DINOSAUR DREAMING 2010 FIELD REPORT

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www.dinodreaming.blogspot.com

Front and back cover images: The Dinosaur Dreaming crew show off their crew t-shirts at the Flat Rocks site

Setting up the Dinosaur Dreaming site at Flat Rocks

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Dinosaur Dreaming 2010 Field Report

By Lesley Kool

Dinosaur Dreaming 2010 was the 17th annual field season at the Flat Rocks site near Inverloch. Although 17 fossil localities have been discovered over the last 25 years of prospecting along the Bass Coast of Victoria, the Flat Rocks site, near The Caves, is the only site where excavations are carried out on an annual basis. This site was discovered in 1991 by a group of enthusiastic fossil hunters from Monash University and Museum Victoria. It was long known that the rocks outcropping along the Bass Coast contained the remains of dinosaurs after the discovery of Australia's first dinosaur bone in 1903 at Eagle's Nest, near Cape Paterson. Regular prospecting along the coast since the mid 1980s had turned up isolated fossil bones, but it wasn't until 1991 that the team came across a four metre wide layer of conglomerate rock, near The Caves, in which more than 20 fossil bones were exposed on the surface. This discovery turned out to be the largest concentration of Early Cretaceous bones and teeth ever found in Victoria.

Since annual excavations began in 1994, more than 10,000 fossil bones and teeth have been removed from this one fossil layer. Admittedly, many of the bones are small and fragmentary and contribute little to our knowledge of the animals that lived and died in this area 120 million years ago. However, a small percentage have been identified as belonging to a steadily growing list of animals that includes dinosaurs, mammals, birds, plesiosaurs, pterosaurs, turtles and fish.

The main objectives for the 2010 field season involved the continuation of excavations at "Bridge East" (see map) and the exploration of the most easterly edge of the fossil layer, closest to the sea. Site manager, John Wilkins, came up with an ingenious plan to help keep most of the sand out of the Bridge East area. He and some of the crew constructed a pipe wall, made up of a number of hollow plastic pipes stacked on top of one another and pinned into place with rock bolts. The whole construction had to be assembled between high tides and it was a close call at the end as John secured the last bolt with the tide lapping around his knees. The wall did keep most of the sand out of the Bridge East area and John is working on an improved version for future digs.

John Wilkins putting the finishing touches on the pipe wall

A number of dinosaur limb bones were found in the area we dubbed "Far East", many of which were incomplete and broken prior to burial. One limb was so badly damaged that one end had been snapped off and forced against the shaft of the bone at an angle.

Limb with damaged end

One unfortunate dinosaur tibia (lower leg bone) just happened to lie exactly where a vertical drill hole was made. The drill went right through the mid shaft of the bone leaving semi-circular cut marks where the bone had been.

Cross-section of limb in drill hole

Another bone, also found at Far East, was nicknamed "Pork Chop" when it was found as its cross-section in the rock defied identification. Because it was so unusual, it was given priority for preparation after the dig ended.

After preparation it became more obvious as to what it was – a dinosaur ilium, part of the hip of an ornithopod dinosaur. Tom Rich elaborates on the significance of the specimen in his report. It is a great example of how various cross-sections through the bone can be very deceiving.

The 'pork chop' bone

Towards the end of the dig some possibly associated limb bones were found at Far East, situated only centimetres apart from one another in the fossil layer. This caused great excitement as no articulated bones have been found at the Flat Rocks site since excavations began in 1994 and we were hopeful that our luck had changed. However, initial preparation revealed that although two of the bones were dinosaur lower leg bones; a femur (thigh bone) and fibula (one of the bones in the lower leg), the lower half of the femur was missing prior to burial, which prevents any indication that they were once articulated. The third bone is a metatarsal belonging to a larger dinosaur and unfortunately it is also missing one end.

Associated bones before preparation (top) and after some preparation to expose the bones (bottom)

The discovery of so many broken or incomplete limb bones from the area known as Far East is associated with a large number of fossil tree trunks and limbs. Sedimentologist, Alan Tait studied this part of the Flat Rocks fossil layer during the dig and gives his interpretation of what may have taken place in his report.

The 'Far East' excavation site

Also found in the Far East area was possibly the third large ankylosaur osteoderm – one of the bony plates in the skin of the armoured dinosaurs. Two large osteoderms, the size of saucers were found in the Bridge East area in 2008. This third osteoderm was only metres away from their position. The cross-section through the bone looks similar to one of the original bones, but it will be some time before it is prepared and pieced together. Then it can be compared with the other specimens.

Ankylosaur osteoderm

A number of small dinosaur teeth and a well-preserved plesiosaur tooth were found during the dig. Thanks to the generous donation of a portable microscope by Wonthaggi optician Dennis O'Donnell, we were able to photograph the tiny teeth and display them on a computer screen for the crew to admire. Here are examples of some of the teeth taken with the microscope:

small ornithopod dinosaur tooth

theropod dinosaur tooth

plesiosaur tooth

ornithopod dinosaur premaxillary tooth

Teeth photographed with the microscope from Dennis O'Donnell

Ace prospector Mike Cleeland has had a busy year so far. Not only did he and Pip Blackie tie the knot in April, but he found a few interesting bones during the dig. Mike's forté lies in spotting exposed bones on the shore platform that everyone else misses. This year was no exception. One of the bones he discovered, west of The Caves in a small boulder, looked initially like an ornithopod dinosaur femur (thigh bone). However, on preparation, it turned out to be a large toe bone (phalanx). Interestingly, the bone is solid, with no pulp cavity, which suggests that it came from an ornithopod dinosaur. If so, this toe bone indicates that there were large plant-eating dinosaurs roaming the area 120 million years ago, not just the small fast-running ornithopods like *Qantassaurus intrepidus*. Interestingly, this conclusion is supported by the dinosaur ilium discussed in Tom Rich's report.

Mike also found something in the third week of the dig that, on the day, was described by the crew as “bone of the dig”. First time volunteer Michael Thomas had the thrill of being with Mike when he found the fossil, an experience he won’t forget for a long time. It was hard to say what Mike had found, but it looked very interesting. Tom describes just how interesting it turned out to be in his report.

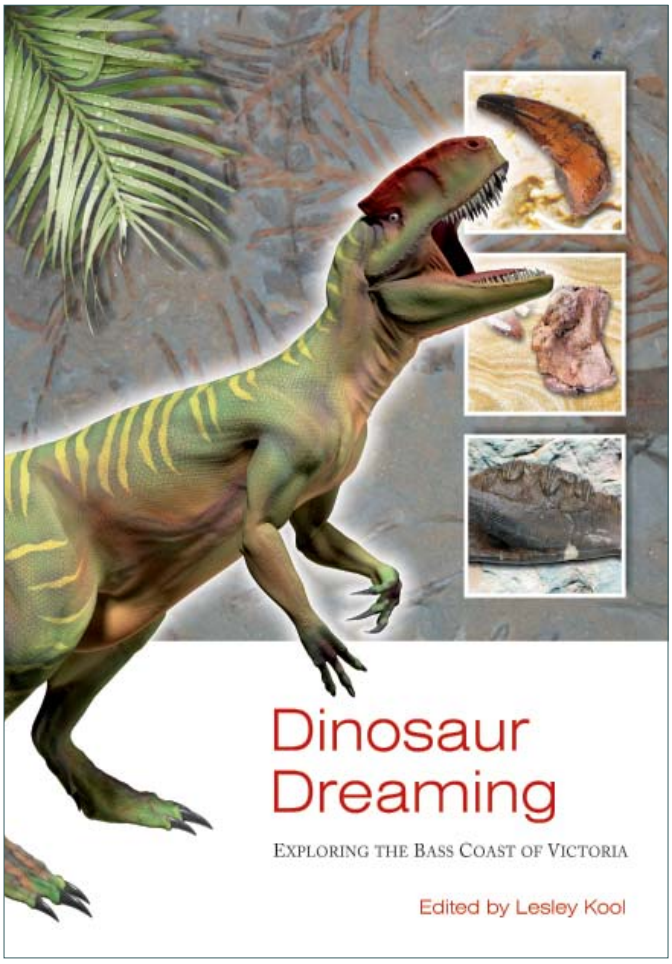
Phalanx found by Mike

Research on the fossil turtles from the Bass Coast took a small step backwards this year when the specimens that had been sent for study with Dr. Gene Gaffney at the American Museum of Natural History in New York were returned to Museum Victoria. Dr. Gaffney has recently retired and found that he could not devote the time to the study of the Victorian turtles and so returned them so other researchers might have the opportunity. On a more positive note, Australian fossil turtle researcher, Dr. Elizabeth Smith gave us access to her thesis on the Early Cretaceous turtles from Lightning Ridge in New South Wales. Elizabeth’s thesis will hopefully shed some light on the comparisons between the Victorian and New South Wales turtles. Initial comparisons suggest that the two groups are closely related and we look forward to further collaboration with her.

Much of the last 12 months has been devoted to updating the small Dinosaur Dreaming booklet, which has served us so well for the last 10 years or so. We were fortunate to receive grants from the Bass Coast Shire Council and Parks Victoria which enabled us to produce a much expanded version of the old green booklet.

The new colour version includes information on all the fossil localities along the Bass Coast as well as a more in-depth look at the premier locality at the Flat Rocks site. Answers to questions such as “what colour were the dinosaurs?” and “how old were the dinosaurs?” are also included. The introduction includes personal memories from the three men who kick-started dinosaur hunting in Victoria in the late 1970s – Rob Glenie, Tim Flannery and John Long. We hope that the booklet will answer many of the questions researchers have been asked over the years we have excavated along the Bass Coast.

The booklet retails for $19.95 but Friends of Dinosaur Dreaming and crew-members (past, present and future) will receive a generous discount.



The all new Dinosaur Dreaming booklet

The 2010 field season ran for four weeks, encompassing the whole of February. More than 60 volunteers took part, including our first Finnish volunteer (Heikki Kokko), as well as Aida Crombach from New Zealand and Francesca (Frankie) Hornsby from the UK. We were delighted to welcome back many "old" faces, some of whom have been involved with the dig for many years. So, it was a good mix of experienced and new volunteers, which is a great combination to have on such a dig.

Monash University student Daniel Thompson visited the site during the dig to announce that he had been able to identify the fossil bivalves found at Flat Rocks. In a paper in the September edition of Alcheringa he describes the bivalves as belonging to the genus *Megalovirgus*, which indicates a close link between Cretaceous freshwater bivalves from New Zealand and southeast Australia. Thanks to Daniel our fossil molluscs now have a name.

Megalovirgus

Also joining us during the dig was the winner of the *New Scientist* competition – Melissa Hetherington. Melissa arrived with her brother Owen and *New Scientist* representative, Dr. Janine Young. They spent an enjoyable couple of days learning about the dig and how to find fossil bones and Owen even found a fish jaw. They joined us for dinner on their first night in Inverloch and got to see how the dinosaur dig crew relaxed after a hard day on the beach. They were extremely interested in the excavations and the history behind it and were enthusiastic participants in the dig.

Other visitors to the dig included *Australian Geographic* reporter Kylie Piper who spent a couple of fun-filled days interviewing the crew and taking photographs for an article that appeared in the July-September 2010 edition. Entitled "Journey to the Past" the article opens with an amazing early morning image of the Dinosaur Dreaming crew on site as the sun comes up. It is a comprehensive review of all the major dinosaur sites in Australia and is well worth reading.

We were also visited by a Japanese film crew who were making a documentary on Australian animals, including our dinosaurs. The footage was used on a Japanese quiz show where contestants had to answer questions relating to the dig. Mike Cleeland is the star of the documentary, even though the show was in Japanese and his voice was dubbed. It was very entertaining.

Dinosaur Dreaming 2010 was also the end of an era. Since the first dig in 1994 the Dinosaur Dreaming crew were fortunate to be able to stay in the same "dig house". Although the house has changed owners during that time we were able to continue renting it each field season. The house was a perfect "dig house" – an older style home on a half acre block in Inverloch, just a few kilometres from the Flat Rocks site. There was plenty of room for tents and a rock-breaking area in the back garden and the house itself was cosy and welcoming. Unfortunately for us, the owners, Dallas and Jude Wyatt decided that it was time for them to make the move from their old home in Echuca and take up permanent residence in Inverloch.

After some frantic searching, we were able to find a new home for the Dinosaur Dreaming crew. Through a "friend of a friend" we found a suitable replacement in Cape Paterson, which should suit our crew perfectly. So we want to take this opportunity to sincerely thank Dallas and Jude for allowing us to take over their home every year for the last 17 years. We didn't break too much and what we broke we fixed.

We will keep those wonderful memories of the great discoveries made in their back garden – the *Qantassaurus* jaw in 1996 and the first mammal jaw in 1997. We wish them as much happiness in their "new" home as we have had over the years.

Now we look forward to our new home in Cape Paterson. Thanks to Norman and Meredith for introducing us to Andrea Ellis.

In May 2010 Tom Rich and Tony Martin, the researcher who found the first dinosaur footprints at Inverloch in 2006, embarked on "The Great Cretaceous Walk". They undertook the mammoth task of walking the Bass Coast from Inverloch to San Remo and the Otway Coast from Lorne to Lion Head, in search of more tetrapod tracks and fossil burrows. It took them four weeks to accomplish and Tony gives us an informative and entertaining synopsis of that epic journey.

FUTURE DIGS

Over the last 26 years, since the first dinosaur dig in 1984, many thousands of fossil bones have been collected. However, only a small percentage of these bones have been fully prepared, or removed from the rock. The preparation of a single bone can take days, sometimes weeks. Consequently there are boxes of unprepared fossils still waiting to be checked. It was decided during the 2010 field season that it might be necessary to postpone our 18th field season until some of the backlog of specimens was cleared.

However, on reflection we have decided to compromise and hold a three week dig in February 2011. We will excavate only as much rock as can be processed on site each day and will work on re-processing previously collected material at the dig house. Hopefully this will satisfy the crew's urge to dig and process some of the backlog at the same time.

One tiny specimen found during the 2009 Otway dig at Eric the Red, near Cape Otway, has led to two digs being planned; one for later this year and one in late March 2011. Tom Rich discusses the implications of this tiny fossil in his report and the reasons why we need to return to the Otways.

ACKNOWLEDGEMENTS

Dom and Tracey Brusamarillo and their wonderful staff at the Foodworks Supermarket in Inverloch looked after our grocery needs with a generous discount. We really appreciate the support they have given the dig over the years.

Lee-anne Knight and Michelle O'Leary from Blundstone Pty. Ltd. made sure that the dig crew got their steel-capped boots prior to the start of the dig. Blundstone has been supporting the dig for a number of years now by donating steel-capped boots for the field crew and for that we are most grateful.

Wonthaggi optician, Dennis O'Donnell presented the dig with a portable microscope and we would like to thank him for his generous donation.

Gerry Kool pleased after a hard day's work

THE STRZELECKI GROUP VICTORIA

MAP B) EARLY CRETACEOUS FOSSIL LOCALITIES IN THE STRZELECKI GROUP

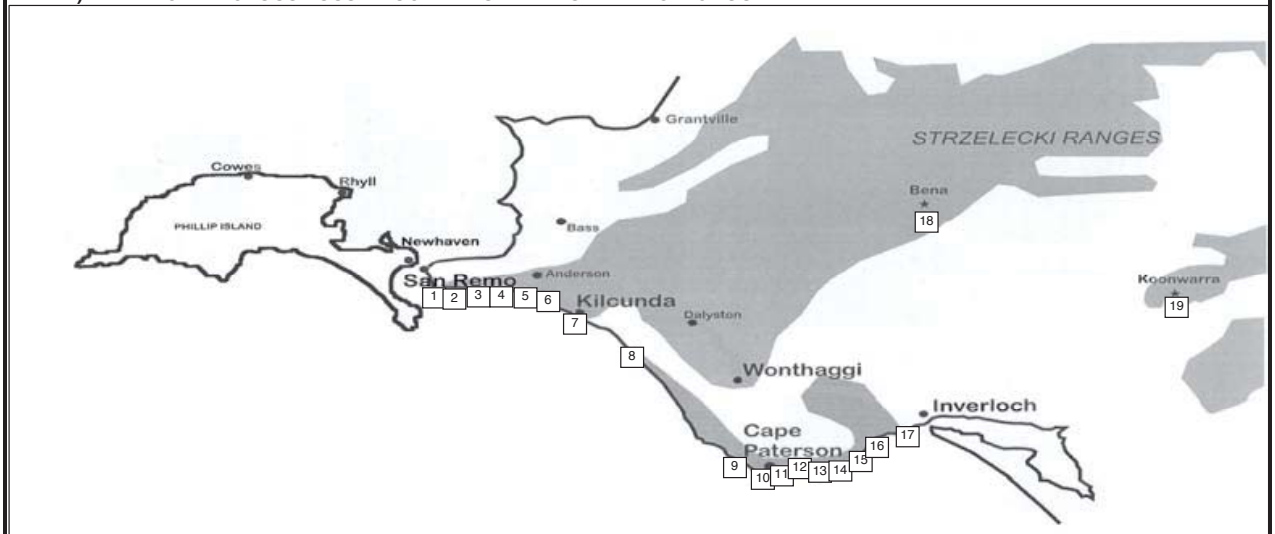
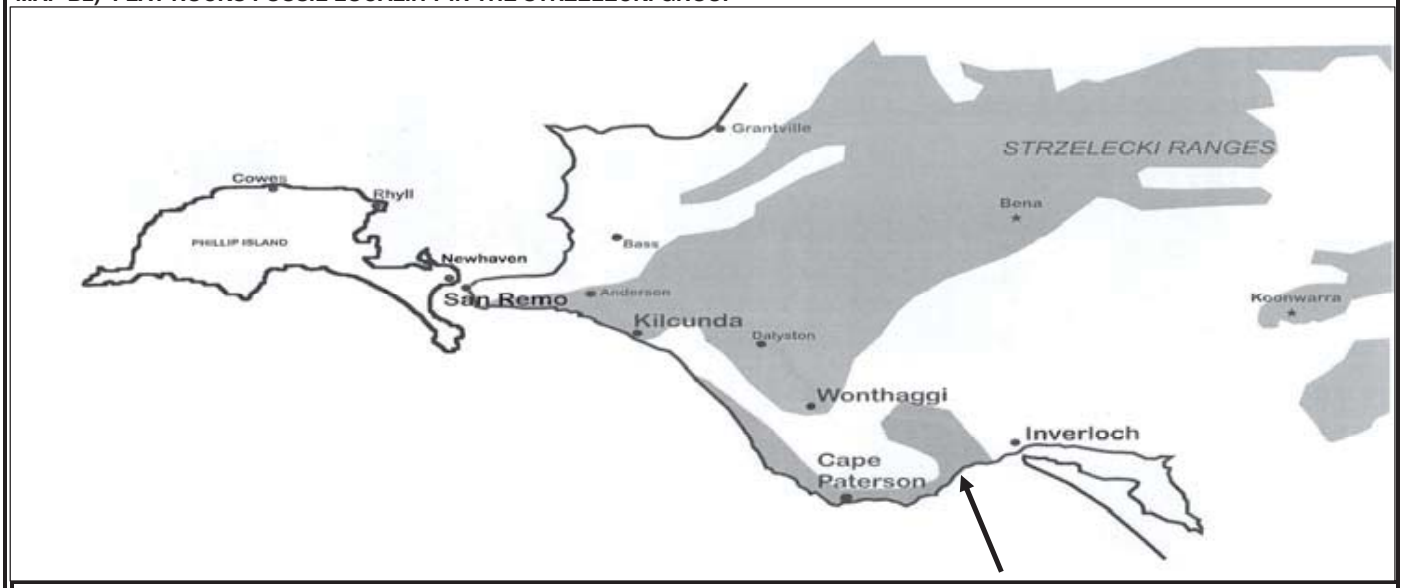


TABLE 3: Distribution of taxa recovered from the main fossil localities within the Early Cretaceous sediment of the Gippsland Basin	Map Key #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
TAXA		San Remo	Potters Hill	Rowell's Beach	Punch Bowl	The Arch	Blackhead	Kilcunda	Powlett River	Harmers Haven	Cape Paterson	The Oaks	Twin Reefs	Shack Bay	Eagles Nest	The Caves	Flat Rocks	Inverloch	Bena	Koonwarra
MAMMALIA:																				
Theria																	X			
Ausktribosphenos nyktos																				
Ausktribosphenos sp.																				
Bishops whitmorei																				
Monotremata:																	X			
Teinolophos trusleri																				
Multituberculata																	X			
Corriebaatar marywaltersi																				
DINOSAURIA:																				
DINOSAUR indet. (Unidentified)		X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	
Ornithopod dinosaurs		X	X		X	X	X	X	X						X	X	X			
Fulgurotherium australe						X									X					
Qantassaurus intrepedius																X				
Theropoda		X			X	X	X	X	X					X	X		X			
Ornithomimid		X					X										X			
Megaraptora						X									X					
Ankylosaurs/nodosaurs						X											X	X		
Protoceratopsidae						X														
Serendipaceratops arthurcclarkei						X														
Other Vertebrates:																				
Plesiosauria									X						X		X	X		
Pterosauria															X		X			
Testudines							X		X		X				X	X	X	X	X	
Aves																	X			X
Dipnoi		X			X			X	X					X	X		X	X		X
Neoceratodus nargun					X										X		X			
Archaeoceratodus avus															X					
Temnospondyli																				
Koolasuchus cleelandi		X	X	X	X															
Teleostei						X	X		X						X		X		X	X
Leptolepis koonwarri																				X
Koonwarria sp.																				X
Holostei																				X
Wadeichthys oxyops																				X
Chondrostei																	X			X
Coccolepis woodwardi																				X
Psilichthys sp.																				X
Invertebrates:																				
Freshwater molluscs: Unionidae						X														
Insects : Insecta																	X			X
Trace Fossils:																				
Dinosaur footprints																	X			
Crustacean Burrows: Parastacid												X	X		X	X	X			

THE STRZELECKI GROUP VICTORIA

MAP B2) FLAT ROCKS FOSSIL LOCALIITY IN THE STRZELECKI GROUP



Inverloch, Flat Rocks Fossil Locality

TABLE 4.
Taxonmic list of Fossil Materials from the FLAT ROCKS Site reflecting the high Faunal Diversity

TAXA	Skull element	Jaw	Tooth	Vertebra	Limb	Girdle	Rib	Shell Armour	Scales	Trace
MAMMALIA:										
Theria		X	X							
Ausktribosphenos nyktos		X								
Ausktribosphenos sp.		X								
Bishops whitmorei		X								
Monotremata	X	X	X							
Teinolophos trusleri		X								
Multituberculata										
Corriebataar marywaltersae		X								
DINOSAURIA										
DINOSAUR indet. (Unidentified)	X	X	X	X	X	X	X			X
Ornithopoda.	X	X	X	X	X	X	X			
Qantassaurus intrepidus		X								
Theropoda	X		X	X	X					
Ornithomimidae				X						
Ankylosauria / Nodosauridae			X				X	X		
Other Vertebrates:										
Plesiosauria			X				X			
Pterosauria					X					
Testudines	X	X		X	X	X		X		
Aves					?	X				
Enantiorthine						X				
Dipnoi			X							
Neoceratodus nargun			X							
Teleostei	X	X	X						X	
Chondrostei	X	X	X						X	
Invertebrates:										
Unionidae										X
Trace Fossils:										
Dinosaur footprints										X
Crustacean Burrows: Parastacid										X

FLAT ROCKS EXCAVATION REPORT

BY JOHN WILKINS

This report outlines the operation and excavation of the Inverloch Flat Rocks fossil locale, granted under the Parks Victoria Permit 10004616.

THE EXCAVATION PROCESS

Sea water caught in catchment areas is pumped out
- using the petrol driven water pumps for large volume areas
- using the small 12V electric pumps for water pockets and the continual run-in of water to the hole from water trapped in the beach sand and upper areas

Both pumps employ filters on the inlets to exclude materials from the uptake
- shade cloth on the petrol driven pump inlets
- filter 'socks' for the smaller 12V pump head units

↓

Sand and debris is removed by brute force and determination
- trusty crews use shovels, a wheel barrow and buckets
- rock overburden is removed using jackhammers, sledgehammers and chisels

↓

Plugs and feathers (expanding wedges) to break off larger chunks of rock
- a number of holes are drilled using the rotary hammer drill (vertically into the rock and along the line where the rock is required to be broken)
- the feathers are inserted parallel to the face
- the plug is inserted and driven home, pushing against the feathers and applying force to the rock
- the rock fractures

→

Sledgehammers and metal wedges
- fossiliferous material is removed using sledgehammers and metal wedges, or smaller hammers and chisels where needed
- for difficult or precarious material that we want to maintain in one piece the Stihl quickcut rocksaw cuts around the material and a hammer and chisel is carefully used to break off the cut block

↓

Marking fossils
- skilled volunteers carefully look over every face of the removed rock and the rock remaining in the excavation area in search of any exposed fossil material
- volunteers use well trained eyes and a hand lens
- exposed fossils are then circled and the other half found and circled with the same colour
- the rocks without fossils are broken up while sitting on the shore or carted up the cliff sherpa-style for later breaking down at the dig house

FLAT ROCKS SITE

The fossil bed is in the intertidal zone on the Inverloch foreshore in an area known as Flat Rocks. The previously exposed fossil layer has been excavated over the last 17 years. The remaining fossil layer is now covered by non-fossil bearing rock layers, sand, debris, seaweed and water. This has to be removed on a daily basis to expose the fossil bearing material.

Fossil excavation teams were organised, including a hole team leader, an experienced crew member to support the team leader, and a second team member who was typically a new volunteer having their first experience in fossil excavation.

Equipment used in 2010

Much of the equipment used in 2010 was the same as the previous year:

- *Stihl* Quick Cut rock saw with diamond blade
- Cobra jack hammer with spade and cup bits
- Two-stroke water pumps
- Four-stroke water pump
- 12V electric boat sump pumps powered by 12V lead acid gel cells
- 240V generator (run on unleaded petrol) powering a 4kg *Bosch* hammer drill
- A variety of hammers, chisels, sledges, spikes, buckets, brooms, and various other hand tools.
- Plugs and feathers (either hammered in using sledge hammers or a special cup bit fitted to the Cobra jack hammer)
- Rotary impact hammers, auger bits and a generator kindly donated by *Total Tools* in Cranbourne and *Bosch Australia* in Clayton

Thanks to everyone who has helped to maintain the equipment throughout the year.

Changes implemented in 2010

Hole masters
This year we rostered the "hole masters" for a few consecutive days in the same location to maintain consistency of working the fossil layer – this seemed well received and appeared to generally work well. Appreciation and thanks to both the new and old "hole masters" and dig management team for their efforts, support and input into this process.

Change-over days
"Change-over days" were moved to Saturday with the idea of having this as a house day to break up stored or materials removed earlier in the dig. This plan, to have the majority of the crew at the house to work through the backlog, rarely happened.

The crew were eager to be down on site and commitments to having a team on site for the public and arranged site tours saw the majority of the team down at the site on change-over days. A small management team stayed at the house to receive and induct the new arrivals.

The groyne
The pipe retaining wall, coined "John's Groyne", was implemented this year and appeared to work to hold back sand and debris up to 300mm in height, allowing quicker access to the working area. A mono-cellular foam was proposed by Lesley for use in place of the original sand bags onto which the first pipe was located. This was not only easier to work with, but also once the foam was completely filled with water, no other water could enter. This created a barrier to water entering the work site from this direction. The first pipe was only a half pipe to allow for variation in the rock floor and to hold the foam down in place. Because the auger bit used was for the larger expansion bolts used to screw the pipe to the rock surface, the bolts were looser than ideal. However, the depth and number of points helped to hold the wall in place. Another auger was sourced, generously donated by Bosch Australia, for the smaller expansion nut/rock bolt combinations.

The venturi
A venturi was trialed again this year using a modified head with water jets to agitate the material prior the suction port, thereby stirring up the debris and allowing the suction port to capture and remove it. Different port sizes and pump capacities were trialled. Unfortunately, time ran out for us to determine the best combination for cleaning the submerged area, though it was proved that small rocks up to 20mm could be sucked up and pushed through the system by the larger capacity pump. Further trials may entail a larger pump being required. Ultimately the walled off area could be pumped and sucked clean at the same time, thereby reducing the amount of time preparing the work area for excavation.

IMPROVEMENTS PLANNED FOR NEXT DIG

Venturi
Further investigation and trials into the venturi system (venturi head port sizes and pump capacities) are planned.

Strike team
A possible strike team to remove non-fossil bearing overburden material may be formed and sent down pre dig season so as not to slow down our fossil extraction teams.

Inlet filters
We plan to add a coarse, easily removable inlet filter to prevent large seaweed from blocking the suction of the petrol pumps, which reduces the water flow and makes the pumps work harder and slower.

Sump pumps
We will investigate the use of higher pressure sump pump / battery combinations or a series of more of the same size pumps with increasing hose lengths. This is needed to cater for the increasing depth of the hole.

Vibration saws
We plan to investigate the use of small vibration saws and compare their ability to cut our sandstone with their "masonry" saw blades. We will trial this on fossil-bearing rock that is not valuable.

The groyne
A taller retaining wall, with a possible dog leg at one end, will be designed for the next dig. It will have marginally larger bolt holes drilled in the piping for the upright rock bolts to pass through more easily. Flushing points to be drilled into the retaining wall to make it easier to remove at the end of the dig. Last year, the pipes became in-filled with beach debris and were therefore heavy to remove. These flushing points will allow water to be jetted into the pipe at various points thereby flushing out the debris.

CONCLUSION

The crews as always did exceptionally well to uncover the area in preparation for the search and extraction of our prehistoric fauna in a suitable time frame to allow adequate extraction of the fossiliferous material.

The "lensing" out to the southern edge means we'll follow the fossil layer heading east along the dip and observe which way the edge of the lens travels to see how far it goes. The eastern edge ("The Far East") was still producing fossil material and while not as abundant as the northern side (east of the sand bar known as "The Bridge", and hence called "Bridge East"), it was producing many of the larger pieces of fossil material.

The northern side ("Bridge East") continues to produce a large number of our smaller fossils and as such will continue to be excavated.

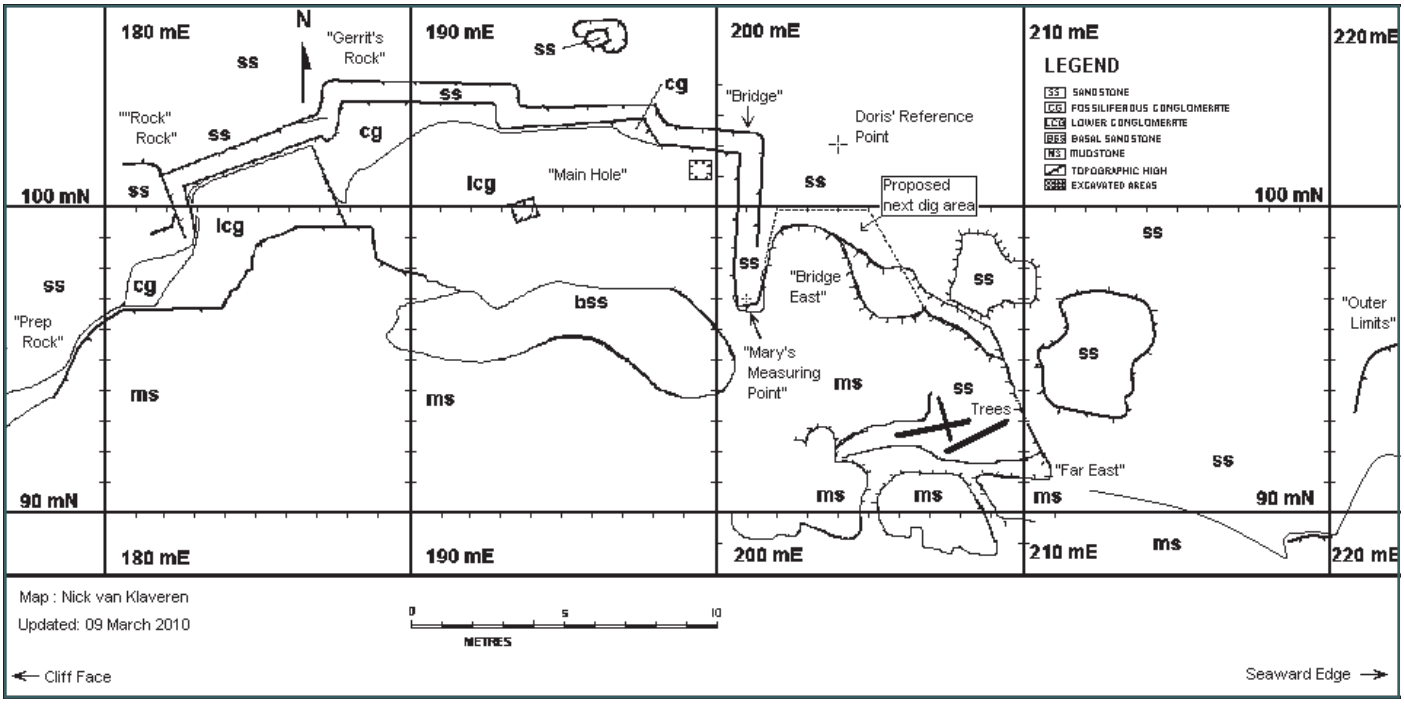
The pipe retaining wall system is planned to be re-used in Bridge East to reduce the amount of material to be dug off prior to excavation

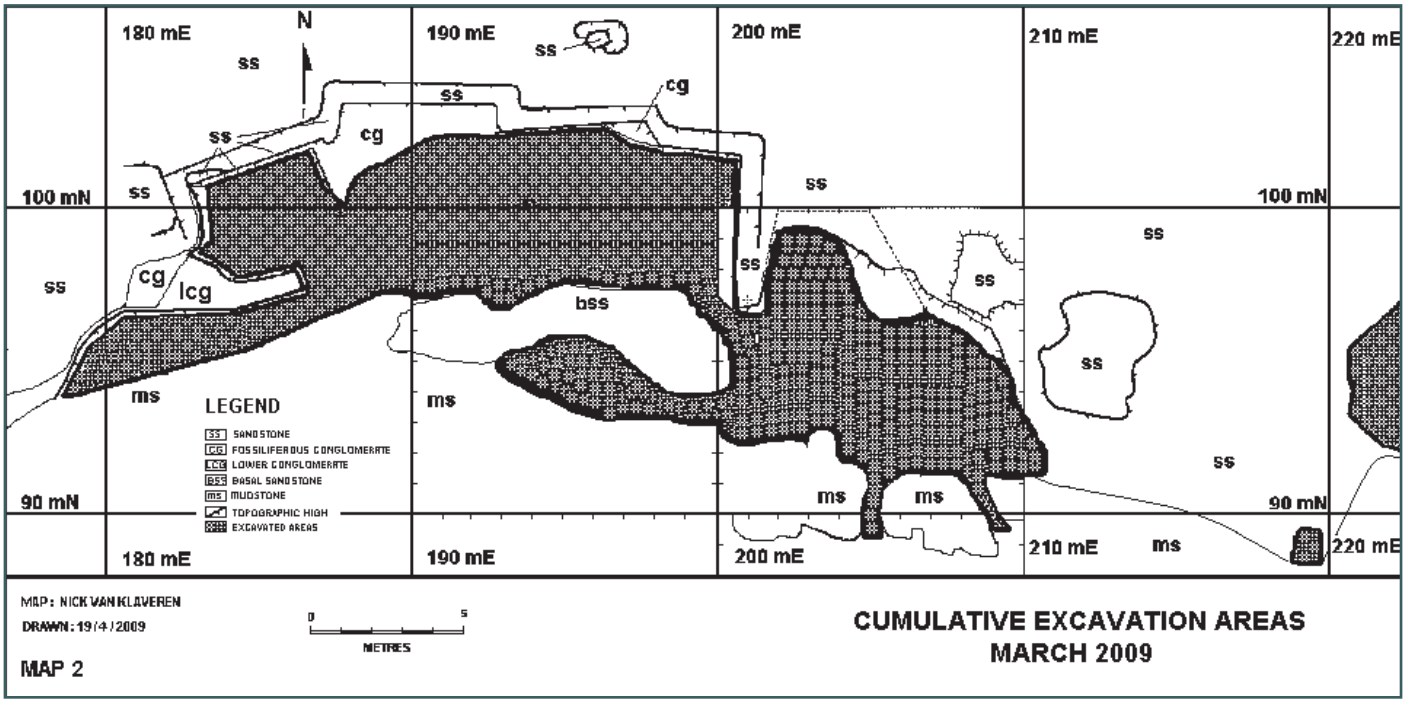
To follow the northern edge, a large amount of overburden will need to be removed. We may remove the large stack that is immediately above it.

New 12V pumps and batteries will be required to cope with the increase in depth of the excavation as well as possible replacements for the ageing petrol pumps.

Our intrepid excavation manager with a new friend

FLAT ROCKS SITE MAPS





RESEARCH REPORT

BY DR. TOM RICH

This past year has seen both productive work at the Flat Rocks site that has long been the focus of the Dinosaur Dreaming project and the recognition of three potential new approaches to finding Early Cretaceous dinosaurs and other land dwelling vertebrates in Victoria.

At Flat Rocks, a large ilium (or bone from the pelvis) was found by David Pickering that appears to have belonged to an ornithopod dinosaur larger than any member of that group found there previously. "That group" includes *Qantassaurus intrepidus*. Smaller ornithopods are one of the most common elements from all the Cretaceous sites in Victoria so the specimen being an ornithopod is not a surprise but the size is. There is a pronounced bias towards small bones and teeth at all the Victorian Cretaceous fossil tetrapod localities so any evidence of larger forms is always most welcome.

Ilium found by Dave Pickering

In the past, all the records of large dinosaurs in Victoria have been based on fortuitously finding the smallest bones of them that can be identified as such. This happens only rarely but it is enough to document that some large dinosaurs were present in the living assemblage. So it is always a welcome discovery when another one of these rare large fossils is found to give evidence for the presence of yet another group with large species in it.

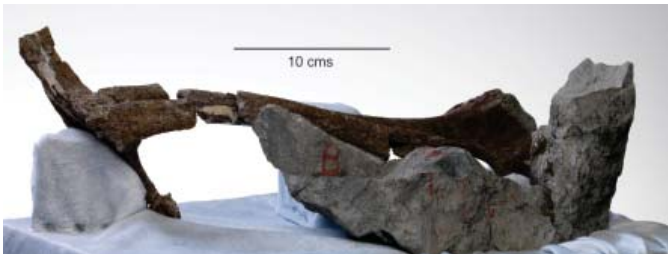
At the point north of the Flat Rocks site about 500 metres the dauntless Mike Cleeland, soon to be a bridegroom, found what appeared to be a fish. When Dave Pickering was finally able to devote some time to extracting the fossil from the rock, it turned out not to be a fish at all.

Rather it was a partial skull of a dinosaur together with at least some ribs. At this writing it is not certain whether the ribs and skull are part of one individual for the rock between them could contain more of the skeleton. What exactly the dinosaur is, is also uncertain at this time. But there are six upper teeth preserved which have a combined length of more than 25 mm. The lower jaw upon which the name *Qantassaurus intrepidus* is based has six teeth with a combined length of 30 mm. Peter Trusler's reconstruction of the skull of *Q. intrepidus* shows a small ornithopod with a relatively short, deep skull. Mike's specimen would fill the bill for that reconstruction.

Mike holding the concretion

This is only the second dinosaur partial skull found in Victoria, the first being that of *Leaellynasaura amicagraphica* in 1987. We are hoping that it does not take another 23 years to find the third one. Keep looking everybody! The setting where Mike's fossil was found may provide the clue as to how to find that third skull.

A single theropod pelvis fragment collected at Dinosaur Cove in 1989 had to wait twenty-one years for its significance to be recognized. But recognized it was in the pages of *Science*, one of the two most influential scientific journals in the world, not once but three times. This happened for the first time on 26 March 2010 and twice five months and one day later on 27 August 2010. The first time, the fossil was described and identified as a tyrannosauroid, a close relative of *Tyrannosaurus rex*. The second article questioned that identification and the third one countered that alternative interpretation, reasserting that tyrannosauroids did occur in Australia.



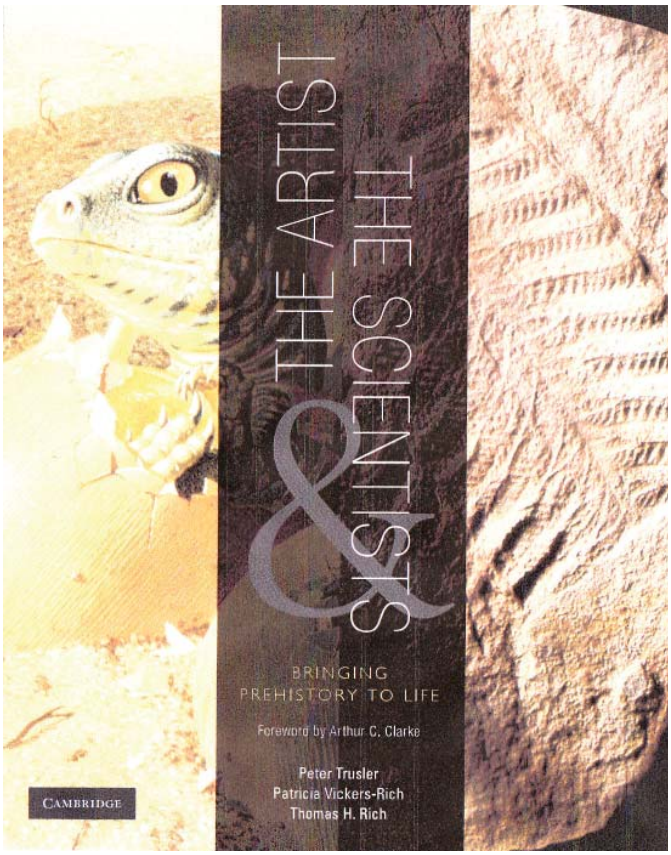
Tyrannosauroid pubis

A tiny bit of fossil from the Eric the Red West site found by Alanna Maguire proved to be particularly exciting to Tom Rich whose heart really goes out to the mammals that lived with the dinosaurs. At Flat Rocks, forty-six lower jaws of mammals have been found there thus far. But not a single upper jaw or molar has been found there, just one tiny isolated upper premolar found by the incredibly sharp-eyed Nicola Sanderson nee Barton. The specimen from Eric the Red West turned out to be two upper molars of a mammal that is neither a monotreme nor a multituberculate. If it is something already known from the Victorian Cretaceous, it is an ausktribosphenid, which includes *Bishops* and *Ausktribophenos*. Unfortunately, neither tooth is complete and one is badly broken. Peter Trusler has thus far spent a week drawing a reconstruction of this tooth and at this writing it looks like it may be an ausktribophenid. Obviously, better specimens are needed to know for sure. Now that we know that such fossils can be found at Eric the Red West, it is clearly worth a major effort to find another specimen of an upper molar or molars of a mammal there. Such a fossil could potentially be critical in deciding whether or not the placental mammals were present in Australia alongside the dinosaurs (placentals being most living mammals, those that bear their young at an advanced stage such as cows, cats, whales and us). The debate about this has been going on since Nicola got the ball rolling back in 1997 when she found the first specimen of *Ausktribosphenos*.

A third new way to find Cretaceous vertebrate fossils here in Victoria was outlined in a publication that appeared in the *Transactions of the Royal Society of Victoria* last December. It seems that some rocks in the South Gippsland region resemble those in China that produce the feathered dinosaurs. In the article, a programme to do just that is outlined. The article has been expanded to be a chapter in a book about Early Cretaceous dinosaurs from all over the Earth. So many people who would never encounter the first article will become aware of this potential that exists in South Gippsland.

Two visitors from overseas came to study various aspects of the collection of Victorian dinosaurs. The first to arrive was Holly Woodward from Montana State University in the USA. Holly spent six weeks in Melbourne from late June to early August preparing thin sections of ornithopod limb bones to assess their growth patterns. Fernando Novas from the Natural History Museum in Buenos Aires, Argentina spent three days studying the theropod fossils in the same collection. The reports from both of them are eagerly awaited.

Very soon in a bookstore near you will appear a book entitled *The Artist and the Scientists: Bringing Prehistory to Life*. Written by Peter Trusler, Patricia Vickers-Rich and Tom Rich, it tells the story of how these three worked together over the past three decades to produce many items of palaeoart. One chapter focuses on the illustrations of the various mammal jaws found at Flat Rock. In other chapters are illustrations of the dinosaurs from Victoria, Queensland, China, and Argentina as they appeared when alive.



'The artist and the scientists'

TAPHONOMY REPORT

BY DORIS SEEGETS-VILLIERS

Some of us working on the Inverloch material have carved a niche in the field of preparation, others thrive on identifying (and sometimes naming new) fossil remains, whilst yet others find it most interesting to investigate causes that have changed the appearance of bones from the time of death of an animal until the time of excavation. This latter field is called taphonomy. To gain insight into this field bone surfaces are examined for signs of modification such as weathering, abrasions and fracture/breakage patterns plus trampling and tooth marks. To allow bone modification to occur on bone material in the first place, it has to be assumed that soft tissue was mostly to completely removed from the bone either as a consequence of decomposition or scavenging.

How do we characterise these different types of bone modification and what do they help us achieve?

WEATHERING

The degree of weathering detected is generally dependant on the length of time a skeletal element has been exposed to the elements. Parameters such as moisture and prevailing temperatures, however, also play an important role, with dry and hot conditions commonly accelerating the weathering process. Although precipitation and temperature are difficult to assess in the fossil record, observed weathering stages can be utilised for the reconstruction of relative timelines i.e. bones that show little traces of weathering have been less affected by prevailing conditions than those that show extensive alteration.

The weathering stages used in the fossil records are defined as follows:

Stage 0: Bone surface shows no alteration (Fig. 1).

Stage 1: Bone shows cracking, generally parallel to the fibre (which is the length axis in long bones). Cracking may be observed on the ends of long bones (Fig. 2).

Stage 2: Both flaking and cracking occur on the outermost bone surface. Long bones can miss ends or ends are substantially eroded.

Stage 3: Outermost layers of bone have generally been removed, revealing homogenously weathered, rough compact bone. Ends of long bones have been eroded or broken away (Fig. 3).

Stage 4: Surface of bone is coarsely fibrous and shows rough texturing. Small and large bone splinters can be observed which may have detached from the bone. Weathering affects inner bone cavities.

Stage 5: *In situ* disintegration of bone. Cancellous bone is usually exposed. This particular stage of weathering will not be observed on complete bones from the Dinosaur Dreaming Site, as skeletal elements have been fluvially transported which means bones in a highly fragile state would have quickly disintegrated.

Fig. 1: Weathering Stage 0. Cracks or fractures do not occur on the bone surface.

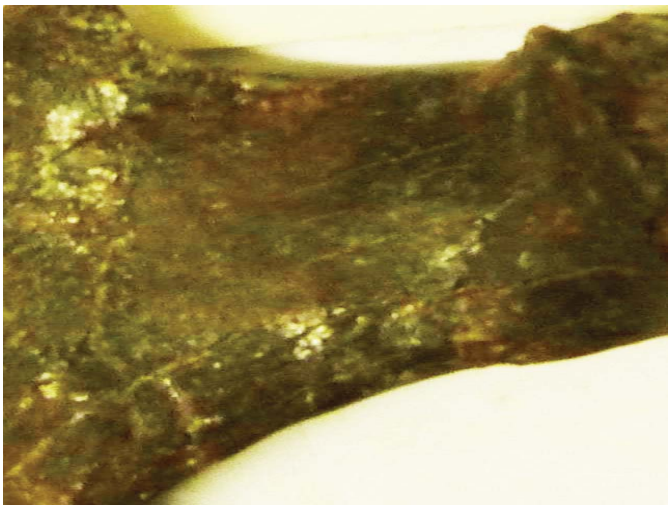


Fig. 2: Weathering Stage 1: Small cracks appear on the surface of bones.

Fig. 3: Weathering Stage 3: Outermost layer of bones has been removed.

ABRASION

Amount and degree of rounding on breaks and edges of skeletal elements is investigated by abrasion. Abrasion can be caused by wind and water action and depends, amongst other factors, on size, hardness and nature of abrading agents, the original condition of a bone and duration of exposure.

As these parameters are difficult to evaluate in a fossil context, this scheme is, as much as the weathering scheme, used in a relative rather than an absolute context.

The different levels of abrasions are characterised as follows:

"none": no abrasion, bones are unaltered.

"light": bones are slightly abraded, processes and broken edges are slightly rounded.

"medium": edges show moderate abrasion and are well rounded. Processes can still be recognised although very much reduced.

"heavy": bones, edges are very well rounded, processes are either very residual or completely removed. In some cases, bones can only be recognized as such by their internal texture.

BREAKAGE/FRACTURING

Everyone who ever experienced a fractured bone will recall that the terms "broken" and "fractured" are colloquially used as synonyms. In connection with Dinosaur Dreaming fossils, however, both terms are used to define very distinct damage patterns to bones. Whilst a break is defined as the splitting of a bone into two or more fragments without connection between these, a fracture is defined as a "crack" on a bone resulting in no more than a displacement along the fracture surface whilst individual fragments are still connected. It is relatively easy to distinguish these two patterns in a transported deposit such as the Dinosaur Dreaming Fossil Site.

If a bone entered the fluvial system broken, or breakage subsequently occurred during transport, all fragments of this bone will be separated during transport and dispersed. Fractured bones (which were damaged after final deposition), on the other hand, will be excavated with fragments still in association.

Furthermore, depending on the preservation of a bone, two distinct patterns can be defined. If a bone was split in a very fresh (unaltered) state then spiral breakage/fracturing can be observed which is defined by an angle larger or smaller than 90 degrees in relation to the bone fibre.

On the other hand, a fossilised (altered) bone will show transverse breakage/fracturing which runs more or less perpendicular to the long axis of a bone. Combining and utilising this information, several categories of breakage/fracturing can be established:

Unbroken bone: no breaks/fractures can be observed.

Indeterminate breakage: fractures cannot be assigned to a specific breakage/fracture cause or pattern.

Collection breakage: fractures are caused during excavation or preparation of an element and may obscure true breaks/fractures patterns. NB: old/fossil fractures should be in at least some cases distinguishable from those caused during collection by adherence of sediment to the broken/fractured surface (Fig. 4).

Transverse breakage: fracturing is indicated by breaks/fractures of a skeletal element at right angle to the fibre of a bone. Damage occurred after original bone material was replaced or mineralised (Fig. 5).

Compression fracturing: Skeletal elements show, often longitudinal, fracturing of the bone surface. Bone looks crushed; damage can be caused by compaction or trampling (Fig. 6).

Spiral breakage: fracturing occurs at an angle larger or smaller than 90 degrees to the bone fibre. These breaks/fractures are thought to be caused in fresh bone, that is, before fossilisation has occurred. (Fig. 7)

Fig. 4: Fracturing caused during the excavation process

Fig 5: Transverse break as it appear on mineralised (altered) bone.

Fig. 6: Compression fracture, bone appears to be crushed

Fig. 7: Spiral breakage pattern as it appears on fresh bone.

TRAMPLING

Trampling marks, characterised by sub-parallel scratches, occur when sediment particles rub on a bone surface as a result of animals stepping on individual or a set of bones. (Fig. 8)

TOOTH MARKS

Tooth marks occur on bones that have been scavenged by predators.

Fig. 8: Scratches on a bone surface indicating trampling marks

SORTING

The analysis of sorting does not depict a type of bone modification (although it can be the underlying course of abrasion and breakage) but rather provides valuable information on the competence of the system that transported the bone remains. Depending on the resistance to the strength of a current, skeletal elements can be assigned to three groups. Group I consists of elements that are immediately removed by low-velocity currents via floatation or saltation. Group II comprises those elements gradually removed via traction in a moderately flowing current, whilst Group III bones are identified as components of lag deposits, these elements are generally only removed by high velocity currents.

Allocation to either of these groups is generally dependent on the ratio of cancellous (spongy, lighter) to compact (heavier) bone: higher percentage of cancellous bone suggests faster currents, whilst higher amount of compact bone indicate later removal of a skeletal element in a current system. Elements characterised as intermediate cannot be assigned to a particular group.

Group I: Ribs, Vertebrae, sacrum, sternum (high percentage of cancellous bone)

Intermediate I: Scapula, phalanges, ulna

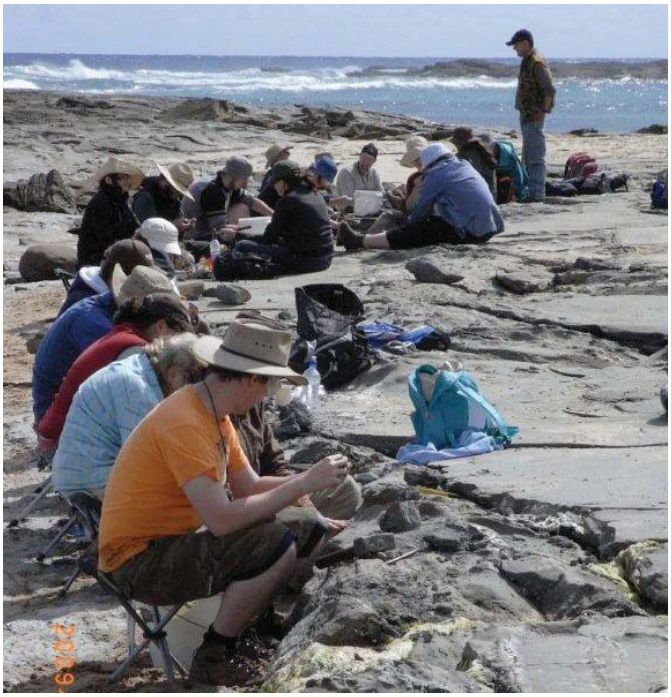
Group II: Femur, tibia, humerus, metapodia, pelvis, radius

Intermediate II: mandibular ramus

Group III: Skull, mandible (low percentage of cancellous bone)

It might sound a bit excessive to assess each bone fragment for any one of these parameters but there is a good reason for it. As much as individual bones can identify an animal and its size, bone modification provides valuable data on the investigated assemblage of bones. For example, various degrees of weathering and abrasion in the same deposit might indicate an accumulative assemblage (where animals gradually died) or that parts of the assemblage were buried quicker than others. High degree of breakage indicates damage inflicted on a bone prior to final deposition, whilst high degree of fracturing suggests damage occurring after final deposition. The presence of all three sorting groups might indicate an untransported assemblage, whilst the presence of Group III elements indicates a lag deposit where all light material has been removed but the current was never strong enough to transport the heavy elements.

At this stage detailed investigation of all elements is in full swing but as the photos show, the outcome promises to be very interesting and above all varied.



The crew diligently breaking rock at Eric the Red West

ERIC THE RED WEST - OTWAYS DIG REPORT

BY DAVID PICKERING

The German statesman Otto von Bismarck was supposed to have said that there are two things which the ordinary person should not see – the making of laws and the making of sausages. We could also add – the selection process of fossils after a field dig.

The list on the page opposite tabulates all the fossils that were collected during the 2009 Otways dig held at the Eric the Red West site. This is the result of 61 people who worked a total of over 180 person days during 9 days to bring back about 60 specimens to the Museum.

Immediately after the dig Paul Chedgey and I scrutinised each piece of rock under the microscope in the Prep Lab, scratching around many of them with hand tools to open them up, before rejecting two thirds of them as being too fragmentary to identify or keep. After the remaining pieces were prepared out of the rock only about 6 specimens were deemed interesting enough to register into the collections. One of these, P231328 found by Alanna Maguire, is unique. It is a maxillary fragment (upper jaw) containing 2 molars from a Cretaceous mammal. At this time Tom Rich does not know whether it can be assigned to one of the existing taxa of mammals represented by the 45 odd jaws from Flat Rocks and the single jaw from Eric the Red West or an entirely new taxon. Although the specimen is not complete enough to give us a good picture of this animal we now know that the upper tooth rows do exist and, more importantly, can be found.

Date	Description	Place	Collector
28/11/2009 01	Dean's Microscope Check – No bone	ERW	
28/11/2009 02	Half rib or Fish Jaw and Fangs – Shattered frag. fish (Discard	ERW-John and Alanna's hole	
28/11/2009 03	Turtle vertebra 2.S – Do.	ERW	
28/11/2009 04	Other half of shattered bone	ERW-John and Alanna's hole	
29/11/2009 05	Little Hollow Limb – Frag. of shaft (Discard)	ERW	Mary Walters
29/11/2009 06	Microscope Check – Microscope check (Discard)	ERW	Gerrit Kool
29/11/2009 07	Find (Sasha) Investigate – Medium Priority.	ERW	Sasha Wright
29/11/2009 08	Dinosaur vertebra – Do.	ERW	Mary Walters
* 29/11/2009 09	Bit – Very Interesting. Priority check	ERW	Alanna
29/11/2009 10	Dubious bit – Investigate further – Interesting.	ERW	Gerrit Kool
29/11/2009 11	Turtly bit – Small frag. turtle – (Discard)	ERW	Kathryn Drury
29/11/2009 12	Cut out from shore platform – Check	ERW	
30/11/2009 13	Fish scale – Low Priority – Investigate	ERW-East excavation	Alanna
30/11/2009 14	Dense cross-secrtion that Marion likes – Fish Scale (Discard)	ERW-East excavation	Alanna
30/11/2009 15	Interesting texture and shade - check – Interesting. Invest. Further	ERW-East excavation	Mary Walters
30/11/2009 16	Cute long bone	ERW-East excavation	John Wilkins
30/11/2009 17	Spongy cross-section – Invest. low priority.	ERW-East excavation	Larry Wakefield
30/11/2009 18	? Turtle (2 pieces) – Interesting. Keep	Dinosaur cove	Time Holland
1/12/2009 19	Long hollow limb bone	ERW-Erratic, east of dig site	Mike Cleeland
1/12/2009 20	Spongy (claw?) bone from hole – Pedal ungual – Dinosaur (Reg)	ERW-Main excavation	
1/12/2009 21	Scappy Fishy bit – Exactly! (Discard)	ERW-East excavation	
1/12/2009 22	Tiny Hollow Shaft – Investigate for poss. end.	ERW-Erratic	David Hocking
1/12/2009 23	? Investigate Farther	ERW-approx. 200m East of Pnt.Franklin	Mike Cleeland
1/12/2009 24	Dark spongy cross-section – Turtle? Investigate	ERW-Erratic, Mike's expedition far east of dig site	
1/12/2009 25	Tooth – Ornithopod tooth – Shattered.	ERW-Main excavation	Sue Moore
1/12/2009 26	? Hollow Shaft – Check	ERW-Mike's expedition east GPS:38d51.19S, 143d 33.4E	
1/12/2009 27	Scrappy bollocks (2 bones) Yer not wrong. fish scrap (Discard)	ERW-East excavation	Alanna
1/12/2009 28	Horrible thing, but it's a small rock-check in lab fish scrap. (Discard)	ERW-East excavation	Alanna
1/12/2009 29	Pathetic bit – Frag. fish (Discard)	ERW-East excavation	Alanna
1/12/2009 30	Spongy large bone – Has Potential. Investigate further	ERW-East excavation	John Wilkins
2/12/2009 31	It's pretty dodgy – Mud (Discard)	ERW-East excavation	Alanna
2/12/2009 32	Thin crystalline thing (fish scale?) – Not promising, but open up	ERW-East excavation	Aleck MacNally
2/12/2009 33	Squidge – Unident. bit – Investigate.	ERW-East excavation	Alanna
2/12/2009 34	Even more ugly than the last – frag. of fish (Discard	ERW-East excavation	Alanna
2/12/2009 35	Tiny bony blob - check – Not promising but open up.	ERW-East excavation	David Hocking
2/12/2009 36	Fishy bit (part missing) – Fish Jaw	ERW-Main excavation	Paul Ch.
2/12/2009 37	Turtly bit – fragment	ERW-West excavation	David Arnold
2/12/2009 38	"No details presnt but was stored with 2/12/2009" – Giant Beetle		
2/12/2009 39	Knob with a dent in it – Distal end of dino phalanx?	ERW-East excavation	Alanna
2/12/2009 40	A more promising bit – Investigate further – low priority	ERW-East excavation	Alanna
2/12/2009 41	Probable pleisosaur tooth – Pleisosaur Tooth (Reg.)	ERW-East excavation	David Pickering
2/12/2009 42	Tiny dense twig shapped bone – Bone fragment (Discard)	ERW-Main excavation	Paul Smith Ch.
2/12/2009 43	Turtly vertebra – Turtle Vert (Reg)	ERW	Amanda Mu Du
2/12/2009 44	Half only long bone – Scrap (Discard)	ERW-Paul&Paul's hole	
3/12/2009 45	Long bone (4 pieces) – ? Dino limb.	ERW-East excavation (good layer)	John Wilkins
3/12/2009 46	Mike's excursion bone #1 Scrap (Discard)	Point Lewis	
3/12/2009 47	Mike's excursion bone #2 – Unident. Check further	Point Lewis	
3/12/2009 48	Little vertebra – Good. Vert – at least – Do.	ERW-Main excavation	Mary Walters
3/12/2009 49	Bone and vertebra (2 pieces) – Dino vert. + Bones Fossil found during trim.	ERW-East excavation (good layer)	
3/12/2009 50	Bone 3 Not bone (Discard)	ERW-East excavation (good layer)	
3/12/2009 51	Skully bit – Very Interesting. Thin/Shapely.	ERW-Main excavation	Mary Walters
4/12/2009 52	Likely fish scale Good call (Discard)	ERW-East excavation (good layer)	Wendy White
4/12/2009 53	Cross-section with hole – Scrap (Discard)	ERW-East excavation (good layer)	Mary Walters
4/12/2009 54	Bulbous bone with tail – Scrap only (Discard)	ERW-East excavation (good layer)	Mary Walters
4/12/2009 55	Dense cross-secrtion – Unident. Check further	ERW-East excavation (good layer)	Eve Eidelson
4/12/2009 56	"Mary's last-of-the-day" small, shaped bone – Interesting bait fishy,	ERW-East excavation	Mary Walters
4/12/2009 57	"Justify her existance" V-shaped dense cross-section – Inter. Do.	ERW-East excavation (good layer)	Wendy White
4/12/2009 58	Dunno-saur in 3 flat bits – Scrap of bone frag	ERW-East excavation (good layer)	
4/12/2009 59	Tiny turtly bit – Scrap (Discard)	ERW-East excavation (good layer)	David Hocking
4/12/2009 60	~~Vertebra~~? Toe? (out of hole) (2 cannisters) Do (Register)	ERW-East excavation (good layer)	
4/12/2009 61	Shapeply spongy cross-section – Low Priority.	ERW-East excavation (good layer)	David Hocking
4/12/2009 62	"Douva" – Low priority check	ERW-East excavation	David Pickering
4/12/2009 63	Dinosaur metacarpal (half prepared)? metatarsal? Good. Do.	ERW-East excavation (good layer)	
4/12/2009 64	Vertebra in 4 pieces – Ornith. centrum/Impression of Neural Processes	ERW-East excavation	Paul Chedgey
5/12/2009 65	Stringy fossil – Bone scrap. (Discard)	ERW-East excavation	Darren Bellingham
5/12/2009 66	Cute little bone – Turtle Scrap (Discard)	ERW-East excavation	Mary Walters
5/12/2009 67	? Open up + check	In erratic on shore platform, bottom of track near EtR anchor	Mike Cleeland
5/12/2009 68	Chisel find	ERW-East excavation	Mary Walters
5/12/2009 69	Fossil	30m south of EtR anchor, west of Pnt.Franklin	Mike Cleeland
6/12/2009 70	Bit from the hole – Paul to investigate	ERW-Main excavation	David Hocking
6/12/2009 71	2 pieces and vial – fishes (Discard)	ERW-Main excavation	Liz Giffen (Ap Brien)
6/12/2009 72	Rebel yell – low priority but investigate further	ERW-Main excavation	Wendy White
6/12/2009 73	Plant fossil: "the turnip" Unusual plant segment (Reg.)	ERW-Main excavation	David Pickering
6/12/2009 74	"Marion's smudge" rock bone? Worth one pick.	ERW	David Pickering
6/12/2009 75	Tree (Reg)	ERW	David Pickering

Field and lab notes from the Otways in 2009. Notice how the most valuable find (*) was originally labelled "bit"!

If we view the 2009 Otways Dig on a purely statistical basis of hours worked versus fossils found we could be excused for being a bit underwhelmed but this ignores the fact that within a relatively short time the site has produced only the third articulated dinosaur from Victoria, the first Victorian Cretaceous mammal jaw outside of the Flat Rocks site and now the first Australian Cretaceous mammal upper tooth row. These fossils extend and compliment the array of fossils we have been finding at Inverloch and it makes it imperative to continue the search for new and unusual specimens at Eric the Red West. One of things that I have learned from Tom Rich is the need for perseverance in the search for fossils.

The Otways Dig is a joint project by Museum Victoria and Monash University.

It was conducted under DSE Permit No. 10004616 granted to Professor Patricia Vickers-Rich.

It could not have happened without the blessing of both Tom and Pat and the cooperation of officers of Parks Victoria at Apollo Bay and Richard Collopy, the representative of the local Indigenous groups.

I wish to thank everyone who participated in the dig and endured driving rain, stinging sand, the odd tiger snake and long sessions of sometimes boring rock breaking without losing their sense of humour.

Astrid is part of the team who carefully catalogue the fossils

Mary, Alanna and Mick hard at work breaking rock while Alan and John scope out the sediments at Eric the Red West

Deep bows and genuflections to Frank and Katrina Fotinas for their wonderful hospitality at Bimbi Park.

Special thanks are due to: Sarah Edwards for letting me go. Wendy White and Alanna Maguire for keeping me sane. John Wilkins for his own form of insanity. Mary Walters - St. Mary of the Mammal Jaws - for shopping. Marion Anderson for being so good at being evil. Alan Tait for manic movement and Matt Herne for trash talk and banjo. Mike and Pip for entertainment and haulage. Sasha Wright for finding a fossil when dad didn't. Paul Chedgey for his infuriating support and last but not least Chris Sinclair for his Ling Pie.

THE MAMMAL JAWS 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 finders don't always get to find out what became of their precious scrap. So here is a list of all confirmed mammal fossils identified since 1997 with Museum catalogue number, notes and taxa.

Reg #	Taxonomy	Collector	Field Number	Year	Preparator	Notes
P208090	*Ausktribosphenos nyktos*	N. Barton	#1111	1997	L.Kool	HOLOTYPE. Right. P6, M1-3
P208094	*Kryoryctes cadburyi*		Dinosaur Cove	1993	L.Kool	HOLOTYPE. Right humerus. Slippery Rock Pillar, Dinosaur Cove
P208228	*Ausktribosphenos sp.*		#329	1995	L.Kool	600my Exhibition display. Right. P6, M1-3
P208230	*Ausktribosphenos ?*			1995	L.Kool	Edentulous jaw fragment
P208231	*Teinolophos trusleri*		Mentors trip	Nov. 1993	L.Kool	HOLOTYPE. M3 or M4
P208383	*Monotremata*		Dinosaur Cove	1993	L.Kool	Premolar. Slippery Rock Pillar, Dinosaur Cove
P208482	*Ausktribosphenos nyctos*	N. Gardiner	#150	1999	L.Kool	Right. M2-3, badly crushed. Found in rock from DD1998
P208483	*Ausktribosphenidae ?*	N. Van Klaveren	#140	1999	L.Kool	Probably Left. x1 premolar & partial tooth
P208484	*Bishops whitmorei*	K. Bacheller	#450	1999	L.Kool	Right. M2
P208526	*Teinolophos trusleri*		#560 same as P208230. Check	1994	L.Kool	Right. Edentulous
P208580		A. Maguire	#200	2000	L.Kool	Jaw fragment. (unprepared)
P208582	*Ausktribosphenidae*	L. Irvine	#500	2000	L.Kool	Right. M3
P209975	*Bishops whitmorei*	R. Close ?	#387	2000	L.Kool	Right. Roots M1, worn M2. OK M3
P210030	*Teinolophos trusleri*			2000	L.Kool	Right. Edentulous
P210070	*Bishops whitmorei*		Rookies day	03.12.2000	L.Kool	Right. Badly broken M1, M2 and x6 Premolars
P210075	*Bishops whitmorei*		Rookies day	03.12.2000	L.Kool	HOLOTYPE. 600my Exhibition display. Left. P2-6, M1-3. (P1 lost since initial preparation)
P210086	*Ausktribosphenidae ?*	J. Wilkins	#250	2001	L.Kool	Right. Root fragment
P210087	*Ausktribosphenos sp.*	G. Kool	#620	2001	L.Kool	Right. Rear half M1, M2-3
P212785		M. Anderson	Rookies day	03.12.2000	L.Kool	Fragment only
P212810	*Bishops whitmorei*		#300	2002	L.Kool	Left. M2-3
P212811	*Teinolophos trusleri*	D. Sanderson	#187	2002	L.Kool	Right. Edentulous
P212925	*Mammalia ?*		#222	1996	D.Pickering	Edentulous
P212933	*Teinolophos trusleri*		#179	2001	L.Kool	Left. Edentulous. (Plus associated molar: since lost)
P212940	*Ausktribosphenos nyctos*	W. White	#171	2003	D.Pickering	Left. M1, M2-3
P212950	*Bishops whitmorei*	C. Ennis	#292	2003	L.Kool	Left. P6, M1-3
P216575	*Teinolophos trusleri*	N. Gardiner	#180	2004	D.Pickering	Left. x2 molars. Probably M2-3
P216576		A. Musser	#500	2004	L.Kool	Isolated tooth
P216578	*Bishops whitmorei*	A. Leorke	#600	2004	D.Pickering	Left. M1-3
P216579	*Teinolophos trusleri*	N. Van Klaveren	#635	2004	L.Kool	
P216580	*Bishops whitmorei*	G. Kool	#800	2004	D.Pickering	Right. P6, M1-3
P216590	*Teinolophos trusleri*	J. Wilkins	#447	2004	D.Pickering	Posterior part of right edentulous jaw
P216610	*Teinolophos trusleri*		#557	2004	L.Kool	Left. Edentulous
P216655	*Corriebataar marywaltersae*	M. Walters	#142	2004	L.Kool	HOLOTYPE. Multituberculata. Left. P4
P216670	*Ausktribosphenos nyctos*		#184	1999	L.Kool	Left. M2-3
P216680	*Teinolophos trusleri*	R. Long	#132	2004	L.Kool	Right. Fragment
P216720	*Teinolophos trusleri*		#648	2002	L.Kool	Right. Edentulous
P216750	*Teinolophos trusleri*	R. Long	#162	2005	D.Pickering	Right. Edentulous
P221043	*Bishops whitmorei*	A. Leorke	#100	2005	D.Pickering	Right. M1-2?
P221044	*Ausktribosphenidae*	C. Ennis	#300	2005	D.Pickering	Left. M2
P221045	*Teinolophos trusleri*	J. Wilkins	#395	2005	D.Pickering	Right. Edentulous
P221046		H. Wilson	#480	2005	L.Kool	Isolated tooth
P221150	*Teinolophos trusleri*	J. Swinkels	#340	2006	D.Pickering	600my Exhibition display. Right. x2 molars. Probably M2-3
P221156	*Ausktribosphenidae*	N. Van Klaveren	#360	2006	D.Pickering	Right. M2 (requires preparation to confirm)
P221157	*Bishops whitmorei*	M. Walters	#585	2006	D.Pickering	Right. Edentulous with alveolae for P6, M1-3
P221158	*Ausktribosphenos ?*	R. Close	#200	2006	D.Pickering	Right. P5-6, half M plus M2-3
P228432	*Ausktribosphenidae*		scrap rock	2009	L.Kool	Right. Molar talonid
P228849	*Bishops sp.*	M. Walters	ETRW, Otways	10.12.2006	D.Pickering	Left. P6, M1, partial M2
P229037	*Teinolophos trusleri*	M. Cleeland	#91	2008	D.Pickering	Right. Edentulous with alveolae for x4 molars and ultimate premolar
P229194	*Mammalia*	N. Barton	#770	07.03.2007	D.Pickering	Isolated upper Premolar
P229408	*Teinolophos trusleri*	M. Walters	#300	14.02.2008	D.Pickering	Left. Ultimate premolar, M1-4
P229409	*Ausktribosphenidae*	N. Evered	#180	07.02.2007	D.Pickering	Possibly *Bishops whitmorei*. Left. P5-6, M1-3
P229410	*Teinolophos trusleri*	C. Ennis	#90	2008	D.Pickering	Right. ?M1 plus M3
P229649	*Bishops whitmorei*	J. Tumney	#330	2009	D.Pickering	Right. P2-3,5-6, M1-3
P231328	*Mammalia*	A. Maguire	ETRW, Otways	29.11.2009	D.Pickering	Maxilla fragment with x2 molars

THE OTWAY GROUP, VICTORIA

MAP A) EARLY CRETACEOUS FOSSIL LOCALITIES IN THE OTWAY GROUP

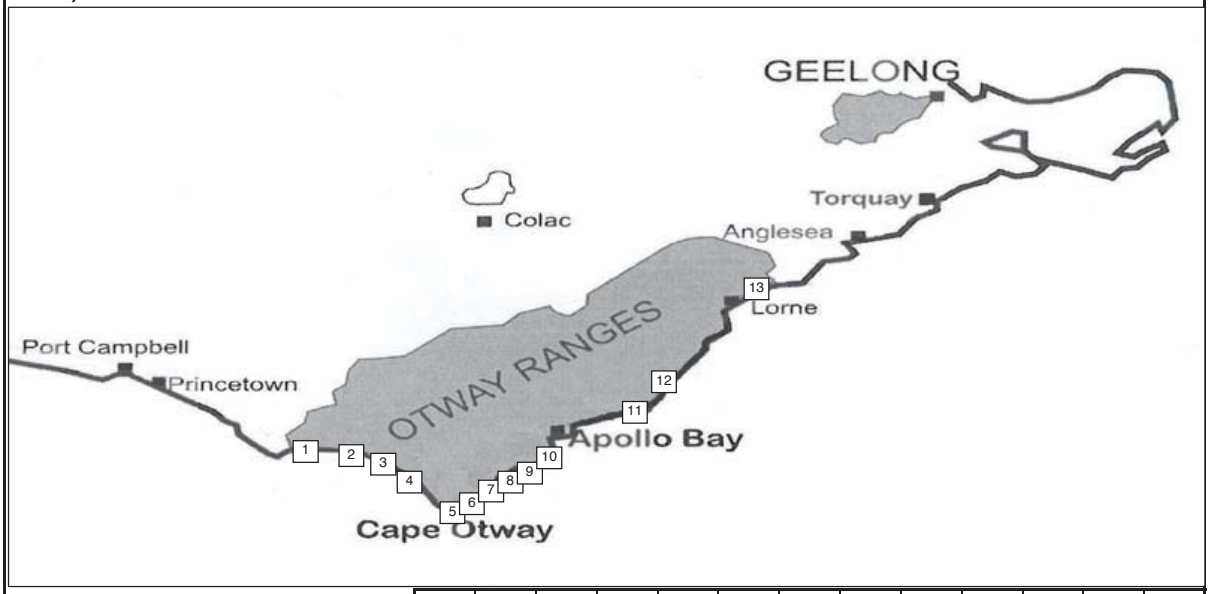
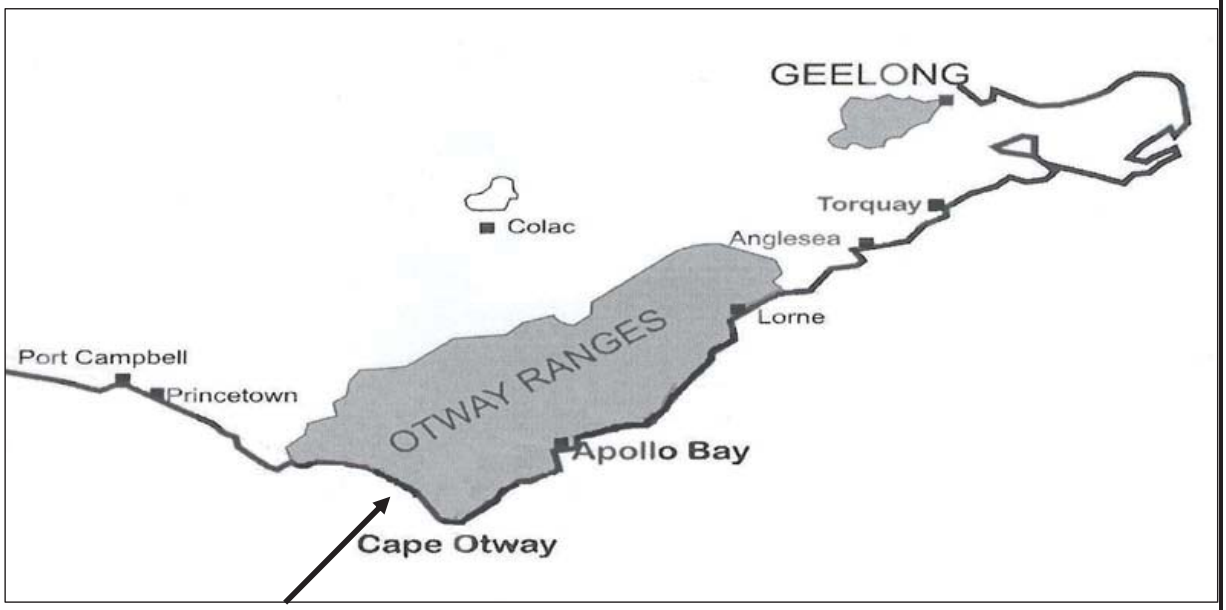


TABLE 1: Distribution of taxa recovered from the main fossil localities within the Early Cretaceous sediments of the Otway Basin

TAXA	Map Key #	1 Ryans Den	2 Knowledge Creek	3 Rotten Point	4 Dinosaur Cove	5 Eric the Red West	6 Eric the Red	7 Point Franklin	8 Elliott River	9 Point Lewis	10 Marengo	11 Skenes Creek	12 Cumberland River	13 Eastern View
MAMMALIA:														
Theria:						X								
Bishops sp.						X								
Monotremata														
Kryoryctes cadburyi					X									
DINOSAURIA:														
DINOSAUR indet. (Unidentified)		X		X	X	X	X	X	X	X	X			X
Ornithopoda.		X		X	X	X			X	X	X			
Atlascopcosaurus loadsi					X					X				
Fulgurotherium australe					X									
Leaellynasaura amicagraphica					X									
Theropoda					X	X		X						
Spinosaurid						X								
Oviraptosaurid					X									
Ornithomimid					X									
Neovenatoridae indet.					X									
Tyrannosauroid					X									
Ankylosaurs/nodosaurs					X									
Protoceratopsidae					X									
Other Vertebrates:														
Plesiosauria					X	X							X	
Crocodylia					X									
Pterosauria					X									
Testudines		X			X		X	X		X				
Dipnoi					X					X				
Neoceratodus nargun					X					X				
Actinopterygii					X									
Invertebrates:														
Freshwater crustacean:					X									
Freshwater molluscs: Unionidae					X									
Trace Fossils:														
Dinosaur footprints			X									X		
?Dinosaur Burrows			X											
Crustacean Burrows: Parastacid			X		X						X	X		

THE OTWAY GROUP, VICTORIA

MAP A2) DINOSAUR COVE LOCALITY IN THE OTWAY GROUP



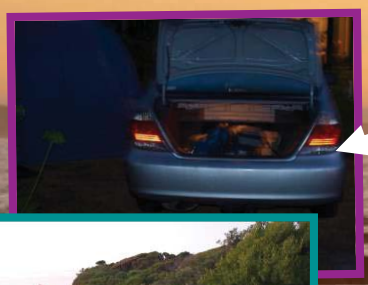
Dinosaur Cove Fossil Locality

TABLE 2: Distribution of taxa and material recovered from the Dinosaur Cove locality

TAXA	Skull element	Jaw	Tooth	Vertebra	Limb	Girdle	Rib	Shell / Armour	Scales	Trace
MAMMALIA:										
Monotreme indet.			X							
Kryoryctes cadburyi					X					
DINOSAURIA:										
DINOSAUR indet. (Unidentified)	X	X	X	X	X	X	X			
Ornithopod	X	X	X	X	X	X	X			
Atlascopcosaurus loadsi		X	X							
Fulgurotherium australe					X					
Leaellynasaura amicagraphica	X	X	X	X	X	X				
Theropoda	X		X	X						
Oviraptosaurid		X		X						
Ornithomimid										
Timimus hermani				X	X					
Neovenatoridae indet.					X					
Tyrannosaurid						X				
Ankylosaurs/nodosaurs				X				X		
Protoceratopsidae					X					
Other Vertebrates:										
Crocodiles: Crocodylia			X					X		
Plesiosaurs: Plesiosauria			X							
Pterosaurs: Pterosauria			X		X	X				
Turtles: Testudines										
Otwayemys cunicularis	X	X		X	X	X		X		
Dipnoi			X							
Metaceratodus wollastoni			X							
Neoceratodus nargun			X							
Actinopterygii	X	X	X						X	
Invertebrates										
Freshwater crustacean:								body fossil		
Palaeoechinastacus australianus										
Freshwater molluscs: Unionidae										X
Trace Fossils:										
Crustacean Burrows: Parastacid										X

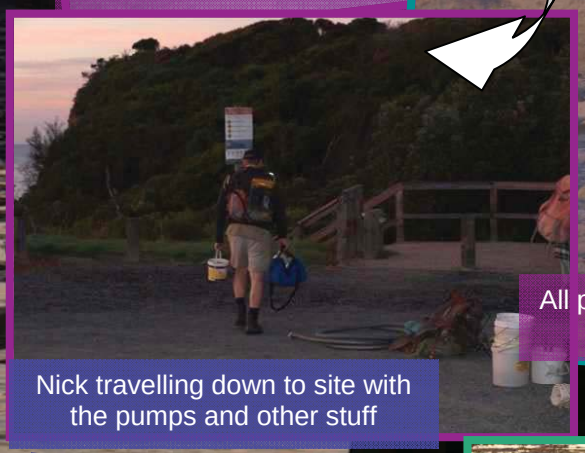
A Day in The Life of... A Dinosaur Digger

Early: Wake up, get out of bed… drag a comb across my head

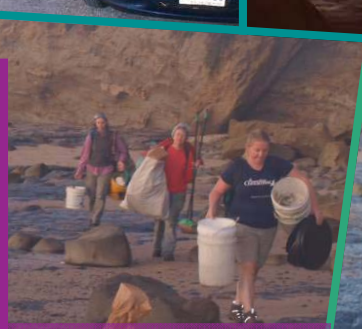


Note: It's dark when we pack the car before heading to site…
…sometimes

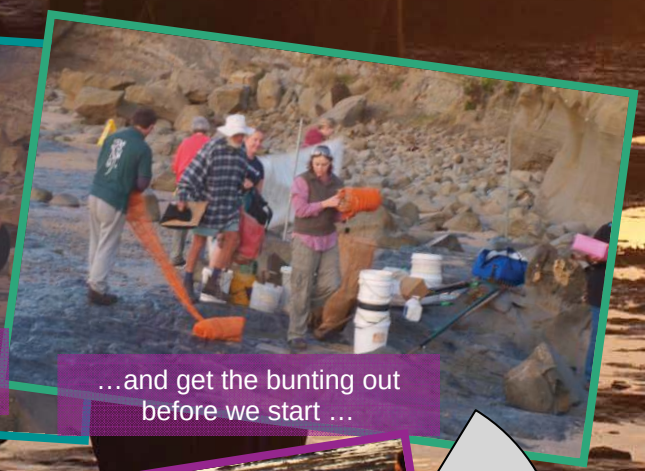
A bit later: Arrive at site with John and the trailer



Nick travelling down to site with the pumps and other stuff



All pitching in to get the gear down quickly …



…and get the bunting out before we start …

…Pumping!

Cleaning the rock face

Prepare the rock Rock!


In The Hole!
Watch your fingers!
Rock Saw!
Breaking Rock… Finding Bones
Today's prizes
The tide comes in
Time to load up!
… and load the trailer to head back home…
And all this before lunch!

SEDIMENTOLOGICAL BITS AND PIECES

BY ALAN TAIT

In the 2009 Dinosaur Dreaming field report, I wrote about the so-called ice wedges at Kilcunda which I consider to be sandstone injectites. I revisited Kilcunda on 25 February 2010 to re-examine the relationship between the injectites and the associated sand volcano, and the nearby undulating coal layer which overlies liquefied sand. It isn't possible to trace bedding planes between the sand volcano and the undulating coal layer because of rock falls covering parts of the cliff but the two features are at very similar heights above the underlying fluvial sandstone and appear to be contemporaneous. This would allow the two features to be the local results of one earthquake, and a victory for Occam's Razor. I still intend to map the features in as much detail as possible and may manage next year.

Injectites are also present at Eric the Red West, as we discovered at the end of November 2009. The succession under the fossil-bearing sandstone consists of a thick fluvial sandstone which fines up into overbank and lake sediments. The top of the thick fluvial sand has been liquefied and injected into the overlying overbank sediments as dykes and sills of sand. More work is required to trace the extent of the injectites.

Within the fossil-bearing sandstone at Eric the Red West, excavation around the upright tree stump revealed that it is not rooted in the claystone under the sandstone but is a transported tree stump with roots and adhering soil, similar to the transported tree stumps in the sandstones at Inverloch. Even though it was transported and is not *in situ*, the tree stump still caused the log jam which caught the articulated dinosaur carcase, and the fact that it is a transported tree stump may mean that coarser material including possible bones could occur around the edge of the soil claystone adhering to the roots. This year's excavation may find out if this is the case.

The fossil-bearing sandstone at Eric the Red West was mapped roughly in an attempt to understand the 3D geometry of the different layers of plant fragments, clay clasts and 'grit' (coarser quartz grains). The map needs more work and I intend to complete it this year.

I also need to map out the complexities around the Far East end of the Flat Rocks excavation where several large bones were found this year. Much of the fossil-bearing sandstone overlies a thin coal over soil claystone, but at Far East the base of the sandstone has cut down about a metre into the claystone with a vertical to overhanging edge lined with transported fossil logs. Many of the bones at Far East are broken and this may have been caused by movement of the bones and sand during initial burial as the tree trunks collapsed and the claystone and sandstone on either side of the eroded edge compacted by different amounts. There are some very large claystone slabs in the sandstone at Far East which may also have compacted more than the surrounding sandstone. The end result is that it is difficult to reconstruct the original geometry of Far East and the edge of the fossil-bearing layer, but another attempt will be made this dig season.

And to return to questionable cold climate features (see beginning of report), the sandstone layer with claystone load balls, interpreted as related to permafrost, was traced from the cliff at Flat Rocks onto the shore platform where the smooth surface eroded by the sea gives a clearer view. The sandstone is composite, made up of a lower layer with climbing ripples which has been partly liquefied, an overlying thin clay layer breached by sand injected from the lower layer, and an upper liquefied layer which contains the claystone load balls. Part of the sandstone contains dish structures which are common in liquefied sands.

It is difficult to reconcile the liquefaction of the sand with the partial freezing invoked to explain the distribution of the clay load balls. Some of the clay load balls are partly a purplish colour, indicating that a soil had formed in the clay above the sand layer before it was liquefied.

It seems that freezing conditions are not needed to explain the features at Kilcunda and in the sand layer with clay load balls at Flat Rocks. In some of my 'real' work, I've been involved in reconstructing the paleogeography of Australia and Antarctica during the Cretaceous. The location of the South Pole during deposition of the Eumeralla and Strzelecki formations was either close to the Antarctic coast or offshore, and the disposition of oceanic currents made it unlikely that an icecap existed, though glaciers were probably present in mountainous areas such as the uplifted sides of the rift valley in which the Eumeralla and Strzelecki formations were deposited, and the volcanos which produced the volcaniclastic sediment may have had local icecaps. Volcanic eruptions melting icecaps would be a possible source of the sheetfloods which deposited much of the Eumeralla and Strzelecki formations. So I believe the climate within the rift valley was no colder than cool temperate rain forest, and hopefully this coming season's investigations will take me closer to proving it.

Alan gets up close and personal with the cliffs at Flat Rocks

FRIENDS' DAY - 21ST FEBRUARY 2010

BY GERRY KOOL

Once again, Friends of Dinosaur Dreaming were invited to spend the day with the crew and around fifty took the opportunity to do so.

The weather was kind to us and everyone was given the chance to learn about the geology of the area as well as get a close up look at the excavation site. Tours were held throughout the day by several of the experienced crew who were happy to field any questions that were asked of them.

Rock breakers (fossil finders) were also happy to answer questions and show the interested visitors how they go about locating the tiniest of fossils.

A feature of this year's event was our "artist in residence", Pip Blackie (now Cleeland), who invited the younger visitors to express their talents on paper. This was a popular attraction.

Thanks must be given once again to the Friends as without their continuing support this project would be more difficult to fund each year.

A young artist on Friends' day

DIGGERS' CAMP REPORT

BY WENDY WHITE

It's funny how each year's dig is different, but when you look back on them it's hard to remember what things happened in a given year. The memories blur together, the jokes sound the same and idiosyncrasies become dig traditions. 2010 marked the last dig at Lavington St, so it seems like a good time to reflect on camp life.

I didn't have a theme song in 2010. In 2009 I couldn't get "Dirty Old Town" out of my head – I hummed, whistled and sang it prolifically, infecting my friends and innocent Newbies. This year – nothing. Not that I wasn't as annoyingly loud, I just didn't exhibit a dominant song. Andrew gave it a good go in Week 3 (Is Everybody Happy? You bet your ass we are!), but it died quickly when he left.

GREAT NEWBIES

From the beginning 2010 was shaping up for a great dig camp experience. We had plenty of returning volunteers and more Newbies applying than we could possibly take.

We had a round of Newbie interviews at the Melbourne Museum, and as usual, liked way too many of them. It takes a pretty special and interesting person to even contemplate a week wallowing in mud with us. We worked hard to winnow down the numbers, but ended up inviting about 30 to The Otways in December. This was a great idea in theory – even those who we couldn't fit into Inverloch would have a couple of days to find out what looking for cretaceous critters was all about. But the organisation was formidable – Newbie training every day (thanks Chris for lots of that) and most people not there long enough to take charge of a night's dinner. But we got to meet everyone, and might not have chosen as well if we did not do it.

Armed with great snapshots of each Newbie from Miklos, Chinese food and a modest amount of alcohol, we made a final selection of some exciting diggers. To make that process easier we assigned preliminary nicknames to Newbies to remind us who they were – the guy with the hair, the guy whose leg only Marion could read and him with the muscles. Some of them got nicknames later – the girl in the apron, the A-team pump crew and the girl who loved rocks.

INVERLOCH CAMP

We rent a house in downtown Inverloch, where most of us live. Many of the old-timers have, over the years, found other accommodation – Lesley and Gerry even bought a house in Wonthaggi to escape to. So the house is full of transients, with most diggers staying one week only. Of the 20 to 25 diggers working each day, 14 or 15 are staying at the house. The house gets really really dirty – we clomp through in our work steel caps, sandy swimsuits and coal-impregnated T-shirts. Some weeks a beautiful brave and wonderful digger would spend considerable effort making sure we didn't actually get buried in our own boot trailings, but clutter was everywhere. Some weeks I would look around the crew to figure out who would break first and pick up a mop/broom/sponge and more than once I'm embarrassed to say that was me (I would've put money on Nick cracking).

Bedrooms were barely contained suitcase explosions, and the tent city in the back yard began to rival a good Steinway novel (I needed to throw in one literary allusion to make Norman our resident English professor proud). And since we're so crowded it's hard to keep anything tidy. Now and then someone will scrub the bathroom. Sometimes I'll remind the crew. Sometimes I'll just step over the mud.

Bedrooms in the dig house can get a little messy.

We have a whole bunch of arbitrary rules that allow us to share the house without killing each other – if we find we're missing a rule to cover a specific situation, I'll just make it up.

We have so many people in the house that we need the neighbours' nature strips for parking (Yes, yes, I admit, I wanted to include a photo of my cool Astra convertible).

'Car city' out the front

I get to wake up the diggers at the house, a job I enjoy immensely. Some days I got to wake them up as early as 6:00 am, but too much of the time I had to wait until 7:30 or 8:00. My favourite approach is my cheeriest "Good Morning Happy Diggers!" directed firstly at each bedroom and finally the tent city. Of course, I repeated it louder and louder until each happy digger grunted a "Good Morning Wendy" back. I am told by a reliable source that on my day off, the recording of me set to a rap beat was particularly appreciated.

'Tent city' out the back

Eating and Drinking

With outdoor physical work, it is perhaps not surprising that much of our interest each day is on what we will be eating. Each morning 14 or 15 people eat breakfast at the house and make lunch, and each night we feed dinner to 20 to 25 people. We eat sitting on plastic chairs in a big circle in the back yard. Mixed in with the ubiquitous pasta and rice were a couple of standouts – Kathryn attempted (and pulled off) the Newbie folly of making a never-ending stream of pizzas, Gerry barbequed often and well, but Wendy T was declared the most popular Wendy on the dig by turning up with half a lamb.

Two diggers (often Newbies) volunteer each week to be the "tea wallahs" – responsible each day for making sure that tea, coffee and bikkies are available at site. They are the most important and beloved people on the dig, and any slip up

(forgetting the milk, or the spoons) causes much angst. Dinner is cooked by a volunteer coerced into being master chef with a couple of helpers – we have a roster on the fridge door. Washing up is a highly prized job fought over by all those who didn't cook that night.

Dinner in the backyard - everyone's favourite time of day

Mary is in charge of shopping, and it's a mammoth effort. One of my obsessions this year was how much toilet paper we were using (we consumed 150 rolls in 4 weeks – even if a dozen of them were for wrapping fossils that's still a lot).

INFORMATION

We run the dig on a white board, and each week appoint a volunteer as information conduit who is responsible for updating the whiteboard with tide times, wake up time, start time, knock off time, weather, the count of the fossils catalogued and the finder and description of "bone of the day".

Diggers are encouraged to check the whiteboard for details, instead of asking the crew organisers. The crew organisers reserve the right to quiz the information conduit instead of walking 10 metres to look at the whiteboard.

Nicole points to 'bone of the day' on the whiteboard

ENTERTAINMENT

When we work at the house, we make sure that we do the quizzes in the daily papers – but not the current event ones because some of us have been thinking only of 115 million year old events for weeks. And we play word games as we hammer – name as many films as we can starting with N, or songs starting with M (but somehow whoever decides one simply has to be sung gets shouted down). We ask each other about our lives, and try to decide who is the geekiest digger there. Some weeks it's a tough call. We tell long pointless jokes over and over again (thanks Jesse).

Breaking rock in the backyard

Word, music and trivia games keep us entertained

After work, we have a TV, but it is almost exclusively used for the Weather Channel. Some of our diggers get quite addicted to the Weather Channel – the wind and the sun and the tides play such an important part in our lives. We play a lot of cards – our specialty being something called "Chase the Ace" which requires little skill and much vindictiveness. But there's plenty of low-stakes poker and 500 as well. I spent one evening learning how to keep a poker chip spinning. It's harder than it looks, especially after a couple of glasses of port. We play Scrabble® and even have developed a set of Inverloch rules.

Cards at the kitchen table is a nightly occurrence

Mysterious chair sculptures regularly appear

We sit out in the back yard and look at the stars. Usually just with our eyes, but during the final week of the dig Darren brings his telescope and shows off the cosmos. The stars are really quite beautiful at Inverloch. Sometimes when we get up in the morning beautiful mysterious chair sculptures have been erected overnight. Occasionally a booby trap has been constructed using cable ties.

Last comments...

2010 marks my ninth field season, and my seventh as house manager. I wake up every day feeling privileged to be part of this crew, and am constantly delighted about the all of the amazing things I get to do - they let me play with 115 million year old dinosaurs!

WEEK 1

BY TRAVIS PARK

Since I had chosen the glamorous, well-paid, and air-conditioned career of palaeontology, I thought I should actually try my hand at actually going on a dig to see if I had indeed made a wise decision. I need not have feared however, as I had an absolute blast of a time, the only downside being that I was only there for a week.

As well as confirming that palaeontology is the life for me, I also learned valuable traits such as being unbeatable at cards, drinking red wine and washing dishes! On top of this was the fact that I was digging up actual dinosaurs! Of course they didn't find the theropod teeth until the day after I left but I'm not the type to hold a grudge (much).

All jokes aside, I thought I loved palaeontology before I went to Inverloch, but I truly fell in love with it during the week I spent at Flat Rocks. I made a multitude of new friends, some of which I'm sure will be lifelong ones. There's plenty more to be found down there and I can only hope that the dig continues for many years to come.

WEEK 2

BY ANN-MARIE O'BRIEN

My family came with me to drop me off at the dig house site on mid-Saturday afternoon. They had graciously given me a week off to indulge myself in a fossil hunt.

When we arrived, the house was quiet and most of the crew was at the site. We were welcomed by Norman who was in the yard, intently chipping at his rocks.

Colourful tents were set up under the shady trees. A resort would have had a pool surrounded by deck chairs, but here, there was a large blue tarp surrounded by plastic chairs with bluestone blocks mounted on sawn logs. This was no resort, and I couldn't have been happier.

The week 2 crew had very civilized tide times. We didn't have to get there too early and we didn't have to stay too late. I felt very spoiled with the working schedule and the environment. This was a very scenic location to work. With the surf breaking in the background, the undulating greenish-gray sandstone had convenient natural tables and seats where we could sit and chip our rocks. I can't forget to mention morning tea with cookies. Talk about being spoiled. Sure we had to haul loads of gear up and down the stairs each day, and then chip rocks in the sun, but the good company and tasty food made it worthwhile. Finding a fossil made it especially worth it.

The week 1 crew had built a groyne to keep the sand away from the excavation location. This worked very well. After pumping out the pit, we only had to remove the seaweed before we got down to business. It was very exciting to work in the pit. I think that finding and helping to pull out a fossil that had been buried for 110 million years is better than opening a birthday present.

Chipping the rock had its ups and downs. The "up" when I found something that wasn't wood, made the "down" of searching through a lot of rock worth the effort. I looked at a lot of rock between the fossils.

The week 2 crew had a mix of age ranges and experiences. I thought this was wonderful and everyone interacted well. The experienced diggers shared their knowledge with the newbies. Thankfully they didn't "stir" us newbies (too much) when we brought them yet another piece of wood for identification. But, we know it is better to ask than to ignorantly throw out a valuable fossil.

It wasn't all hard work. In addition to being enthusiastic fossil hunters, the week 2 crew looked at the stars, used mobile phone technology to track incoming storm fronts, diverted water from

around the tents using a styrofoam box, hoses, and bubblegum (a system that MacGyver would have been proud of), played poker, artistically stacked poker chips, played Chase the Ace, answered the newspaper's trivia questions, visited Wonthaggi and Cape Paterson during a rain delay, went swimming, shared the dig house, cooked and had meals together, and had a really neat experience working together to find some interesting fossils.

The week passed quickly. Before we knew it, the week 3 volunteers had arrived and it was time to pack up our tents. When my family came back to pick-me up, I got to introduce them to my new friends and show them about the site. Then it was time to go home.

WEEK 3

BY GABI TURCU

Dreaming..... dreaming....

One week of treasure hunting along the beautiful shores of Inverloch, promises of dinosaurs, though if you ask me turtles ruled this world. Definitely, absolutely, lacking in any teeny tiny marsupials with teeny tiny jaws. Buckets full of rubble were testimony to my tireless search, though at one point it was looking like I was going to have to fit the rubble back to its original shape like a jigsaw from hell, scary yet somehow strangely addictive. Maybe it was the therapy that I hadn't realised I needed, those endless hours of breaking rock, or maybe it was Norman's biscuit power. My fellow treasure hunters, treasures in themselves, spurred on by daily doses of trivia, anecdotes, greek meatballs and Norwegian singing, searched and searched. Some were victorious while others tallied up the beetle bums. As for me, Wendy's morning mantra ...happy diggers...happy diggers... happy diggers ....became my mantra. Yes, I was happy digger.

WEEK 4

BY LARRY WAKEFIELD

As a first-timer arriving for week four of the dig, my first impression was "how on earth can 20 people live in and around this house?" I soon found out that it was due to well-oiled routines, skilful management and goodwill of the volunteers. It is surprising how one gets used to living like a student again. Being involved in dinner preparation was an experience in its own right. Large pots on an ancient stove with elements that provided variable heat required a bit of juggling to prevent burning the meal, but it all worked out well. The resulting meals were consumed with great gusto.

The dig site is a marvellous location to spend a week hunting for fossils. The weather started off hot but mellowed out and ended with a superb storm before dawn of the last day. Nothing like clear skies, a sea breeze and the ever-changing seascape to get away from it all. The tides for week four were very civilised, with the work window being from mid-late morning to mid-late afternoon. Compared with the Otway site, fossils were discovered with regular frequency. I found working in "the pit" particularly satisfying as rock was carefully pared back and bones were exposed. Breaking up quarried rock yielded up interesting finds and I had the personal satisfaction of discovering "bone of the day" with an ornithopod jaw bone. That sort of discovery whets the appetite to keep looking for more.

And we weren't alone during the week. A variety of people visited the site, Friends of Dinosaur Dreaming, TV crews and school parties all provided extra interest to the daily routine. The resulting news slot on WIN TV had the entire crew crammed into the living room; cheering, laughing and hurling comments on the way the news editor presented our dig. After my first week at the dig, I now appreciate what motivates volunteers to keep coming back year after year. It is the good company and the thrill of discovering that special fossil.

A UNIQUE DIG APPLICATION

HEIKKI KOKKO

Dear Madam & Sir,

The application form didn't leave much opening for telling more about myself, so I'm taking the liberty of telling a bit about myself, who I am, why do I want to participate your dig project and why you might want to consider having me as a part of your merry crew.

About myself
I'm a 43 year old unmarried technician in information technology, no children. As judging from my age I should, I consider myself quite mature, though at the same time I try to cherish some childish traits, such as trying to be able to look at the world with new eyes and with curiosity towards fields of knowledge in which I still have something new to learn.

Even though my earlier pick of studies qualified me to pick any line of studies in the University, from psychology to chemistry, I ended up taking a college level degree in information technology, thinking that I might take some other studies later. However, years seem to have been rolling by in an ever-increasing tempo and I didn't get to that just yet. Still I have the very basic knowledge of most sciences and have maintained the interest to many of them, though not studying actively further. I also appreciate cultural achievements in fields of architecture, music, theatre, cinema and to some extent as well in the arts of painting and sculpture, though I can't claim being very knowledgeable in those fields.

I'm a Finnish citizen, living in the Northernmost Norway at 69th Parallel, in Tromsø, which has been the last stop before the great unknown on many polar expeditions. I consider myself as fluent in English, both written and spoken.

Why do I want to participate the Dinosaur Dreaming project?
Trying to look at myself and my motives a bit from a distance, I suppose that my main motivation is fame and fortune; it would be ultimately cool up here in the Arctic to boast about having been in Australia digging dinosaur bones. However, I don't have any false expectations of some Indiana Jones adventure; I have studied your web blogs an got a pretty realistic idea what it is all about: clearing the previous day's site from seaweed, shovelling muddy sand, hammering rock and breaking it carefully into tiny parts in case that it might have a tooth or a tiny bone in it – all this while getting sunburned, insect-bitten, wet and cold, maybe all of it during the same day, and maybe not finding anything at all as the reward from all of it. I have also done enough background study to know that it's not likely to find any big bones in the area, so I don't expect getting my picture in the front page of the National Geography either. The best I can hope is to get to wear a hat that many people might consider silly. Still I find the idea of it inviting. I also have always wanted to visit Australia, and being able to take part to the dig would be a good reason to do it, combining it with an additional couple of weeks stay if I first get there. I also recently discovered scuba diving, a childhood dream, and I hear that the marine life at the Great Barrier Reef is beyond imagination, so I will try to combine that with the trip too, if my humble person is accepted to the dig crew, and thus giving me the proper excuse to travelling half way around the world in the first place.

Why would you take me as a part of your team?
Time to throw in some big American-style superlatives to sell myself to this great career opportunity?

Ok, I'm tall (195cm) and handsome (105kg), likely strong enough to carry both some smaller team member and his/her 10kg of equipment or rock up and down 20 steps (though maybe not fully fit for that stunt at the time being), modest, raised by the superior Finnish education system, come from the mythical North …

To be more serious, I like working in a team, I'm not afraid of getting my hands (or my feet or any other part) dirty and I feel that I am fit and able to put in an effort that will help the project more than worth enough for having another mouth to feed. I have been in the boy scouts and the military, so the camp life won't be anything that I can't adjust to and I won't be scared off just by being told about the bathroom conditions. Furthermore, I believe that I can learn the job fast, have eye for details and ability to stop and listen in the first place when being shown or ask for advice later instead of trying and failing all the wrong ways first. I have had and maintained an old car, so I can solve many minor mechanical issues. I can also cook well enough to dare mention it. My field experience is unfortunately so far limited to a potato field, but that makes only half a joke; It's also about working in the dirt and getting something out of the ground unharmed, though the technique is of course very different.

I consider myself as social, solution-oriented and a team player, and would be genuinely honoured if I get the opportunity to be part of your volunteer team. Writing applications is not my strongest side, but I hope that I manage to present the information you need to make your judgement about if I am given a try.

Please feel free to ask for any additional information you might need and provide me with any additional information that I might need to know or arrange beforehand: Vaccinations, etc.

Best regards,

Heikki Kokko

The Evolution of the Dinosaur Dreaming Dig T-Shirt

By Lesley Kool

The first annual dig at the Flat Rocks site took place in 1994. There were just over 20 volunteers involved in that first dig and we felt it should be commemorated with a dig T-shirt.

The official logo for the Dinosaur Cove project, in the Otways, was "Dinosaurs of Darkness" : a theropod dinosaur under the rainbow colours of the Aurora Australis. The design was created by Peter Trusler, the project artist who produced most of the illustrations. So it was decided to continue with that design for the first dig in the Strzeleckis.

We did decide, however, to move away from the black T-shirts of Dinosaur Cove and try a lighter colour, particularly as black is not the best colour to wear on a really hot day.

The T-shirts for the first two annual digs at Flat Rocks were very similar: with the Dinosaurs of Darkness logo on the front and "Inverloch 94" and "Inverloch 95" respectively, on the back.

It was sometime in 1995 that Nicole Evered, who had been part of the project since 1992, came up with a new name for the project: "Dinosaur Dreaming". She chose the name because, as most Dinosaur Dreaming volunteers know, if you spend any time as part of the dig crew, you inevitably end up dreaming about dinosaurs. We also felt that by giving the research work being done along the Bass Coast its own name, it would help to differentiate it from the Dinosaur Cove era.

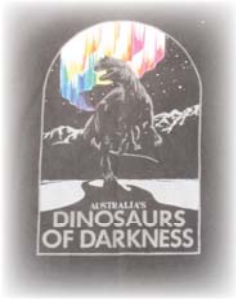
Consequently, we added "Dinosaur Dreaming" before "Inverloch" on the backs of the 1996 and 1997 dig T-shirts but kept the Dinosaurs of Darkness logo.

The move away from the "Dinosaurs of Darkness" logo began in 1998 when we decided to use another of Peter Trusler's works that captured the essence of the dreaming dinosaur far better. Peter had painted a scene depicting a polar winter with small ornithopod dinosaurs looking up at the Aurora Australis, while a larger, theropod dinosaur lay curled up asleep in the corner. It was perfect for the Dinosaur Dreaming project and appeared on the next three T-shirts from 1998 to 2000. 1998 was also the first year we started putting the words "Dinosaur Dreaming – Inverloch. Victoria. Australia. Dig Crew" on the front of the T-shirts, instead of on the back.

Andrew Plant, another talented artist, provided us with a great reconstruction of what researchers thought the dinosaur belonging to the "Cape Paterson" claw may have looked like. So, on the 2003 T-shirt, we placed an image of the claw on the front, below "Dinosaur Dreaming" and Andrew's reconstruction went on the back.

Andrew supplied us with another of his illustrations for the 2004 T-shirts. He has produced a children's book called *Could a Tyrannosaurus play table tennis?* in which he depicted a different dinosaur for each of the letters of the alphabet.

1994 - 1997



1998 - 2000 (and 2002)

2001

2003

For the 2001 field season Peter offered to produce a comic depiction of Arthur C. Clarke's "2001 – A Time Odyssey". The result was a cartoon with a small mammal touching an obelisk while the dinosaurs looked on. It was a tongue in cheek caricature of the fossil mammals that we were finding at the Flat Rocks site. A T-shirt was sent to Arthur C. Clarke, who appreciated the humour involved.

In 2002 we returned to Peter's "Dinosaur Dreaming" image for the last time before celebrating the one hundredth anniversary of the discovery of Australia's first dinosaur bone in 2003.

He had been stuck on finding a dinosaur starting with the letter "Q" until the first officially named dinosaur from the Flat Rocks site was named *Qantassaurus*. Andrew kindly allowed us to use his illustration of *Qantassaurus*, holding a G-pick instead of quoits, for the 2004 T-shirt.

Due to financial constraints we could not afford the advance payment for the 2005 dig, so there was no official T-shirt for that year.

Finances improved for the 2006 dig and Brian Choo, PhD student and palaeo-artist, agreed to provide the logo for the T-shirt. His "Mammals Rule" T-shirt poked fun at the fact that the dig had become more well known for its fossil mammals than for its dinosaurs. Hence the mammal riding on the back of the ankylosaur.

Some members of the crew felt this was a little unfair, so the 2007 T-shirt sported some "pay-back". Brian's "Popcorn of the Cretaceous" was extremely popular and went a long way in restoring the dinosaurs' respectability.

Brian Choo's "Popcorn of the Cretaceous" proved so popular that we decided to bring it back for the 2009 T-shirt. That year we gave the crew a choice of coloured T-shirts – traditional grey or green, with the design printed in white on the green T-shirts. The results were very successful.

As the two colours proved so popular for the 2009 dig, we decided to continue with the choice for the 2010 dig. This year we wanted something different. Some-one suggested a theropod dinosaur crawling up the back of the T-shirt. So, Jeremy Kool - yes, he is related to Lesley and Gerry Kool - was

2004

2006

2007 (and 2009)

2008

2010

The 2008 T-shirts were a break-away from the traditional grey colour of former years. Although there was some initial resistance to the pale blue shirts, most crew members had to agree that they made a really good background to the equally colourful logo that was chosen for that year. In 2007 Tony Martin, a palaeo-ichnologist (expert in fossil tracks) from Atlanta, Georgia, USA, discovered the first evidence of borrowing dinosaurs. His wife Ruth, an artist, painted her interpretation of an adult ornithopod dinosaur with two juveniles, inside a burrow. We were all so impressed with Ruth's interpretation that we asked her if we could use it for the 2008 T-shirts and she generously agreed. The result was the most colourful T-shirt ever produced for Dinosaur Dreaming.

approached to come up with a design on that theme. Jeremy is a graphic artist and is used to being asked to draw all sorts of weird designs. His illustration of the theropod dinosaur crawling up the T-shirt was well received and looked equally good on both the grey and the green shirts.

Dinosaur Dreaming 2010 was the 17th annual dig at the Flat Rocks site and it has been an interesting exercise recording the evolution of the dig T-shirts from Dinosaurs of Darkness to Dinosaur Dreaming. We look forward to seeing what amazing illustrations we can come up with in the future.

TRACE FOSSILS

BY DR. TONY MARTIN
EMORY UNIVERSITY, USA

Up until this year, my research on trace fossils in the Early Cretaceous rocks of Victoria had been done opportunistically and in a piecemeal way. It all started with a one-semester sabbatical from my home institution (Emory University), hosted by Monash University in February 2006, and continued through brief visits to coastal outcrops during the Australian winters of 2006, 2007, and 2009. All told, when these days of field work were summed, it came to about 12 days, or just short of a fortnight. Yet these 12 days produced some fairly significant fossil finds: large theropod tracks from the Dinosaur Dreaming site (Martin et al., 2007); the oldest known fossil crayfish in the southern hemisphere and the oldest crayfish burrows in Australia (Martin et al., 2008); and purported dinosaur burrows, the first reported from the Southern Hemisphere and the oldest in the geologic record (Martin, 2009). Not bad, all in all, and I was very pleased to know that my "ichno-obsession" was contributing to the paleontological database of such an already well-studied and famous area.

Along with these finds were preliminary data on the presence and types of invertebrate trace fossils, too. Although these trace fossils might never make the cover of *National Geographic* (let alone *Sheep Magazine*), I actually consider them the most valuable scientifically. This is because of how the burrows of insects, crayfish, and other smaller animals might reflect seasonal changes in the ancient environments of Victoria, and hence give insights on how life adapted to changing environments in polar environments during the Early Cretaceous. Considering how this area of Australia was at 75-80° S then, most burrows, dens, tracks, and other traces must have been made when the ground was thawed and animals were out and about in their local ecosystems. On the other hand, polar winters, with their prolonged cold and darkness, would have shut down much biological activity, giving animals fewer reasons to be out and about making traces. Moreover, sediments would have been too hard and ice-bound to preserve traces of those animals that stayed active during the winter.

Hence trace fossils in a given vertical sequence of strata might reveal: (1) when the polar summers and winters had taken place; (2) how animals behaved during these seasons (especially the summers); and (3) which animals were active. The last of these three interpretations would further augment the body fossil record for the Early Cretaceous of Victoria, especially for those animals that might not have been lucky enough to get their body parts preserved in the extensive sandstones and conglomerates of the coast.

With the help of my friends and colleagues in Australia – Pat Vickers-Rich, Tom Rich, Lesley Kool, David Pickering, Peter Trusler, Mike Hall, and many others – I had been able to patch together a semi-coherent, only partially inebriated picture of the Cretaceous trace fossils in Victoria (Martin et al., 2009). But it was time for a more serious and comprehensive survey of the trace fossils in the Strzelecki and Otway Groups of Victoria, an investigation that would be done over the course of a continuous month or so. In this respect, Tom Rich was the progenitor of this bold idea, and he had a plan on how to make it a reality. First of all, he thought that I might try to mimic a similar survey that was done for body fossils (bones, that is) in the late 1970s by him, Michael Archer, and Tim Flannery, whereby they walked along much of the Victoria coast and prospected a vast volume of rocks. The big difference is that I would look for trace fossils – not bones – in those same rocks. Secondly, Tom was hopeful that I might find other possible dinosaur burrows in either the Strzelecki

or Otway Groups. Thirdly, he expected that such trace fossils might have dinosaur bones associated with them, entombing their former tracemakers. Was this so far fetched of an expectation? Not really, considering how the first known burrowing dinosaur, *Oryctodromeus cubicularis*, was found in a burrow-like structure in slightly younger Cretaceous rocks of Montana (USA), along with the remains of two presumed offspring (Varricchio et al., 2007).

Well, it was a great idea, and I heartedly agreed with Tom that a trace fossil survey would indeed be a worthwhile endeavor, for all of the reasons just given. I also emphasized to him that it would be scientifically invaluable regardless of whether we discovered any dinosaur burrows, with or without the remains of their makers. As someone who aspires to be a consummate ichnologist, I would be searching for all sorts of trace fossils: from the tiniest of larval insect burrows to vertebrate burrows or tracks, which in my eyes were all good and all important. Yes, dinosaurs inspire most of the headlines in paleontological research along the Victoria coast (what is the name of this report?), but these dinosaurs shared their original ecosystems with a wide variety of animals. Trace fossils would thus fill a big gap in our knowledge about the paleoecology of these formerly polar environments, whether anyone was specifically interested in dinosaurs, mammals, crayfish, insects, or other denizens of these formerly polar environments.

So it was then a matter of planning how to accomplish this lofty goal, and especially how to pay for my travel to and from Australia and take care of field-related expenses (little things like lodging and food). Fortunately, Tom was able to secure funds from the Museum of Victoria that reimbursed me for my plane tickets before I had even arrived in Melbourne. Also, the Museum provided a field vehicle for Tom and me, paid for petrol in the vehicle (always a good thing), as well as a generous amount of funds devoted to making sure I had a roof overhead and a full belly at the end of each day spent walking and looking at rocks, keeping me refueled for more walking the next day. With this financial assurance in hand, I was then able to persuade Emory University to match some of this funding for my travel. This was a very fortunate circumstance in a year filled with angst and austerity at Emory, which like many universities was still recovering from the worldwide economic crash that started in 2008. Tom and Pat (Vickers-Rich) also hosted me for part of my time in Melbourne, and Mike and Naomi Hall were gracious enough to rent their flat in Apollo Bay to me as a "home base" during much of the field work in the Otways.

The best time for me to visit for a month or more was soon after my school year had finished, and I arrived in late May, ready to start walking and looking. The research plan was terribly old-fashioned, consisting of visiting many localities – most of which I had never seen before this trip – and walking across extensive marine platforms and along seacliffs, and scanning these rocks for trace fossils. I even brought two geology field notebooks (with pages made of real paper!) and pencils, in which I recorded most of my field data. The only nods to modernity were in my choice of other tools to bring with me into the field each day: a lightweight digital camera (a Nikon Coolpix) for recording thousands of high-resolution digital images (and occasional video clips), and an up-to-date GPS receiver (Garmin GPSMAP 60CSx). The GPS turned out to be a very good tool to bring along for the research. It was switched on at the start of each walk, put into a side pocket of my backpack, and turned off once Tom and I were back at the vehicle at the end of each foray. In this respect, I was being an ichnologist studying myself, as routes recorded while prospecting each day meant these "trails' could be mapped and possibly prove useful for future generations looking to duplicate and otherwise test my observations. Such a continuous record of locations and times also could be connected with times taken for each photo, providing a database that constituted a good "first step" toward a comprehensive study of Cretaceous trace fossils in Victoria.

Yet another important part of the research was to publically share some of its progress while it was happening. This was done with the acknowledgement that public outreach – or what U.S. universities like to call "engaged scholarship" – has gained more deserved recognition in recent years. So just before leaving for Australia, I started a Web log (or as all of the kids call them nowadays, a "blog"), and gave it the exciting name *The Great Cretaceous Walk* (www.greatcretaceouswalk.blogspot.com), based on the occurrence of Cretaceous rocks alongside the Great Ocean Road and all of the walking I would be doing on these rocks. This blog was updated throughout the field research and some time afterwards with reports of what was done each day, where we prospected, who we met, and general musings about the history of paleontological research in coastal Victoria. This was also a chance to have a little fun, especially in the retelling and embellishing of adventures while in the field. Much of the frivolity was enhanced by the participation of Greg Denney, who with his partner Deb I can count on now as "good mates" while in the Otways.

How did it go? Mostly very good, with a few very exciting and noteworthy discoveries, none of which I can discuss until after the trials and tribulations of peer review. (Sorry about that!) One major insight I can share for now, though, is that the Strzelecki and Otway Groups can be broadly divided by their ichnological content. For example, the Strzelecki Group is remarkably poor in trace fossils, whereas the Otway Group has strata teeming with ichnological content, especially invertebrate trace fossils. Why is this disparity so apparent? I suspect the main reason is that Strzelecki time (Aptian Stage, about 120-115 million years ago) was colder than Otway time (Albian Stage, about 110-105 million years ago). This circumstance not only limited the activities of potential tracemaking organisms, but also hindered the preservation of their traces. Torrential spring floods would have "wiped the slate clean" in river valleys so that tracks, trails and burrows were eroded nearly as soon as they were made, or erased with each subsequent spring. On the other hand, warmer conditions, accompanied by less flashy flooding, would have been more amenable to animals doing what they do best – eating, moving about, reproducing, raising young, resting, and so on – and the signs of those activities were more likely to be preserved and thus allow us to observe them more than 100 million years later.

Anyway, this idea and many more were born from rocks and trace fossils observed during *The Great Cretaceous Walk* of 2010, and I left Australia very pleased with my results. So be looking for articles in the next several years about what was found, and find out how these trace fossils will bring us just a little bit closer to better understanding the Early Cretaceous world of the place we now call Victoria, Australia. I probably will be back to visit, but now it would be more for lectures, "mateship," and good beers (perhaps not in that order), rather than having to see more rocks. The Great Cretaceous Walk was indeed great, but I'm now ready to do a little less walking.

References

Martin, A.J., Rich, T.H., Poore, G.C.B., Schultz, M.B., Austin, C.M., Kool, L., and Vickers-Rich, P. 2008. Fossil evidence from Australia for oldest known freshwater crayfish in Gondwana. *Gondwana Research*, 14, p. 287-296.

Martin, A.J. 2009. Dinosaur burrows in the Otway Group (Albian) of Victoria, Australia and their relation to Cretaceous polar environments. *Cretaceous Research*, 30: 1223-1237.

Martin, A.J., Rich, T.H., Vickers-Rich, P., Kool, L., and Trusler, P. 2009. From crayfish to dinosaurs: Early Cretaceous trace fossils of Victoria, Australia and their uses in interpreting circumpolar environments. *Geological Society of America Abstracts with Programs*, 41(7): 162.

Varricchio, D.J., Martin, A. J., and Katsura, Y. 2007. First trace and body fossil evidence of a burrowing, denning dinosaur. *Proceedings of the Royal Society of London B*, 274: 1361-1368.

MEGAFAUNA TRACKWAYS

BY DR. STEPHEN CAREY
UNIVERSITY OF BALLARAT

When is finding a wonderful fossil a fluke and when is it not? Thinking that a visiting Canadian biologist had been somewhat deprived, as he was about to return home from a sabbatical at the University of Ballarat without seeing any of the landscapes of the Western District, I asked him if he would like to do a day trip to see the Twelve Apostles, volcanoes and whatever else we might come across. After the Twelve Apostles and the volcanoes, it was down to the "whatever else". I thought of lunettes, the sliver-moon-shaped dunes on the lee sides of many lakes in the Western District. Almost immediately, we came across a lovely lunette with a well made farm track leading to and over it from an open farm gate — too inviting to pass up! We sought permission of the landowner to examine the lunette but struck gold when she began telling us about "dinosaur footprints" that were under the waters of the lake.

It required patience (six years of it, in fact) for the lake to dry up and expose the trackways. And what excitement it was: every trip to the locality for the first year or so, we found something new. The landowners, who have looked after the trackways for decades, showed me the mightily impressive trackway of a diprotodont. Then, as we cleaned up the locality, and the wind blew away the modern lake mud, we found trackways made by bounding animals (guess what!) and numerous others made by wombats. The howling dust storm of April's fool's day in 2008 uncovered another diprotodontid trackway, and this one was found by the Museum's chief preparator, Peter Swinkels.

As well as the trackways, we found some bones, and this is where Dave Pickering and the museum volunteers stepped in. They did a great job of excavating almost every last fragment of bone from the locality. The bones are now safely housed at the museum where they are progressively being prepared and, of course, are well looked after.

Peter Swinkels and his team of preparators were, needless to say, at the locality for a purpose. Over the period of a week, they made silicone-rubber moulds of six lengths of trackways that sampled the diprotodontid, kangaroo and wombat trackways. They have since been cast in polyurethane and one of the diprotodontid casts is now mounted in the marvellous new display, *600 million years — Victoria's evolution.*

On the science side, we submitted a manuscript on the trackways to a journal in the middle of the year, and are currently working on another that addresses the bones. The news of the Western District trackways provoked interest from people on the coast of both the Western District and Gippsland who knew of tracks in the dune limestones that occur in narrow strips along the Victorian coast. We are currently documenting these, and the preparators have moulded some of them as well.

The involvement of Museum Victoria and its estimable volunteers has been a huge boon for the project. The preservation of parts of the trackways as casts is most important. You may not know that Peter Trusler's portrait of diprotodon for Australia Post's megafaunal stamp series was influenced by what he learnt from the trackways; he mentions this in his wonderful book. Some of the volunteers, along with Dave Pickering, starred in the segment on the trackways bradcast by ABC TV's *Catalyst*. Now an exquisite photograph of the diprotodontid trackway has appeared in *National Geographic*.

My most exciting, most stimulating, most enjoyable research project certainly started out as a fluke. It was given me the opportunity to work with Museum staff and volunteers which has been wonderful for me and so too for those students from Ballarat who have got sucked into the volunteer programme at the Museum. I am delighted that we are constructing a permanent record of this megafaunal trackways site, the most important Australia — which probably means the world, doesn't it?

THIN SLICES OF PREHISTORY

BY HOLLY WOODWARD
MONTANA STATE UNIVERSITY, USA

During the Early Cretaceous period, 112 million years ago, Australia was in the process of separating from Antarctica as the southern hemisphere supercontinent Gondwana continued to fragment. Because of its location in southern Australia, Victoria was either within or very close to the Antarctic Circle during this time. Although the average annual temperature is debated, animals living in this environment would have undoubtedly experienced prolonged periods of light and dark. It is possible that other aspects of the environment were different from the more arid to temperate conditions found at lower latitudes during the Cretaceous, and therefore the dinosaurs living in this area would have had to cope with unique stresses.

Dinosaur fossils have been found predominately from two localities in Victoria, one near Inverloch and the other near Cape Otway. To date, no complete skeleton has been found for any dinosaur from Victoria. It is more typical to find isolated limb bones instead. Because of this, it is difficult to form a picture of the dinosaurs that lived there, and reconstruct how they grew and developed. In fact, the majority of fossils collected are from herbivorous dinosaurs that would have been equivalent to a large dog in size. This raises the question of whether or not this was the adult size of the animals or if there was simply a higher selective pressure against immature individuals.

OSTEOHISTOLOGY

However, with the use of osteohistology - the study of bone microstructure - the complete skeleton is not required to infer aspects of an animal's life.

This information is recorded in bone tissue and can be observed by looking at thin slices of bone with a microscope. Microscopically, bone records features such as growth rates, age, and even if it was an adult or juvenile. There is only so much to be learned from the overall shape of a bone. A bone can be measured, photographed, and even replicated in the form of a cast. Once this is done, in order to learn even more about an extinct animal, the internal structure of the bone must be examined.

The goal is to develop a more accurate picture of Victorian dinosaur diversity, physiology, and strategies for surviving in a unique environment with the intention of applying what is learned to dinosaurs as a whole. This is achieved by:

1) histologically examining multiple dinosaur bones to observe trends in bone tissue microstructure;

2) attempting to confirm the maturity status of the specimens;

3) determining if the diminutive size of the fossils is a result of dwarfism or simply immature individuals;

4) estimating growth rates through either the use of known bone apposition rates for tissue types or by growth models.

THE TECHNIQUE

Upon arrival at the Melbourne Museum, the first batch of dinosaur fossils to be histologically examined was selected. To prepare them for microscopic analysis, the fossils were sketched, photographed, and measured. A piece of bone was removed from each sample, which was then moulded and cast, exactly replicating the shape of the piece removed.

This cast piece was then painted to resemble the original bone in colour, and reinserted into the real bone. In this way the original shape of the bone is preserved.

The real pieces removed were processed further by embedding them in a polyester resin for strength and then taken to Monash University where several thin slices were cut from the embedded bone using a rock saw.

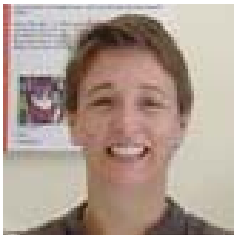
The rest of the process was performed at the Melbourne Museum. Slices were glued to frosted glass thin section slides and ground thin using progressively finer grit papers on a lapidary wheel. The final thickness of the samples was only tens of micrometers - thin enough to allow the passage of light through the sample so that the bone microstructure could be observed with the use of a transmitted light microscope.

After the initial batch of bones was analysed, several more batches were processed in the same manner. The original proposal concerned examining only herbivorous dinosaurs, but the study was expanded to include several bones from carnivorous dinosaurs as well. The project was also extended to include the unique case of pathological dinosaur bone in order to compare the structure of a diseased bone to normal bone tissue. In addition to dinosaur bone microstructure, several side projects were also initiated to examine the microstructure of extinct as well as modern marsupials.

Next Steps

The analysis of the thin sections is continuing – by your next field report I may be able to tell you more about how these dinosaurs lived.

Exhibition install team at the Bibliotek, Aileu, Timor-Leste (right to left) included Ms. Karis Cooper, Mr. Stephen Thompson, Sra. Diamantina, Dr. Corrie Williams, and Prof. Patricia Vickers Rich.



Dinosaur Dreaming Helps Teach Geology in Timor-Leste

By Corrie Williams
Monash Science Centre

Geological specimens from the Dinosaur Dreaming site in Inverloch are being exhibited in a number of educational exhibitions in Timor-Leste.

Each of these exhibitions is being used by local teachers to enhance the teaching of geology and history of Timor-Leste and its close neighbour Australia.

President Jose Ramos-Horta has been the patron of the activities for some time and hosts the major exhibition on the long history (250 million years) of Timor in the front foyer of his newly constructed offices in Dili - the beginnings of a major exhibition program for the building of a National Museum in this country.

In August 2010, Professor Vickers-Rich - Director, Monash Science Centre and Personal Chair, School of Geosciences and Dr Corrie Williams - Exhibitions Manager Monash Science Centre installed a regional exhibition in the village of Aileu in the highlands south of Dili. This exhibit, which was installed in the local library, is already being used by teachers and their students to learn about past environments.

Another regional exhibition is planned for late 2010 in a science classroom being constructed by a Silesian College in Timor's second city, Bacau.

Each of these exhibitions has been supported by ConocoPhillips and the ADF along with the Ministry of Education and the Office of the President of Timor-Leste.

NEW MUSEUM EXHIBITION PUTS INVERLOCH IN THE SPOTLIGHT

BY WAYNE GERDTZ
MELBOURNE MUSEUM

On July 2nd of this year, Melbourne Museum launched a new exhibition called *600 Million Years – Victoria Evolves*. This was the third of four new exhibitions in the Museum's Science and Life Gallery, part of a multi-million dollar redevelopment project funded by the State Government of Victoria. This particular exhibition shows some of the highlights of the story of Victoria's evolving life and landscapes.

The exhibition is a significant update and upgrade from the previous 'Travellers through Time' exhibition at Melbourne Museum, and incorporates thousands of fossils, minerals and rocks (yes, rocks!) along with custom-built detailed models, dioramic displays, animatronics and multimedia technology. The geological content is extensive and diverse, incorporating violent terrestrial and underwater volcanic activity, hydrothermal mineral formation and glaciations. I will, for obvious reasons, focus mostly on the vertebrate palaeontology content.

The exhibition is arranged chronologically; it 'starts' with the beguiling yet cryptic Ediacaran biota wending its way through the Paleozoic, Mesozoic and 'Tertiary' towards the present day. The Mesozoic section, unsurprisingly, includes a number of dinosaurs.

ANIMATRONIC ORNITHOPODS

The most popular segment is an animatronic display of a pair of small ornithopods in a reconstructed forest with a computer-animated backdrop, creating the illusion of a 'window to the Cretaceous'.

The display is the result of a collaboration of many people – Museum Victoria's skilled preparators created the forested dioramic setting, using realistic-looking, age-appropriate plants, including elements from an araucarian tree growing in nearby Carlton Gardens.

The animatronic dinosaurs themselves are based on *Qantassaurus*, with inspiration initially coming from Peter Trusler's beautiful painting of this beast. Puppeteers, model-makers and robotics experts from Melbourne firm *The Creature Technology Company* (creators of the *Walking with Dinosaurs* arena shows) collaborated with Museum Victoria's Tom Rich, Dave Pickering and Wayne Gerdtz with the additional artistic and technical input of Peter Trusler and Matt Herne (University of Queensland). The final display is unlike any other.

Melbourne-based animation company *Act3* had the task of creating a convincing background that blended with the diorama to complete the scene. This includes more *Qantassaurus* individuals feeding in the forest, making occasional contact vocalisations. The animations feature cameo appearances from a dromaeosaur-like theropod and a pterosaur flyover; each of these is a nod of acknowledgement to fossils found in the same setting as *Qantassaurus* at the Flat Rocks site. *Wax Sound Media* created a plausible array of noises for the animals to complete the illusion. It was a pleasure to co-ordinate this collaboration and to watch it all come together to stunning effect!

The animatronics amaze adults and children alike

Muttaburrasaurus skeleton

Elsewhere in the Mesozoic section of the exhibition, a cast of the skeleton of *Muttaburrasaurus* is displayed. Whilst less dazzling than the animatronics to the undiscerning eye, the skeleton's posture is significantly different to any other display of this animal – again Museum preparators worked with Dave Pickering, Tim Holland and Matt Herne to ensure the most up-to-date interpretation of *Muttaburrasaurus* was exhibited, moving away from the *Iguanodon*-like interpretation to something more closely resembling an upsized version of the Victorian ornithopods. Also on display are highlights from the Museum's collections of Cretaceous fossils, including an array of dino material from the Otway and Strzlecki Groups as well as those familiar tiny mammal jaws from Flat Rocks, the enormous jaws of the temnospondyl *Koolasuchus* and the immaculately-preserved fish, feather and mayfly fossils from Koonwarra. Many of these are displayed with some of Peter Trusler's development sketches, each a fascinating blend of artistry and science which help visitors interpret the fossils.

Muttaburrasaurus at the exhibition

Ichthyosaur skull

Rounding off the Mesozoic segment is a near-complete skull of the ichthyosaur *Platypterygius*. This remarkable fossil was discovered by Tom Rich for the express purpose of this exhibition – I had not been aware of Tom's ability to find fossils to order, but this is precisely what had happened.

In 2008, Tom bravely offered to prospect and retrieve a marine reptile skull from Boulia in Queensland for the exhibition. Little did we know we would end up with one of the most complete skulls known for this animal. The talents of Peter Trusler were again used to reconstruct the beast, and many months of patient and skilful preparation from Dave Pickering, Tim Holland and Natalie Schroeder went into making the skull look beautiful – and it worked.

The ichthyosaur skull in profile and cross-section

More information

Anyone interested should have a look at the exhibition's website where you'll find more information on the exhibition, including video interviews with familiar faces like Tom Rich, Pat Vickers-Rich, Lesley Kool, Mike Cleeland and Dave Pickering. I've described just a fraction of the exhibition here, I encourage readers to come and have a look at *600 Million Years: Victoria Evolves* when next in Melbourne Museum, if only to come and say "G'day" to the animatronic *Qantassaurus* – they may just say it back to you.

PROSPECTING AROUND THE WORLD

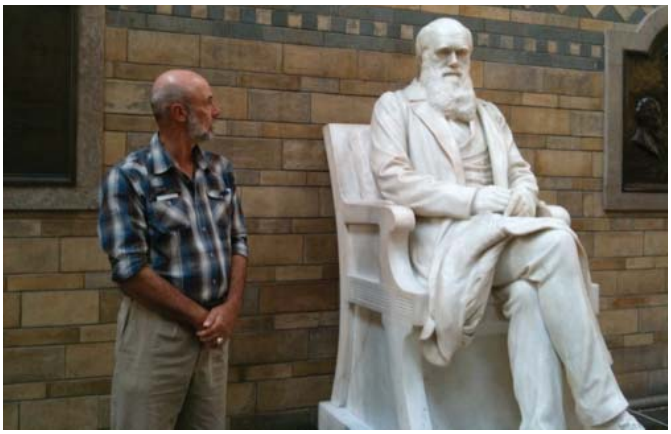
BY MIKE CLEELAND

As a result of discovering a particularly fine specimen at the Inverloch dig in 1997, who I then married in April this year, I have spent much of the time since then honeymooning with Pip in the UK and Europe. Ever keen to explore new and interesting outcrops, we have been visiting several sites of palaeontological significance. One of the standouts was the sauropod trackways at Serra's de Aire in Portugal. Claiming to be the world's longest and oldest sauropod trackway, the mid Jurassic site features one trackway 147 metres long, and smaller lengths from around 20 other individuals. Large elliptical prints are made by the rear feet, while the smaller, half moon prints are from the front feet. After the recognition of several theropod or ornithopod prints in the Victorian Cretaceous in recent times, this encounter with the traces of big sauropods can hopefully give us an idea of how to look for evidence of these beasts in this area, if in fact they ever lived here.

A visit to the *British Museum of Natural History* is always a must for any serious palaeontology buff. One of the interesting exhibits shown here was a collection of sauropod gastroliths. So if you've ever wondered about those occasional quartz or chert pebbles that pop out from the Inverloch Cretaceous, maybe now we know! The display label reads "these rounded pebbles called Gastroliths were worn smooth inside the stomach of a large plant eating dinosaur".

Here in the *BMNH* visitors also get a chance to get up close and personal with the very man who proposed the Theory of Evolution

Pip marvels at the British Museum's gastrolith collection



Mike Cleeland and Charles Darwin... notice any similarities?

An expedition onto the Isle of Skye in northwestern Scotland promised much of interest, following recent discoveries of dinosaur bones and footprints in Jurassic outcrops in the northeast sector of the Island. Ammonites, belemnites and other Mesozoic marine Gastropods were out in force, but the elusive dinosaurs were, sensibly, staying out of the rain!

A Scottish ammonite

INVERLOCH IMAGES...









Clockwise from top left: Jesse loaded up; Dale and Nick on bucket duty; Ann-Marie and Alistair - the pump A-team; Alan, Jesse, John and Travis work on the groyne; Nicole welcomes visitors on Friends' day; Mary finds a fossil; Anouska juggles some hoses; Digging, digging, digging...; Alan is very pleased with his find.

A NEW WALLABY DINOSAUR

BY WENDY WHITE

As you know, Dinosaur Dreaming plays host to a number of media each year. This year, we were filmed by Totally Wild, WIN news and a Japanese quiz show, and we were interviewed by ABC regional radio, the Sentinel Times and the Leongatha Star.

The ABC radio interview caused a bit of a stir. Lesley has long been in the habit of comparing our small bodied ornithopod dinosaurs to Wallabies. They're about the same size, and stand up on their hind legs, which were bigger and more muscular than their forelimbs.

After this had been duly reported, David Pickering back at Museum Victoria started receiving phone calls (we diggers were down at site obliviously working away and not checking our phones)

"Would Museum Victoria like to comment on the exciting new find?"

"In what way is the Wallaby Dinosaur different from others - did it hop or have a pouch?"

Dave had not talked to us for a few days and was wondering why we hadn't called him if we'd found something that new. By the time we talked to Dave that evening and sorted it all out, we had a number of other media outlets trying to confirm the story, and Lesley banning the phrase "Wallaby Dinosaur".

Illustration by Pip Cleeland

DINO DREAMING NUPTUALS

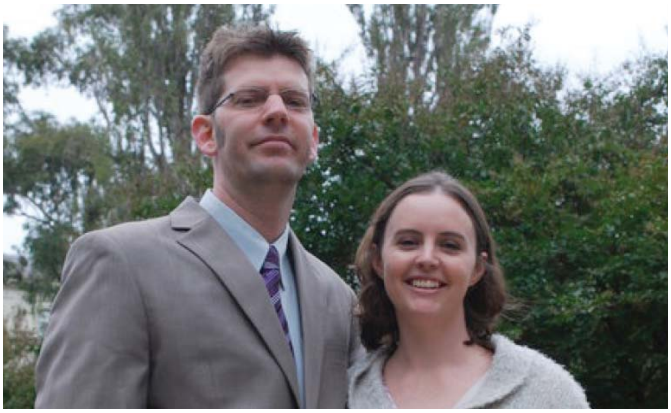
BY WENDY WHITE

This year we saw two dig couples tie the knot.

Mike Cleeland, dino prospector extraordinaire met Pip Blackie on the dig in 2008. On April 24th they married in a ceremony in Mike's dad's rose garden, followed by a reception full of chaos, music, love and old-fashioned Philip Island hospitality. The bride arrived on a horse-drawn carriage wearing a tartan scarf over a stunning white dress embroidered with local shells. The groom wore a kilt and a freshly trimmed beard. The festivities included a special "Walk like a dinosaur" song featuring Fotini in costume. Mike and Pip have been honeymooning all over Europe ever since.

Jacqui Tumney and Andrew Stocker have been volunteering on the dig since 2007. Those of us who are their facebook friends noticed a curious change on Jacqui's profile this year – she flagged herself as "Married". Subsequent investigations proved that, indeed yes – Andrew and Jacqui tied the knot on Friday May 14th in a small civil ceremony.

We wish both couples long lives together of light and laughter and love.



The happy couple Jacqui and Andrew

Mike and Pip had a wedding to remember

Fotini walked like a dinosaur at Mike and Pip's wedding

DINOSAUR DREAMING FAREWELL 2010

BY NICOLE EVERED

Dig 17 comes to an end
and we must say farewell my friend.
One last bone query before the close
"It's FISH " is said with wrinkled nose!

"Oh, good morning happy diggers"
Rings out in Wendy's dulcet tones
The only answers heard each day
Were the assorted sleepy groans!

We've pumped 'n dug 'n broken stone
Just to find that elusive bone.
We've had heat and cold, rain and sun
We've shared much laughter and such fun.

4 film crews visited our Dig
Radio and print news was BIG.
Lesley the Star in all of this
With her Dig team – how could we miss!

The "blogspot" keeps us up-to-date
The whole production is First Rate.
The photos and the text are scanned
By diggers across every land.

Grateful thanks to every digger
But our special thanks are even bigger
- Wendy, Mary, John and Norman
For Bikkies, Groyne, Food and Foreman.

Dear Lesley, how can we thank you
For letting us be diggers too.
Your accolades and all the rest
Confirm to us – you are the BEST.

As we all go our separate ways
We will be counting up the days …
We shall meet again, dear Lesley Kool,
By the waters of the Dreaming Pool.

OTWAYS FIELD CREW
27 NOV - 6 DEC 2009

Marion Anderson
Dave Arnold
Katherine Barta
Darren Bellingham
Pip Blackie
Trevor Blüm
David Bowman
Cassandra Buttle
Tamara Camilleri
Paul Chedgey
Win Chedgey
Mike Cleeland
Tim Couch
Cate Cousland
Aida Crombach
Sarah Davey
Kathryn Drury
Amanda Du
Eve Eidelson
Toni-lee Ferrier
Elizabeth Giffin
Tony Hegedus
Matt Herne
David Hocking
Tim Holland
Irene Holoyda
Simon Hulls
Fotini Karaksitos
Lesley Kool
Gerry Kool
Les Kriesfeld
Hana Lee
Gavin Lewis
Miklós Lipcsey
Aleck MacNally
Sharyn Madder
Alanna Maguire
Lisette Mill
Sue Moore
Dale Nelson
Ann-Marie O'Brien
Kathryn Owen
Travis Park
David Pickering
Doris Seegets-Villiers
Christopher Sinclair
Brittany Smyth
Alan Tait
Alistair Tait
Michael Thomas
Gabriela Turcu
Theresa Um
Jessie Vitacca
Larry Wakefield
Mary Walters
Wendy White
John Wilkins
Leah Wilson-Baring
Dean Wright
Sean Wright
Sasha Wright

INVERLOCH FIELD CREW
30 JAN - 27 FEB 2010

WEEK ONE CREW MEMBERS

L-R standing: Helen Hughes, Nicole Evered, Gerry Kool, Lisette Mill, Travis Park, Kathryn Drury, Miklos Lipcsey, Norman Gardiner, Mary Walters, Wendy White, Dianne Morgan, Lesley Kool. L-R seated: John Wilkins, Alan Evered, Gayle Jones, Nick van Klaveren, Roger Morgan, Aida Crombach, Darren Hastie, Jessie Vitacca. Absent: Mike Cleeland, Pip Blackie, Alan Tait and Alanna Maguire

WEEK TWO CREW MEMBERS

L-R standing: Tamara Camilleri, Paul Smith, Alistair Tait, Gerry Kool, Ann-Marie O'Brien, Norman Gardiner, Alan Evered, Frankie Hornby, Dale Nelson, Sharyn Madder, Penny Loughran, Cate Cousland, David Elliot, Nicole Evered. Seated: Nick van Klaveren, Mary Walters. Absent: Kat Rachjl, Mike Cleeland, Pip Blackie, Matthew Lambert, Wendy White, David Pickering

WEEK THREE CREW MEMBERS

L-R seated: Frankie Hornby, Michael Thomas, Fotini Karaksitos, Tim Couch, Nick van Klaveren, Jacqui Tumney, Gabi Turcu, Norman Gardiner, Nicole Evered, Alan Evered, Peggy Cole, Astrid Werner, Gerry Kool, John Wilkins, Lesley Kool, Sarah Davey, Wendy White, Aleck MacNally, Mary Walters. Kneeling: Heikki Kokko and Andrew Stocker.
Absent: Mike Cleeland, Pip Blackie, Alanna Maguire, Dean Wright, Danielle Shean

WEEK FOUR CREW MEMBERS

L-R standing: Larry Wakefield, John Wilkins, Darren Bellingham, Kim Davis, John Swinkels, Gerry Kool, David Bowman, Norman Gardiner, Nicole Evered, Owen Hetherington, Alan Tait. L-R seated: Wendy Turner, Mike Greenwood, Lesley Kool, Vicki Anceschi, Kathryn Owen, Mary Walters, Wendy White, Anouska Teunen, Melissa Hetherington.
Absent: Mike Cleeland, Pip Blackie, Rohan Long, Hala Assouad, Doris Seegets-Villiers