duncan
Wendy White
Adele Pentland
Elaine Anderson
Mary Walters
Tim Ziegler
Darren Bellingham
Alan Tait
L-R Seated:
Sharyn Madder
Cassia Paragnani
Nick van Klaveren
Lesley Kool


KOOL ONE
KOOL TOO