
DINOSAUR DREAMING 2014 FIELD REPORT





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FRONT COVER: P239464: The large theropod claw (manual ungual) found this season at Eric the Red West, after further preparation back at Melbourne Museum. Photograph by Darren Bellingham.

BACK COVER: A selection of clasts found at Eric the Red West. Photograph by Alan Tait.

The Dinosaur Dreaming 2014 Field Report was compiled and edited by Wendy White. Special thanks to proofreaders Mary Walters and Alanna Maguire. Uncredited photographs by the editor.

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Photo: D Bellingham

P250519 Tibia of a small bodied ornithomimid #332



DINOSAUR DREAMING 2014 FIELD REPORT

BY LESLEY KOOL

After 20 productive annual field seasons at Inverloch, on the Bass Coast of Victoria, the decision to move the Dinosaur Dreaming project to the new fossil locality on the Otway Coast was a gamble. Short field trips to the Eric the Red West site, discovered by Mike Cleeland and George Caspar in 2005, had resulted in the discovery of a number of significant specimens including evidence of the first tribosphenic mammals in the Otway Group and the first evidence of a spinosaurid dinosaur in Australia (Benson *et al* 2012).

A visit to the site in 2011 found it unusually free of sand and the Dinosaur Dreaming team was able to trace the extent of the fossil bearing conglomerate exposed on the surface. The layer appeared to extend for a considerable distance to the west and east of the original site where the articulated dinosaur skeleton was found in 2005. The purpose of the three week dig in 2014 was to discover if the conglomerate layer was fossiliferous and just how far it extended.

I was fortunate enough to be present on the day that an exciting discovery was made. Dig co-leader David Pickering had returned to Melbourne



Eric the Red West exposed in 2011

for a couple of days and I was supervising the excavations when veteran Dinosaur Dreamer and long time excavator, John Wilkins, pulled out a piece of bone from the very bottom of a one metre deep hole. It turned out to be the tip of a large theropod dinosaur claw which extended into the floor of the excavation.

It took John and co-excavator Alan Tait quite some time to remove the cubic metre of rock above the claw to gain access to it and even then the claw fought "tooth and nail", refusing to come out in one piece. Fortunately we did not have to worry about the tide coming in before removing the claw. One of the big advantages of the Eric the Red West site over the Flat Rocks site is that the fossil layer is mostly above the high tide mark and the sea rarely enters the excavation area. In his report, David Pickering discusses other results of the dig and what the future holds for the site.



John Wilkins excavating the claw

Turtles

In 1996, chief prospector Mike Cleeland and fellow prospector Gary McWilliams found a boulder at The Caves, near Inverloch, containing the remains of a turtle carapace. The carapace was badly eroded and only the back edge of the shell and a row of dorsal vertebrae remained. Removal of the shell was given low priority as the sediment it was encased in was particularly hard and there was no guarantee that any more of the animal



Photo: L. Kool

The carapace in the boulder

was inside the boulder. In October 2013, David Pickering arranged for some of the turtle material from the Flat Rocks site to be CT scanned at the Queen Victoria Hospital. On a whim I decided to include the boulder in the hope that it might show some indication of other bones. The results of the CT scans were amazing. They clearly showed the presence of what looked like an in situ plastron, although it was unclear just how complete it was. Once we realised the position and extent of the plastron we were able to estimate how much of the boulder could be safely removed without damaging the specimen. David and Museum volunteer Paul Chedghey carefully cut the boulder using a diamond bladed rock saw and over a period of weeks I slowly chipped away at the remaining rock with a pneumatic drill. The result was the oldest and most complete turtle plastron in Australasia.

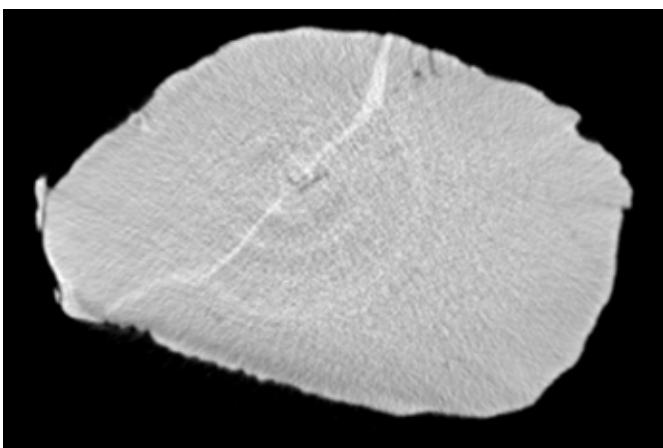


Image supplied by L. Kool

A Computed Tomography (CT) scan of the plastron

An added bonus was the discovery of a thin carbonaceous film covering a small area of the plastron. Initially thought to be the remains of an algal mat, it is possible that it could be the remains of the original keratin scute layer that covered the bony plastron when the animal was alive. Tom Rich generously donated some of the time allotted for the scanning of dinosaur material from Dinosaur Cove in the Australian Synchrotron in June this year to produce close-up scans of the area on the plastron. Results of the Synchrotron scans are inconclusive, but further studies of the scans may reveal more information. If it can be shown that the film is keratinous in origin it will be the oldest evidence of keratin in a vertebrate.



Image supplied by L. Kool

Section of the synchrotron scan

The rockfall

In January this year Mike Cleeland noticed that a 3 to 4 metre long horizontal crack had opened up through the fossil layer, approximately one metre from the base of the cliff at the Flat Rock site. After a week at the Eric the Red West dig in February, I returned to the Flat Rocks site to discover that



Photo: L. Kool

The cliff before the fall, showing the crack



Photo: L. Koof

The cliff after the rockfall in February

the rock below the crack had fallen down and lay in large blocks at the base of the cliff. The rock that had fallen was an extension of the fossil layer that we had excavated on the shore platform over the last 20 years and, therefore, it was important that it not be left to break apart and disintegrate. I arranged to meet with local Parks Victoria ranger Brian Martin to discuss the removal of the blocks. We came up with a plan to remove the blocks from the base of the cliff and either break them up on site or store them off site.

In consultation with David Pickering and some of the Dinosaur Dreaming core crew, we decided that the weekend of the Friends of Dinosaur Dreaming Day at the Flat Rocks site in late March would be the ideal time to move the fallen rock. Prior to that weekend Marion Anderson, Monash University first year Geology coordinator, brought a group of John Monash School students to the site on a one day field trip. She invited me to talk to the students about the excavation process that we had undertaken at the site and in return the students carried buckets of rock from the rock fall back to



Photo: L. Koof

Alan Tait and John Wilkins dragging rock on a tarpaulin



Photo: L. Koof

The cliff after the rock was removed in March

the car park, from which they were transported to a storage facility.

On the weekend of the Friends Day a number of Dinosaur Dreaming crew arrived at the site and we carefully removed boulders at the base of the cliff to give better access to the fallen rock. Only four experienced members of the team, wearing hard hats, were allowed to approach the base of the cliff and manhandle some of the large blocks onto a tarpaulin. The tarpaulin was then dragged across the sand, away from the base of the cliff. The rocks were then broken into smaller, more manageable sized blocks for the rest of the crew to break down.

Over the years a number of bones have become exposed in the fossil layer in the cliff, including a small ornithopod femur approximately 15 centimetres long, but it was thought that this part of the fossil layer was less rich than further out on the shore platform in the areas known as Main and Bridge East. The results of the Friends weekend confirmed that although a number of bones were found, including a theropod dinosaur tooth, an ornithopod dinosaur tooth and an unusual skull fragment found by Wendy Turner, the



Photo: L. Koof

The theropod tooth found in the rock from the rockfall



Photo: L Kool

Skull fragment found by Wendy Turner (scale in centimetres)

total number of specimens indicates that this part of the fossil layer is not as fossiliferous as Main or Bridge East.

The amount of rock that fell from the cliff far exceeded the amount that could be processed on the Friends' weekend. Some of the rock was transported to the storage facility for future processing and some of the larger blocks were dragged to an area above high tide where they will weather naturally and will be processed on future one-day digs at the site.

Coast

In April, a number of the Dinosaur Dreaming crew took part in the filming of an episode of *Coast* at Eagle's Nest on the Bass Coast near Inverloch. For those unfamiliar with the Coast documentaries, the original series travelled around the coast of the UK checking out the local geology, history and unique features. The producers of the show decided to expand their horizons and are currently filming parts of the Australian coastline, which is what brought them to Victoria. Eagle's Nest is the site of the first Australian dinosaur bone, found by field geologist William Ferguson in 1903, and was rediscovered in 1978 by cousins Tim Flannery and John Long and field geologist Rob Glenie. Tom Rich had been instrumental in encouraging an enthusiastic Tim to explore the area under Rob's guidance and so the episode focussed on them. Tim reminisced with Rob about their field trips and the fossil bones they subsequently

discovered. Then a team of Dinosaur Dreaming diggers headed down to the site itself, where Tom and Tim discussed the implications of that original discovery more than a century ago. Meanwhile John Wilkins, Kim Davis, Wendy Turner and her son Harrison, Joerg Kluth, Pip Cleeland and Gerry Kool spread out on the shore platform and began breaking up some of the rock that we had brought with us from the Flat Rocks cliff fall. To add some variety to the background scene while Tim and Tom were being filmed, Mike Cleeland and I wandered around looking for exposed fossil bones on the shore platform. Of course, Mike found one, only metres from the filming. The producer was delighted with the discovery and incorporated it into the episode, which included Tim, Tom and Mike discussing what they thought the bone might be and then Mike cutting it out with his trusty rock saw. Unfortunately, the rest of the diggers were not so lucky with only Wendy and Joerg finding a couple of scraps.

After the filming session, I prepared Mike's bone and it turned out to be the dorsal processes of a dinosaur vertebra. The episode should be shown on Australian television later this year.

Reference:

Benson RBJ, Rich TH, Vickers-Rich P, Hall M (2012) Theropod Fauna from Southern Australia Indicates High Polar Diversity and Climate-Driven Dinosaur Provinciality. PLoS ONE 7(5): e37122. doi:10.1371/journal.pone.0037122



Photo: L Kool

Filming Coast in April



ERIC THE RED WEST FIELD REPORT

BY DAVID PICKERING

To really understand what palaeontologists do, reading is not enough: you have to get out to the badlands and actually dig up some fossils. Shovelling off a meter-thick layer of overburden in the desert sun gives one a robust sense of reality. It also helps to follow a fossil from the field to the laboratory where preparators exercise the utmost meticulousness in removing specimens from their matrix and preparing them for display or study. When you dig something out of the ground, remove the encrustation of a million centuries, and recognize a jaw or femur, there is a palpable sense of connection to a very real, very deep past.

— Keith M. Parsons, *Drawing out Leviathan*

1903	Discovery of first Australian dinosaur fossil by William Ferguson at Eagle's Nest near Inverloch.
Late 1970s	Prospecting for fossil sites in the coastal Strzelecki Group.
Early 1980s	Prospecting program moves west to the Otway Group.
1984	First Dinosaur Cove dig.
1994	Last Dinosaur Cove dig. First dig at Flat Rocks near Inverloch.
1997	Discovery of the holotype of <i>Ausktribosphenos nyktos</i> by Nicola Sanderson (née Barton) at Flat Rocks.
2006	Start of a series of limited digs at Eric the Red West near Cape Otway. Discovery of first cretaceous mammal jaw found outside of Flat Rocks by Mary Walters at Eric the Red West.

2009	Alanna Maguire finds first upper molars from a Victorian cretaceous mammal at Eric the Red West.
2013	Final Dinosaur Dreaming Flat Rocks dig.
2014	First full scale Eric the Red West dig.

It is noticeable that the pendulum of activity has swung East - West (Strzeleckis - Otways) a number of times during the history of Victorian Cretaceous fossil collection. After twenty years of continuous work at Flat Rocks, which resulted in finding many important fossils, Tom Rich decided to relocate the Dinosaur Dreaming program back to the Otways where the annual dig would be held at Eric the Red West. The lure of this site is the potential of finding more mammalian upper teeth and (hopefully) skulls, even though the *per diem* fossil output was always higher at Flat Rocks.

Accommodation

The 2014 dig saw us based at our usual Otways haunt, Bimbi Park, where the koalas almost outnumber the campers. We have been regulars there since 2007 when we met the owner Frank Fotinas on site and he made us a deal we could not refuse. Since then Frank and his wife Katrina have been exceedingly helpful accommodating our needs to the point where we look upon them as our friends. This year we were housed in an assortment of cabins, on site vans and dormitories, but many opted for tents as the weather was fine for much of the time.

Meals

The meals were provided by Pip Cleeland with assistance from Tamara Camilleri and a relay of rookie volunteers. Mike Cleeland and Tom Rich assisted Pip in purchasing the provisions. The meals were always up to Pip's high standards, tasty and filling. Frank gave Pip the night off on a couple of occasions by providing free pizza dinners.

Crew

The crew comprised many of the veterans from Flat Rocks and past Eric the Red West digs plus a group of rookie volunteers who had been recruited

from Monash University, University of Melbourne, Deakin University and Museum Victoria. The number of new volunteers was higher this year due to the nonattendance of some of our regular crew. I hope that these friends, who were dearly missed, can return to our digs in the future.

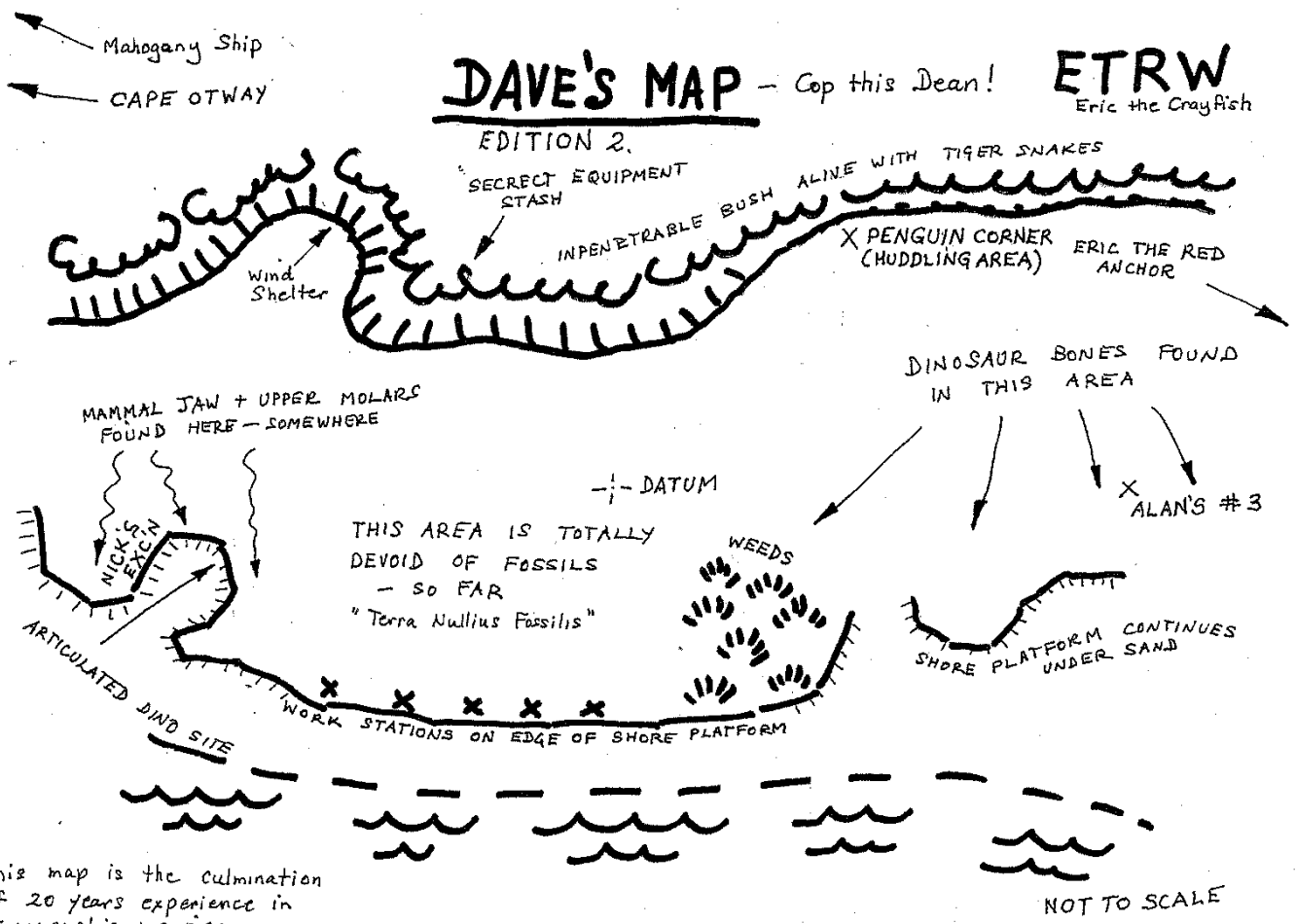
Because of the large number of rookie volunteers there was a concern that the quality of the work could suffer. In this we were completely incorrect and we consider that this rookies intake has been the best for many years. We congratulate you all!

Weather

Being the first Eric the Red West dig conducted in February (and with the help of the "Weather God") we enjoyed the best conditions ever experienced at this site. Only one working day was lost during the three weeks and we almost missed the sand blasting, horizontal rain and group huddling.

On-site fossil extraction

During the last days of the 2013 dig a section of the shore platform east of "the weeds" started producing a series of interesting fossils which were well preserved. Since this rock continues east for at least 50 metres it was the obvious place to start the excavation. With plenty of work space available, Alan Tait and John Wilkins managed two separate excavation teams, assisted by a daily selection of volunteers. They proceeded to remove large sections of the work face (as they always do). The excavated material was duly broken down and scrutinised for fossils by the rest of the crew in the time honoured method. This quarry gradually moved East to become "Alan's #3 Hole, 20 metres east of the weeds". This site location now appears on over fifty specimen registration cards at Museum Victoria. At the same time as this work, Nick van Klaveren, with his assistants, excavated



This map is the culmination of 20 years experience in Topographic mapping

Map: D Pickering

several sites west of “the weeds” as far as the area around the discovery site of the articulated ornithopod specimen. Although several fossils were found, it was decided to concentrate our efforts at Alan’s location in the East as bones were being uncovered there at an increasing rate. The search for specific “mammal” rock was abandoned as it was noted that the main quarry area was comprised of layers which contained large bones but were surmounted by layers producing very small elements - the ideal environment for mammal remains (which was Tom’s main goal).

Meanwhile, during the sound and fury of excavation, sitting apart in a sometimes pretence of serenity, Wendy White performed a crucial role in the safe delivery of the specimens to the Museum Lab. The finding and extracting of the fossils is meaningless unless all the pieces are collated (this process sometimes involves inquisitorial talents), wrapped as carefully as bone china, labelled (with cryptic explanations) and catalogued. She does this every day of the dig, rain or shine. Still working some days when the crew have packed up and walked off. Wendy received her training from Lesley Kool who has performed this duty for more than twenty years. Bravo to both of you!

Equipment

Only the basic kit was required: a selection of chisels and hammers, demolition saw and portable angle grinder with diamond tipped blades, pinch bar, shovels, buckets, sponges, scoops, brooms and a sump pump.

The jackhammer, plugs ‘n’ feathers, electric drill and petrol water pumps were not used this year but will probably be required in the future.

Many are called but few are chosen

The fossil tally for the dig was:

Week 1	128
Week 2	179
Week 3	177
<hr/>	
Total	484



Photo: D Bellingham

P250522 Thin-walled limb (pterosaur humerus?)

Of these, 25 were fresh water bivalves (a surprisingly high number) and 3 were fossil plants.

Since February, the Museum prep team and Lesley Kool have prepared and registered nearly 80 fossils into the collection, some of which are featured in this report. Another 173 are in temporary storage, but all have been earmarked for future preparation. On the debit side, 231 have been discarded as being only fragmentary pieces. Although this may seem a high percentage of rejects it is in fact, from past experience, a very respectable number. The figures also do not indicate the high level of scientific interest and wonderful state of preservation of some of these specimens. Check out “The Claw”... but also the pterosaur wing bone, the many dinosaur skull elements, the complex clusters of small bones which require micro scanning, the large plesiosaur tooth, the furcula (sorry Blaire, I mean the haemal arch), the turtle femur, the tiny ornithopod maxilla, the theropod tooth, the many complete dinosaur vertebrae and limb bones — sorry Tom, no more mammals. Yet.



Photo: D Bellingham

P239450 Plesiosaur tooth found by Mike Cleeland #1

Thanks to Tom and Pat for the cash, the permit and the willingness to take a punt!



Photo courtesy Museum Victoria

RESEARCH REPORT

TOM RICH

At three weeks duration, the 2014 field season at Eric the Red West was the longest one in that locality to date. The productivity increased significantly as the days passed. That this occurred was no surprise to me. In my experience, as a field crew becomes more acquainted with the unique aspects of a given site by working at it for a while, so they become more proficient at finding fossils in the prevailing circumstances. Even a field crew experienced with a particular site reacquires insights about how best to proceed after returning to that site. They do not start out again where they left off the previous field season. There is inevitably a re-learning curve. It was for this reason that I was pleased that a longer dig at Eric the Red West was possible this year.

Alan Tait came back to the site convinced that the eastern end of Eric the Red West was the most promising. Focussing on it, with the aid of other members of the crew, his hypothesis was rewarded with the recovery of the bulk of the specimens found during this field season.

The prize specimen was a terminal toe bone of a theropod dinosaur that resembles that of the first one of the Queensland carnivorous dinosaur *Australovenator wintonensis*. The Victorian specimen is more slender — a difference that might be because the relevant specimens are of different genders. That this fossil might be closely allied to *Australovenator wintonensis* rather than to some other theropod dinosaur is indicated by a feature first recognized by David Pickering. This is a structure in the form of a ridge with depressions on its sides at the base of the toe bone. It is found in *Australovenator wintonensis*

but we are not yet aware of it in any other theropod. However, it must be borne in mind that detailed images of the toe bones of theropod dinosaurs are not common in the scientific literature. Nevertheless, this feature certainly justifies looking closely at actual specimens of other theropods when the opportunity presents itself.

Less spectacular than this scimitar-shaped toe bone are a number of smaller finds, amongst these some clumps of small bones together. These could be the associated bones of a single small animal. Perhaps they were concentrations formed much like owl pellets are today by those animals regurgitating the bones of their prey after digesting the flesh. Such clumps of bones are prime candidates for scanning to determine more about them than can now be seen.

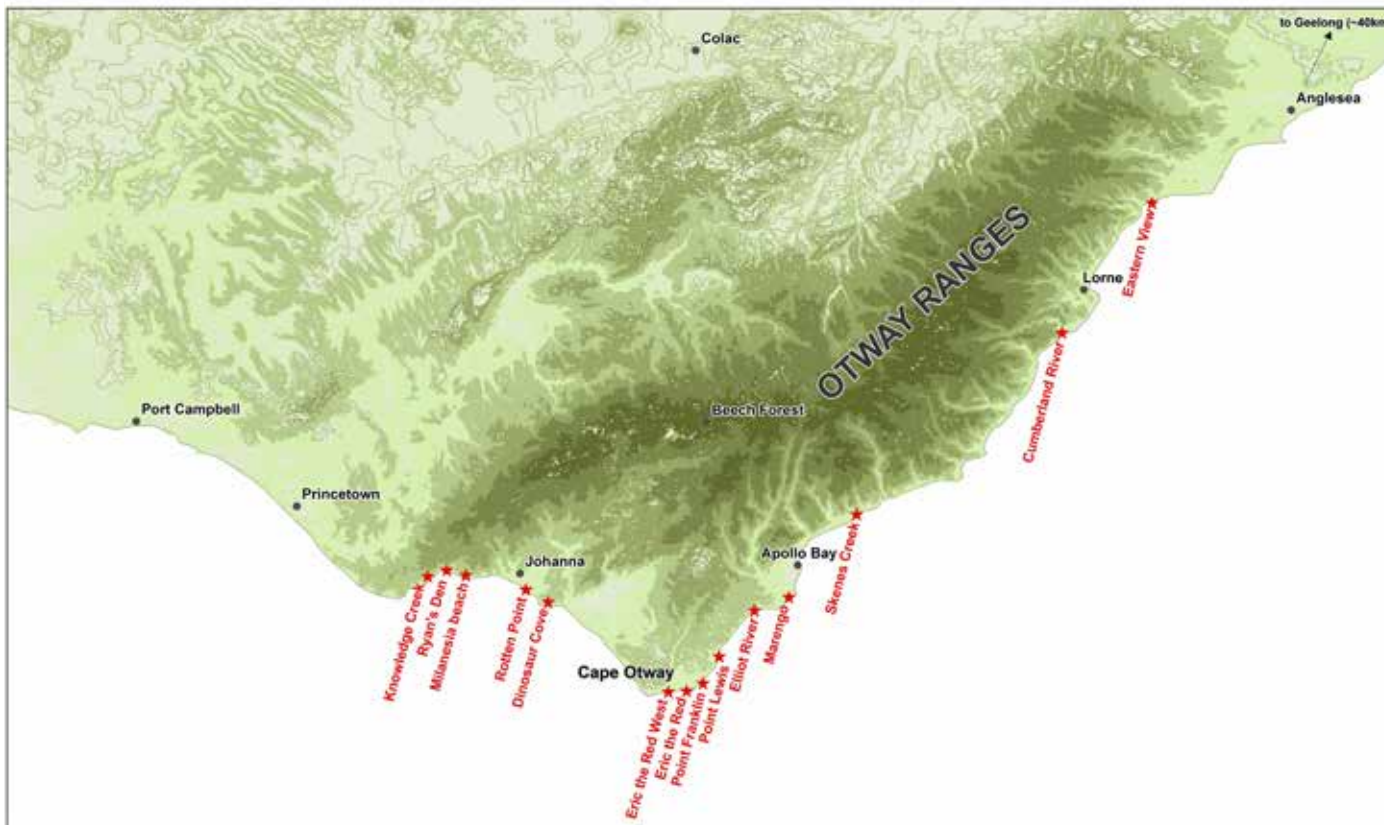
A number of small fragments of delicate bones appear to be partial elements of skulls of diminutive dinosaurs or other vertebrates.

The presence of these smaller elements are particularly encouraging as they are evidence that with more excavating not only will more of them be found but with enough effort, specimens with features sufficient to make detailed identifications might turn up.

In addition to the possible *Australovenator wintonensis* claw, other larger elements of dinosaurs were found. Not all were isolated bones. Some occurred together which suggests that the partial skeleton of a hypsilophodontid (found by George Caspar when prospecting with Mike Cleland, and the basis for first recognising the importance of Eric the Red West) is not the only occurrence of associated fossil bones at this site.

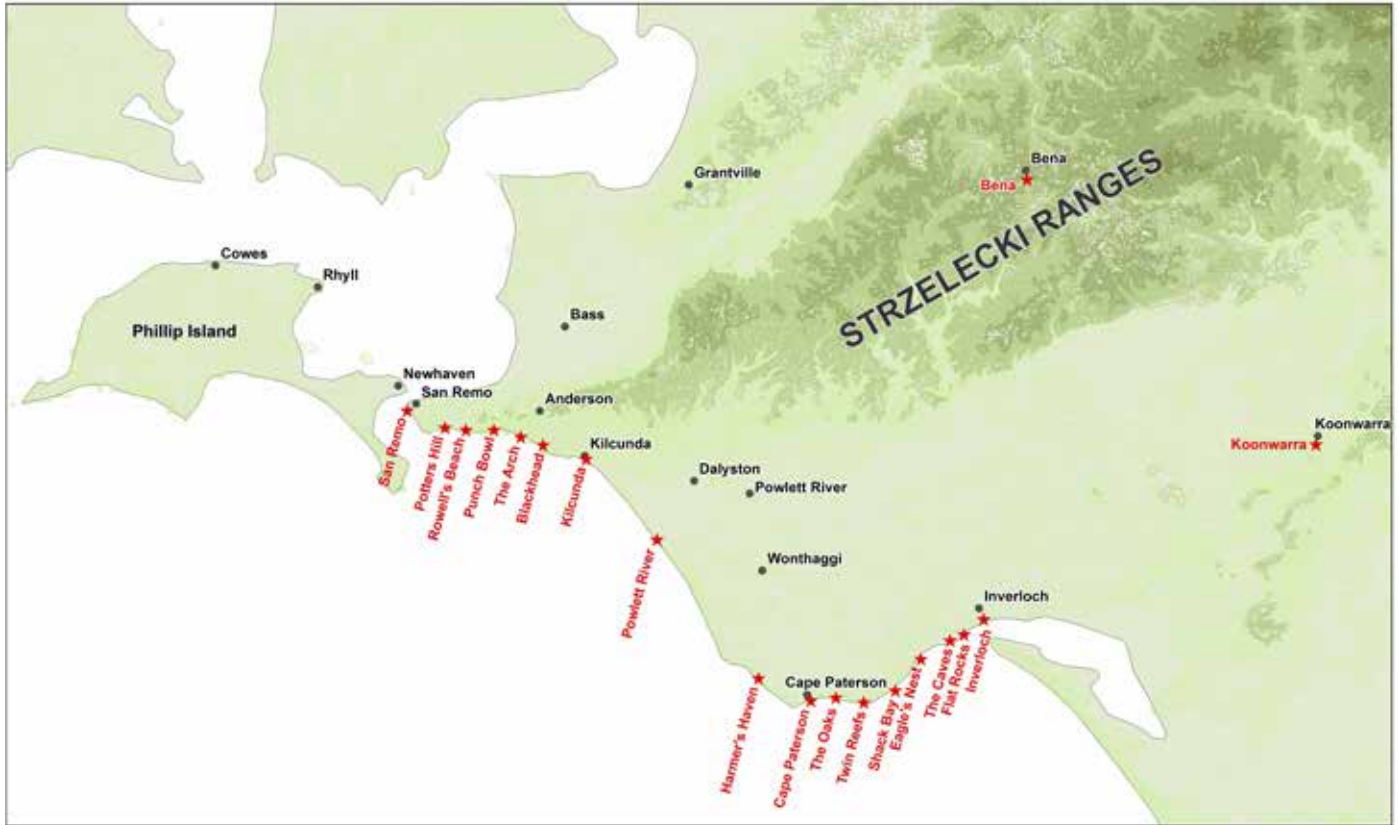
Thus, between the discovery in 2014 of a number of smaller bones and the association of some of the larger ones with one another, the more prolonged effort at Eric the Red West in 2014 is paying off in an increase in both the kinds and quantities of fossils found there.

FOSSIL LOCALITIES IN THE OTWAY GROUP



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	Marango	Skenes Creek	Cumberland River	Eastern View
Mammalia:														
Tribosphenic (Unidentified)							X							
<i>Bishops sp.</i>						X								
Monotremata (Unidentified)														
<i>Kryoryctes cadburyi</i>					X									
Dinosauria:														
Dinosaur (Unidentified)	X			X	X	X	X	X	X	X	X			X
Ornithopoda (Unidentified)	X			X	X	X		X	X	X	X			
<i>Atascopcosaurus loadsi</i>					X				X					
<i>Fulgurotherium australe</i>					X									
<i>Leaellynasaura amicographica</i>					X									
Ankylosaurs/nodosaurs					X									
Neoceratopsian					X									
Theropoda (Unidentified)					X	X		X						
Spinosaurid						X								
Oviraptorosaurid					X									
Ornithomimid					X									
Neovenatoridae indet.					X									
Tyrannosauroid					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					
<i>Otwayemys cunicularis</i>					X									
Dipnoi (lungfish)					X	X			X					
<i>Neoceratodus nargun</i>					X				X					
Actinopterygii (ray finned fish)					X	X								
Invertebrates:														
Freshwater crustaceans														
<i>Palaeoecchinastoc australianus</i>					X									
Bivalves (Unidentified)					X	X								
<i>Megalovirgus flemingi</i>					X									
Trace Fossils:														
Dinosaur footprints	X		X		X									X
Bird footprints					X									X
Dinosaur Burrows	X													
Crustacean Burrows: Parastacid	X				X						X	X		

FOSSIL LOCALITIES IN THE STRZELECKI GROUP



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		
<i>Ausktribosphenos nyktos</i>																	X		
<i>Ausktribosphenos</i> sp.																	X		
<i>Bishops whitmorei</i>																	X		
Monotremata (Unidentified)																	X		
<i>Teinolophos trusleri</i>																	X		
Multituberculata (Unidentified)																	X		
<i>Carriboatar marywaltersi</i>																	X		
Dinosauria:																			
Dinosaur (Unidentified)	X	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			
<i>Fulgurotherium australe</i>					X									X					
<i>Qantassaurus intrepidus</i>																	X		
Ankylosaurs/nodosaurs					X				X							X	X		
Neoceratopsidae (Unidentified)					X														
<i>Serendipaceratops arthurcclarkei</i>					X														
Theropoda (Unidentified)	X			X	X	X	X	X					X	X		X			
Ornithomimid	X					X										X			
Megaraptora					X									X					
Ceratosaur	X																		
Other Vertebrates:																			
Plesiosauria (aquatic reptiles)	X		X					X						X		X	X		
Pterosauria (flying reptiles)														X		X			
Testudines (turtles)						X		X		X				X	X	X	X	X	
Aves (birds)														X		X			
Temnospondyli (amphibians)				X												X			
<i>Koolasuchus cleelandi</i>	X	X	X	X															
Dipnoi (lungfish)	X			X			X	X					X	X		X	X		X
<i>Neoceratodus nargun</i>				X										X		X			
<i>Archaeoceratodus avus</i>														X					
Actinopterygii (ray finned fish)					X	X		X						X		X		X	X
<i>Leptolepis koonwarri</i>																			X
<i>Koonwarria</i> sp.																			X
<i>Wadeichthys oxyops</i>																			X
<i>Coccolepis woodwardi</i>																			X
<i>Psillichthys</i> sp.																			X
Invertebrates:																			
Bivalves						X										X			
<i>Megalovirus flemingi</i>					X											X			
Insecta (Insects)																			X
Trace Fossils:																			
Dinosaur footprints																X			
Crustacean Burrows: Parastacid											X	X		X	X	X			



CLAST DISTINCTION

BY ALAN TAIT

The sandstone that we quarry for vertebrate fossils at Eric the Red West is a crossbedded fluvial sandstone erosively overlying a claystone soil developed on floodplain lake sediments. The bulk of the sandstone is fine to medium grained sand made of volcanic rock that was derived from beyond the east end of the rift valley (and was therefore extrabasinal). The sandstone also contains intrabasinal material in the form of:

- claystone clasts eroded from local floodplains
- tree stumps with roots and attached claystone soil
- plant fragments up to tree size (more than 5 metres long and around 30 centimetres in diameter, but flattened)
- charcoal clasts.

Some layers in the sandstone also contain very coarse grained quartz sand (otherwise known as grit) which is extrabasinal but with a different source from the volcanoclastic sand.

A few digs ago, a gritty layer started producing rounded clasts up to cobble size, which popped out of the sandstone as we hammered and chiselled it and broke it up. The clasts popped out because of their roundness and because they were not cemented to the surrounding sandstone, which consists of sand-sized volcanic rock grains coated with greenish chlorite. I started collecting the pebbles because they were unusual and indicated another extrabasinal provenance. I ended up with quite a number (around 400 I think, thanks to the help of other diggers) but many smaller clasts eluded collection and several specimens are incomplete broken pieces.

The clasts range in size from granules to small cobbles (3 to 78 millimetres) and consist of several different rock types and quartz. The

lithic clasts (rock fragments) range from small pebbles to small cobbles (7 to 78 millimetres) and consist of sandstone (reddish and grey varieties), metamorphic quartzite and pelite, and apparent tuff. The quartz clasts are mostly smaller, ranging from granules to large pebbles (3 to 23 millimetres), and are usually translucent with colourless, grey, purplish and yellowish varieties, although some appear dark like the lithics but are actually translucent. Most of the clasts are speckled by adherent chlorite from the coatings of the surrounding volcanolithic sand grains. The picture on the back cover shows the collection so far.

Many of the clasts have similar unusual shapes, which suggest a particular origin and sequence of events. The unusual-shaped clasts are faceted with rounded edges and have three or four sides, usually slightly concave (Figure 1). The overall shapes are reminiscent of dreikanter (German for three-edged), which are pebbles with facets meeting in sharp edges, produced by wind erosion and hence called ventifacts (made by wind). If the pebbles are ventifacts, they have subsequently undergone water transport to round their edges. Several of the pebbles have been broken since the rounding, and those have slightly rounded edges to the broken surfaces (Figure 2). This last slight rounding presumably took place during transport in the Early Cretaceous rivers before final deposition, so the rounding of the sharp ventifact edges may have occurred in a previous cycle of erosion and transportation. The ventifacts could



Figure 1: Pebble exhibiting characteristics of a ventifact

Photo: A Tait



Photo: A Toit

Figure 2: Slightly rounded edges to the broken surfaces

have formed at least as far back as the Permian in cold deserts, so there is plenty of time for rounding of the edges to occur.

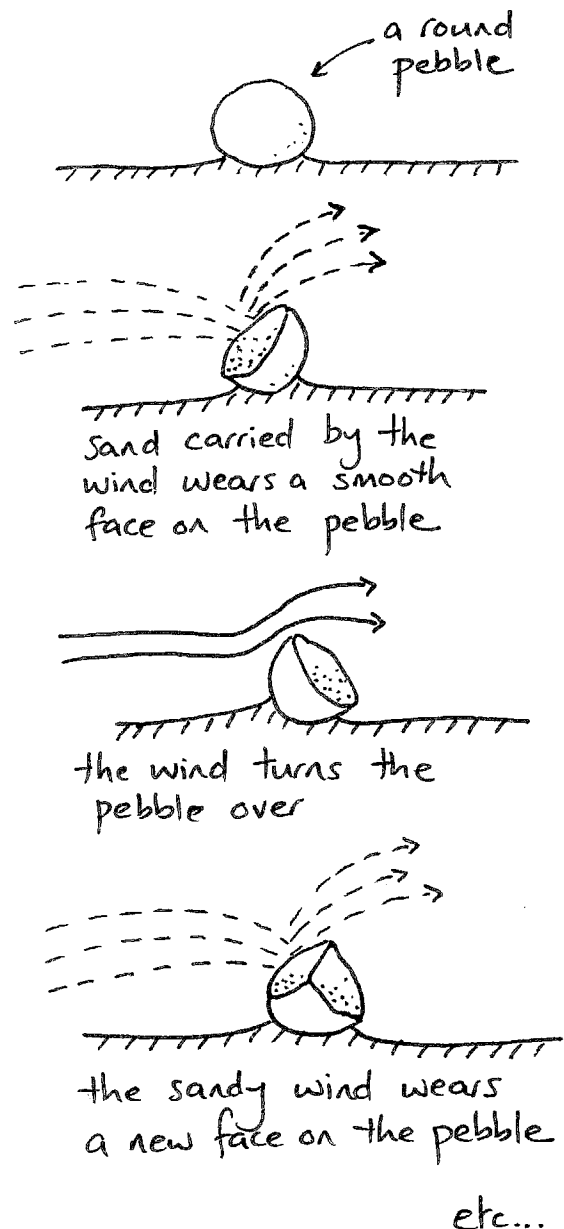
The bulk of the sediment forming the Strzelecki Group and Eumeralla Formation in the Early Cretaceous rift valley was volcanoclastic sediment derived from volcanoes at the eastern end of the rift and transported westwards. However, large amounts of quartzose sediment entered the rift valley from its north side where the rift changed direction in South Australia. This quartzose sediment contains pink garnets and forms the Pretty Hill Sandstone in South Australia and western Victoria. Another input of quartzose sediment from the north side of the rift valley forms the Tyers Conglomerate in Gippsland. At Marengo, near Apollo Bay, angular quartz grit is present in the Eumeralla Formation, and the sandstone at Eric the Red West contains angular quartz grit and the rounded clasts which I have been collecting. Marengo and Eric the Red West are closer to the southern side of the rift than the north, so the source of the various grits and clasts may be the King Island area or Tasmania.

But the ultimate provenance of the clasts is yet to be determined. This requires information about the lithology and distribution of the pre-Cretaceous rocks of Victoria and Tasmania, bearing in mind that the source lithologies of some or all of the clasts may have been completely eroded. Complete erosion may also have been the fate of the intermediate sediments in which the clasts

resided before erosion and incorporation into the dig sandstone at Eric the Red West. However, provenance information may come from other sources, such as palynological studies, which have already reported reworked Triassic and Permian palynomorphs from parts of the Eumeralla and Strzelecki sediments.

And there are likely to be more clasts to collect next dig. Hammers ready?

The making of a ventifact...



Drawing: A Maguire



WHY MAMMALS MATTER

Photo courtesy, Museum Victoria

BYTOM RICH

As all the volunteers who participate in the Dinosaur Dreaming fieldwork well know, there is an emphasis on recovering fossil mammals in particular. Why is this so?

Despite rumours to the contrary, this emphasis is not solely because a future palaeontologist became fascinated with the implication of this picture of mammals eating dinosaur eggs in 1953 — we humans had ancestors that lived at the same time as the dinosaurs. A mind-boggling concept to a twelve year old.



Image from *All About Dinosaurs* by Roy Chapman Andrews

One particular group of mammals, the Ausktribosphenidae, recovered primarily from the Flat Rocks site, is the most enigmatic of all the vertebrate fossils found in the Cretaceous rocks of Victoria.

The principal consideration in deciding where and how fossil collecting is to be done on the Cretaceous shore platform deposits of Victoria is finding the fossils that might shed more light on how the Ausktribosphenidae are related to other mammals.

What is enigmatic about the relationships of the ausktribosphenids and how might it be understood?

When the project to understand the Cretaceous polar terrestrial vertebrates of Victoria began in 1978, the general character of the Australian dinosaurs was known in only the broadest outline. At that time, it was quite conceivable that when a more complete picture of the dinosaurs of this continent was revealed, they would turn out to be as unique to it as wombats, koalas and echidnas are today.

Owing to the efforts of a few palaeontologists, assisted by literally hundreds of volunteers over the decades since, a quite different view has emerged. Unlike the monotremes and marsupials of the present day which are found only in Australia, the dinosaurs now known can be placed in superfamilies or even families known on other continents. This implies that (unlike those living mammalian groups unique to Australia whose presence only here is the apparent outcome of the long isolation of the continent) at the time the known dinosaurs of Victoria lived, interchange with other continents was either possible or had been so in the recent geological past.

Since the dinosaurs were similar to those on other continents, there were no surprises amongst those found. Certainly, it was pleasing to find the evidence for this — to discover that tyrannosauroids and ceratopsians were in fact in Australia, when previously these were considered to be exclusively Northern Hemisphere groups. Their discovery fit into an emerging pattern and so were, with relative ease, accommodated into the increasingly more detailed view of the Australian Cretaceous land vertebrate fauna. Their discoveries, along with those of monotremes and even a multituberculate mammal, were not totally unexpected, given this emerging view.

However, two discoveries were quite unexpected.

The first of these was finding the temnospondyl amphibian *Koolasuchus cleelandi*. Prior to the discovery of it in Victoria in the Early Cretaceous, the temnospondyls (a major group of amphibians that may have given rise to the living frogs, newts and salamanders) were thought to have become extinct about 195 million years ago at the beginning of the Jurassic. To find them in Victoria in rocks about 120 million years old extended their range by about 75 million years. Although a remarkable range extension in time for a major group of animals that have an extensive earlier fossil record in many places of the world, the fossil evidence that *Koolasuchus cleelandi* was a temnospondyl amphibian is so unequivocal that it has not been challenged.



Peter Trusler's drawing of *Ausktribosphenos nyktos*

The same cannot be said for another unexpected discovery in the Cretaceous of Victoria — the ausktribosphenid mammals, *Ausktribosphenos nyktos* and *Bishops whitmorei*.

When *Ausktribosphenos nyktos* was first described in 1997, it was tentatively assigned to the placental mammals. Placentals make up 94% of living mammal taxa. They give birth to young at a relatively advanced stage of development and include us, horses, dogs and European hedgehogs in their number.

What made this discovery so unexpected was that all previous evidence indicated that land-living non-flying placentals did not reach Australia until about four million years ago when rodents appeared. There is a sufficient fossil record, beginning about 20 million years ago, of terrestrial Australian mammals to be confident that, with the exception of bats, whales and seals, there were no placentals here. If the ausktribosphenids in the Early Cretaceous are in fact placentals, it means that Australia joins Antarctica as the second continent on which placentals once lived on land and subsequently became extinct.

In the case of Antarctica, the reason for the disappearance of land mammals during the last 40 million years can be readily attributed to the freezing conditions that now prevail there.

For Australia, the answer is not so simple. If ausktribosphenids are placentals, Australia would be the one continent where placentals may have gone extinct in competition with marsupials. Thus the reluctance to accept ausktribosphenids as placentals. By rejecting the hypothesis that ausktribosphenids are placentals, there is no problem to solve.

Remarkably few years after *Ausktribosphenos nyktos* was described from Victoria in 1997, even older mammals that also resembled placentals turned up in the Jurassic of Madagascar (in 1999) and Argentina (in 2002). In all cases, the specimens were lower jaws.

Based on features of the lower dentition, an alternative hypothesis was proposed in 2001. This was that these Jurassic and Cretaceous mammals, although resembling placentals, represented an entirely separate radiation of mammals based in the Southern Hemisphere. This group was given the name Australosphenida (southern shearing wedge teeth). Although the teeth of monotremes are quite different from those of the placental-like forms, in this hypothesis they were included in the australosphenidans.

The australosphenidans had nothing to do with the marsupials and placentals. To emphasize this difference, a contrasting new group was proposed for the marsupials and placentals — the Boreosphenida (northern shearing wedge teeth), reflecting the hypothesis that they originated in the Northern Hemisphere.

The following year, in 2002, another analysis, that was again primarily of the lower dentition, put the ausktribosphenids in the placentals and separated them from the monotremes.

And there the matter has stood for more than a decade. Lower dentitions alone are clearly not sufficient to resolve this impasse. What is needed for a decision to be made between these two hypotheses are other parts of the skeleton and particularly the upper dentition of the ausktribosphenids.

Either outcome, if established, would be intriguing. If ausktribosphenids are part of a radiation of mammals centred in the Southern Hemisphere that began in the Jurassic (the Australosphenida hypothesis), it would mean that a previously unrecognised major group of mammals once existed. On the other hand, if ausktribosphenids are indeed placentals, not only did they die out in Australia only to return millions of years later as rodents, but that they may have been displaced by marsupials. Such displacement happened nowhere else.*

This puzzle, so central to the history of mammals on this continent, is the reason we are now focussing the Dinosaur Dreaming project on the Eric the Red West locality. Although it is true that 52 lower dentitions of mammals have been found at Flat Rocks and only two specimens of mammals at Eric the Red West, one of those two consists of two badly worn and broken molars with a significant difference. Those two teeth are upper molars. They show that the conditions were right at Eric the Red West to preserve upper dentitions of mammals.

It is not all that obvious why this difference exists between the two sites. But the fossils retrieved by digging at each site are strong evidence that a significant difference does exist.

The potential recovery of more informative mammal specimens is the reason for shifting operations from Flat Rocks to Eric the Red West. This does not mean that the dinosaurs are no longer of interest. Far from it. The past season at Eric the Red West saw the recovery of about 450 fossil specimens. Many of those are dinosaurs — some quite intriguing. Preparation thus far of the specimens collected has not turned up a single mammal. Although the fundamental question about mammalian evolution in Australia is the deciding factor on where the collecting will be carried out, they are always going to be a minor component of what is found. So the name *Dinosaur Dreaming* will always be appropriate for the palaeontological field work on the Cretaceous shore platforms of Victoria.

* To make things even more complicated, at the moment there is no firm evidence that ausktribosphenids and marsupials were present in Australia at the same time. The oldest known unquestioned Australian marsupial is less than half the age of the ausktribosphenids. So, prior to the last 4 million years, terrestrial placentals and marsupials may not have overlapped in Australia even if ausktribosphenids are placentals. However, there is some weak evidence that ausktribosphenids and marsupials did overlap in the Cretaceous of Australia. This is because the two known, worn and broken upper molars from Eric the Red West just might belong to a marsupial.

THE MAMMALS OF VICTORIA'S CRETACEOUS

As long-time Dinosaur Dreaming diggers can attest, the tiny fragments of Cretaceous mammals that we find are celebrated and prized. But mammal jaw (and other element) finders don't always get

to find out what became of their precious scrap. So here is a list of all confirmed mammal fossils from the Victorian Cretaceous, with their Museum catalogue numbers, notes and taxa.

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



Photo: R. Schowalter

IT'S A BIRD!

BY TONY MARTIN

The track seemed familiar, like a face I had seen before but couldn't quite identify. Then I realised to whom it belonged, and where I had seen many others like it. It was a bird track, remarkably similar to those made daily by the herons, egrets and shorebirds of the modern-day Georgia coast, near my home in the United States. The other two tracks near it were similar in size and shape, but not nearly as evocative as this one. This footprint conjured an image of a bird slowing its descent from flight then abruptly halting, planting its feet on a moist, sandy surface.

Except this track was from a vastly different time, place, environment and climate. It was fossilised and collected from sandstone at Dinosaur Cove. Because Australia was close to the South Pole then, this track and the other two near it were made in a polar environment. The environment was not coastal, either, but the sandy floodplain of a river valley shaped by melt-waters that flowed with each spring thaw.

Even more incongruously, I first saw this track and its petrified companions in the basement of Museum Victoria in downtown Melbourne. Mentally and physically, I was about as far away from home as I could be, rendering the track's familiarity both jolting and eerie.

It had four thin toe impressions, like a slightly askew "peace" sign, with three forwardly pointing and spread widely, and one pointing behind. A linear claw mark – nearly as long as the three-toed part of the footprint – corresponded with the rearward-pointing toe, which had also left a faint impression. Sand piles only millimetres high were in front of the other three digits; another small mound of sand in the centre toe impression was



Photo: A. Martin

The bird track. Scale in centimetres

neatly bisected by a claw mark from that digit. This central claw mark was a trace of its next step, in which it pushed against the sand with the bottom of its foot and cut through the resulting hillock as its foot retracted. The forward toes made for a foot length slightly greater than the fingers on my hands, so it was about the right size for a small bird (like a heron or egret).

The long, linear claw mark behind most of the track was the primary clue to both its identity and behaviour. This was from a hallux, which in

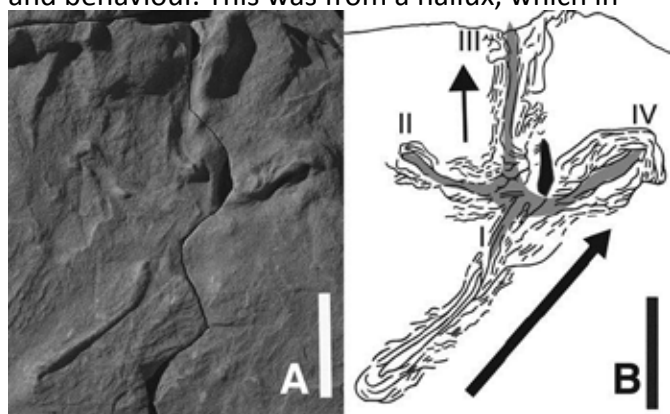


Photo and drawing: A. Martin

(A) Photo of bird track (B) Drawing showing: each digit labelled from I (hallux) to IV; an approximation of the foot's overall form (gray outline), the main direction of movement by the foot as the bird landed (big arrow), and the direction of movement taken by that foot in its next step (little arrow).

humans is our “big toe,” (digit I). In birds, however, it is the backward-pointing toe of those that perch, a trait that better allows them to grasp branches in trees. Earlier that year (2011), I had determined that the thin-toed theropod dinosaur tracks we discovered in rocks just east of Dinosaur Cove in 2010 were likely not made by birds because they all lacked this identifying feature. Although Cretaceous bird tracks identified elsewhere in the world (Canada, the US, Korea and China) do not always have a hallux, its absence makes it much more challenging to separate these tracks from those of similar looking non-avian dinosaurs.

Yet it was not just the hallux impression that convinced me of its identity, but its length. This mark tells us that this bird had been flying. The then-soft, wet sand had been sliced by the sharp claw on the hallux, which contacted the sand first before the rest of the foot registered. As this toe slid forward and stopped, the other digits came down, and forward momentum caused their leading edges to push against the sand, mounding it in front of these toes.

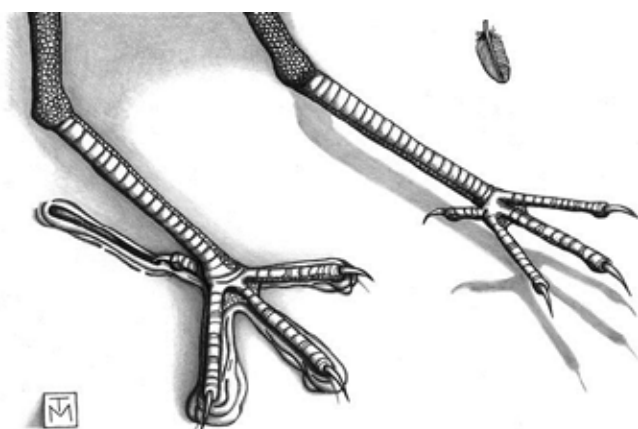
Based on my years of experience with Georgia coast bird tracks, these tracks were similar to those made by small herons or egrets that landed after flight. Ichnologists call such traces volichnia (flight traces), which are rare in the fossil record, but abundantly represented in soft substrates today wherever flying birds live. Some of the

most evocative of such traces are left in snow, such as those made by owls preying on small mammals, but they are common on beaches or river floodplains. Volichnia thus neatly answers the oft-asked question: why do birds’ tracks suddenly appear?

Frustratingly, the rock holding these tracks lacked any other evidence of that next step, as well as the other foot. The track was of the bird’s right foot. Volichnia made by landing birds have paired footprints, right and left together but slightly offset, and with one foot behind the other. But the slab of rock had no track behind this right-foot impression, and it was broken along the front edge of the middle digit. If this bird had landed with the right foot first – which I think it did – then the left foot would have been more than a track length ahead of the right. If so, it may be gone forever, taken by the coastal erosion of the Victoria coast.

How were these tracks found? Not by me, that’s for sure. They were discovered by the invaluable, indispensable and intrepid allies of desk-bound, exam-grading, lab-teaching, and meeting-imprisoned palaeontologists everywhere: volunteers.

On 29 November 2010 Museum Victoria volunteers Sean Wright and Alan Tait were at



How the right foot of a heron-like bird, combined with its behaviour and a wet, sandy substrate, could have caused the primary features in the Early Cretaceous bird track from Dinosaur Cove.

Drawing: A Martin



Close-up of landing tracks of a tricoloured heron (Egretta tricolour) on a loose, moist, fine-grained sand in the back-dune area of St. Catherines Island, Georgia. Notice how the hallux claw impression in the left foot is longer than the one on the right foot, which only shows up as a dot. Scale in centimetres.

Photo: A Martin

Dinosaur Cove, scouting for bones along its rugged, rocky shore. Excavated during the 1980s-1990s, Dinosaur Cove is about a three-hour drive west of Melbourne and was among the most logistically difficult dinosaur dig sites in the world.

Thus Sean and Alan were not searching randomly along the coast, but were looking for rocks that might contain fossil bones that had eroded out of the coastal outcrop. Instead of bones, though, Sean spotted the three-toed patterns of fossil tracks in a slab of rock amongst the boulders and cobbles in the surf zone. With this discovery, Dinosaur Cove was suddenly and inadvertently added to a very short list of Cretaceous vertebrate track sites in southern Australia.

At the time, Sean and Alan figured these were probably fossil footprints of dinosaurs, such as theropods or ornithopods, both of which make three-toed tracks. When Tom Rich emailed me photos of the tracks, I confirmed that they were tracks, and that they looked a lot like the theropod-dinosaur tracks I had described from rocks of the same age from Milanesia Beach, about nine kilometres east of Dinosaur Cove.

About four months later, on 31 March 2011, Alan Tait went back to Dinosaur Cove with some hand tools and a backpack, and broke the slab into four large pieces so they could be transported on foot: which he did, with all 45 kilograms on his back. For anyone who has hiked into and out of



Photo: A Tait

The slab with the oldest known bird tracks in Australia. The two on the right we diagnosed as from birds, whereas the one on the left is probably a mere non-avian theropod track.

Dinosaur Cove – which I have several times – this was a remarkable one-person recovery effort, one that some people might term as “crazy”. But this craziness paid off big time.

The bird tracks had also come in for a landing a second time on the rocky shore of Dinosaur Cove, having fallen off the outcrop as a consequence of coastal erosion. Tom recognized the rock as coming from a sandstone bed just above the Slippery Rocks Tunnel site, where he and many volunteers had dug, broke, blasted, sifted, cursed and otherwise laboured in their quest to collect the dinosaurs there.

Consequently, I asked Pat Vickers-Rich and Tom Rich to co-author a paper on these tracks, and was delighted when they accepted; sedimentologist Mike Hall of Monash University later joined us as a co-author, too. A year and a half later, in October 2013, the paper was finally accepted and published in the journal *Palaeontology*.

Notice I said “tracks”, as in plural. During the review process, it was suggested that the track just left of the “landing” track was another one. Although I had originally thought it was from a non-avian theropod, this was correct: it was from a bird’s left foot, and one with a foot close in size and form to the first, although it had a much less obvious hallux impression. One of the more interesting traits of this track, too, was how one of its digits flexed as the foot moved against the sand, leaving a curved impression.



Photo: A Tait

The Slippery Rocks Tunnel (SRT) site. The arrow shows where the slab holding the tracks was located. The probable source bed (SB) for the tracks is just above the tunnel.

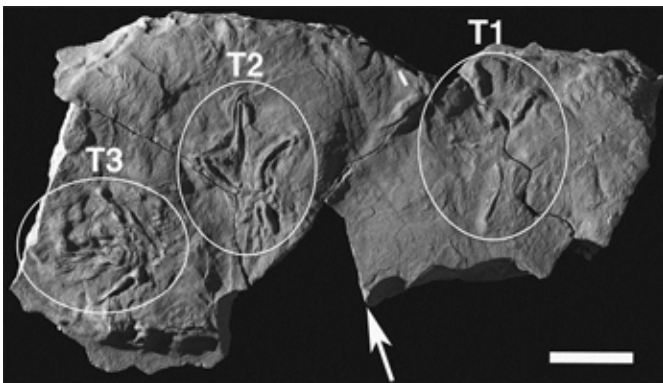


Photo: A Martin

The broken slab of rock. T1 and T2 are bird tracks, whereas the one on the far left (T3) is probably a non-avian theropod dinosaur track. The arrow shows where the rock was sampled for describing the nature of the original sediments

The third track presented a dilemma, as it had qualities of a thin-toed, non-avian theropod track – think something like an oviraptorid or ornithomimid – but easily could have been that of a bird, in which its hallux didn't register on the sand at the time. So we concluded that it was probably from a non-avian theropod, but are open to the possibility that it was from a bird, too.

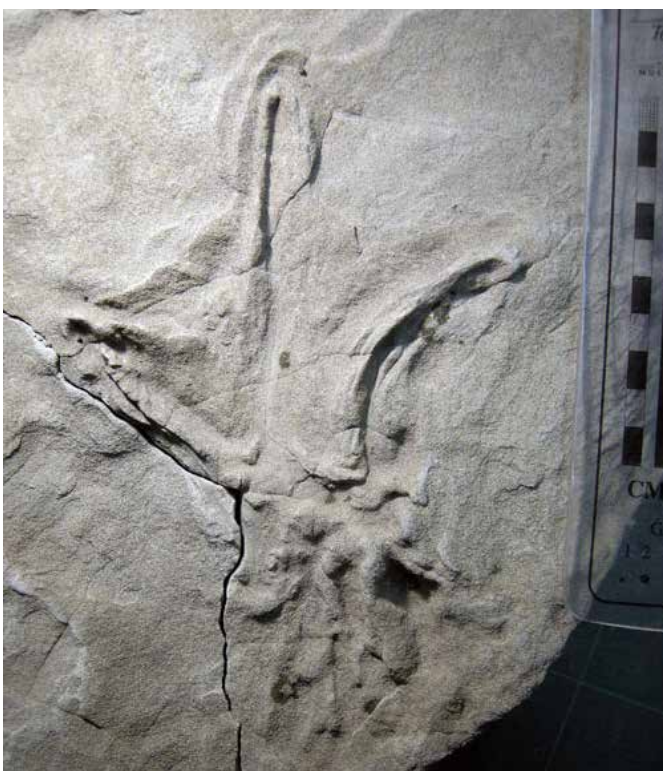


Photo: A Martin

Close-up of the other large bird track on the same surface and close to the first one. This one is probably just walking, not flying, but has the right anatomical traits for a bird, including a hallux impression on the lower right.



Photo: A Martin

The third track, probably a non-avian dinosaur.

This find should be celebrated as:

- The oldest known bird tracks in Australia.
- The only Early Cretaceous bird tracks in the Southern Hemisphere.
- The presence of fair-sized birds (herons or egrets) during the Early Cretaceous in a polar environment.
- Evidence for flight in an Early Cretaceous bird track, one of the few examples known in the world.
- The first vertebrate tracks known from Dinosaur Cove, a place previously famed for its dinosaur bones.
- The first dinosaur track from Dinosaur Cove.
- More evidence for Early Cretaceous birds in Australia to supplement the few bones that have been found thus far, including only a single furcula (wishbone) from Victoria.

All in all, it might just be three fossil tracks, but those three tracks just made the fossil record for the birds on an entire continent and the rest of the Southern Hemisphere just a little bit better. So now that they've landed, let's allow our imaginations to take off, and go find some more.

Reference:

Martin AJ, Vickers-Rich P, Rich TH, Hall M (2014) Oldest known avian footprints from Australia: Eumeralla Formation (Albian), Dinosaur Cove, Victoria. *Palaeontology*, 57: 7–19. doi: 10.1111/pala.12082



FINDING THE DINOSAUR COVE FOOTPRINTS

BY ALAN TAIT

On 29 November 2010, during the Eric the Red West dig, Sean Wright and I visited Dinosaur Cove. On the shore platform, about 15 metres from the Dinosaur Cove tunnel entrances, Sean noticed a slab of rock with footprints on it. The slab was wedged between other boulders and too large to move. As we had no large hammers or chisels with us, we noted its position for later.

During the next year's Eric the Red West dig (on 28 March 2011), I revisited Dinosaur Cove and recovered the footprints. The slab consisted of interbedded sandstone and claystone layers. I had only a large chisel and a 1.25 kilogram hammer but managed to split off the top sandstone layer of the slab along a claystone/sandstone boundary. The footprint layer cracked into four pieces while I was removing it, which helped with transport. I put two pieces (wrapped) into my backpack and carried the other two in shopping bags hanging from my shoulders. The four pieces weighed around 40 kilograms so I was not able to carry all four the whole way back to my vehicle but had to take them some of the way two at a time, especially on some of the steeper parts of the track.

I delivered the footprints to Dave Pickering at Museum Victoria on 31 March 2011 and I waited until this year for our find to be published.



Alan Tait on the day the footprints were found



THE NEW DINOSAUR DREAMING WEBSITE

BY ROBERT HUNTLEY

I created the website www.dinosaurdreaming.net in April 2012, and have maintained it as webmaster ever since. Building and maintaining websites is a hobby of mine — I now have eleven of them. The Dinosaur Dreaming website was originally intended as an additional website to the one run by Monash University. Its main purpose was to advertise the then new Book and CD, which feature prominently on the Home page.

Currently, the website includes the annual field reports for the whole 20 years of Dinosaur Dreaming and a featured site, fossil and activity. Older features are available to registered website visitors (crew, friends and casual visitors), of whom there are now 86.

The Dinosaur Dreaming website is now under reconstruction using more up to date programming. Eventually, it will replace the original Monash website. As part of this process, the site is being made more friendly to portable devices such as tablet computers and smart phones. This includes converting the rather ordinary early field reports (apparently scanned) into a more readable format (php/html), which considerably reduces their file sizes.

For a preview of the new Dinosaur Dreaming website, including this dramatic file size reduction, see www.dinosaurdreaming.net/DDnewSite/, but note that some menus are still under construction — expect broken links in those areas. Also, some pages in this preview are out of date (such as *Features*). Any comments on the new website would be welcome. The new website will not replace the existing one until all issues have been resolved. In the meantime, new material is being added to the existing website.



FRIENDS OF DINOSAUR DREAMING

BY GERRY KOOL

This year Friends' day was once again held at the Flat Rocks site but this time away from the usual summer excavations.

The dig this year was conducted in February at Eric the Red West near Cape Otway but this is not a very easy site to get to for the general public, particularly those with young children. Weighing up all the pros and cons, we opted to stick with the more accessible Flat Rocks site to conduct Friends' day.

Fortune would have it that part of the fossil layer in the cliff face had become detached some weeks before the set date, which gave us an opportunity to showcase something different from the usual "hole" and associated workings.

As we are not allowed (for safety and ecological reasons) to work the cliff face, it was fortuitous that this event had occurred, enabling us to remove this otherwise inaccessible layer without having to excavate. Hard hats and other safety precautions put in place, we were able to remove most of the layer to a safer place on the beach for processing by the volunteers.



Photo: L Koool

Wendy White signposts the starting point of the geology tour

Activities were available for the children and geology tours for all those interested in the make-up and prehistory of the site.

Finds from the February dig at Eric the Red West were also on show with dig leader David Pickering and others available to answer everyone's questions.

Many Friends took the opportunity to attend, with the weather once again being kind to us.

I would like to mention once again that without the Friends it would be much more difficult to run these digs. Thank you to all those who regularly subscribe.

It is with some sadness that we note the passing of Rhys Walkley in July. Rhys was a long time supporter and keen follower of all that occurred both during the digs, and in the subsequent research of the collected specimens.

Next year we may have to rethink the location of the Friends' day to enable more of our supporters to attend. Perhaps a day at Flat Rocks and a day at Eric the Red West?

Until then, happy digging, fossicking or whatever you may be up to.



Pip Cleeland and a selection of Friends' dinosaur designs



TRAVELLING FOSSILS

BY PAT VICKERS RICH

This year, material from Flat Rocks and Eric the Red West have been on show in three places.

The first was the ArtScience Museum at Marina Bay Sands in Singapore where several hundred thousand visitors saw material from these sites as well as the lovely Noddy documentary starring David Pickering. This was a popular exhibit — translated into Chinese! The exhibition was a joint venture with the American Museum of Natural History in New York and the San Juan Natural



“Human beings are the first species on the planet with the brains and foresight to really manoeuvre the future.”

Article in the Singapore Tatler

History Museum in Argentina. It occupied 4000 square metres and was one of the best ever shows of our material and the art of Peter Trusler.

Two other regional exhibitions that have showcased the Victorian polar dinosaurs and Peter Trusler’s work are now on show in Bathurst at the Fossil and Mineral Museum and in Geelong at the National Wool Museum. These exhibitions (Bathurst’s *Upstream/Downstream: The Flow on of Peter Trusler’s Art* and Geelong’s *SuperCroc and Polar Dinosaurs*) have been very successful and both were put in place at the request of those regional centres — they came to us, not we to them.

All of these exhibitions have been put together by PrimeSCI! and SCI!Expo based in the School of Earth, Atmosphere and Environment at Monash University.

CLOSE-UP

The Bone Whisperer

World-renowned palaeontologist and curator of Singapore’s latest dinosaur show PATRICIA VICKERS-RICH tells MELISSA GAIL SING about the perks and perils of being at the forefront of science

PATRICIA VICKERS-RICH’S idea of shopping is to dash in and out of a store within five minutes. On her recent visit to Singapore however, the globetrotting world-renowned palaeontologist and geologist found a good excuse for some real shopping: to get an outfit for this photo shoot.

“My daughter, who’s very eco-conscious, brought me to Anne Fontaine,” says the US-born Australian who was in town for the launch of *Dinosaurs: Dawn to Extinction*, at Marina Bay Sands’ ArtScience Museum. “The brand’s founder was born in Brazil, so she’s very aware of the need to protect the Amazon rainforest. I have great respect for her.”

Vickers-Rich herself is internationally respected for her contributions to science. Synonymous with Australia’s Dinosaur Cove, she and her palaeontologist husband Tom Rich made significant discoveries such as the *Leaellynasaura* (named after their daughter) and *Timimus* (named after their son). They also found the remains of an ancient river channel that used to exist on Australia’s south coast 30 million years ago. Outside of her home country, the founding director of Monash Science Centre in Australia has helped to build science museums in Timor-Leste, Argentina, Namibia, Russia and the Middle East. No stranger to Singapore, she has contributed fossils to the Lee Kong Chian Natural History Museum.

While she enjoys visiting cities like ours, Vickers-Rich is happiest out in the field. Over the past 40 years, she and Tom have led fossil digs in Australia, the Andes, Siberia, Saudi Arabia, South America and South Africa. “You’re the first to find things like an ancient tooth or a claw bone, small things that give an insight into things you really had no idea about before. Working with a pool of experts, you reconstruct what life was like in an area during a certain period. It’s amazing!” she says.

Vickers-Rich defies the stereotype of the straight-faced scientist with her animated ways and candid answers. However, talk to her about priceless fossils being auctioned for

millions of dollars and ending up as a trophies in someone’s living room, and she becomes dead serious: “It’s okay if people want to keep them for study, but it can make our work dangerous. I’ve worked in one place in Siberia where you cannot go into an area until after May, for fear of being shot by collectors there who deal illegally in fossils, selling them for large sums to private collectors,” she says, adding that one of her sites in Australia was almost compromised by people who excavated fossils just to profit from them.

Such illicit practices rob researchers of the chance to study significant fossils, an opportunity that is lost when a rare piece vanishes into a private collection. To counter this, Vickers-Rich, who chairs the UNESCO International Geoscience Program Scientific Board, encourages students to visit museums and exhibitions to see the real value of fossils. She also hopes to lead high-level tours for affluent individuals to dinosaur sites. “Together with other scientists, I’d take them to Australia or South Africa to appreciate, not collect, fossils. It’d be a lifetime experience, far more meaningful than a rock on a mantelpiece,” she says.

Even if the odds are sometimes against her, Vickers-Rich remains convinced of the sometimes-overlooked power of science and research, especially in terms of environmental sustainability: “We are facing some difficult times ahead. Human beings are the first species on the planet with the brains and foresight to really manoeuvre the future. We do this by looking into the past, looking at what’s going on now, and using this knowledge to ensure we don’t ruin the future,” she says.

“On the other hand, we’re also the first species that can destroy the planet. So it’s not just scientists that need this information; everyone needs it, to be able to make day-to-day decisions with wisdom for the best possible outcome.”

Patricia Vickers-Rich shares more about her youthful passions and ambitions on SingaporeTatler.com/may14

PHOTOGRAPHY: LUCILLE LACROIX/STYLIST: ANDREW WANG/UPISHA SHAW/LEUNG SEBASTIEN/PROFESSIONAL AND CHANNEL

SINGAPORE TATLER • MAY 2014

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Image supplied by P. Vickers-Rich

FABULOUS FOSSIL FINDS

It's all about the fossils. Here is a selection of some of the prettier ones that we found this season. Where known, the museum registration number (the "P-number") is captioned, as well as the Field Catalogue number. Museum Victoria photos by Darren Bellingham.



BY WENDY WHITE



P239460 Ornithopod mandible #429



P232654 Frontal ventral



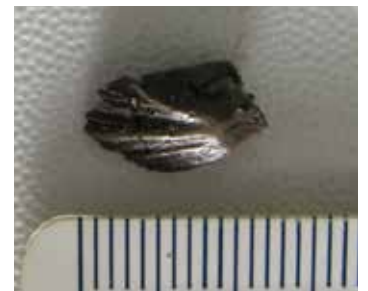
P239464 Araucaria Cone found by Astrid Werner #461



P250520 Ornithopod femur #309



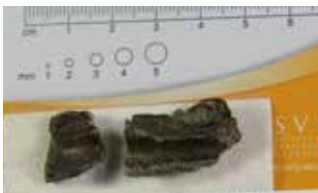
P250521 Scapula



P239457 Ornithopod tooth found by Saraj Alkemade #393



Two limb bones #23



P250527 Dinosaur vertebra found by Cate Cousland #40



P239455 Ornithopod tooth found by James Rule #50



P239459 Theropod tooth found by John Wilkins #236



P232653 Skull element



Femur and tibia found close together #295



P239461 Ornithopod pubis #54



P250525 Possible ornithopod jugal found by Chris Honrado #152



25 YEARS WALKING THE COAST

BY MIKE CLEELAND

2014 marks 25 years since I first joined the Dinosaur Dig team in January 1989, so I thought it appropriate to reflect on some highlights, milestones and fun moments from the recent past.

Dinosaur Cove was classic field palaeontology in those days, a rough camp in a bush setting full of people with common interests and diverse backgrounds. I had responded to an article in The Age Good Weekend magazine, travelled to Apollo Bay and got directions at the pub, and met Pat Rich at the camp. In between cooking for the crew and looking after her two kids, Pat managed to get me a helmet and a set of steel capped boots, and send me on down the track to Dinosaur Cove. By

odd coincidence, The Age Weekender returned 25 years later, to produce a story at the Eric the Red West dig this year.

My week at the Cove passed in a blur of rock dust, cliff climbing, rock breaking, food, wine and good company. Part of my job was to help one of the crew to drill holes in the roof of the tunnel with an upside down pneumatic drill, to allow for rock bolts to hold mesh in position (to stop rocks from falling on us).

Later that week I was to have my first taste of prospecting, at Marengo to the west of Apollo Bay. Lesley Kool showed me a rock with an exposed bone on the surface, which initially I couldn't recognise. She held it closer in front of me, but still nothing. It was only when she traced her finger around the bone that I was able to make out the well-disguised, but characteristically patterned, spongiosum of a typical dinosaur centrum. A team of us spent the day combing the shore platform, alas without success but always with the sense that the next big find was just up

Diggin' it

John Elder meets a disparate group of people drawn together by a shared passion for uncovering ancient bones.

PHOTOGRAPHY BY THOM RIBNEY

MIKE CLEELAND HAS THE LOOK of a digger on the verge of breaking off. He is, in fact, the middle dig of dinosaur hunting. One every two weeks, he'll head down to the beach on Phillip Island, Victoria, and walk the coast. He carries no shovel or pickaxe. He doesn't dig in search of fossils. He walks along, just looking. "See and then he finds a dinosaur looking back at him from the surface of the rock. Only there will be various his bones and blood, or rather the hole where he dug. It's for the professional to look over. But he's always looking at the point to see what his diggers." "If you're seeing things on the ground, that's a good bit there are some of them scattered in the paddock," he says.

Cleeland grew up a high school science teacher, in the environmental education officer at the National Environmental Centre at Werribee, where school groups came for a tour of the local dinosaur dig site. He was a small collection of dinosaur bones, including one that Cleeland keeps for educational purposes as a model of a world where almost all life forms (including dinosaurs) are amphibians that walked with the dinosaurs about 125 million years ago. "It looks like a horse up there," says Cleeland. "Except it's a dinosaur walking like a horse, the same size as a crocodile, with a helmet like that."

Then, however, the climate-change narrative and a planet of dinosaurs hunting in Victoria, discovered the first dinosaur fossils in 1976, but it was discovered, both in the north and the south, that the fossil description. Cleeland found a good part of his work, both in 1989. The species was described in 1997.

It was 1989 to be based on a 1000-year-old fossil which together makes more than 50 years ago in palaeontologists and have been studied since a described dinosaur appearing in the area, under the banner of Museum Victoria is building a picture of what life was like when Australia was still connected to Antarctica.



of New Agre from because his hearing, it was a moment (which isn't great for deep concentration). Rich is a senior lecturer of vertebrate palaeontology and palaeohistology at Monash University, and the museum the dinosaur skeletons get together in the first place. They're essentially concepts to his living room.

ON CHRISTMAS DAY, 1988, RICH was making a rock called AP (Dinosaur). He was 12 years old. The first dinosaur, something the end of the age of the dinosaur, instead an image of "fossilized dinosaur egg." He knew that a person who studies fossils is palaeontologist and, divided in his young years, that it's not the dinosaur that has to dig up over a - it's how you get it to see what it is. "It's not a fossil," he says.

In Rich's first year at the University of California, Berkeley, the palaeontology history was one Professor John Huxley, which is really in Australia in 1953 and discovered primate mammals. Rich was impressed when Rich the Academy was a wonderful of fossils coming to be dig up, in fact, Rich the first year and returned primate mammals. Rich was impressed when Rich the Academy was a wonderful of fossils coming to be dig up, in fact, Rich the first year and returned primate mammals. Rich was impressed when Rich the Academy was a wonderful of fossils coming to be dig up, in fact, Rich the first year and returned primate mammals.

Rich had found one of the volunteers at Dinosaur Cove in 1984. A number of two small children, the horizontal position, to make a hole in the ground and he had helped the digger on the dig and got a set of his bones. "I had a little bone and I was hooked. It changed my life."

It was Rich who, previously unexcited about the rock, Rich the museum had been looking for since he was 12 years old. "The first fossil, my first dig site." Rich later wrote of the discovery. "It was clearly a most unexpected moment to be found alongside dinosaurs in Australia. It is a fossil of a dinosaur, it is a fossil of a dinosaur, it is a fossil of a dinosaur." Rich later wrote of the discovery. "It was clearly a most unexpected moment to be found alongside dinosaurs in Australia. It is a fossil of a dinosaur, it is a fossil of a dinosaur, it is a fossil of a dinosaur."

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John Elder's article in The Age Good Weekender, featuring a prominent photo of Mike and Pip Cleeland, Saturday 31st May

ahead. Twenty-five years later, the next big find is still just up ahead...

I finally found my first bone late in January that year. Having returned from Dinosaur Cove, I was determined to head for the Strzelecki coast, armed with new knowledge of what the bones looked like and how to recognise the channels in which they were often found. In those days there had been almost no prospecting since Tim Flannery *et al* searched in the late 1970s, and the ensuing ten years had allowed erosion to expose a new surface. I lucked onto a temnospondyl centrum in an awkward crevice at the bottom of the cliff east of The Punch Bowl, and managed to dig it out with a hammer and screwdriver, mercifully causing relatively little damage with my inexperience and over-enthusiasm.

Few of life's experiences are as exhilarating as one's first genuine discovery, and that small, dark and otherwise relatively unremarkable bone must have wished it could get back into the rock after being turned over and over, examined from every angle and at every magnification, on the kitchen bench back home.

Erosion is the prospectors friend, and the discovery of the type specimen of *Koolasuchus cleelandi* at Rowells beach would not have happened without the removal of much overlying sand. It was, and remains, the biggest Cretaceous bone I have found, and I recall finding it difficult to convince myself that it wasn't part of a tree. It was only when the tell-tale labyrinthine infolding of the enamel and dentine became apparent under the hand lens in a sand-polished cross section through an exposed tooth that its identity could be confirmed.

The Punch Bowl Claw was another highlight of prospecting from those early days. After being introduced to palaeontology as a seven year old by poring over dog-eared pages of the *How and Why Wonder Book of Dinosaurs*, I was smitten with the thrill of searching for the big theropods. The isolated claw fragment was the missing piece, reinforcing the significance of Flannery's Allosauroid astragalus from Eagle's Nest. Since

then, it has been included in Roger Benson's study of Victorian theropods (Benson *et al* 2012).

Yes, there were lowlights. In one season Lesley and I spent nine days prospecting the enticing, expansive and inviting shore platforms of Harmers Haven, and found absolutely nothing.

The discovery of the Dinosaur Dreaming site at Inverloch was a seminal moment in the history of field research in this area. I recall a group of eleven of us prospecting in a line search pattern, when Ian Hawkins stopped for a rest and found himself sitting beside 3 bones. Eventually about 20 were found, exposed on the surface, that day.

Good friendships and fond memories were made over the ensuing years as the Inverloch dig became my annual working holiday. Resounding notes of "Good morning happy diggers!" before sunrise sessions on the beach, long nights of good food and raucous games of Balderdash, birthday celebrations for crew members, stunning night skies seen through the telescope and the firm tradition of "what's said in the spa stays in the spa" all contributed to a rich kaleidoscope of experience that may not be matched in many other fields of research.

It gets better. Pip Wilson and I became the second couple to marry after meeting at the dig site. Seeing the Monash Science Centre dinosaur costume dancing around the floor at our wedding reception could only be experienced among this group of special people.

Much can be promised for the next 25 years — new finds can be expected, new technology will change the field and open new windows on the past, and new people will refresh and invigorate our group. Watch this space for another 25 years.

Reference:

Benson RBJ, Rich TH, Vickers-Rich P, Hall M (2012) Theropod Fauna from Southern Australia Indicates High Polar Diversity and Climate-Driven Dinosaur Provinciality. *PLoS ONE* 7(5): e37122. doi:10.1371/journal.pone.0037122

I FOUND A FOSSIL!

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



BY WENDY WHITE



Mike Cleeland



Mel Mackenzie and Livvi Campell



Alan Tait and David Pickering



James Rule



Blaire Dobieki



David Pickering

Photo: B Dobieki



Victoria Seesaha

Photo: L Nink



Nick van Klaveren



Asti Fletcher

Photo: B Dobieki



Phil Spinks



Bronwyn Jeynes



Chris Honrado



Amber Craig



Jane Lindsay



Fabrizio Giabardo



Fotini Karakitsos



Blaire Dobieki



Lisa Nink



Chantelle Roberts



Lauren Swann



Maddy Lord and Amber Craig



Kim Davis



Lesley Kool

Photo: L Nink



James Rule



Mel Mackenzie



Tamara Camelleri

Photo: L Nink



Jacqui Tunney



Ture Carlson



Lauren Swann



Tim Ziegler



Tim Ziegler and Nova Taylor



Anant Khimasia



Mary Walters



Nova Taylor



Darren Bellingham



Hannah Carle



Fotini Karakitsos



Astrid Werner



Maddy Lord and Asti Fletcher



Nick van Klaveren



Sharyn Madder



Saraj Alkemade



Chloe Marie



Jane Lindsay



Sean Wright



Blaire Dobieki and Wendy White

Photo: L Nink



Kerrie Lee

Photo: L Nink



Joerg Kluth

Photo: L Nink



Mary Walters



Cate Cousland



Chantelle Roberts



I FOUND A FOSSIL (AT FLAT ROCKS)!

Although we spent most of this year's Field Season at Eric The Red West, we did spend 3 days digging at Flat Rocks. We found some fossils there, too.

BY WENDY WHITE



Mel Mackenzie



Nalani Villiers



Mel Mackenzie



Wendy White



Hannah Carle



Chloe Marie



Wendy Turner



Monique Winterhoff



Asti Fletcher



Joerg Kluth



Anant Khimasia



Mary Walters



Hannah Carle



John Wilkins



Bronwyn Jeynes



Doris Seegat-Villiers



Mary Walters



Lesley Kool



Hannah Carle



Miklos Lipscey



TOM'S 40 YEARS AT MUSEUM VICTORIA

A LETTER FROM ROBIN HIRST

Dr Thomas H. Rich commenced his career at Museum Victoria as Curator of Fossils on 8 July 1974. Now Senior Curator of Vertebrate Palaeontology and Palaeobotany, Tom has made contributions which are fundamental to our understanding of the evolution of life in Australia and it is fair to say that he has put palaeontology (especially dinosaurs) at Museum Victoria squarely on the map.

The major enduring work of Tom, with his wife and fellow palaeontologist Patricia, was recognized in 2000 by the National Geographic Society's Committee for Research and Exploration Chairman's Award:

In their investigations of vertebrate palaeontology in Australia, Dr Thomas Rich and Prof Patricia Vickers-Rich have accumulated an extraordinary record of life from the Age of Dinosaurs in Australia ranging from dinosaurs to mammals. This has completely revised our understanding of Mesozoic life at high latitudes. In recognition of their tireless and virtually superhuman efforts to gather and interpret fossils of great significance, this award is given.

Tom's career highlights over the last 40 years include:

- discovery of the oldest fossil mammals in Australia
- discovery of the most diverse polar dinosaur fauna anywhere on Earth
- direction of the longest running field excavation of dinosaurs in Australia
- writing of more than seven books on the vertebrate palaeontology of Australia, creating the majority of the primary literature, from university texts to children's books
- writing of dozens of magazine articles

communicating the significance of Australian fossils to the public

- co-organising several exhibitions on spectacular fossils, including the first major dinosaur exhibition in Australia (Dinosaurs from China) and the Great Russian Dinosaurs for Museum Victoria
- involvement in more than a dozen dinosaur-themed documentaries for BBC, Channel 4, ABC, National Geographic, NOVA and others
- mentorship and supervision of Australian scientists who began their careers as students of Tom, including Prof Tim Flannery, Prof John Long and Dr Erich Fitzgerald.

Tom's 40 years of putting Victorian palaeontology into the international arena are unsurpassed. Join with me in congratulating Tom.

Regards

Dr Robin Hirst

Director, Collections, Research and Exhibitions,
Museum Victoria

... AND FROM ERICH FITZGERALD

Over the course of four decades Tom Rich has doggedly pursued the Mesozoic and Cenozoic history of vertebrates in Australia, Gondwana, and elsewhere across the globe. Tom's tireless adage, "You need the will-to-fail to learn anything about the history of this continent" has challenged and inspired students, colleagues and volunteers to fan out across Australasia and Gondwana in quest of fossil vertebrates from the Devonian through Holocene.

His determination and success in uncovering the vertebrate palaeontology of Australia, with a special emphasis on Mesozoic mammals and dinosaurs (and their environments), has fundamentally enhanced our knowledge of vertebrate evolution in this part of the world.

Best regards,

Dr Erich M.G. Fitzgerald

Senior Curator of Vertebrate Palaeontology,
Museum Victoria



BIMBI BEAT

BY WENDY WHITE

We run this dig for the fossil finds and the science, but there is more to running a memorable dig than just hitting rocks with hammers. Each evening, tired diggers would make their way up the cliff and back to Bimbi Park ready to recharge by trading stories, playing games, making a little music and eating mountains of food.

Food

They say an army marches on its stomach, and an army of dinosaur diggers is no different. To be fair, Dave never made us actually march on our stomachs, but if he asked, we would've given it a red hot go. Once again we were fortunate to have Pip Cleeland in the kitchen, effortlessly turning out masterpieces like Jumbuck Stew and Casserole with Dumplings, and on a cold evening a bread-and-butter pudding to delight the crew. We were also lucky to have Tamara Camilleri run the kitchen for many days which meant we tried Maltese pasta and one night even got scones for dessert! Frank Fotinas from Bimbi chipped in with a couple of pizza nights (thanks Frank!) where the crew happily lined up to choose toppings for a gourmet pizza custom-made to their specifications. At morning tea we did miss our Norman-bikkies (Norman was unable to attend the dig this year), but shop-bought ones left no-one hungry. This



A Koala sleeping near the road on the way to site

Photo: A Craig



Wildlife warning sign on the road to Bimbi Park

Photo: S Wright

year was remarkable in that never once did we forget to bring down hot water, or tea bags, or milk and sugar – the fuel that allows us to work through the horizontal rain and blowing sand with a smile plastered on our faces.

Travel

The trip to and from the dig site is sometimes exciting, because tourists stop suddenly in the middle of the road around blind corners. That is because they've seen a koala in a tree and need a photo of it right now before it moves. We old hands know that there are dozens of koalas in the area – so many that Parks Victoria is treating it as a problem to be solved – and that they rarely move, at least during the day time. As it gets darker they might wander down the road and sometimes decide to stop and just sit in the middle of the road, but during the day time you can spot a koala, hit rocks with a hammer for eight or nine hours and trust that the koala will be in the same spot snoozing away when you return. But carloads of tourists do not understand this, and spontaneously form clusters of road hazards.



A Superb Fairy-wren near Bimbi Park

Photo: B Dobiecti



Photo: S Alkemade

Alan Tait points to ripples in the stone

Evenings

Evenings at Bimbi pass pleasantly. Before dinner, diggers often stroll through the bush looking for insects or spiders or birds. This year, Alan Tait (our resident sedimentologist) was striding along a pretty path when he heard a strange sound from the bush – something like a child crying. Upon investigation the sound was being made by a lost baby koala (perhaps six months old). The koala was rescued, named Winston, and a carer for him was found.

This year had the usual assortment of game-playing, and the common room verandah was our favourite hang-out. This was not always completely practical since the floor is made of wood with fairly wide gaps between the slats. One evening we were all entertained by John Willkins lying under the table for several hours attempting to retrieve a Scrabble® tile that had fallen through. We think it's still there. And that it is the letter H. Tamara Camilleri was somewhat luckier. Her phone also explored the underside of the verandah, but Alan Tait managed to rescue it for her.



Photo: A Craig

Socialising on the verandah at Bimbi Park



Photo: B Dobiecki

Quiz time at Eric the Red West

There were a number of musical offerings this year. Mike Cleeland was in fine form, sliding between keys with his usual enthusiastic abandon, and Hannah Carle gave us a more introspective interpretation of what a guitar could do. The biggest surprise was Chantelle Roberts, a classically trained soprano, who treated us to a selection of arias (some in foreign languages). Although not everyone raved about her Mozart warm-ups in the ladies' showers.

Cryptic crosswords become community consultations at the dig. Cate Cousland managed to find several old copies of The Age with crosswords that we completed, partially completed, or, in a couple of cases, passed from hand to hand to stare at in frustration.

At site

But crosswords were completely overshadowed by newspaper quizzes. The crew loves newspaper quizzes. The science questions are, unsurprisingly, answered quickly and accurately; the sporting ones often lie unanswered; and Doctor Who and Harry Potter questions are sniggered at for being too easy. One digger in every crowd seems to emerge as "in touch" with popular culture, and all of us lose touch with current events.

Sometimes the days get long and the fossils don't come. We made a number of exploratory holes in the shore platform that looked promising and yielded little. On those days the crew was forgiven for having side projects. The crew starts taking photos of each other. Then they start posing for photos of each other. Then they go all out and start staging photos of each other.



Photo: H Asgaard

Robin Long

That's when we get Alan Tait to run a geology tour of our beach, where he speculates about what was happening during the Early Cretaceous and points to ripples in rocks to explain why his speculations might actually be right. He's very good at that.

Some diggers arranged a pile of rocks into a love heart, although I'm not sure who was the target of that message.

One day, in order to battle the incoming tide and extend the usability of his favourite sitting spot, Nick van Klaveren decided to build a dyke. He spent most of morning tea time building it, but (alas!) it was washed away after less than an hour.

Diggers play with fashion in the field. Mary Walters may well be the fashion queen. She fashioned a hat out of a cushion and a feather, and accessorised with a broom.



Nick van Klaveren and Mary Walters protected by the dyke



Photo: A Craig

Love heart rock pile (Monique Winterhoff for scale)

Rain

Happily, we only lost one day due to rain. Crew napped, read books from the Bimbi Park book exchange (they have the usual campground mixture of bodice rippers, childrens' books and spy novels), or drove into Apollo Bay for shopping and the pub. I used the time to update the blog (dinodreaming.blogspot.com) which now has over 75,000 page views.



Joerg Kluth expertly tears tape for wrapping

Safety

We were almost injury free – Lauren Swann belted her hand with a hammer and was rewarded with a sling but nothing was broken and she continued to find fossils. And we don't count Bronwyn Jeynes who arrived with the tip of her finger bitten off, or Mike Greenwood who arrived with a big swollen eye socket. Joerg Kluth needed hammering instruction to take the strain off his wrist, but was an excellent wrapping assistant between practices.

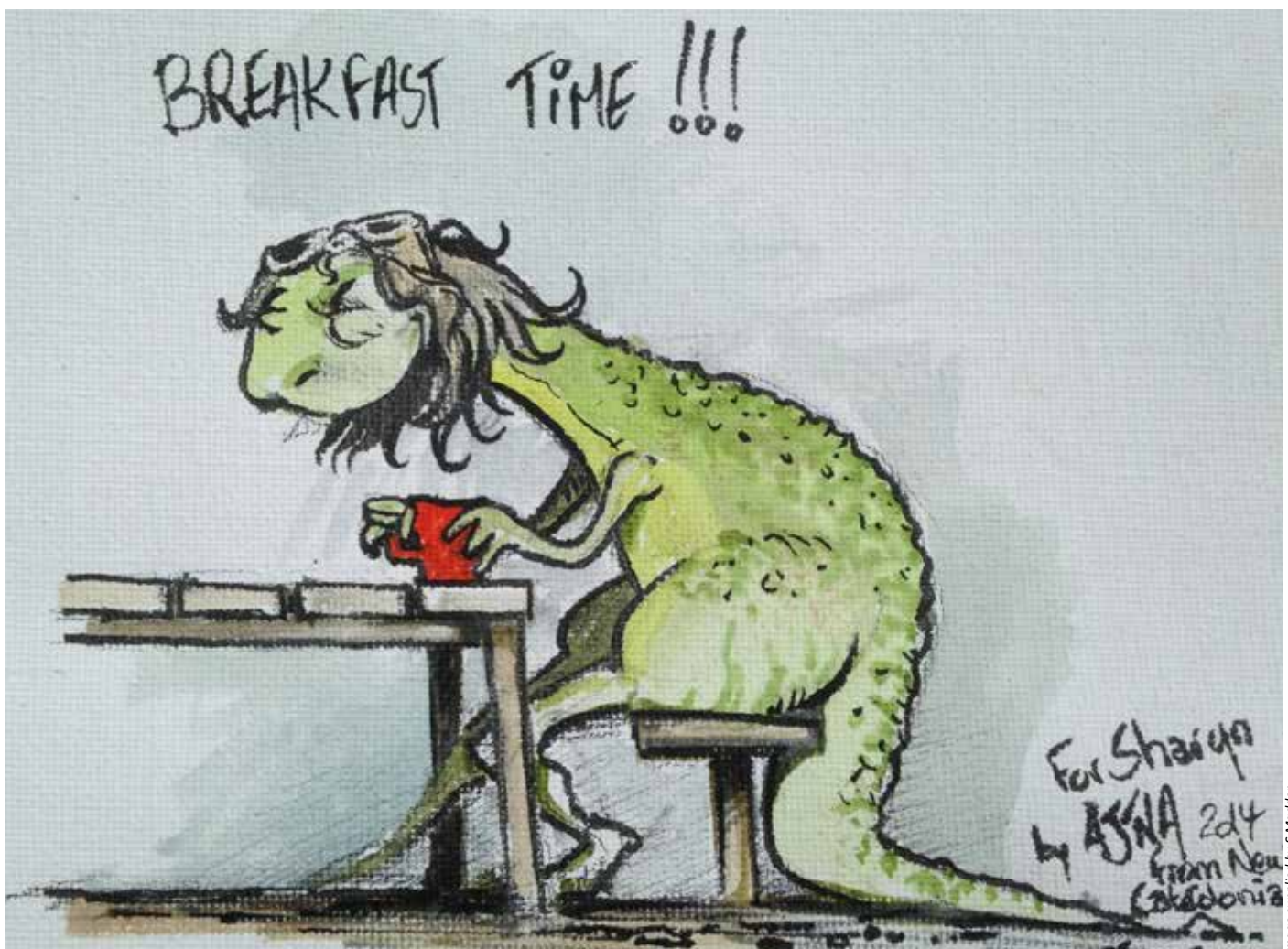
Absences

Rohan Long, who had not missed a dig for 12 years, was absent this year. His partner Hala, a less frequent digger most famous for hiding sweets in our toilet paper deliveries and introducing Gerry's BBQ to haloumi, was also nowhere to be seen.

Their first child, a daughter they called Robin, was born on 21 April. Congratulations to Rohan and Hala and best wishes to baby Robin.

Travis Park, palaeontology PhD candidate and digger since 2010 was also absent – he was married on 1 February and he and Heather decided that Travis leaving straight after the wedding for field work was not conducive to a long and happy union. Congratulations and best wishes to Travis and Heather.

Gerry Kool, who keeps threatening to retire from the dig, was stuck at home with a mangy cat, but he dropped off and picked Lesley up so at least we got to have a glass of red. He tells me that the cat is now fully recovered and is actually quite pleasant (for a cat).



New Caledonian artist Ajna's imagining of Sharyn Madder as a dinosaur (Ajna's work can be found at www.ajna.artsbook.net)

Image supplied by S Madder



OFF SEASON AT INVERLOCH

BY MIKE CLEELAND

“So, what happens at the Inverloch dig site for the rest of the year?”, I hear you ask. “Quite a lot!”, you may be surprised to hear.

I generate much of the activity, since my day job is Education Officer at the Bunurong Environment Centre in Inverloch. This involves interacting with incoming school groups, mostly from the Gippsland and Melbourne areas, on a range of activities including visits to the dig site. At the site, I show these groups around the prominent geological and palaeo features, then it’s an all in rock hunt! Students are shown how and where to find the erratic boulders of conglomerate on the beach in the vicinity of the dig site, then directed to bring them in for checking over. Although all these rocks have already been examined by dig crew members, the erosive effect of being tumbled over the beach by ocean waves at high tide regularly exposes new bones, and it’s actually rare for a group of students to spend half an hour combing the beach without someone at least finding something.



Mike Cleeland with a likely crop of budding palaeos

Photo courtesy of the Bunurong Environment Centre



Mike Cleeland’s fossil hunt stretches over the shore platform

Photo: L. Kool

Similarly during school holidays and over the summer period, regular visits are scheduled to the dig site, beginning at the Environment Centre.

Many of the bones recovered in this way are small, scrappy and indeterminate, but occasional teeth or other specimens of value have been recovered. In this event, the lucky finder is promised copious honour and glory, and receives a Certificate of Discovery recognising their find, which then becomes part of the Museum collection. Other dig crew members often get called in to help when I have a big group.

For more information see the Bunurong Environment Centre’s site www.sgcs.org.au.



A vertebra from the Flat Rocks site

Photo: L. Kool



DIARY OF A DINOSAUR DIGGER

BY BLAIRE DOBIECKI

Note to dino diggers: This is an article that I have written for the CSIRO's magazine 'Scientriffic', aimed at children aged 7+. This version is before their edit, but the final article is available in issue #91. I have been a regular writer for them since January, 2013.

Dinosaur digs happen all over the world, even in Australia. Scientriffic writer and Melbourne Museum presenter, Blaire Dobiecki, was lucky enough to volunteer on Museum Victoria's most recent dig in Cape Otway.

Introduction

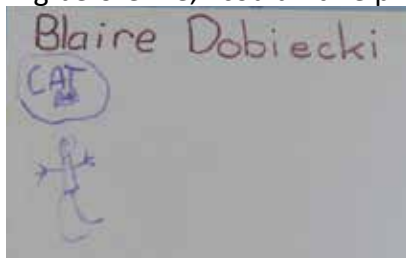
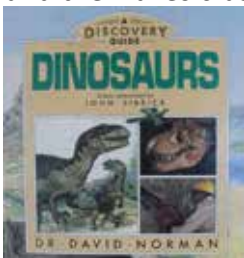
When I was four, my Dad took me to the local bookshop and told me I could choose any book that I wanted. I chose an illustrated scientific book by Dr. David Norman... all about dinosaurs.

From that moment, I loved dinosaurs. I now work at the Melbourne Museum as a presenter and get to walk beneath dinosaur skeletons every day.

That's why I couldn't wait to go on the Museum's 2014 dinosaur dig in Cape Otway, Victoria. This is the 21st year that Museum Victoria has held a dig and allowed members of the public to join in.

Day 1 – "What a great office!"

Walking out onto the beach with the sun shining and the waves crashing before me, I couldn't help



Blaire's dinosaur book with her name in the front cover

Photo: B Dobiecki



Photo: B Dobiecki

Looking at the ocean from the Eric the Red West site

but think "What a great office!" It is a beautiful place to work.

This dinosaur dig isn't like the movies. There isn't a giant skeleton laid out for a bunch of people to crowd around and sweep with brushes. The bones that have been found in Victoria are small and usually found in tiny fragments.

That's because most of the Victorian dig sites are old river systems or flash floodplains. When water flows quickly, bones are broken more easily.

This means the rock that the fossils are found in needs to be broken into small, sugar-cube sized pieces. The equipment is simple: safety glasses, mallet, hammer, chisel and magnifying glass.



Photo: B Dobiecki

The equipment our diggers need to find fossils

How to identify a dinosaur bone

Finding dinosaur bones isn't easy. That's why all the volunteers, myself included, had to do some fossil identification training before the dig. The sorts of things you need to look out for are:

- Clear edges or shapes.
- Colour: generally brown for bone.
- Inside bones is a spongy texture. It is called the 'spongiosa' and is a dead giveaway for a fossilised bone.

Unfortunately, there are always fossilised bones that will break these rules. They might be a different colour, have fuzzy edges or you can't see the spongiosa, so you have to ask the experts if you're unsure.



No heavy machinery is allowed. Parks Victoria issued a permit allowing us to dig, but only using equipment that can be carried down to the beach. This can include electrical items, just not big ones.



How to break rock into smaller pieces



Amber Craig's fossil, thought at the time to be a tooth

We had a tour of the site and I knew the dig had begun when I heard the clanging of hammers onto chisels.

I patiently chiselled at my own rock, looking for fossils and found nothing... until... at 3 pm, a fossil tooth from a carnivorous dinosaur was found by Amber, one of the crew members!

Day 2 – You always remember your first

The smell of salt water and sunscreen swept across the beach. Being on the dig site all day means you have to be sun smart!

It had been a slow day. Each rock I broke open revealed more rock and no fossils. Until at 2 pm... I found my first fossil! A tiny limb bone of a small-bodied ornithopod. I was told by the experienced crew members that you always remember the first



The hole!



Blaire and her first fossil find

fossil you find. It is truly amazing to crack open a rock and reveal a fragment of life that has not seen light for millions of years.

Day 3 – The hole

There are two main jobs on a dig: rock-breakers and hole-workers. Today I got to work in ‘the hole’. This is where big pieces of the rock are dug out for the rock-breakers to break into smaller pieces. It’s the rock which has been identified as having the best chance of finding fossils.

Day 4 – Bone of the day

Today was the best! I found not one, but TWO bones. One was awarded ‘bone of the day’! That’s because the palaeontologists think I found a furcula. That’s the wishbone from a bird.

If it really is a furcula (it must be confirmed in the laboratory*), it will be the second one found in Australia from the Cretaceous. Could it be an undiscovered species? I’ll have to wait and see. Either way, it will be kept in the Museum’s palaeontology collection forever.

Day 5 – Bone bonanza!

We hit the jackpot! Many fossils were found today, including my fourth dinosaur bone fragment.

There was much celebration back at the camp. A dinosaur dig is a lot like a school camp (without

*Editor’s note: Museum scientists do not think Blaire’s bone is a furcula. It has been registered in the museum collection as a probable haemal arch from a small-bodied ornithopod (which means it’s a dinosaur!).

How do you know where to dig?

Knowing where to find dinosaur fossils is all about rocks! But rocks are everywhere, so which ones are the ones with the fossils?

The type of rock must be ‘sedimentary’. That means that it was formed by layers of small sediments (mud, sand, pebbles) being pushed down on top of each other over time. Other types of rock like ‘igneous’ (volcanic) or ‘metamorphic’ (changed from heat and pressure) are formed in a way that cannot preserve bones. The rock also has to be the right age. The dig site at Cape Otway was known to have rocks from the Cretaceous age when dinosaurs lived (about 100-110 million years old) because early settlers to Australia had done geological surveys of the area and worked it out.

Sometimes dinosaur dig sites are found by luck because someone just saw some bone sticking out on the surface of a rock or on the side of a hill.

the teachers). There are lots of people around and you all eat meals together, play board games and quizzes and you get to sleep in cabins or under the stars in tents.

Day 6 – Time travelling

I’ve always wanted to travel back in time and today I realised that’s basically what I’m doing. Fossils tell us about the things that once lived on our planet, and the rocks surrounding the fossils can tell us what the environment was once like. Palaeontology and geology are windows into the past.

Day 7 – The final day

Today was sadly the last day and I didn’t find another fossil. In total the crew found 107 bones (I found four) and a handful of plant and shell fossils.

Not only did I learn a heap about digging up dinosaurs, but I have made a whole crew of new friends too! What a wonderful week. My four year old self would be proud!

MY FIRST DIG



BY CHANTELLE ROBERTS

After a lecture on Palaeontology in first year Geoscience, in which the lecturer Marion Anderson told us about the Dinosaur Dreaming digs, I marched down to the front and DEMANDED to know how to get involved.

A few months later, there I was breaking rocks.

As this was the first dig I've ever been on, I didn't really know what to expect. I figured that it would be a really good opportunity to make some friends, so I volunteered to give people lifts in order to know some other crew members before we got there. I gave a lift to Victoria, Jane and Anant who were also there for the first time, and we became very good friends.

When we arrived at Bimbi Park I was excited to meet so many interesting people. Throughout the week I had time to really think about the possibilities of where my studies could take me, and talking to members of the dig crew really opened my eyes to the opportunities out there.



Chantelle Roberts asks Mary Walters to check a possible fossil



Chantelle Roberts' first fossil

The first day seemed really long, but I quickly got used to the routine. I can still hear the "MORNING TEA TIIIIIMMMEE" alarm. There is something really satisfying about smashing a big rock into lots of little rocks, and it was really nice to be on the beach. The first bone I found looked like a stick at first but I noticed the white material on the inside, and sure enough, after I checked with Wendy, it turned out to be a tiny bone. I found 3 bones overall which I was pretty happy with. Each time I found one, I felt really happy, as though I was truly contributing to science.

One of the highlights of the trip for me (besides Pip's amazing cooking, of course) was how we managed to somehow squeeze other activities into the day after the long hours on site. We went on heaps of walks along the different nearby beaches and visited the koalas. I even had time to practise my classical singing and the crew let me perform for them. With the help of Mike Cleeland the following ditty was written (to the tune of *Oh what a beautiful morning* from Oklahoma!):

*There's a great pile of mudstone below me,
There's a great pile of mudstone beside me,
And we're breaking that rock with a hammering
knock!
And we're looking for fossils till it's time to stop...
Oh what a beautiful morning
Oh what a beautiful day
I've got a beautiful feeling
We're gonna find vertebrae...*

I want to thank everyone for giving me such a great experience and I look forward to the next dig!



DIG MEMORIES

BY TURE CARLSON

My name is Ture and I'm a student at Monash. I came down to Cape Otway for a week in February not knowing what to expect. I had images of Jurassic Park in mind as my friend Chris and I drove from Melbourne. When we arrived at the caravan park, I was disappointed that the large electric fences and automated tour vehicles featured in the movie were not covered in the dig budget, but I did hear rumours of a particularly vicious koala that had eaten a goat the night before!

In all seriousness, the experience itself was very different from what I had assumed but I came away from it with more than just a sore hammer

hand. I met many scientists, professional and amateur, that impressed me with their dedication, passion and knowledge of the area and the animals we were looking for. The feeling of breaking rocks hour after hour and seeing nothing — then, "Bingo!". A piece of bone from a creature that died millions of years ago appears and you realise that you are the only person in the history of humanity to have seen any evidence of this particular creature's existence. It is pretty special and it makes you feel connected to science, to history and to the world.

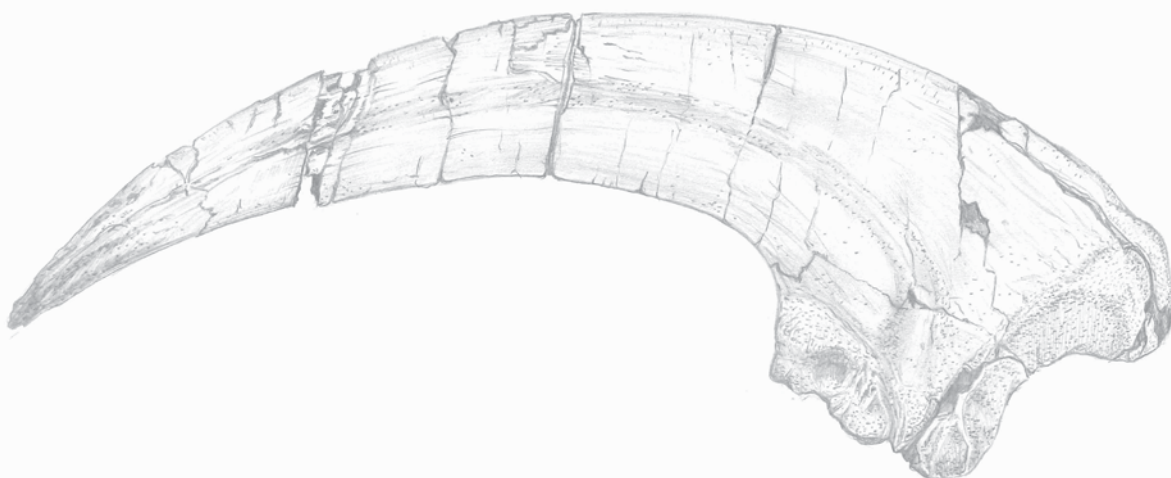


Ture Carlson shows off a fossil find



A SKETCH OF THE 2014 CLAW

BY SAM MILKOVITS



FASHIONS IN THE FIELD

Once again the Dig Crew show that field wear does not have to be boring or khaki. Or at least not all boring and khaki.



BY WENDY WHITE - FASHIONISTA



Nova Taylor and Livvi Campbell show style is compatible with sun-safe

Photo: S Alkemade



Pip Cleeland strikes a pose



Corrie Williams — a classic scarf adds class to any dig



Hannah Carle. "The kids' raincoat was cheaper"



Mary Walters invents a hat



Saraj Alkemade with gaiters that never go out of style



Mary Walters in one of her more dashing ensembles

Photo: L Nink



David Pickering goes retro



Lauren Swan in rain-wear



Chloe Marie in purple pantaloons



Fotini Karakitsos, John Swinkels and Lisa Nink pose in caps and hoods



Amber Craig, Monique Winterhoff and Fotini Karakitsos model hats and jackets



Lisa Nink and Tim Ziegler soften the bandito look with a smiley face bandana



John Wilkins takes fashion by the horns in a move not universally understood by the pundits

Photo: L. Koal

ERIC THE RED WEST DIG FIELD CREW

2 - 23 FEBRUARY 2014

Saraj Alkemade	Mel Mackenzie
Darren Bellingham	Sharyn Madder
Tamara Camilleri	Chloe Marie
Livvi Campbell	Lisa Nink
Hannah Carle	David Pickering
Ture Carlson	Tom Rich
Mike Cleeland	Chantelle Roberts
Pip Cleeland	James Rule
Peggy Cole	Victoria Seesaha
Amber Craig	Jacque Smith
Cate Cousland	Phil Spinks
Kim Davis	Lauren Swann
Blaire Dobiecki	John Swinkels
Asti Fletcher	Alan Tait
Fabrizio Giabardo	Nova Taylor
Michael Greenwood	Jacqui Tumney
Chris Honrado	Nick van Klaveren
Bronwyn Jeynes	Mary Walters
Fotini Karakitsos	Astrid Werner
Anant Khimasia	Wendy White
Joerg Kluth	John Wilkins
Lesley Kool	Corrie Williams
Kerrie Lee	Monique Winterhoff
Jane Lindsay	Sean Wright
Miklos Lipscey	Tim Ziegler
Maddy Lord	



Lisa Nink, Bronwyn Jeynes, Asti Fletcher, Nick van Klaveren, Maddy Lord, Fotini Karakitsos, Blaire Dobiecki, Chloe Marie, Amber Craig, Monique Winterhoff — happy diggers at Bimbi Park

FRIENDS' WEEKEND DIG FIELD CREW

22 - 23 MARCH 2014

Hannah Carle	Lesley Kool
Mike Cleeland	Miklos Lipscey
Pip Cleeland	Sharyn Madder
Peggy Cole	Lisa Nink
Amber Craig	David Pickering
Kim Davis	Doris Seegets-Villiers
Blaire Dobiecki	John Swinkels
Eve Eidelson	Alan Tait
Nicole Evered	Nova Taylor
Alan Evered	Wendy Turner
Asti Fletcher	Nalani Villiers
Bronwyn Jeynes	Mary Walters
Fotini Karakitsos	Wendy White
Joerg Kluth	John Wilkins
Gerry Kool	Monique Winterhoff



Monique Winterhoff, Wendy White, Hannah Carle, Joerg Kluth, Nova Taylor, Wendy Turner, Amber Craig and Bronwyn Jeynes made signs for Friends' Day

FIELD CREW PHOTOS

ERIC THE RED WEST WEEK 1 CREW



Photo: L Nink

L-R Back Row:

- Monique Winterhoff
- Bronwyn Jeynes
- Fotini Karakitsos
- Nick van Klaveren
- Blaire Dobiecki
- Chloe Marie
- Maddy Lord
- John Swinkels
- Amber Craig
- Mike Cleeland

Middle Row:

- Wendy white
- Kim Davis
- David Pickering
- Miklos Lipscey

Front Row:

- Mary Walters
- Alan Tait
- James Rule
- Asti Fletcher

ERIC THE RED WEST WEEK 2 CREW



L-R Standing:

- Lisa Nink
- Lesley Kool
- David Pickering
- Darren Bellingham
- Sean Wright
- Jacqui Tumney
- Victoria Seesaha
- Kerrie Lee
- Mary Walters
- Jane Lindsay
- John Wilkins
- Nick van Klaveren

Seated:

- Chantelle Roberts
- Anant Khimasia
- Joerg Kluth

ERIC THE RED WEST WEEK 3 CREW



Photo: L Nink

L-R Standing: Tim Ziegler, Darren Bellingham, Kerrie Lee, Mary Walters, Lauren Swann, Astrid Werner, Nova Taylor, Mel Mackenzie, Cate Cousland, David Pickering, Sharyn Madder
Seated, Crouching, Reclining: John Wilkins, Saraj Alkemade, Hannah Carle, Livvi Campbell, Fabrizio Giabardo, Nick van Klaveren, Alan Tait, Wendy White

FRIENDS' DAY DIG CREW



L-R Standing: Mike Cleeland, Alan Tait, Wendy Turner, David Pickering, Lesley Kool, Gerry Kool, Wendy White, Mary Walters, Eve Eidelson, John Swinkels, Pip Cleeland, Sharyn Madder, Joerg Kluth, Miklos Lipscey, Kim Davis, Bronwyn Jeynes, Monique Winterhoff, Asti Fletcher, Amber Craig
Seated, Kneeling: John Wilkins, Alan Evered, Nalani Villiers, Doris Seegets-Villiers, Lisa Nink, Fotini Karakitsos, Nicole Evered

METRIC 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

