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# Dinosaur Dreaming 2009 Field Report





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[www.dinosaurdreaming.monash.edu.au](http://www.dinosaurdreaming.monash.edu.au)

and our blog at [www.dinodreaming.blogspot.com](http://www.dinodreaming.blogspot.com)

*Cover image: Alan Evered, Lesley Kool, Norman Gardiner and David Pickering at the 'prep' table down at the site with the day's haul.*

*Back cover: Gerrit Kool wearing a favourite Dinosaur Dreaming t-shirt.*

## Dinosaur Dreaming 2009 field report

*Lesley Kool*

Dinosaur Dreaming 2009 began on the 1st February and ended on the 28th February. It was the 16th consecutive annual dinosaur dig at the Flat Rocks site near Inverloch, Victoria.

Thanks to a surplus from the great success of the "Dig Deep for Dinosaurs" auction in November 2007 and a generous donation of \$3000 from the Royal Automobile Club of Victoria (RACV) the Dinosaur Dreaming fieldtrip was adequately funded. The usual six week duration was reduced to four weeks but we still managed to accommodate almost as many volunteers as we have in the past. This was partly due to Mary renting a separate house and taking in some of the extra crew.

In mid 2008 Parks Victoria resurfaced The Caves car park, where we park our vehicles during the dig. They also replaced the ancient wooden bridge with a very sturdy steel bridge and moved the access path to the beach. Slow erosion of the cliff had made the old access path a little dangerous so the rangers redirected it away from the cliff edge and lined it with strong fencing. Finally, they installed the four Dinosaur Dreaming information panels that were created three or four years ago with the help of a Parks Victoria community grant. The result is a much better access to the beach and visitors can read about the history of the site as they walk down the path. Many thanks go to the Parks Victoria rangers for accomplishing this task.

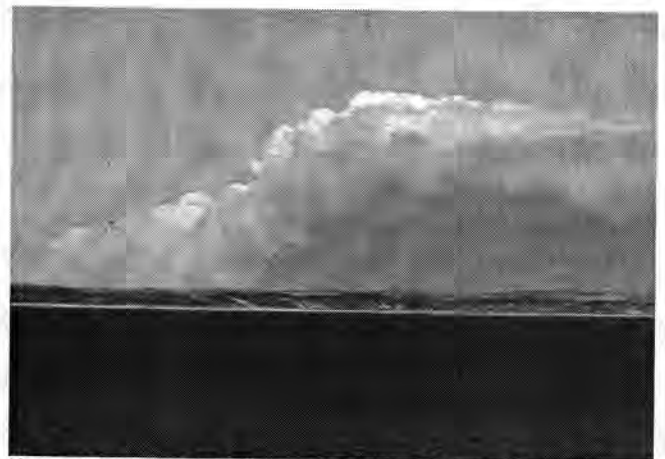


*The new path and Dinosaur Dreaming information panels*

The training for the new volunteers for the 2009 field trip once again took place at the Eric the Red West site, near Cape Otway lighthouse, in early December 2008. Fifteen new volunteers, along with some die hard core crew members, braved the wind and rain during a bitterly cold week. Everyone survived and although the number of fossil bones found was quite modest it was a great learning experience. Thanks go to Frank and Katrina at Bimbi Park for all their support.

In sharp contrast, the weather during the Dinosaur Dreaming 2009 fieldtrip was often extremely hot. The week before the dig commenced produced three days of over 40°C and we counted ourselves as very fortunate not to have started the dig that week. However, we spoke too soon, as at the end of the first week of the dig, Victoria experienced its hottest day on record. The weather forecast for Saturday 7th February indicated extreme heat and strong winds – an explosive combination. It was close to 40°C by noon when we officially called a secession to work and told everyone to find somewhere to keep cool. During the afternoon the temperature climbed to 46°C in Inverloch and it was much hotter further away from the coast. We were very fortunate that no bushfires occurred around Inverloch but other areas were not so lucky. By late afternoon it became apparent that a numbers of areas were being devastated by bushfires and lives and property were lost.

From the dig site we could see the fires raging on Wilson's Promontory for days following that terrible day, which be forever known as "Black Saturday".



*We could see smoke billowing out above Wilsons Prom*



We do have some good memories of the 2009 dig, which include the generosity of the manager of Total Tools Cranbourne, which is covered in John Wilkins' report. We managed to catalogue more than 500 fossil teeth and bones in the four weeks, including a lovely mammal jaw, found by Jacqui Tumney. The 2009 field season was Jacqui's fourth dig, but until this year she had never found a mammal jaw. So congratulations go to her and also thanks to Jacqui and her partner Andrew Stocker who took on the mantle of joint "house managers" for the 3rd week when Wendy was unable to make it.

We continued working the Bridge East section of the fossil layer of the principal Flat Rocks site (see map enclosed). This area produced two mammal jaws and the single mammal upper molar during the 2008 dig, as well as the most complete turtle skull yet found. This year an old excavation technique was employed, which had been used at Dinosaur Cove in the Otway Group but had never been tried at this site. John explains the principles behind this ancient technique and the results achieved.

Norman Gardiner excelled himself by finding two small dinosaur jaws. The first jaw was identified by its teeth as belonging to a small ornithomimid dinosaur, similar to *Qantassaurus intrepidus*. The under side of the second jaw was exposed so until it has been prepared we won't know what type of dinosaur it belongs to.



*Qantassaurus intrepidus* jaw

More fossil bones from small ornithomimid dinosaurs were also recovered, including tibiae and fibulae (lower leg bones) and femora (thigh bones). A lovely ornithomimid ischium was also found. This bone is part of the hip and is very fragile, so to find an almost complete specimen is very exciting.



*Ornithomimid ischium*

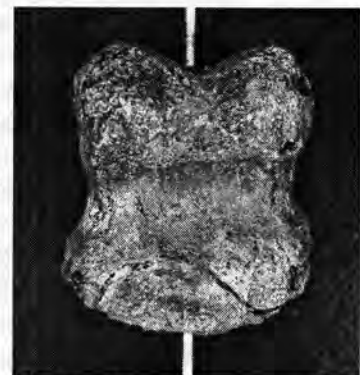
As usual, we found a number of isolated dinosaur teeth including a particularly well preserved theropod (meat-eating) dinosaur, which was found by our German volunteer Mareike Schmidt.



*Isolated theropod tooth*

Most of the fossil bones were transported to Museum Victoria for preparation by David Pickering and his volunteers. However, a few fossils, including the turtle specimens were prepared by me. A particularly ugly specimen had me intrigued as I could not decide what it was. It was in four or five pieces and the exposed bone was very porous. I infilled the missing areas with epoxy putty and prepared it as a whole bone rather than preparing the individual pieces and then gluing together. It turned out to be the largest phalanx (toe bone) that I have seen from either the Otway or Strzelecki Groups.

Measuring more than 3.5cm in length and width, it obviously belongs to a quadrupedal dinosaur as it is far too robust to belong to the gracile two legged ornithomimid and theropod dinosaurs.



*Phalanx (toe bone)*

The obvious answer is that it belongs to an ankylosaur, an armoured quadrupedal dinosaur, which roamed the area and whose bones and teeth have previously been found at the site. More research will have to be carried out to compare this bone with the toe bones of other ankylosaurs, particularly those from Queensland, which seem to be closely related.

During the 2008 field season John Wilkins uncovered a large fragment of turtle shell at the Bridge section at Flat Rocks. The shell was very thin and unfortunately had split down the middle making preparation very awkward. It was put in the "too hard basket" until a few months ago when I finally decided to prepare it. Initially I thought it was a large piece of shell from a small turtle, but it turns out that it was a smaller piece of shell from a larger turtle. It should still be able to give us information about this enigmatic group as it possesses four vertebrae fused to the underside of the shell.



*Turtle shell - in the rock (left) and prepared - ventral view (right)*

Research into the specimens recovered from the Flat Rocks site and other sites along the Strzelecki and Otway coasts is a very time consuming process. Sometimes it is years between the time a fossil is found and when it is finally prepared, identified and published. Such a fossil is a small bird furcula (wish bone), which was found the week before the first mammal jaw during the 1997 field season. Years of comparing it to other furculae, both bird and dinosaur, has finally led to its publication this year. Tom comments on the specimen in his report along with details of other papers, which were published this year or are in press.

In March this year we hosted two groups of students from Singapore and Japan. Each group of enthusiastic students stayed at the RACV Inverloch resort and spent a couple of days being "Dinosaur Dreamers" at the Flat Rocks dig site, under the supervision of Professor Pat Vickers-Rich, Dr. Corrie Williams from the Monash Science Centre and a handful of dig crew. The students had a great time and even found a few fossils. We were unable to expose the main part of the fossil layer as that takes the full Dinosaur Dreaming crew, but that didn't seem to worry the students at all. We enjoyed hosting them and there are plans for more visits in 2010.



*University students from Republic Polytechnic in Singapore*



*Happy visitors from Notre Dame Jogaquin in Japan*

Apart from continuing his regular prospecting along the Strzelecki and Otway coasts and finding more fossil bones, Mike Cleeland has a very happy story to impart in his report this year.



Palaeo-ichnologist Tony Martin (Emory University, Atlanta, Georgia USA) and his lovely wife Ruth visited us again in May. Part of his visit involved visiting a number of trackway and/or fossil burrow sites both in the Strzelecki and the Otway Groups. At one site near Eagle's Nest, Tony enlisted the services of Dr. Mike Hall from Monash University to be his human ladder so he could get a better photo. He has been very busy writing papers on what he found and his report is very interesting.



The human ladder - Tony and Mike

Long time Friends of Dinosaur Dreaming will notice a big difference in the Fossil Localities maps in this edition of our annual reports. The maps were becoming so crowded with additional icons that it was decided to try and make them a little easier to read. Site manager John Wilkins came up with a combination of maps and taxonomic lists, which we feel works very well. Let us know what you think.

We would like to thank Dallas and Jude Wyatt for allowing us to rent their house in Inverloch at a generous discount. When we first began our annual excavations in 1994, we searched for quite a while to find the right house for our crew. As soon as we saw the Lavington Street house we knew it would be perfect for our needs and we have been very fortunate to have been able to use the same house for the last 16 years. We are pleased to report that we have secured the house for the 2010 field season as it is just like "coming home" to many of the regular crew.

Some of our best discoveries have been found while breaking rock in the back garden of the dig house, including the holotype lower jaw of *Qantassaurus intrepidus*, found by Nicole Evered in 1996 and the first mammal jaw (*Ausktribosphenos nyktos*) found by Nicola Sanderson in 1997.

Quite a few crew members opt to erect small tents in the back garden, which we colloquially term "tent city". About three years ago the Wyatts installed a huge shed in the back garden, which acts as our prep lab and storage area, although we are sure they didn't erect it just for our use.



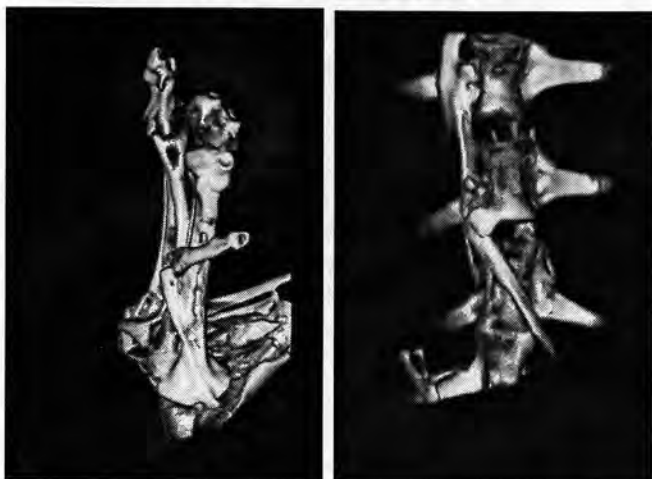
Diggers hard at work in the back garden

Most of you are aware of the small "Dinosaur Dreaming" booklet that we sell to help with our funding. The booklet concentrates mainly on the Flat Rocks site near Inverloch, but there are many more fossil localities along the Bass Coast, which have not been fully described. So it was decided that we would produce a larger colour booklet describing all the localities along the coast so that interested people can visit these sites. We applied for and received grants from Bass Coast Shire and Parks Victoria, which will help fund the cost of printing the booklets. We anticipate that the booklet will be in print by mid 2010.



Nick looking right at home with little Rowan

Finally we are happy to announce the safe arrival of Rowan Sanderson, son of Nicola (of *Ausktribosphenos nyktos* fame) and Dale Sanderson. The Sanderson family currently live in Kalgoorlie so only Nick van Klaveren has had the good fortune of meeting Rowan, but the photos are great.



CT scans of limb elements (left) and vertebrae (right) of the *hypsilophodontid* partial skeleton from Eric the Red West, being described by Matt Herne

## Vertebrate fossils

Tom Rich

The plan at the moment is to publish, in the next few years, scientific articles about all the dinosaur material collected in Victoria since 1978. Many of these fossils have already been described, some more than once. But after 31 years, all of them need to be out there for professional colleagues around the world to be able to know about what has been found in this State.

Of the undescribed material, a manuscript has been submitted concerning the ankylosaurs or armoured dinosaurs. At this stage, it is unknown whether the Victorian fossils can be referred to *Minmi paravertebrata*. That species is one of the most complete dinosaurs known from Australia and occurs in Queensland. Paul Barrett of the Natural History Museum, London, is the senior author on this paper. Others who have contributed are Tat'yana Tumanova of the Paleontological Institute in Moscow who previously has studied Mongolian ankylosaurs and Matthew Inglis who initiated the study as an Honours project under Pat Vickers-Rich and myself.

An astragalus or ankle bone of a group of theropod or carnivorous dinosaurs not previously known from Australia is under study by Erich Fitzgerald and David Pickering plus Pat Vickers-Rich and myself.

From Victoria, there are four different types of small theropod teeth, all known as isolated specimens, much to the frustration of Lesley who yearns for a jaw or skull fragment of at least one of these theropods with the teeth in place. Such a specimen could make it possible to assign a generic and specific name to one of these small species - we know on the basis of isolated teeth that they are there but the fossil records are insufficient to give them a scientific name. In the meantime, Steven Salisbury, Phil Currie of the University of Alberta, Edmonton, Pat Vickers-Rich and myself have a manuscript describing the approximately 80 such isolated teeth now known.





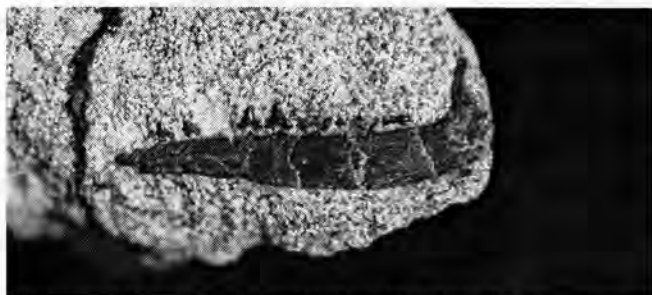
The astragalus of an unknown theropod dinosaur from San Remo.

At this writing, I am on my way to London to work with Paul Barrett. We shall be analysing a number of other Victorian theropod specimens that have not been previously mentioned. Amongst them is a partial vertebra that may represent yet another family of this group not previously known in Australia.

All of this Victorian theropod material, plus what has been described before, indicates a diversity of this group in this State comparable to that of the hypsilophodontids.

The Victorian material of the hypsilophodontids [= euornithopods = non-dryomorph iguanodontians] is being currently reviewed and described by Matthew Herne of the University of Queensland for his Ph.D. dissertation.

Progress on the mammalian front was made this past field season when Jacqui Turney found a jaw of *Bishops whitmorei*. Her discovery shows for the first time what the anterior part of the jaw was like. Although the tooth is gone, there is a large alveolus for the canine. An enlarged canine for this species fits well with the premolar and molar dentition behind in showing that *B. whitmorei* was likely to be a very active predator on what were rather tiny prey, perhaps primarily insects and worms.



*Bishops whitmorei* - a lower jaw found by Jacqui Turney

While *Bishops* and its co-familial *Ausktribosphenos* have generated much controversy over the years as to their placement in the mammalian family tree, the other mammal from the Flat Rocks site, *Teinolophos*, a monotreme, has been equally controversial and thus exciting. In the living monotremes, the echidna and platypus, a single bone forms the lower jaw as it does in all other mammals.

In *Teinolophos* and reptiles, a number of bones form the lower jaw. In fact the condition in the jaw of *Teinolophos* is so different and, for this reason so unexpected, that there are people who have asserted in the scientific literature that those reptilian-like extra bones do not even exist! For this reason, teaming up with James Hopson of the University of Chicago and Pamela Gill of the University of Bristol, Pat Vickers-Rich and I are documenting that *Teinolophos* does show the reptilian jaw condition.

In the meantime, our knowledge of *Teinolophos* continues, like that of *Bishops*, to grow. And grow in the same manner. That is, a specimen found in 2008 gives us an idea of what the anterior part of the jaw was like. Although totally unrelated to bandicoots, the long, shallow nature of the jaw of *Teinolophos* shows a remarkable resemblance to them. In addition to that, this specimen has teeth preserved anterior to those known in previously collected specimens of this genus. Since this remarkable specimen was found more than a year ago, David Pickering has been patiently extracting it from the rock, the condition of the specimen and the character of the rock making this a very delicate operation indeed.

After more than 30 years of searching for and collecting dinosaurs and other fossil vertebrates in Victoria, two new approaches to be trialed in the years to come have been recognised as feasible in the past twelve months.

As explained elsewhere in this report, Tony Martin has recognised what he thinks are likely to be dinosaur burrows exposed in the coastal outcrops of the Otway Group. Building on this, the thought is for Tony to prospect all the coastal outcrops of both the Otway and Strzelecki groups, mapping those structures he interprets as possible dinosaur burrows.

Once that is done, an assessment will be made of which, if any, of these burrows should be excavated to attempt to recover dinosaur bones within them. Tony participated in a study of the first dinosaur burrows recognised anywhere in the world. The burrow structure central to the study carried out in Montana had the remains of two juveniles and one adult hypsilophodontid in it.

A trip I made in June to the area of China known to yield feathered dinosaurs showed a remarkable resemblance of some of the fossil-bearing units there to the well known Koonwarra site. Koonwarra is a locality about 17 km north and east of Inverloch where fossils the same age as Flat Rocks occur in a quite different geological setting. Instead of being a sandstone laid down in stream deposits, at Koonwarra the fossils occur in much finer grained shales and claystones deposited in the quiet waters of a lake bottom.

In the similar deposits in China, the dominate fossils are small fish, arthropods, and plants. Those are exactly the same three groups that dominate the Koonwarra assemblage. And although feathered dinosaurs have not been found yet at Koonwarra, that may be simply a lack of effort. The amount of area excavated in China to recover a single feathered dinosaur at the site where I saw specimens in place was far greater than all the area ever excavated at Koonwarra.

Feathers are not common as fossils as they usually rot away. A few isolated ones have been found at Koonwarra. This suggests that the similarity to the Chinese occurrences may well be significant.

To excavate a similar area to that which produced the Chinese feathered dinosaurs at Koonwarra would require tunnelling at that site. Before doing that, a prolonged effort will be made to find an alternative site or sites in the Strzelecki Ranges where there are lake deposits similar to Koonwarra that can be more readily excavated. Three fossil tunnels are enough in one lifetime.

## The ponderings of an excavation manager

*John Wilkins*

I humbly present the following for your understanding, insight and, hopefully, entertainment – the excavation manager's report on the operation and excavation of the Inverloch Flat Rocks fossil locale granted under the Parks Victoria Permit 10004616. I'd like to thank our loyal and energetic crews and acknowledge the input and guidance from those more knowledgeable and experienced than myself.

### Dinosaur Dreaming 2009 method

We pumped seawater out of catchment areas using the two-stroke water pump for large volume areas and the small 12V electric pumps for water pockets and the continual run in. We put filters on the inlets of both pumps to exclude materials from the uptake - shade cloth on the two-stroke inlets and filter "socks" for the smaller 12V pump head units.

Sand and debris were removed by the brute force and determination of the trusty crews throughout the dig using shovels, wheelbarrow and buckets. Overburden was removed using jackhammers, as well as sledges and chisels, and carted away manually.

This year, we trialled the use of expanding wedges (called "plugs and feathers" because of their shape) to crack the rock face. We drilled a number of holes into the rock and inserted feathers parallel to the face, along the line of where the crack was required. We then inserted the plug and drove it home, which pushed against the feathers and applying force to the rock to cause it to fracture. This system split the rock through all the way down through the fossil layer. This not only allowed us to remove overburden quickly, it also made the process of extracting fossiliferous rock much cleaner and more efficient.

A rotary impact hammer, auger bits and a generator were generously donated to us by "TOTAL TOOLS" in Cranbourne. These tools proved to be extremely efficient and worked well with the plugs and feathers. They made excavation much easier and less back breaking. Many thanks to "TOTAL TOOLS" and to John Swinkels for making this possible



We removed the fossiliferous material using sledgehammers and, for the more delicate operations, smaller hammers and chisels. For difficult or precarious material we used a diamond blade rock saw to cut around the fossil, reducing the likelihood of it breaking when we chipped it out - hopefully in one piece.

Much of the extracted rock was broken up on the beach by our expert crews. The rest was lugged up the cliff side Sherpa-style and broken up at the dig house by our intrepid crew of fossil freaks.

**Equipment used in 2009**

Much of the equipment used in 2009 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 ULP) powering a 4kg Bosch hammer drill
- a variety of hammers, chisels, sledges, spikes, buckets, brooms, and various other hand tools.

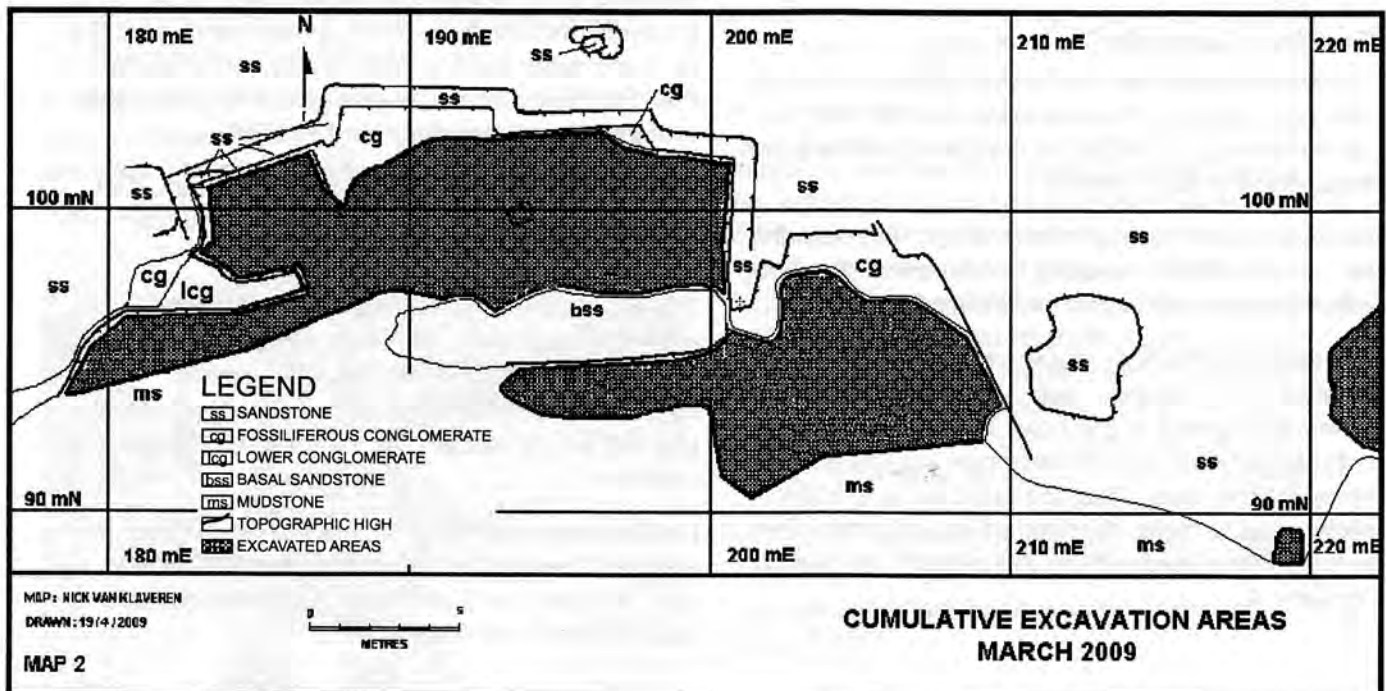
We also used some new equipment:

- Plugs and feathers (either hammered in using sledge hammers or a special cup bit fitted to the Cobra jack hammer)
- Rotary impact hammer, auger bits and a generator kindly donated by "TOTAL TOOLS" in Cranbourne

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



The kind lads from Total Tools hand John our new generator



**Changes implemented in 2009**

Managing and co-ordinating the activities in each excavation area was assigned to a team leader or "hole master". This year, we gave more crew members experience as hole master to expand our skill base. Feedback from both the new and old hole masters was that this worked well overall and we plan to continue introducing more hole masters throughout the dig in 2010.

Feedback from the 2009 hole masters indicated there were some challenges that we can mitigate in 2010:

*"Not enough time to get used to being hole master"*

We will aim to roster hole masters for two consecutive days in the same location so they can continue from the previous day and gain experience of the position rather than having to come to terms with a new location. We expect keeping this continuity will reduce the time each crew spends analysing the rock face.

*"Too many chiefs"*

New hole masters were receiving perhaps too many suggestions from several experienced hole masters. We intend to appoint an overseer to provide consistent advice to new hole masters.

*"Insufficient instruction"*

The overseer role will take responsibility for training new hole masters. We anticipate that the need for an overseer will diminish as the crew members gain experience in hole mastery.

Appreciation and many thanks to both the new and old hole masters, and to dig management, for their efforts, support and input into this process.

To assist with the hole roster a notice board was created so that people could see when they were scheduled to work in the hole. This allowed conflicts to be raised early and let everyone see the planned roster for the week. This appeared to be effective, allowing us to make changes as issues arose. Due to the positive feedback on this system, we plan to continue it.

In previous years the storage, cataloguing and fossil inspection areas had been separate. The fossil inspection area was by the back door of the dig house (good light and close to tea services). This year, it was all relocated into the large and beautiful dig shed. This reduced the clutter around the back door and minimised the risk of damage to the fossils placed there awaiting inspection. The process and movement of the specimens is now more streamlined, with identification, field cataloguing, wrapping and storage all done in one centralised area.



*John and Kim give the pump a helping hand*

**Improvements planned for 2010**

We have been devising a retaining wall system that prevents the hole from filling up with sand, enabling us to excavate deeper fossil layers. Unfortunately, in the 2009 field season there wasn't time to trial this system. We will hopefully try it in 2010.

Further investigation into the venturi system, and trials of some minor modifications to hand tools, are also planned.

When key personnel were absent (or just the collective memory wasn't working) key information was not effectively communicated. We are considering developing a 'dig manual' that covers site and house matters for new and returning crew members.

Crew change over day has previously been on Sunday. This has, at times, left us with depleted crew numbers for that day, and reduced capacity to properly train new volunteers.



In 2010 we will trial a Saturday crew change over, and consider spending that day at the house to train new personnel and reduce the backlog of excavated material. We might, on those days, send some of the crew down to site so that members of the public who come down will see the dig in operation.

#### In conclusion:

No construction was used to exclude sand from the target area. The crews did an exceptional job of uncovering the area in a suitable time frame to allow for the adequate extraction of the fossiliferous material.

Using plugs and feathers allowed us to remove a large amount of rock quickly.

The eastern edge of the fossil layer is dipping down and "lensing" out, so we will continue heading north, following the dip and observing which way the edge of the lens travels.

Work at the seaward edge by Alan Tait and David Pickering has shown that there is still viable material in this direction. We will follow this to determine how the fossil layer progresses.

The length of Bridge East, from Pond to the seaward edge, is still producing fossil material. We will continue to work this in 2010, with possibly a few exploration points further North.

Further attention to mapping and documentation on a regular basis (including column layers) will help generate a more complete picture of the excavation and fossil layer at this location.



Sharyn on a bucket run to wash down the 'rock - rock'

## The age of the Dinosaur Dreaming fossil site

Doris Seegets-Villiers

Thanks to some tiny spores and a relatively new zonation scheme (Partridge, 2006) we are finally able to reveal the "exact" age of the site. Several different zone indicators (Fig. 1) utilized by Partridge (2006) were recovered from the sediments below and above the excavation site, each characterised by a distinct first (FAD) or last (LAD) appearance datum. (FAD's and LAD's mark the first and last time respectively palynomorphs are observed in an investigated area). For example, the first appearance of *Ruffordiaspora australiensis* in our sediments suggested an age younger than Berriasian whilst the occurrence of *Foraminisporis asymmetricus* indicates an age younger than Aptian for the deposits of the Dinosaur Dreaming Site sediments (Fig. 1).

Whilst both these taxa helped narrowing the time frame of sedimentation, it was the first appearance of specimens of *P. parvispinosus* and last occurrence of *Cooksonites variabilis* spores which ultimately decided the age of the fossil site. Both taxa are observed in the *Cyclosporites hughesii* Zone, therefore indicating an age of between early Late to mid Late Aptian or between 120 and 116.5Ma.

You might have wondered why the word "exact" was written in inverted comas before. A time frame of 3.5 Ma is not exactly very precise. However, Fig. 1 shows all the zone indicators utilized by Partridge (2006) and it is obvious that no additional index fossils have been identified between the occurrences of *P. parvispinosus* and *C. variabilis* which might further restrict the age of the site. Originally, the proposed time frame of deposition was not even as "precise" as it is now. It looked like the age of the site might have to be determined by the FAD of *Foraminisporis asymmetricus* instead of the FAD of *P. parvispinosus*, which would have extended the possible time frame of deposition by a further 5 Ma.

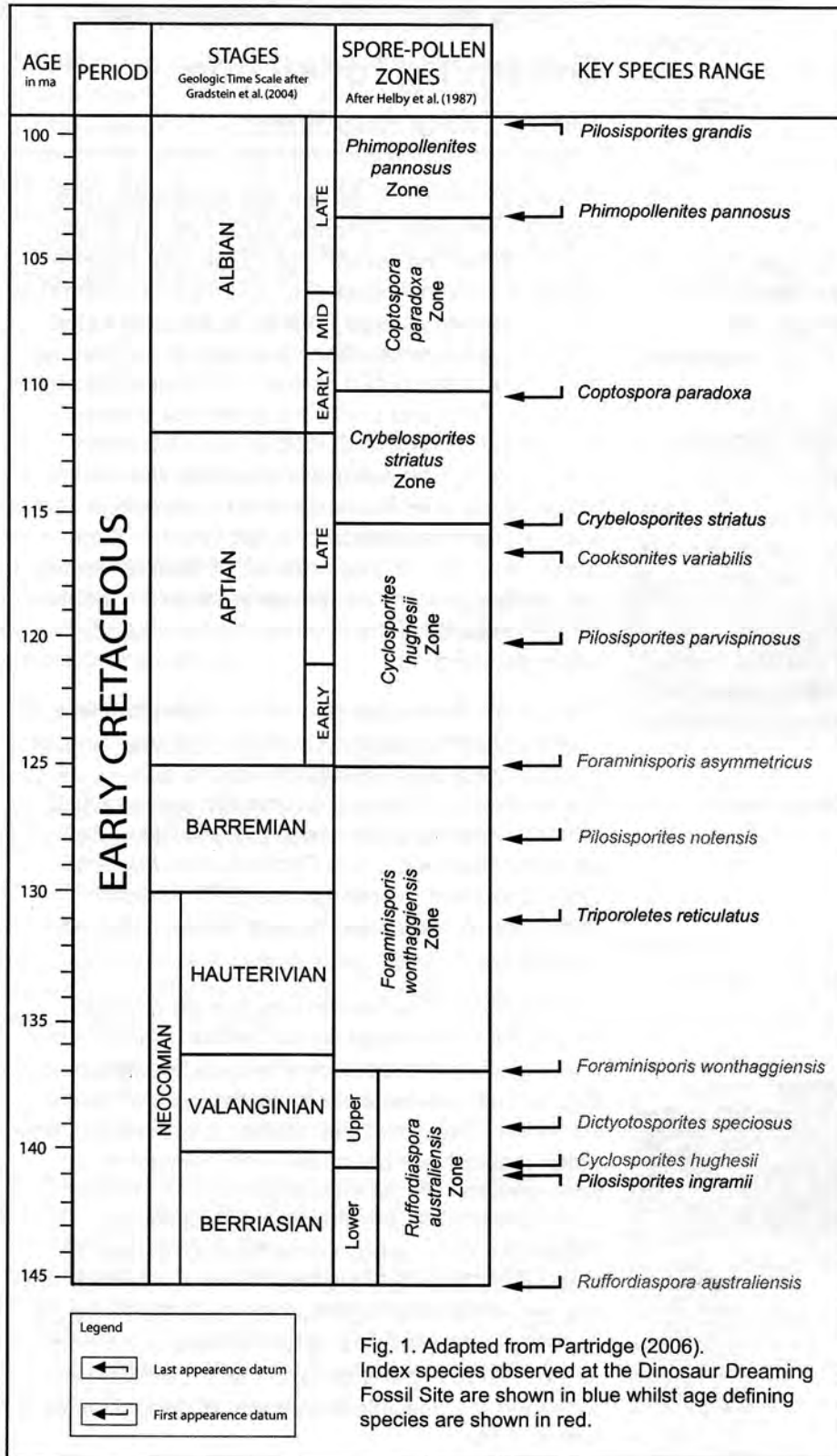


Figure 1. from Partridge 2006



Fig. 2: *Pilosisorites notensis* covered in long, thin spines. Size 125µm.



Fig. 3: *Pilosisorites notensis* covered in short spines. Size 103 µm.



Fig. 4: *Pilosisorites parvispinosus* showing much shorter spines than representatives of the species *P. notensis*. Size 94 µm.



More precise age determination was made possible by the re-evaluation of slides examined by Barbara Wagstaff from Kilcunda and submitted for her honours thesis (Wagstaff, 1983). Direct comparison of specimens of *P. parvispinosus* in Barbara's thesis to specimens found in the Inverloch assemblage made it clear that some of these had been wrongfully assigned to the species *P. notensis* instead. How was this possible??

### The *P. notensis* saga

*Pilosisporites notensis*, at first glance appears to be a palynologists dream. Its large size (71 to 125µm) does not only make this spore, even under low magnification, stick out like a sumo wrestler in a busy Tokyo street, it also features distinct ornamentations which aid identification. On top of this it can also be reliably used in determining the age of sediments. Initially all specimens of large size and distinct ornamentation were lumped as *P. notensis*. However, as time passed and numbers of examined slides increased, it became clear that diagnosis (description) and images in existing publications (e.g. Burger, 1980; Cookson and Dettmann, 1958b; Dettmann, 1963) did only match some of the specimens observed at the Dinosaur Dreaming Site.

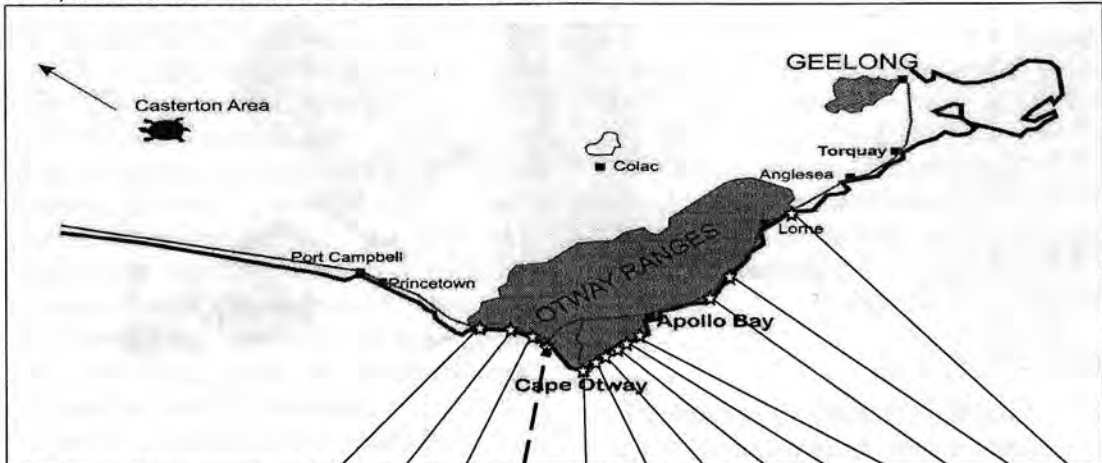
It was especially the distribution and size of spine and cone shaped ornaments on the outer surface of the spore grain that caused concerns and led to comparing of specimen from the Dinosaur Dreaming Site and those of Kilcunda (Wagstaff, 1983). As it turned out, both sites, Kilcunda and the Dinosaur Dreaming Site, show similar changes in the morphology of the taxon and it seems that the taxon can be split into two distinct morphological end members. The first shows curved or straight spines of up to 5.5 µm length, with a narrow base of as little as 1 µm (Fig. 2), the second comprises species with shorter spines and cones (up to 3 µm high) and base diameter of between 0.5 – 3 µm (Fig. 3). It is now clearer why *P. parvispinosus* (Fig. 4) was initially not separated from this vastly diverse group. The slightly shorter spines of this latter taxon were identified as yet another morphological variety *P. notensis* had to offer rather than the distinct species they really represent. Luckily, I could get hold of Dettmann's (1963) (thanks Dave!) and Wagstaff's old slides and compare their specimens directly to those of Inverloch.

If any of these morphological variations had ever been observed by Burger, 1980; Cookson and Dettmann, 1958b or Dettmann, 1963, they certainly had not been made obvious in the descriptive section of these papers and definitely not been shown in accompanying images. It is possible that *P. notensis* was relatively uniform in the samples described by these authors and that changes only occur within the Inverloch/Kilcunda areas of the Gippsland Basin, however one can only be certain if more samples are investigated. If the variety of *P. notensis* is observed in other sections of the Gippsland Basin or even better, in other basins as well, then a subdivision of this taxon into further species might be possible. Who knows, one of these new taxa might even receive zone indicator status and aid in the further subdivision the 3.5 Ma time gap between *P. parvispinosus* and *C. variabilis* thus providing a narrower time frame of deposition for the site.

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**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	Ryans Den	Knowledge Creek	Rotten Point	Dinosaur Cove	Eric the Red West	Eric the Red	Point Franklin	Elliot River	Point Lewis	Marengo Creek	Skunas Creek	Cumberland River	Eastern View
<b>MAMMALIA:</b>													
Tribosphenic mammal:					X								
<i>Bishops sp.</i>					X								
Monotreme mammals:				X									
<b>DINOSAURIA:</b>													
DINOSAUR indet. (Unidentified)	X		X	X	X	X	X	X	X	X			X
Ornithopod sp.	X		X	X	X			X	X	X			
<i>Atlascoposaurus loadsi</i>				X					X				
Theropod dinosaurs				X	X		X						
Oviraptorosaurid dinosaur				X									
Ornithomimid dinosaurs:				X									
Ankylosaurs/nodosaurs				X									
Ceratopsian dinosaurs				X									
<b>Other Vertebrates:</b>													
Plesiosaurs: Plesiosauria				X								X	
Crocodyles: Crocodylia				X									
Pterosaurs: Pterosauria				X									
Turtles: Testudines	X			X		X	X		X				
Lungfish: Ceratodontidae sp.				X					X				
<i>Neoceratodus nargun</i>				X					X				
Modern fish: Teleost				X									
<b>Invertebrates:</b>													
Freshwater crustacean:				X									
Freshwater molluscs: Unionidae				X									
<b>Trace Fossils:</b>													
Dinosaur footprints		X									X		
?Dinosaur Burrows		X											
Crustacean Burrows: Parastacid		X		X						X	X		

**Table 2. Taxonomic list of Fossil Materials from the DINOSAUR COVE Site reflecting the high Faunal Diversity**

TAXA	Skull element	Jaw	Tooth	Verte bra	Limb	Girdle	Rib	Shell / Armour	Scales	Trace
<b>MAMMALIA:</b>										
Monotreme indet.			X							
<i>Kryoryctes cadburyi</i>					X					
<b>DINOSAURIA:</b>										
DINOSAUR indet. (Unidentified)	X	X	X	X	X	X	X			
Ornithopod dinosaur sp.	X	X	X	X	X	X	X			
<i>Atlascoposaurus loadsi</i>		X	X							
<i>Fulgurotherium australe</i>					X					
<i>Leaellynasaura amicagraphica</i>	X	X	X	X	X	X				
Theropod dinosaurs sp.	X		X	X						
Oviraptorosaurid dinosaur		X		X						
Ornithomimid dinosaurs:										
<i>Timimus hermani</i>				X	X					
Ankylosaurs/nodosaurs				X				X		
Ceratopsian dinosaurs:					X					
<b>Other Vertebrates:</b>										
Crocodyles: Crocodylia			X					X		
Plesiosaurs: Plesiosauria			X							
Pterosaurs: Pterosauria			X		X	X				
Turtles: Testudines										
<i>Otwaymys cunicularis</i>	X	X		X	X	X		X		
Lungfish: Ceratodontidae sp.			X							
<i>Metaceratodus wollastoni</i>			X							
<i>Neoceratodus nargun</i>			X							
Modern fish: Teleost	X	X	X						X	
<b>Invertebrates:</b>										
Freshwater crustacean:								body fossil		
<i>Palaeoechinastacus australianus</i>										
Freshwater molluscs: Unionidae										X
<b>Trace Fossils:</b>										
Crustacean Burrows: Parastacid										X



THE STRZELECKI GROUP VICTORIA

MAP B) EARLY CRETACEOUS FOSSIL LOCALITIES IN THE STRZELECKI GROUP

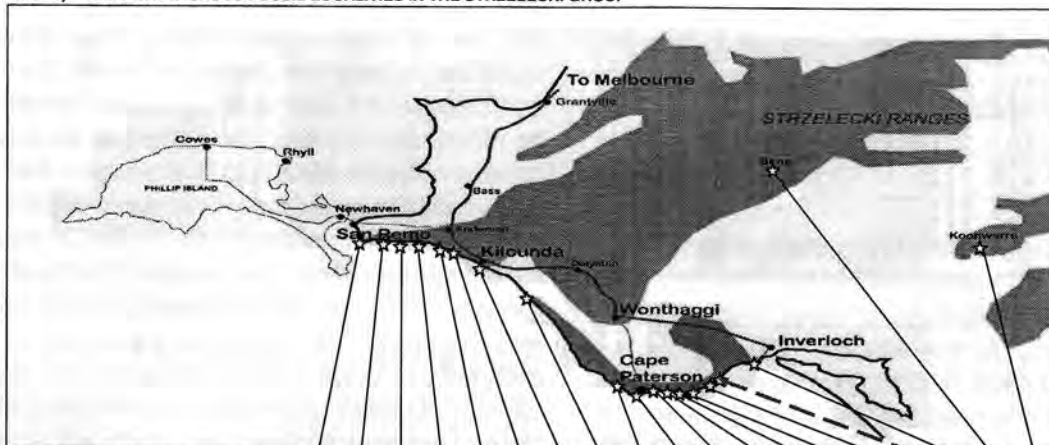


Table 3: Distribution of taxa recovered from the main fossil localities within the Early Cretaceous sediment of the Gippsland Basin

TAXA	San Remo	Paterson Hill	Rowell's Beach	Punch Bowl	The Arch	Blackhead	Kilounda	Powlett River	Hammers Haven	Capa Paterson	The Oaks	Twin Reefs	Shack Bay	Eagles Nest	The Caves	Flat Rocks	Inverloch	Bena	Koonwarra
<b>MAMMALIA:</b>																			
Tribosphenic mammals:																	X		
Monotreme Mammals:																	X		
Multituberculate Mammals:																	X		
<b>DINOSAURIA:</b>																			
DINOSAUR indet. (Unidentified)	X	X	X	X	X	X	X	X	X	X	X						X	X	
Ornithopod dinosaurs	X	X		X	X	X	X	X								X	X		
<i>Fulgurotherium australe</i>																X	X		
Theropod dinosaurs	X			X	X	X	X	X					X	X			X		
<i>Australovenator sp.</i>					X									X					
Ankylosaurs/nodosaurs					X											X	X		
Ceratopsian dinosaurs					X														
<i>Serendipaceratops arthurclarkei</i>					X														
Ornithomimid dinosaurs	X					X											X		
<b>Other Vertebrates:</b>																			
Plesiosaurs: Plesiosauria								X						X		X	X		
Pterosaurs: Pterosauria														X		X			
Turtles: Testudines					X		X		X					X	X	X	X	X	
Birds: Aves														X		X			X
Lungfish: Ceratodontidae sp.	X			X			X	X					X	X		X	X		X
<i>Neoceratodus nargun</i>				X										X		X			
<i>Archaeoceratodus avus</i>														X		X			
Modern fish: Teleosts					X	X		X						X		X		X	X
<i>Leptolepis koonwarra</i>																		X	X
<i>Koonwarra sp.</i>																			X
Modern fish: Holosteans																			X
<i>Wadeichthys oxyops</i>																			X
Modern fish: Palaeoniscoids																	X		X
<i>Coccolepis woodwardi</i>																	X		X
<i>Psilichthys sp.</i>																			X
Amphibians: Temnospondyli																			
<i>Koolasuchus cleelandi</i>	X	X	X	X															
<b>Invertebrates:</b>																			
Freshwater molluscs: Unionidae					X												X		
Insects: Insecta																			X
<b>Trace Fossils:</b>																			
Dinosaur footprints												X	X			X			
Crustacean Burrows: Parastacid											X	X		X	X	X			

Table 4. Taxonomic 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
<b>MAMMALIA:</b>										
Tribosphenic Mammals:		X								
<i>Ausktribosphenos nyktos</i>		X								
<i>Ausktribosphenos sp.</i>		X								
<i>Bishops whilmarei</i>		X								
Monotreme Mammals:	X	X	X							
<i>Teinolophos trusleri</i>		X								
Multituberculate Mammal:										
<i>Corriebataar marywaltersae</i>		X								
<b>DINOSAURIA</b>										
DINOSAUR indet. (Unidentified)	X	X	X	X	X	X	X			X
Ornithopod dinosaur sp.	X	X	X	X	X	X	X			
<i>Qantassaurus intrepidus</i>		X								
Theropod dinosaurs	X	X	X	X	X					
Ankylosaurs / nodosaurs			X					X		
Ornithomimid dinosaurs				X						
<b>Other Vertebrates:</b>										
Plesiosaurs: Plesiosauna				X			X			
Pterosaurs: Pterosauria					X					
Turtles: Testudines	X	X		X	X	X		X		
Birds: Aves					?	X				
Birds: enantiornithine						X				
Lungfish: Ceratodontidae sp.			X							
<i>Neoceratodus nargun</i>			X							
Modern fish: Teleost	X	X	X						X	
Modern fish: Palaeoniscoids	X	X	X						X	
<b>Invertebrates:</b>										
Freshwater molluscs: Unionidae										X
<b>Trace Fossils:</b>										
Dinosaur footprints										X
Crustacean Burrows: Parastacid										X

## Dinosaur Dreaming research

Anthony J. Martin

Emory University, Georgia USA

I am very happy to report that my research on Early Cretaceous trace fossils of the Victoria coast, started in early 2006, reached some noteworthy milestones this year. The one that garnered the most media attention was a paper of mine (singly authored) that proposed the presence of small dinosaur burrows in the Otway Group at Knowledge Creek, the first such trace fossils reported from the Southern Hemisphere and the oldest known in the geologic record (Martin, A.J., 2009, "Dinosaur Burrows in the Otway Group (Albian) of Victoria, Australia and Their Relation to Cretaceous Polar Environments," *Cretaceous Research*, v. 30, in press).

One of the structures in particular caught my eye during my first visit to Knowledge Creek in May 2006 because of its uncanny resemblance to the only previously known dinosaur burrow, described from a Cretaceous formation in Montana, USA. As part of the research team that described the Montana burrow and the dinosaur interpreted as the burrower (*Oryctodromeus cubicularis*), I was extremely fortunate to have seen it only eight months before arriving in Australia, which provided a mental image for comparison to the one at Knowledge Creek. Two nearby partial structures, preserved in a similar manner and having nearly the same-sized cross sections, accompanied the most complete one.

All three features were originally hollow, tubular structures that were later filled with sediment, and their sizes indicated tracemakers about 10-20 kg, which matches sizes estimated for some small ornithopods in the Otway Group. Moreover, Dinosaur Cove, with its bountiful remains of age-equivalent dinosaurs, is only 7 km to the southeast, and some dinosaur tracks (including one found by Pat Vickers-Rich and Tom Rich in 1980) are about 5 m below the stratum containing the burrows. Consequently, plenty of dinosaurs were in the area at the time that could have made such structures.

This hypothesis, which (of course) needs much more testing and discussion (for one, a burrow containing the bones of its dinosaurian maker would be nice); nevertheless, it provides an explanation for how some polar dinosaurs in the region that were too small to migrate may have overwintered. The research results provoked much popular interest, including news stories by the *BBC*, *National Geographic News*, *New Scientist*, *Science News*, and a series of ABC radio interviews with various affiliates in Australia. I also will be publishing a popular-outreach article for *Australasian Science* on the same topic later this year, which should further public education about the study in Australia.

My most recent visit to Knowledge Creek in May 2009 also was an opportunity to describe other trace fossils there. Despite the difficult access to the site (especially getting out of it, which consists of a very steep bushwalk), this is among my favorite outcrops in Victoria for its gorgeous exposures, sense of isolation, and (last but not least) the most varied trace fossil assemblage of any place I have seen in either the Otway or Strzelecki Groups. So however crazy it might seem to those who have been there once and vowed to never go back (Pat and Tom included), I will likely come back to Knowledge Creek again some day!



Chris Consoli by the dinosaur burrow described by Tony Martin in "Cretaceous Research" this year.

Later this year, the invertebrate trace fossils from this site and a few other Otway Group outcrops will be summarised in an article for a special issue of *Alcheringa* on the Cretaceous of Australia. Another article for that same issue will be written about the dinosaur tracks at Knowledge Creek and the large theropod tracks at the Dinosaur Dreaming site, the first two of which I discovered in 2006, then a third very nice specimen found by Tyler Lamb during the 2007 Dinosaur Dreaming dig season. This article will be co-authored with Pat, Tom, and Lesley.



Other than Knowledge Creek, two other ichnologically significant sites I studied in more detail during my all-too-brief visit to Victoria in May 2009 were at Eagle's Nest (in the Strzelecki Group, just 1-2 km west of Dinosaur Dreaming) and Marengo (Otway Group). The subjects of study at each site were gigantic invertebrate burrows. How big were they? Not much smaller than the dinosaur burrows: about 20-30 cm wide!



*Cretaceous burrows found along the Otway coast*

I had first noticed the Marengo burrows in May 2006 (the day after my first trip to Knowledge Creek), and although their forms were definitely those of crustacean burrow systems (fitting the ichnogenus *Thalassinoides*), I tried to ignore them because of their massive sizes. Nevertheless, once Anne Leorke found another large burrow system at Eagle's Nest in late 2006 (Lesley had successfully trained her and other volunteers to look for fossil burrows), I had no more excuses and decided to study the burrows at each locality in earnest. These burrows, which I interpreted as the works of very large (7-8 kg) freshwater decapods (probably crayfish), became the subject of a paper (co-authored with Lesley) presented at the North American Paleontological Convention in Cincinnati, Ohio (USA) in June 2009.

In July, I then submitted an article to the journal *Biology Letters*, which was still undergoing peer review as of this writing. In both the presentation and the article, we proposed that the unusually large sizes of the tracemakers represented Bergmann's Rule. This is an evolutionary principle in which certain lineages of animals (especially crustaceans) evolve to become much larger in cold-water environments, a result of surface area-volume ratios and heat conservation. The article is again co-authored with Lesley, and we added Jillian Garvey (LaTrobe University) as an additional author in recognition of the fine mapping she did of the Eagle's Nest burrow system.

In October 2009 I presented a comprehensive report at the Geological Society of America meeting (Portland, Oregon) on all of the trace fossils found thus far and their applications toward a better understanding of the paleoecology of these circumpolar Cretaceous environments. This paper, coauthored with Pat, Tom, Lesley, and Peter Trusler, summarised how the trace fossils fill in important gaps in the paleontological database of the Otway and Strzelecki Groups.

Of course, I would be terribly remiss in not mentioning all of the fantastic people in Victoria who have helped me in my ichnological endeavors, most particularly in May 2009.

Despite all of the significant discoveries coming out of Otway and Strzelecki Groups, I have not been able to garner any funding to support this research, and for our most recent visit, my wife (Ruth Schowalter) and I used personal funds to buy our plane tickets to Australia. Fortunately, Mike and Naomi Hall, as well as Gerry and Lesley Kool, provided us with lodging, meals, and (most importantly) beverages for much of our time there, which enabled us to complete the field work that needed to be done. Pat, Tom, and Peter Trusler also hosted us for a rollicking luncheon discussion one day, and Dave Pickering and Sarah Edwards were a delight to see again at the Melbourne Museum. (We also saw Dave again in the field at the Victoria Pleistocene fossil-mammal tracksite, but that's another story, too long to tell now.) We look forward to seeing all of you again some day, somehow. Thank you, thank you!

## Flat Rocks on the international road

*Pat Vickers-Rich*

Finds from Flat Rocks and other sites along the Victorian coast have been on the move in 2008-2009. Two exhibitions that are traveling include materials from the Dinosaur Dreaming project. One is on show in the Wildlife of Gondwana Exhibition at the Monash Science Centre on the Monash University Clayton Campus, Building 74. This exhibition follows the history of life on the once great continent of Gondwana - which, of course, involved the southern coast of Victoria when it lay smack-dab up alongside Antarctica in the Cretaceous - no ocean separating Australia and the south polar continent.

And another exhibition O Mundo Perdido Timor-Leste has been constructed by the Monash Science Centre and presented to the government of Timor-Leste. This exhibition is on show in the foyer of the new Presidential Offices of Jose Ramos-Horta in Dili and a short video presentation about its installation can be found at:

<http://www.monash.edu.au/news/monashmemo/stories/20090722/uni-news3.html>

This exhibition will become a showpiece in the new National Museum of Timor-Leste when it is constructed, hopefully in the next 2-3 years in Dili. A smaller exhibition by the same name has also been opened in one of the rural districts of Timor-Leste, in the village of Aileau in the mountains behind Dili. Both exhibitions are being used by the schools in Timor as part of their curriculum. Accompanying these exhibitions is a book written by Ramos-Horta and Pat Vickers-Rich, called *The Lost World of Timor-Leste. A Boy and a Crocodile Travel Through Time*. The characters that have been collected by the Dinosaur Dreaming Team are persona in this book for primary and early secondary kids, so the word of the finds at Flat Rocks have gone a long way from home.

The Wildlife of Gondwana Exhibition will travel to the South Australian Museum later this year and then next year to Singapore and back to Darwin and after that will hopefully make its way to the Middle East.

Our little dinos and mammals may have been dug up from a long time ago, but boy are they on the move chalking up the miles today.



*Wildlife of Gondwana Exhibition in Taipei (at the National Taiwan Science Education Center).*



Corrie Williams and Pat Vickers-Rich (representing the Monash Science Centre) set up an exhibition about the Flat Rocks project in the Inverloch RACV resort with explanation of the biota, the environment and the project. Included is a model of *Leaellynasaura* (or *Qantassaurus* as they both don't look all that different). This was in thanks for the \$3000 that the RACV kindly gave as a donation for work at Flat Rocks.

The Monash Science Centre invited two groups of international visitors to Flat Rocks and members of the Dinosaur Dreaming Team hosted them on site. The visitors set up house at the Inverloch RACV Resort. One group was high school girls, their mothers and two teachers from Notre Dame Jogaquin in Kyoto, Japan. The second was a group of university students (led by a lecturer) from Republic Polytechnic in Singapore. These visitors made major contributions to the field funds for 2010.



RACV Resort, Inverloch - just over the road from Flat Rocks

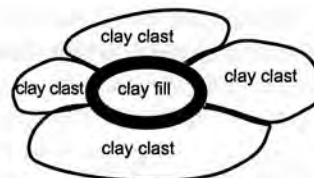
## How beetle bums got their dimples

Alan Tait

Beetle bums are the glittery orangey-brown objects which appear to be 'real' fossils at first glance. They were identified as fossil seed pods by Dave Pickering in the DD2007 field report. They are usually wrinkly and dimpled but several I found this year were smooth. They were not in sandstone as normal but were surrounded by claystone clasts.

I looked at a few beetle bums in sandstone and noticed that their dimples seemed to be similar in size to the sand grains around them. Also the dimples on the beetle bums are not in any regular pattern as might be expected in an organic object. All this leads to the hypothesis that the original seed pods were smooth and remained smooth when preserved between soft claystone clasts while seed pods in sand were dimpled by the surrounding sand grains pressing against them as burial compaction proceeded.

The claystone clasts were softer than the seed pods so even if there were sand grains between the seed pod and claystone clast, the sand grains would press into the claystone and not dimple the seed pod.



Smooth seedpod surrounded by clay clasts



Seedpod dimpled by sand grains



Empty seedpod flattened by compaction

Some seed pods have been squashed by compaction but others are filled with sand or clay and have been preserved in 3D, either dimpled or smooth depending on the surrounding medium. Two completely flat seed pods have been found in a flattened layer of plant fragments.

So depending on whether the original seed pods were empty or filled with sand or clay, and surrounded by sand or clay or plant fragments, the resulting beetle bums can be smooth, dimpled or squashed flat.

## Otways (Eric the Red West) Dig 2008

*David Pickering*

The systematic extraction of fossils in the Otways ceased with the closure of the Dinosaur Cove sites at the end of the 1994 field season. Since that time sporadic discovery of fossils has occurred by a program of prospecting sections of the Otways coast. It was during one of these prospecting trips led by Mike Cleeland in November 2005 that George Caspar spotted some small pieces of bone which, after preparation by Lesley Kool, were found to be the articulated tail and complete right foot of a small ornithomimid dinosaur. This was only the third articulated dinosaur uncovered from the Cretaceous rocks of Victoria and the only one found outside of Dinosaur Cove.

On the same day, another specimen was found nearby which has been identified as a cervical (neck) vertebra of a theropod dinosaur. The site was given the name "Eric the Crayfish" because it was situated between Crayfish Bay and one of the rusty anchors of the ship "Eric the Red". The site name has since been changed to "Eric the Red West" site at the suggestion of Dr. Tom Rich who recognised its connection with the already named "Eric the Red" site situated around the ship's anchor.

Because of the importance of these finds, a number of digs of short duration were organised by David Pickering and manned by a small crew comprised of Dinosaur Dreaming volunteers and Museum Victoria and Monash University personnel.



*Rugged-up diggers keep looking for bone*



*The Otways crew*

The finding of a mammal jaw by Mary Walters in December 2006 was the deciding factor for Dr. Tom Rich to ratify an expansion of the project. This specimen is the only mammal jaw that has been recovered outside of the Flat Rocks, Inverloch site and the 10 – 15 million year age difference between the rocks of the two sites may supply important information on the evolution of the Victorian mammals.

The December 2007 dig was lengthened to 10 days and it was decided to utilise the occasion to train the new volunteers for the Inverloch 2008 dig. A crew of thirty-eight, including thirteen trainees, participated during this time and fifty nine specimens were recovered. These fossils included ornithomimid and theropod dinosaurs, fish, turtles and plants.

The December 2008 dig was conducted over eight days and involved the participation of thirty-nine workers, fifteen of which were new trainees. Unfortunately a number of factors arose that severely affected the successful collection of fossils.

Only a few days before the start of the dig we were notified by the Parks officer from Apollo Bay that we would require the agreement of the local indigenous groups to excavate the site. We were thankful that Richard Colopy, who represented the local groups, was able to meet with us on site. Richard explained to us the importance of the area to the local people and the significance of several nearby features. After we demonstrated to him the nature of our work, he agreed to let us proceed with the dig.



I gratefully acknowledge the co-operation of Richard and Garry Summers from Parks Victoria and would also like to thank Lesley Kool and Darren Bellingham for facilitating a positive outcome in my absence. Regretfully, though, we had lost two days work and the new volunteers who were due to return home were yet to sight a fossil. In fact it would be another three days before any of us found a fossil.

A combination of foul weather that would be deemed unworkable at Inverloch and a recently overhauled jackhammer that had mysteriously lost all power conspired to seriously limit the amount of rock that could be excavated. The end result, a handful of fossils, would appear to be an unacceptable tally for those that are used to the output from sites such as Flat Rocks. It must be kept in mind that unlike Flat Rocks where we can identify the layers that can be relied on to produce fossils, the bones found at Eric the Red West were deposited in a sheet flood event. Except for those that have been trapped in the root balls and log jams of the trees, they are scattered haphazardly through the rock. The only way to find them is by processing a lot of rock and a bit of luck. The number of specimens that the site has yielded so far which are unique, important or interesting ensures that we should persevere for a while longer.

**Eric the Red West 2008 crew members**

- |                 |                   |
|-----------------|-------------------|
| Courtney Brown  | Sharyn Madder     |
| Paul Chedghey   | Alanna Maguire    |
| Win Chedghey    | Louise McLaughlin |
| Mike Cleeland   | Jay Naire         |
| Timothy Couch   | David Pickering   |
| Cate Cousland   | Steven Poropat    |
| Sarah Edwards   | Chava Rogriguez   |
| Rhiannon Foster | Denise Smith      |
| Mike Greenwood  | Paul Smith        |
| Melissa Gunter  | Anouska Teunen    |
| Matt Herne      | Simon Travers     |
| Helen Hughes    | Wendy Turner      |
| Doug Ivey       | Mary Walters      |
| Gerrit Kool     | Wendy White       |
| Lesley Kool     | John Wilkins      |
| Miklos Lipcsey  |                   |



*Alan keeps the crew warm*

I wish to thank all the volunteers that have participated in this project for putting up with, at varying times, plagues of flies, exfoliating sand storms and questionable music.

I wish to thank in particular Tom Rich for all our breakfasts and lunches and allowing us to carry 250kg of rock to the top of the hill.

Thanks also to Lesley and Gerry Kool, John Wilkins, Wendy White, Matt Herne and Alan Tait for all their work and suggestions. Mary Walters for shopping for supplies and finding a mammal jaw and lastly thanks to Matt, Alanna and Mike for the aforementioned music.



*Matt and Alanna provide some entertainment*

## Friends of Dinosaur Dreaming

*Gerrit Kool*

Recognition of this dedicated group of individuals and families is well overdue.

"Friends" was an idea based on other such groups in existence to allow families in particular, to get closer to the workings and information gathered from this exciting and important site at Inverloch.

Friends of Dinosaur Dreaming had its inception on the 9th December 1997, the year that the first mammal jaw was discovered.

This exciting discovery set the wheels in motion for the core crew to organise Dr Tom Rich to give a lecture at Inverloch to not only brief the (local) general public on the importance of this discovery and the site in general, but also launch Friends of Dinosaur Dreaming.

Individuals and families can join the group for a modest annual subscription and in return they get a copy of the field report as well as an invitation to an information session where updates of the previous summer's field season are released.

A day at the site is set aside for the Friends to visit and this is always well attended and a huge success as everyone is able to 'get up close and personal' with the crew and get a great insight into the daily 'hard yakka', humdrum rock breaking as well as site preparation and initial on site identification of any fossil finds.

This year's Friends' day was held on the 15th of February and, with the weather being kind, the day was well attended and as always, much fun was had by all.

Funding for the dig is always an issue and the Friends have in no small way over the last 13 years contributed greatly in this way. House rental and the purchase of new equipment have been covered in many instances by the annual subscriptions each year.

Members have joined from far and wide with quite a few from interstate and even some from overseas.

Special thanks must be given to Bernie and Margaret Brown & Bob and Bev Huntley for making their holiday home "The Tardis" available to house the overflow of overseas visitors from time to time. Also to Bob for giving his time and use of his van and trailer on set up and clean up days.

Several of the Friends have been with us since 1997, some not so long but appreciation is passed on to all, past and present, for their contribution to help keep this important site and research alive.

Presently we have about 65 active individuals and families in the group and we look forward to catching up with you in the near future.

## Prospecting – new discoveries in the last 12 months

*Mike Cleeland*

The last year has seen a steady flow of new specimens popping to the surface, although perhaps fewer of the remarkable discoveries of previous years have emerged.

A field trip into the Otways in December 2008 concentrating on work at the Eric the Red West site included prospecting east to the mouth of the Parker River. Several new bones were recovered on the shore platform at Point Franklin, in two previously productive localities.

These were:

1. the far southern extremity of the platform itself where Mary Walters found an interesting limb bone, and
2. the platform adjacent to the two boulder beaches east of the point, where exploratory digging had been carried out during the 1980s. Jackhammer marks from this operation are still visible, and rusting wreckage presumably derived from Eric the Red encrusts tide pools within the fossil layer.

A limb fragment found two years previously, east of Point Franklin, was partially removed at the time with the intention of returning with a rocksaw to complete the excavation. The 2008 prospecting group could not relocate it, the site possibly being buried beneath beach sand.



The 2009 group was more fortunate, and the long carry of the rocksaw around the point proved fruitful when the halves were able to be reunited in the lab after two years apart.

The trip was probably more remarkable for the weather than the quality or quantity of bones recovered. Participants particularly in the early part of the week were reminded of the very conditions that led to the demise of so many of the ships along this coast, with the long suffering rock breakers being subjected firstly to sand blasting from the west, then from the east later in the week.

The new year was welcomed in with further discoveries on the rock platform within several hundred metres of the Inverloch dig site, including several finds by Katerina Rajchl during the digging season. New bones were also found in summer prospecting at Tree Trunk Point and the headland further east.

A trip into the Otways in March assisted by Pip Blackie and Cate Cousland uncovered one new bone at Marengo, then carried out a small quantity of rock breaking at the Elliott River site which revealed a well preserved turtle humerus. Exploration towards Cape Patton saw the party enter Ramsdens Cave, a remarkable feature which is easily the biggest of its type in the Victorian Cretaceous.

Further discoveries were made on San Remo Back Beach later in the year by Andrew Ruffin, showing that this known area continues to erode and produce.

From a personal point of view perhaps my best discovery this year has been my fiancée Pip Blackie, who I originally met at the Inverloch dig in February 2007. Pip & I now have many plans for future trips, a highlight being our honeymoon on the appropriately named Wilsons Promontory (Pip's maiden name was Wilson) after our wedding in April 2010.



## Kilcunda 'ice wedges' reinterpreted as injectites

*Alan Tait*

I was taken to see the reputed ice wedges at Kilcunda by Mike Cleeland and Doris Seegets-Villiers on 21 February 2009 and returned on 2 March 2009 for another look.

The Kilcunda sediments belong to the Strzelecki Group as at Inverloch and consist of crossbedded fluvial channel sandstones and flatbedded overbank floodplain claystones.

At the Kilcunda 'ice wedge' site, there are two channel sandstones separated by overbank claystone. The lower sandstone is exposed on the shore platform, the overlying claystone is exposed on the shore platform and part way up the cliff, and the upper sandstone forms the upper part of the cliff. Within the claystone are several vertical sandstone features which cut across the bedding in the claystone and are hence called sandstone dykes. These dykes have been interpreted as sand-filled ice wedges by Andrew Constantine in his 2001 thesis (pers. comm. Doris Seegets-Villiers).

Inspection of the sandstone dykes shows that they are not wedges in that they do not close downward but merge into the underlying fluvial sandstone. The sandstone forming the dykes is the same throughout all the dykes and is identical in grainsize range and appearance to the sand in the underlying fluvial sandbody. Most of the underlying sandbody shows crossbedding but in the upper part the bedding has been contorted by liquefaction and soft-sediment movement. The continuity of the underlying sandbody with the sandstone dykes indicates that the dykes were formed as the liquefied sand was injected upward into fractures in the sandy claystones. The fractures were formed by a sudden shock, such as an earthquake, which also liquefied the unconsolidated sand of the fluvial sandbody.

Some of the vertical sandstone dykes have horizontal 'sills' injected along bedding planes in the sandy claystone, and networks of small sills and dykes are present in places. Some sandstone dykes include fragments of sandy claystone dislodged from the fracture walls as sand injection occurred.

The underlying fluvial sandbody contains rafts of sandy claystone that have been separated from the overlying claystone by fractures and have sunk into the liquefied sand. One of the sandstone dykes terminates upward in a lens of sand which is interpreted as a sand volcano erupted on the contemporaneous ground surface. It contains thin claystone layers indicating it was erupted under water in pulses. Modern earthquakes in unconsolidated sediments result in flooding because the shaking compacts the sediment, and the ground level subsides as the 'extra' interstitial water is expelled to the surface via cracks carrying sand with it and forming sand volcanoes and also flooding the area above the subsidence.

The sandstone dykes and sills are generally called injectites because of their method of formation. Features of this type occur worldwide but are not characteristic of any particular environment requiring only an unconsolidated sand and an overlying impermeable claystone. Two other localities with sand injectites are present near the Inverloch dig site and will be revisited in 2010 for detailed investigation.

Another possibly earthquake-induced feature is present at the Kilcunda site. It occurs to the east of the sand injectites and at a slightly higher stratigraphic level in the overbank claystones. It consists of a thin undulating layer of coal overlying several layers of sandstone and claystone with various soft-sediment deformation features. The sediments below and above are flatbedded. It appears that the feature formed by liquefaction of one sand layer which intruded up through a thin claystone layer and lifted up the coal (then peat) layer in a number of small diapirs or as larger domes.

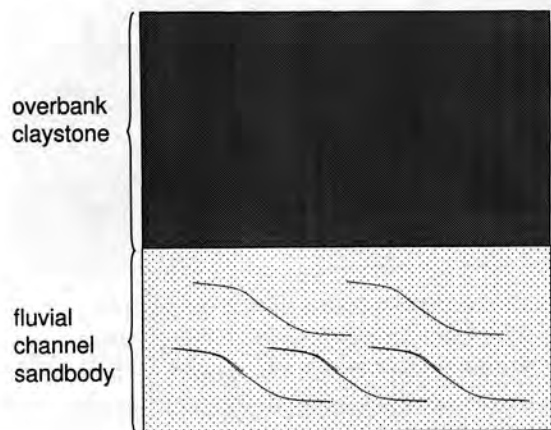
The overlying claystone then accumulated in the hollows between the diapirs and eventually covered them. The sand diapirs seem not to have broken through the peat layer but have just pushed it up, perhaps because of the felted nature of peat. There are no apparent roots below the peat and it probably represents a drifted accumulation of plant material in a shallow pond on the river floodplain. The event that triggered the liquefaction of the sand is unknown but it could have been an earthquake as suggested for the injectites, or perhaps a herd of dinosaurs passing by!



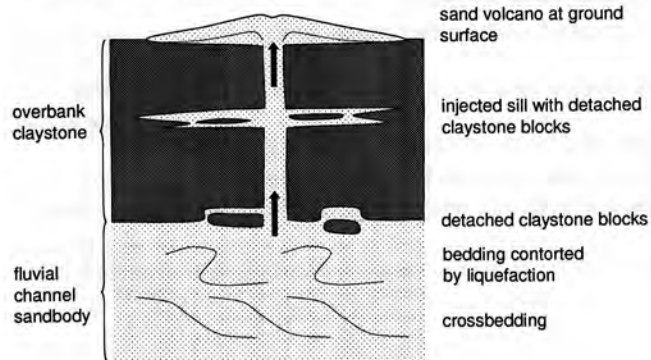
Thus both the injectites and the undulating peat layer have sandstone liquefaction as their underlying cause. Sandstone liquefaction can occur in many depositional environments, including periglacial, but cannot be used to infer periglacial conditions in the absence of unambiguous periglacial indicators.

I intend to revisit the Kilcunda site next year and gather data for a paper on these excellent examples of sand liquefaction and its effects.

BEFORE EARTHQUAKE



AFTER EARTHQUAKE



Friends' day 2009

## What to do when it's too hot to work

*Wendy White*

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It was a hot day. Very hot. We called off work by morning tea time.

The house was stifling and the backyard no better, so most of us headed towards the ocean.

My posse headed to the Dinosaur Dreaming site.

The usual swimming hole was beckoning and the excavation hole this year (now known as the Dreaming Pool) looked temptingly like a swim-up bar...

Preparations first - the cool change was not due for hours so we needed to be prepared to stay there most of the day.

So, we did some packing:

- A hat per person
- Sunscreen
- Bottled water
- Ice from the service station
- Chips (for the salt content)
- Limes (in case we got stranded and needed vitamin C)
- Champagne (in case we got stranded and needed the bubbles to inflate the rescue raft)
- Tonic (see justification for champagne)
- Gin (for medical emergencies... or maybe we didn't have an excuse)

And we sat in the swimming hole and chatted to each other about random trivial stuff. For four hours.

Like how the dig was going and what expensive equipment would make it easier. But also funny stories from our childhood and assorted views on important social matters (none of which still spring to mind...). And shoes and ships and sealing-wax and cabbages and kings.

Every now and then one of us would emerge long enough to make another round of Gin and Tonics, or to apply more sunscreen, but we could not enjoy the beach for more than a few minutes before we needed to scamper back to the ocean.

Or we'd have a half-hearted ice fight, but it really was too hot for that sort of shenanigans.

Soon we decided it was time for champagne. I know, technically it was Australian Sparkling Wine, but I'm not about to stop calling it Sherry either no matter what the pedants say.

The next paragraph may disturb those readers with more delicate or frugal dispositions, so you might choose to skip it.

The champagne pouring goes badly... and it is spilt on the rocks! Tragedy!

All is not lost, however, when Mary takes the opportunity to fulfil her life-long dream of dancing in champagne. And we all applaud 'cos it was that sort of day.

Eventually, half a dozen prune-fingered people make their way back to the house in the cooling afternoon. We all hoped tomorrow would be a cooler day so we could get back to work. Really, we did.

## Dishes, bones, beers, lessons, love, laughter & even more dishes!

*Tim Couch*

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I am a 24 year old, second year Monash University Environmental Science student majoring in Geology who has managed to hold onto his childhood loves - "Transformers", "The Simpsons" & of course, dinosaurs. "Dinosaur Dreaming" was a wonderful experience with memories I will cherish. Some of which include the amount of work experienced during my stay, whether it be cleaning dirty dishes, cooking tuna pasta bake for 25 people (with a great cooking team), shovelling out many kilograms worth of mischievous sand overlying the bones, being yelled at for doing childish things like briskly walking on wet rocks on the beach with kilograms of tools in a pair of buckets, finding the love of my life and a whole lot more dirty dishes!!!!





Tim at the Otways dig

### Why did I go?

The reason I became involved with DD was to assist in propelling science. Every single find at any palaeontological site paints a more accurate picture of animal evolution. With the finds from this particular site we believe that it was once a river environment within a rift zone (a continent which is splitting apart into two continents – complete with volcanoes, rivers which pool to form lakes reminiscent to what is currently witnessed in Eastern Africa). It linked Australia with Antarctica, probably inside the Polar Circle during the Cretaceous period (144 million to 65 million years ago). Several scattered animal remains have been found including theropods (two legged meat eating dinosaurs ranging from a long bus length to dog-sized), ornithopods (two legged, plant eating dinosaurs up to human height – more commonly chicken-sized), ankylosaurids (a four legged, army tank-like dinosaur some of which had a large club on their tails), amphibians like *Koolasuchas cleelandi* – roughly 10 foot long (found nearby at San Remo) and the crown jewel, MAMMALS (mostly around rat to mouse-sized). These land animals are likely there because they fell into the river and were deposited on the river bank, or their bones had been scattered by scavengers which consumed the decomposing animal shortly after their deaths. Fish and turtles and maybe even a freshwater plesiosaur (a swimming reptile) are also found at the site.

The fossils are not full fossil bodies but scattered bone debris, which were sturdy enough to survive transport to the site. Whether teeth, jaws or claws, there is still enough to identify the animals in question due to similar fossils found at other sites. This is not the complete picture of what was once there in the Cretaceous period. The progression of Science will increasingly divulge what animals inhabited south eastern Australia in the age of the dinosaurs, furthering our understanding of the palaeo-environment. Only time will uncover what we find next...

### What was life like for the week?

One thing that surprised me about the dig was how much people ate. Under such a tight budget, we ate like royalty. There was so much food that it was a struggle to get through the leftovers, which always made a tasty breakfast or lunch. This food epidemic resulted in a dishes epidemic, and being the helpful newcomer that I was, I thought I would lend a hand... at every opportunity. It was also an entertaining experience, as we had "The Beatles" playing to ease the pain of another 500 dishes to wash...

At the dig site, there was always a roster for our duties. Some people were working in the hole, which is the rock outcrop only accessible at low tide. When I was rostered in the hole, I assisted with pumping water and shovelling cubic metres of sand. When I was not rostered in the hole, I was chipping rock down to the size of sugar cubes, which is time consuming but well worth it for those who found a little mammal jaw looking at them in that one last rock fragment. If it was a house day, we chipped down the rock (brought from the site to the house) to sugar cube size in search of bones. Personally, I only found fish and turtle fragments, but I know I will be back for the coming years to find something major!

I was in awe of the people I met in my time at the dig. I would personally like to thank Lesley, Gerry, Dave, Wendy, Fotini (xoxo) and the many others who made my time there a truly unforgettable experience. I can't wait to catch up with them all in February next year!

Thank you

## Dinosaur Dreaming 2009 crew members

Vicki Anceschi	Alan Evered	Lesley Kool	Mareike Schmidt
Marion Anderson	Nicole Evered	Anne Leorke	Denise Smith
Darren Bellingham	Warrick Foot	Miklos Lipcsey	Paul Smith
Sheahan Bestel	Rhiannon Foster	Sharyn Madder	Andrew Stocker
Pip Blackie	Norman Gardiner	Alanna Maguire	John Swinkels
Courtney Brown	Jillian Garvey	Sue Martin	Alan Tait
Jeremy Burton	Tim Gatehouse	Louise McLaughlin	Anouska Teunen
Mike Cleeland	Mike Greenwood	Dave Pickering	Simon Travers
Alice Clement	Melissa Gunter	Udo Polzin	Jackie Tumney
Peggy Cole	Darren Hastie	Stephen Poropat	Wendy Turner
Tim Couch	David Hocking	Katerina Rajchl	Nick Van Klaveren
Cate Cousland	Helen Hughes	Lisa Robinson	Mary Walters
Kim Davis	Doug Ivey	Chava Rodriguez	Astrid Werner
Fay Dunn	Fotini Karakitsos	Doris Seegets Villiers	Wendy White
David Elliott	Gerrit Kool	Danielle Shean	John Wilkins

## Acknowledgements:

Mike Cleeland and Lesley Kool conducted a number of tours to the site during the summer school holidays, including two tours for the Inverloch Big 4 Holiday Park. In return the Holiday Park made a generous donation to the Dinosaur Dreaming Project, which allowed us to purchase some equipment for the dig.

We welcomed two overseas volunteers during the 2009 dig season. Mareike Schmidt came all the way from Germany and Pip Blackie joined us for her second "tour of duty". Mareike was great fun and threw herself wholeheartedly into every aspect of the dig. Pip, who contributed a wonderful cartoon of some of the core crew for the back cover of the 2007 annual report, was just as enthusiastic as on her first visit, winning at least one heart...

Blundstone boots once again supplied the steel-capped boots for the Dinosaur Dreaming crew. Their on-going support provides a huge cost benefit to the crew and we very much appreciate their generous donation.

Total Tools in Cranbourne very generously donated a rotary impact hammer, auger bits and a generator to Dinosaur Dreaming. The new equipment made a huge difference to our excavations and we are very appreciative of their support. Thanks also to John Swinkles for initiating this relationship.

The RACV Inverloch resort is in walking distance to the main fossil site at The Caves and we conducted two official tours of the site for the patrons during the field season. The RACV's generous grant of \$3000 helped to cover the cost of providing for the volunteers' food and accommodation and was much appreciated by all.

Our grateful thanks go once again to Dom and Tracie Brusamarello and their staff of the Inverloch Foodworks supermarket. Dom and Tracie have supported the Dinosaur Dreaming Project for a number of years with a generous discount on the huge amount of food it takes to feed 60 plus volunteers for four weeks.

We would also like to thank Eddy Kan who also helped feed the crew with a generous donation of bread and wraps.

The Dinosaur Dreaming 2010 field season will commence on Saturday 30th January and will continue for four weeks. New volunteers will once again be invited to spend a day or two at the Otway fieldtrip, which will take place at the start of December. Let us hope the weather is a little kinder to us this year.





*Week one dig crew*



*Week two dig crew*



*Week three dig crew*

*Week four dig crew*







**MAMMALIA**

Popcorn  
of  
the  
Cretaceous