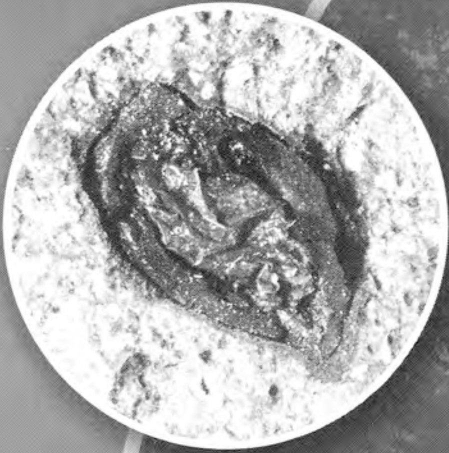
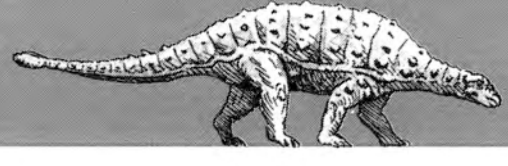


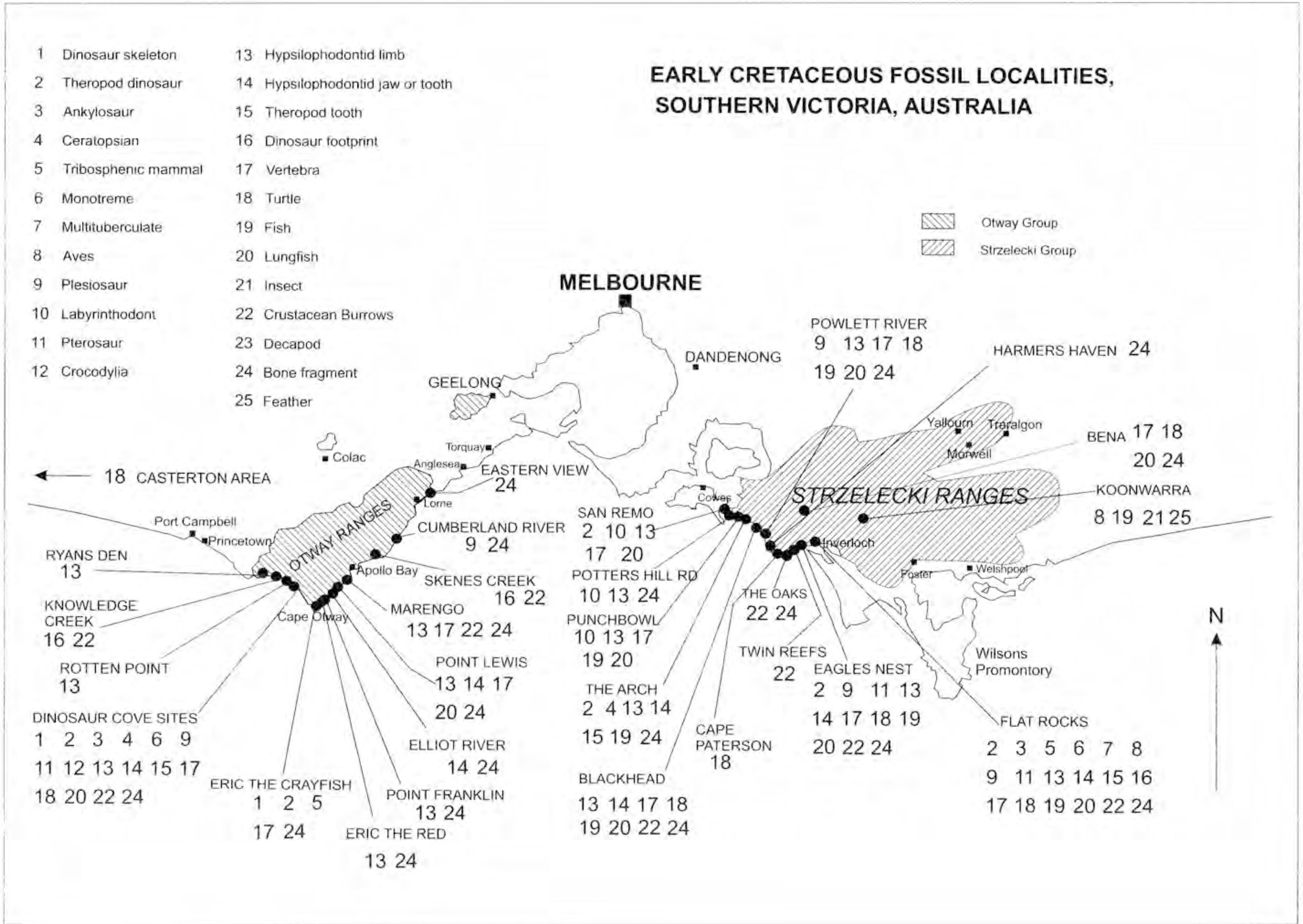
Beetle bum turned into seed pod husk

Theropod track found at the Flat Rocks site

New mammal jaw - found at Eric the Crayfish in the Otway Group - 10 million years younger than its ancestors in the Strzeleckis

DINOSAUR DREAMING 2007 FIELD REPORT

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The youngest Early Cretaceous ausktribosphenid mammal - from Eric the Crayfish, in the Otways

Museum Victoria specimens photographed by Lucy Gibson

Field Report

By Lesley Kool

The 2007 Dinosaur Dreaming field trip marked the tenth anniversary of the discovery of the first Early Cretaceous mammal from the Flat Rocks site. Since that first discovery, during the 1997 field season, a total of 43 mammal jaws have been found; 42 of them from the Flat Rocks site and one that turned up, totally unexpectedly, more than 400 kilometres to the west of Inverloch. Dave Pickering describes the discovery of this mammal jaw in his part of the report and Tom Rich will discuss its implications to the evolution of tribosphenic mammals in Australia.

The discoverer of the first mammal jaw, Nicola Sanderson (nee Barton), now lives in Kalgoorlie with her geologist husband Dale, who she first met on the 2000 Dinosaur Dreaming dig. Nicola has been an important member of the crew for many years but has never been able to duplicate her amazing find, until this year. The first mammal jaw was found on the morning of the 8th of March 1997 in the back yard of the rented house in Inverloch. For those not aware of the unique nature of the fossil site at Flat Rocks I will elaborate. The fossil layer is situated on the shore platform near Inverloch and is completely covered at high tide. Consequently we can only access the layer between three and four hours either side of low tide. As soon as the tide has retreated sufficiently to expose the site, we firstly pump out any remaining water and then dig off any sand that has accumulated during the previous high tide. Once the designated area has been exposed a crew of three will remove as much of the fossil layer as they can, using sledge hammers and large chisels. This rock is carefully checked for any exposed bones before being given to the rest of the crew who break the large blocks of rock down to very small rock fragments.

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This is a very laborious and time consuming job and, more often than not, there is rock that has been removed from the fossil layer that has not been broken up before we have to pack up and leave the beach before the next tide inundates our excavations once again. This unbroken rock is placed into back packs and is taken back to the rented house where it is placed on tarpaulins in the back garden.

The accumulated rock is eventually broken down on those days when we only have a short time at the site because of tide restrictions. We have a large tarpaulin spread out over most of the grass in the garden, on which we set up our rock-breaking stations. Each rock-breaker has their own stool, tree stump and basalt block at which to sit and break the rock. It is a surprisingly pleasant and relaxing pastime and has produced some of best discoveries, including the first mammal jaw and the first Qantassaurus dinosaur jaw.

So it was that we were breaking rock in the garden on the morning of the 8th of March 2007 when Nicola found what initially looked like two tiny fish teeth. The fossil looked sufficiently interesting enough for me to expose a little more of it under the microscope. What we first thought were fish teeth turned out to be two roots of a tiny mammal tooth, which was exciting enough as it meant that Nicola had managed to repeat her amazing feat of ten years previously almost to the hour. However, the tooth proved to be a lot more exciting once Dave Pickering started to uncover more of it at the Melbourne Museum after the dig had ended. My part in the story ends here and I will leave Dave to continue with his description of how he prepared the tiny tooth and then Tom will comment on what he thinks the tooth is. Suffice to say, Nicola has done it again.

Breaking rock in the back garden can be both relaxing and rewarding.

Apart from Nicola's tiny mammal tooth, another mammal jaw was found this field season. It was discovered by Nicole Evered, one of our original crew members who also found the lower jaw of a small herbivorous dinosaur in 1996, which was later named Qantassaurus intrepidus. Nicole's mammal jaw is currently being prepared by Dave Pickering at the Melbourne Museum.

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Anne's mystery jaw

Mammals were not the only animals represented in the more than 800 specimens catalogued during the 2007 field season. Two large platy bones were found less than 30 centimetres apart in the Bridge East section of the fossil layer. They appeared to be osteoderms, or bony armour from the skin of an ankylosaur.

On a recent visit to Queensland Gerry and I took the opportunity to call in at the University of Queensland in Brisbane and meet Dr. Steve Salisbury and Matthew Herne, his Phd student who is studying basal ornithischian dinosaurs. They kindly allowed us access to an almost complete skeleton of *Minmi paravertebra*, a small ankylosaur (armoured dinosaur), found near Minmi Crossing in Queensland. The skeleton is covered with thousands of tiny round bones, packed very close together, that would have been embedded in the scaly skin of the dinosaur when it was alive. They surround larger platy bones or osteoderms, also embedded in the skin, similar to those seen in the skin of crocodiles. Together they formed a very effective barrier against attack by predatory dinosaurs. The Minmi skeleton is very special as most of the body armour is still in place. After careful comparison we were able to identify where our two osteoderms would have been positioned on the dinosaur that had lived near Inverloch millions of years ago.

The two ankylosaur osteoderms found at the Flat Rocks site during the 2007 field season.

The larger of the two osteoderms came from close to the base of the tail and the smaller osteoderm was adjacent to the hip. These two bones were found very close to one another in the fossil layer and in real life they were also situated close together on the dinosaur. This makes it very tempting to conclude that they came from the same animal and that is very likely to be the case, but in the past we have found the fossil bones of different animals lying very close together so we can not say conclusively that the two osteoderms are associated. However, we will be returning to the Bridge East locality next field season and will be searching for more evidence of ankylosaurs.

One of the largest vertebrae ever found at the Flat Rocks site was found during this field season and was discovered after it was accidentally rock-sawn through. The cross-section through the vertebra revealed a large cavity that had been infilled with sediment, which prevented the walls from being crushed flat.

Cross section through the theropod vertebra showing large infilled cavity.

One of the major differences between saurischian dinosaurs, including theropod or meat eating dinosaurs, and ornithischian dinosaurs, including hypsilophodontids, is the large hollow cavities found inside the bones of saurischians. This was particularly important in the large theropod dinosaurs and the sauropod dinosaurs as it meant they could grow much larger without being burdened by the weight of solid bones. The vertebra found at Flat Rocks is significant as it is one of a few large theropod dinosaur elements that have been found at the site.

Two larger than average theropod teeth, each about 1.5 centimetres in length, were also found this year. Most of the theropod teeth found at the Flat Rocks site are "shed" teeth, which means they fell out of the mouth of the dinosaur when it was alive. We know this because only the crown of the tooth is found. The root of the tooth was resorbed or dissolved back into the jaw before the tooth fell out, similar to the baby teeth of mammals. However, unlike mammals, dinosaurs continuously replaced their teeth throughout their lives and shed the worn or broken teeth at regular intervals. We now have more than 120 theropod dinosaur teeth from the Flat Rocks site alone and all but two of them are shed teeth.

The first mammal jaw was found during the 1997 field season but it was not the only exciting find that year. A week earlier, a small hollow bone was found and catalogued, but it was not until a few months after the dig had ended that its significance became apparent. Roger Close, a Monash University student and one of the Dinosaur Dreaming crew, has studied the specimen and can finally reveal its identity. His report, in association with Professor Patricia Vickers-Rich, is included in this report. This is a good example of just how long it can take to research and describe some specimens.

During the Dinosaur Dreaming 2006 field season we were visited by Dr. Anthony Martin from Emory University in Atlanta, Georgia. Tony is a palaeo-ichnologist and spends his life looking for fossil tracks and traces. Whilst at Flat Rocks he found evidence of the oldest fresh-water crustacean burrows in Gondwana and two theropod dinosaur footprints. In an effort to expand Tony's research it was decided to spend one day a week during the field season to prospect nearby localities for more evidence of burrows and trackways. The crew were shown the burrows and footprints that Tony had found previously at Flat Rocks so they would know what to look for and this produced immediate results. In the first week of the dig after showing the new crew what the dinosaur footprint looked like, Tyler Lamb, a Monash University science student, found something that looked very much like a footprint only metres from our dig site on the shore platform. Not only was this exciting, but it was also embarrassing for the regular crew members who had been coming to this site for more than 15 years and had never noticed the footprint.

Images of the possible footprint were sent to Tony in Atlanta and he confirmed that it did indeed look like a dinosaur footprint. Subsequently Tony was able to see the footprint in person when he spent a week in Melbourne in July and was convinced that it is indeed a theropod dinosaur footprint (well done Tyler). He took images and measurements and will discuss, in his report, his results along with comments on more burrows that were found on our prospecting trips.

One of the localities we visited on one of our prospecting days produced not only more burrows but a nice haul of fossil bones. The Black Head site was found in 1990 and is probably the second richest fossil locality along the Strzelecki coastline. We spent one day excavating the site in 1992 and there appear to be at least three distinct fossil layers, each separated by non-fossiliferous sandstone. The last time we visited the site was in 2004 when only one exposed bone was found and so we were pleasantly surprised to find more than a dozen bones when we prospected this year.
Among the bones found was a small hypsilophodontid dentary (lower jaw), a number of small limbs and an unusual limb found in the cliff by Dave Pickering. He discusses this specimen in his report.

Field Report

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The dinosaur footprint was not the only tracks to be discovered, or in this case rediscovered, during the 2007 field season. We were approached by Eulalie Brewster, a well know local naturalist, who visited the site to see the dinosaur footprint and mentioned that she had been involved in the discovery of some Pleistocene bird tracks near Tarwin Lower, south of Inverloch, in 1969. She offered to lead a small group of us to where she remembered seeing the tracks and amazingly she took us straight to them. Although they had weathered somewhat over the intervening years they were still visible. A report on the bird tracks written by K.N. Bell and J.A. DeMerlo appeared in the May 1969 edition of the Victorian Naturalist. The authors were only able to estimate the age of the block of aeolianite (consolidated dune limestone), containing the bird tracks, as between 150,000 and 30,000 years ago, much younger than the Inverloch dinosaur tracks. They were also unable to identify the type of bird which left the tracks but suggested it was some kind of hopping bird and probably not a sea bird as there was no evidence of webbing between the toes.

Eulalie Brewster with the Pleistocene bird tracks at Tarwin Lower, Victoria.

They also mentioned that vertebrate remains had been found in similar aged deposits in Victoria and suggested that further investigation could reveal more tracks and possibly fossil bones. This may be an interesting exercise for the crew next field season.

Last year the New Scientist journal, in conjunction with Museum Victoria, held a competition with the winner spending two days at the dig. The winner, Kym Holliday from Umina in New South Wales and his daughter Tamasin, arrived with Dr. John Long at the site and quickly learnt how to recognise the fossil bones. At the end of the first day they joined us for dinner and we showed them some of the interesting fossil bones that had been found earlier in the dig. The next day John took them along the coast looking at some of the local geology and then they came back to the site for a few more hours before heading back to Melbourne.

New Scientist is running another competition this year and we look forward to meeting the winner at Dinosaur Dreaming 2008.

Dinosaur Dreaming's "Friends Day" dawned fine and sunny. This year there were a few fun items, including the "celebrity fossil" and "find a fossil". Over fifty friends turned up and enjoyed a great day at the beach.

During the dig we received a visit from Mitchell Leslie, science writer for the Smithsonian Magazine in Washington, USA. He spent two days talking to individual crew members, including Tom Rich, and we look forward to reading his article when it is published.

Although our good friend Keiichi Aotsuka was unable to join us this year, he did send us a copy of the paper he wrote on his research into Australian dinosaurs. Entitled "The Characteristics of Dinosaur Fossils from Lower Cretaceous in Southeastern Australia", Keiichi describes the dinosaurs found in the Strzelecki and Otway groups. The paper is in both Japanese and English and has been added to the dig library.

We are currently organising a "Dig Deep for Dinosaurs" fund raising event in the form of an auction, which will take place in November at the Royal Society of Victoria building in Melbourne. The auction will feature original artwork by Peter Trusler, who has illustrated most of the dinosaurs and mammals found in the Victorian Early Cretaceous over the last 25 years. Also Andrew Plant, who wrote and illustrated the children's book "Could a Tyrannosaurus play table tennis?", will have some of his original work in the auction. We will also have dinosaur memorabilia from the early days at Dinosaur Cove as well as Dinosaur Dreaming. We are hoping to raise enough to fund Dinosaur Dreaming 2008 and beyond.

Museum Report

by David Pickering

Museum Victoria Preparation Report

Of the many interesting specimens that I have worked on this year there are two that stand out because of their scientific importance and also for the difficulty of their preparation. There often seems to be a correlation between the two. The specimens in question are the mammal jaw from the Eric the Crayfish site found by Mary Walters and the single mammal tooth from the Lavington Street Quarry found by Nicola Sanderson. An honourable mention goes to Nicole Evered for her lovely *Bishops* jaw. Come on boys the ladies are stealing all the glory! I must apologise for the slowness in the preparation production line this year and as excuses I will use disruptions caused by the CAVEPS conference, a holiday in Alaska with Tom, preparation of John Long's Gogo fish and an ever mounting pile of Museum paperwork.

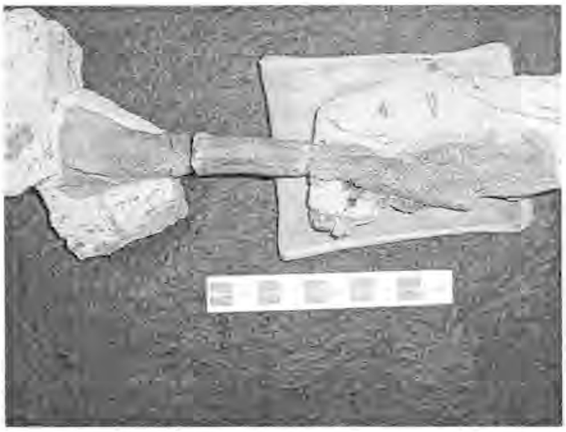
Mary's jaw took difficulty to a new level. The Inverloch mammal jaws are stressful enough to scratch out (I can't imagine why Lesley's hair isn't pure white after prepping about 40 jaws!) but this Otways rock is particularly nasty. Unlike the more polished quartz grains from Flat Rocks the jaw was surrounded by raw, jagged grains that when removed leave gaping shrapnel wounds in their place. The rock is also comprised of a high percentage of aggregate of all sizes making it dangerous to remove near the specimen. On the positive side I have been perfecting a technique to repair pieces such as cusps of teeth that have fallen apart. It involves the use of a secret ingredient, (excuse me) saliva. This enables me to hold the broken bit in place before I secure it with a drop of glue on a hair from a paint brush.

By contrast Nicola's tooth was relatively fun to prepare. When I examined the tooth under the Leica stereo-microscope I noticed that the line made by the two exposed root ran at an angle to the longitudinal line of the crown. It made me suspect that there was a third root lurking in the matrix (a triangular pattern) and this made it exciting because three roots would make it a maxillary tooth; an upper! Tom has been waiting to find upper teeth for a long time. This was confirmed when the third root was finally located. It was fortunate that the matrix around the roots was clear sandstone which made the job a lot easier. At the moment it is not certain whether the tooth is a molar or a posterior premolar but I will let Tom tell you that story. Congratulations Nicola.

Although Nicole's jaw is not a new type it is in particularly good condition and promises to be one of the best examples of Bishops. Well done, Nicole.

The limb bone that I found in the cliff at Blackhead turns out to be a dinosaur tibia and according to Stephen Salisbury most likely theropod. I have found at least two similar ones in our collection.

At the moment we are preparing two large pieces from the back of the skull of *Koolasuchus cleelandi*. This specimen was found by Andrew Ruffin back in 1996. Andrew has worked both alone and with Mike Cleeland for many years prospecting the Strzelecki coastline and is responsible for many fine discoveries.



Theropod tibia found by Dave at Blackhead February 2007

Finally I would like to thank my volunteers in the Vertebrate Palaeontology department of the Museum who have all made valuable contributions in many ways including preparation of fossils.

They are: Malcolm Carkeek
Paul Chedgey
Rohan Long
Dee Milligan
Michelle Thompson
Dean Wright

New Mammal Jaw Find from the Otways
A Short History of the Eric the Crayfish Site

One morning in early December 2006 I began to lay out a tray of fossils which I had just brought back from a field trip to the "Eric the Crayfish" site near Cape Otway. Interrupted in this work by a meeting appointment at the Museum I asked Rohan Long, one of my volunteers who had also attended the dig, if he would unwrap the specimens and run them under the microscope while I was away. I returned to my small Prep Lab to find a party in full swing. There were so many people in there including Dr. Tom Rich and Dr. John Long that I could barely enter. Under the microscope Rohan had seen the teeth on the splint of bone that Mary Walters had found but which had been invisible to us on the beach. Thank goodness we brought it back with us!! Mary had uncovered the first mammal jaw found outside of the Flat Rocks site at Inverloch!

This story has its beginning in November 2005. Mike Cleeland was prospecting the area with a small group of volunteers when the sharp eyes of George Caspar spotted a small row of fossils weathering out of the shore platform. Initially Mike thought that they had found a tooth row because of the spacing and shine of the exposed pieces. Having cut the specimen out he noticed that the bone continued so he cut out the adjacent block only to find that the bone kept going. The four blocks which finally contained the specimen resembled a rock pizza! The boys were on a roll that day as they also uncovered a cervical (neck) vertebra from an, as yet, unidentified theropod approximately two metres from the first find.

After Lesley Kool worked her magic on the specimen it was found to be an almost complete left foot of a Euornithopod dinosaur (a "Hypsi" to the traditionalists) with the distal end of the tibia attached and a tail consisting of 22 caudal vertebrae in articulation. It had probably been a complete animal but the specimen had been found on the edge of the shore platform facing the ocean and so the head and body had been washed away long ago. D'oh! This specimen is only the third articulated dinosaur found in Victoria and the first found outside of Dinosaur Cove.

During the preparation Lesley noticed that the tail ended with the impression of the next vertebra. That meant that there was more of the tail to recover. The week before Christmas 2005 I rounded up as many troops as I could on short notice and headed off to Cape Otway to take a look at the most promising new Cretaceous site in years. The site is a conglomerate sandstone shore platform extending for an approximate 50 metres with the side facing the sea rising vertically about 50cm. It seems to be an island in a sea of clear sandstone. We named the site "Eric the Crayfish" because it is situated east of Crayfish Bay and 170 metres west of the rusted remains of the anchor of the sailing ship "Eric the Red". It is so close to Cape Otway that you can see the lighthouse from the site.

On inspection of the excavation site it was easy to see how some of the specimen was missed. The tail took a dive through a coal layer making it almost invisible due to the mess made by the rock saw. The rest of the tail consisting of 11 caudal vertebrae was recovered but we had neither the time nor personnel to do much more.

George Caspar and Malcolm Carkeek examining the area where the partial dinosaur skeleton was found in December 2006

The potential of the site prompted me to organise another field trip there in the near future. This time I wanted the services of the Inverloch crew who are highly trained to identify unbelievably small fossils in the rock. I have always wondered if a crew of this experience and training could have found mammal jaws at Dinosaur Cove. Here was a chance to find out. So in March 2006 a crew of fourteen diggers set up camp at the Apollo Bay Caravan and prepared to attack the rocks. A limited amount of rock was removed from around the area of the original find in case there were more pieces of the Euornithopod near by. Much of the remaining time was used in sampling the different layers along the full extent of the exposure. Although a few good specimens (including a delicate caudal vertebra of a theropod found by Rohan) and many fragments of bone were uncovered the verdict was that the layer in which the articulated dinosaur was found was, by far, the most productive. The weekend had been disappointing in terms of the small number of quality specimens found but the time had not been wasted. We had found a couple of good specimens and more importantly we had identified the layer to target in the future. Further encouragement was the fact that the crew were finding the very small, mammal jaw sized fossils.

December 2006 saw nineteen diggers settling in at our new base of operations at Bimbi Park for one more throw of the dice. It would be hard to justify continuing the digs at Eric the Crayfish if we did not produce something out of the hat this time. Even with a dozen or more workers the volume of rock which can be processed in a few days is rather small so I decided to use a strategy suggested by Al Fraser, an American veteran of Dinosaur Cove digs, which was to break down the rock to a bigger size than was usual at Inverloch but still smaller than was the norm at Dinosaur

Cove. The coarser grain size and the many inclusions in the conglomerate from the Eric the Crayfish site was also a factor. Whether this decision was correct or not we began to find a number of good specimens including a complete dinosaur vertebra, perfect lungfish tooth and John Swinkels produced a mystery bone which looks like a bulla (shell-like ear bone). The fossils were not exactly pouring out of the rock like a good day at Inverloch but the point was that many of them were different.
And as we know Mary reached deep into her hat and pulled out a brand new mammal jaw. Bless you!

Postscript: In July 2007 Sarah Edwards and I visited the site while on holidays in the area. The visit was brief due to driving rain but we found a dinosaur limb bone at the extreme eastern end of the exposure. This means it is possible to find fossils along the full length of the exposure. We will return in full force in December 2007.

Beetle Bum Breakthrough

The humble "beetle bum" doesn't even deserve capital letters! Who, amongst all those who have worked at Dinosaur Cove or Inverloch, has not wondered what the bloody things are? Everyone has found them. Sometimes they are the only things that you find in a day's work. You can get to hate the shrivelled up little things.

But what are they? It is a mystery that has baffled generations of both workers and researchers in the Victorian Cretaceous. Even the origin of the term "beetle bum" is lost in the mists of time. When I first worked at Dinosaur Cove I recall I heard that the name was invented by Helen Wilson but we can't blame her for everything. Have I piqued your curiosity? Is the suspense too great? (Drum roll please, Paul).
In an exclusive scoop for the annual report ("Nature" and "Science" eat your heart out) I can announce that the case is cracked - literally.

Paul Chedgey and I were working our way through a batch of specimens which had been collected at the last Flat Rocks dig. We passed each of them under the Leica MZ8 stereo microscope judging which were worthy of further preparation. Sorry diggers but it is either the work bin or the dust bin! One of the fossils was particularly awful (I apologise to the proud finder of #123) but a nearby seed pod caught my eye. It had been split neatly in half (part and counterpart). What I saw neatly nestled in one side of the semi carbonised nut was a beetle bum in mint condition. The seed pod had been sealed before the rock had been split so that it could not have crawled in.

Mystery solved! The wrinkled mass inside this seed pod is one of our "beetle bums".

Earlier this year I had given a number of beetle bums to Dr. Bill Birch (Curator of Mineralogy, Museum Victoria) who sent them to some mineralogical researchers. I suspect that most of them threw the things away but one of them replied that he thought they were of biological origin.

Now for the denouement! I postulate that a beetle bum is a seed which has shrivelled up or the husk of a seed. Buy a packet of "Beer nuts". The brown husks around the peanuts may be extant beetle bums. The research into beetle bums is still in its early stage and there is still much to do. For instance I have noticed that the beetle bums from the Otways are morphologically different from those found in the Strzeleckis which is not surprising considering the ten million year difference between the two groups. I will ask the diggers at Inverloch to keep any seed pods which they come across so that we can open them under laboratory conditions to examine their contents. I have invited Dr. David Cantrill, a noted Palaeobotanist and head of the National Herbarium, to join our research team but he is yet to return my calls and emails.

CAVEPS 2007

11th Conference on Australasian Vertebrate Evolution Palaeontology and Systematics
10th April - 13th April 2007

This year CAVEPS was held at Melbourne Museum and jointly sponsored by Museum Victoria and Latrobe University. Victoria is well known for its world class vertebrate fossil sites, including diverse and well preserved Devonian and Carboniferous fishes from the Mansfield Mt.Howitt regions, possibly the oldest known tetrapod trackways, the superb polar dinosaur and mammal sites on the eastern and western coasts, amazing new fossil cetaceans from the Mid Tertiary marine sites along the Great Ocean Road, and the historical Pleistocene Megafauna localities from the Western Districts, south west coast and East Gippsland cave deposits. All of these fossils which are housed within the vaults of Museum Victoria were made accessible for study to the more than a hundred delegates from all around the world.
The huge task of catering to the needs of the many researchers in the collections was made easier by splitting the responsibility between Dr.John Long Palaeozoic fish, Eric Fitzgerald marine mammals and David Pickering megafauna, Cretaceous fauna and the rest.

CAVEPS is a biennial meeting of vertebrate palaeontologists and systematic zoologists and CAVEPS 2007 consisted of four days of general sessions, posters and pre and post conference field trips.

The Victorian Cretaceous was represented by a presentation given by David Pickering and Lesley Kool entitled "A Short History of Victorian Polar Dinosaurs and other Vertebrates".

The pre conference field trip was held between Friday 6 April and Monday 9 April and was organised by Dr.John Long and Dr.Jillian Garvey. It took in some classic Devonian fish sites around Taggerty and Carboniferous sites around Mansfield but unfortunately the Mt.Howitt sites were not accessible due to the aftermath of the summer bush fires. The field trip concluded with visits to the Flat Rocks site where Lesley Kool acted as guide and explainer and the *Koolasuchus* sites near San Remo where Mike Cleeland did the honours.

The post conference field trip was held on 14-15 April and was organised by Eric Fitzgerald and David Pickering. Unfortunately Eric suffered a foot injury before the event and was unable to attend but Doris Seegets-Villiers kindly filled in on short notice. Cenozoic marine vertebrate sites around Jan Juc and Bells Beach were visited where Doris ably explained the geology of the area. The next day the group descended into Dinosaur Cove where David gave a presentation on the history of the site and the faunal assemblage found there and Doris once again explained the geology. Mike Cleeland organised a search of the erratics which turned up a few fossils. The field trip concluded with a walk through a typical Otways temperate rain forest.

Research Report

by Dr. Tom Rich

Victoria

Significant Cretaceous discoveries of dinosaurs and mammals were made at two Victorian sites during the past year.

Four brief visits were made to a site discovered only in the past two years by Michael Cleeland a few km east of the Cape Otway Lighthouse.

The first problem to be overcome at this site was a name. Located midway between an anchor retrieved from the 1880 wreck of the American ship *Eric the Red* and *Crayfish Bay*, for a time, the site was referred to as either *Eric the Red* or *Crayfish Bay*. A compromise was reached by combining parts of each name: *Eric the Crayfish*. And so it will be henceforth known in the scientific literature.

With that nomenclatural problem solved, the work was carried out. Numerous specimens were found. Amongst them, two were of particular significance. One of these was the third partial dinosaur skeleton found in Victoria. Like the first two, it was the posterior region of a hypsilophodontid. Second was a mammal jaw. When initially discovered, this specimen was not recognised to be a jaw at all. Months were required to prepare that jaw for study as the matrix was particularly recalcitrant. David Pickering literally spent more than a day trying to tease one grain apart. To do that and not destroy the jaw was a daunting task which he patiently and skillfully performed.

The ausktribosphenid jaw found by Mary Walters at Eric the Crayfish in December 2006

At this stage the jaw appears to belong to the same family as two of the mammals from the Flat Rocks locality near Inverloch: the Ausktribosphenidae. As it is about 10,000,000 years younger than *Ausktribosphenos* and *Bishops*, while it likely does belong to the ausktribosphenids, it is clearly different from those two genera. The teeth of this new genus are noticeably taller than the older ones from near Inverloch.

With the discovery of a partial dinosaur skeleton and a mammal jaw amongst other fossils in such a short time, it is to be hoped that the site will continue to yield numerous specimens. If a ten day effort there in December proves to be equally productive, plans will be made to initiate an annual dig there late in the year to compliment the one at Inverloch. Like Inverloch, if Eric the Crayfish is productive enough to warrant a dig there for a number of years, if possible it will be of similar duration, six weeks annually. Work will go on at Inverloch as well because it continues to yield new material that is quite unexpected; e.g. a multituberculate.

On the morning of 8 March 1997, Nicola Barton was cracking rock from the Flat Rocks site in the backyard at the field head quarters of the field party, 23 Lavington Street, Inverloch. At that time, she cracked open a walnut-sized rock and found the specimen that meant that the work at Flat Rocks would not be closed down at the end of the 1998 field season: the little jaw that was the basis for naming the mammal *Ausktribosphenos nyktos*.

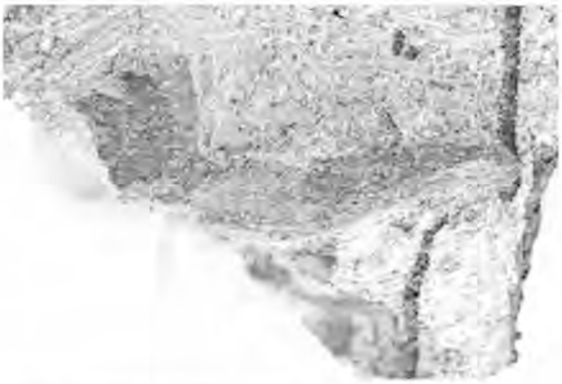
A decade later on 8 March 2007, almost to the hour, Nicola Sanderson nee Barton was again cracking rock in the back yard at 23 Lavington Street. While more than 40 additional mammal jaws had been found at Flat Rocks during the intervening decade, no upper dentitions had been found there, much to the consternation of Tom and Pat Rich. In the following decade, although Nicola had participated in several more of the digs at Inverloch, no more mammals had come her way. But on the anniversary of her critical discovery, she not only broke open another rock and found another mammal but this time she also broke the pattern of "only" lower jaws. What she found was a miniscule single right upper premolar of a mammal. Another incredible, ground breaking discovery on her part. Given the pattern, she has vowed to be at the Inverloch site on 8 March 2017 to do it again! The favorite hypothesis at the moment is that it is an upper premolar of an ausktribosphenid like *Ausktribosphenos* or *Bishops*.

The first upper premolar of a mammal found by Nicola Sanderson exactly ten years after she found the first mammal jaw at the Flat Rocks site.

While a good guess, we will only know for sure when a similar tooth turns up in a more complete specimen. After a decade had to pass before this one was found, no one who is realistic expects that to happen any time soon. But the next rock cracked open at Inverloch could yield just that specimen. At least we now know that tiny upper cheek teeth of mammals can be preserved at Flat Rocks because, thanks to Nicola, the evidence exists that this is so.

With the discovery in 1997 by Nicola of the lower jaw of *Ausktribosphenos nyktos*, it was immediately obvious that the search procedure at Flat Rocks needed to be changed. Instead of break down individual rocks there to the size of a clenched adult human fist, from that time on they were broken down to the size of sugar cubes. As a consequence of that change, typically between two and four mammal jaws turned up each subsequent field season. In this case, however, because the 2007 isolated tooth is only just over one mm in its maximum dimension instead of 16 mm long like the 1997 specimen, how to alter the search procedure to recover that size of specimen now that it is known they are present, is not obvious. Now, it is known, however, that such specimens do occur and that has set people to pondering a real problem rather than a hypothetical one. For it is quite likely that for every fossil jaw in the Flat Rocks deposit there are far more than one isolated tooth. The question has thus become, "how do we systematically find more?" now that once again, Nicola has shown the way.

Nicole Evered found at Flat Rocks what seemed in the field to be at best a toothless or edentulous mammal jaw. As such, it did not get high priority to be prepared after the field season was over. It is just as well that it appeared to be such a marginally good specimen when first seen in the field. This is because when Dave started preparing it, as he excavated the tooth of the jaw, a tooth appeared. Then another one. And then another one. Until finally there were five teeth exposed. Having remained totally hidden in the rock when Nicole struck that blow that exposed the "edentulous" jaw, the teeth were in the same condition they had been for the past ages rather than being at all damaged by the very process that exposed them to the light of day for the first time in 115 million years. This new specimen adds to our knowledge of *Bishops*, the second ausktribosphenid to be found at Flat Rocks. Every additional specimen of a previously known form adds further information about it. This new information includes both details of the structure of the organism and the variation to be seen within a species, both valuable insights to have.



Nicole Evered's first mammal jaw is a Bishops whitmorei

A most enigmatic toothless jaw from the Flat Rocks locality found by Anne Leorke is a most tantalizing fossil. It does not appear to be a dinosaur. More likely, it is a mammal. If so, it hints most intriguingly at the former presence at the Flat Rocks locality of a mammal significantly larger than those ones already known from the site. It would be about the size of the large Early Cretaceous monotremes known from Lightning Ridge and Dinosaur Cove. The only way to know for sure will be to find a more complete fossil of the same species of animal.

Steve Salisbury, a palaeontologist based at the University of Queensland, has analysed the Victorian collection of small theropod dinosaur teeth, the approximately one hundred and twenty of which are known from Australia. Most of those are from the Flat Rocks site with only one from Dinosaur Cove and one or two from Queensland. Steve concluded, as had Tom before, that based on their shapes, there are four different classes of these teeth. Naming new dinosaurs on the basis of such specimens will not be done but it does indicates a significant diversity of small carnivorous dinosaurs 115 million years ago lived near what is today Flat Rocks.

Larger carnivorous dinosaurs are known from Victoria as well. Almost the first dinosaur specimen found near Eagles Next in Victoria when the modern phase of work began in 1978, was the astragalus (ankle bone) referred tentatively to *Allosaurus*. It was near there that seventy-five years before that Australia's first dinosaur was discovered. Several other bones of large carnivorous dinosaurs have been discovered in subsequent years. One of these is an astragalus found by Mike Cleeland one year ago near San Remo. It is smaller than the one referred to as related to *Allosaurus* and differs fundamentally in its shape. Possibly one of the small theropod tooth types could be the same species. Because the other larger carnivore bones were not found as parts of a single skeleton but individually at many different sites, they might represent several different species or just one or two. So at a minimum, there were five different theropods or carnivorous dinosaurs present in the Victorian Cretaceous. Most of those specimens were from the older Stretzlecki Group deposits east of Melbourne rather than from the Otway Group west of Melbourne. This does not mean there were more carniovorous dinosaurs present when the Strzelecki Group deposits were laid down but that more were preserved there, quite a different thing.

Theropod astragalus found by Mike Cleeland at San Remo

The enigmatic specimens found at Flat Rocks and elsewhere in the Victorian Cretaceous are in some ways the most exciting ones. For they show that yet to be discovered are many different fossil vertebrates that these tantalizing fragments a tangible evidence that once existed where we have been looking. Their mere presence demonstrates unequivocally that there are more exhilarating things yet to be found.

A paper in Science in 2005 about *Teinolophos* continues to stir debate concerning the origin of the monotremes. At the moment, another manuscript is well advanced which advocates an age for the split between the platypus and echidnas as being no younger than Teinolophos; i.e. 115 million years ago. This is older than almost all estimates based on study of the DNA of living monotremes. Reconciling those conflicting estimates for this fundamental division within the monotremes is occupying a lot of molecular biologist's time these days.

ALASKA

In the northern summer of 1989, Pat and Tom Rich made a brief reconnaissance trip to the Late Cretaceous outcrops on the left bank of the Colville River that flows across the North Slope in northern Alaska. They did so because a few years earliest polar dinosaur bones had been first collected there and it was logical to visit an area where fossils that as once living animals might have inhabited an environment similar to that in Early Cretaceous Victoria.

It was, therefore, logical to explore an area where such fossils had been found, a once living fauna that inhabited an environment similar to that which prevailed in the Early Cretaceous [105-115 million years ago] of southeastern Australia. At that time, the Riches had been collecting somewhat older polar dinosaurs for eleven years along the south coast of Southeastern Australia.

Alaska with Liscombe site marked

The traditional method to collect dinosaurs that had previously been applied on the Colville River was to excavate in the open, much as one would in Montana or Mongolia. For three reasons, the alternative to excavate a tunnel to recover dinosaurs on the North Slope came to mind. First, on a wet summer, as was the case in 1989, the rumble of 1-10 tonnes of mud spontaneously slipping off the bank and plunging into the river about every two minutes was a constant background noise. If one were unfortunate enough to be below such an event, they would either be buried in mud or swept into the freezing waters of the Colville River. When that nearly happened to Tom, it concentrated his mind. Second, the fossil bones excavated by the conventional method have all been repeatedly thawed and refrozen each year as they gradually approach the surface. The banks of the river recede an average of 4 inches per year by natural erosion. The surface collected fossil bones are frequently riddled with fractures. Third, fossil sites high on the bluffs were known but could not be readily accessed because the surfaces of the bluffs above the Colville River were often too unstable in the summer. A tunnel cut at such a site in the late winter-early spring site could provide a safe, stable work place in the summer, accessing bone bed otherwise unattainable.

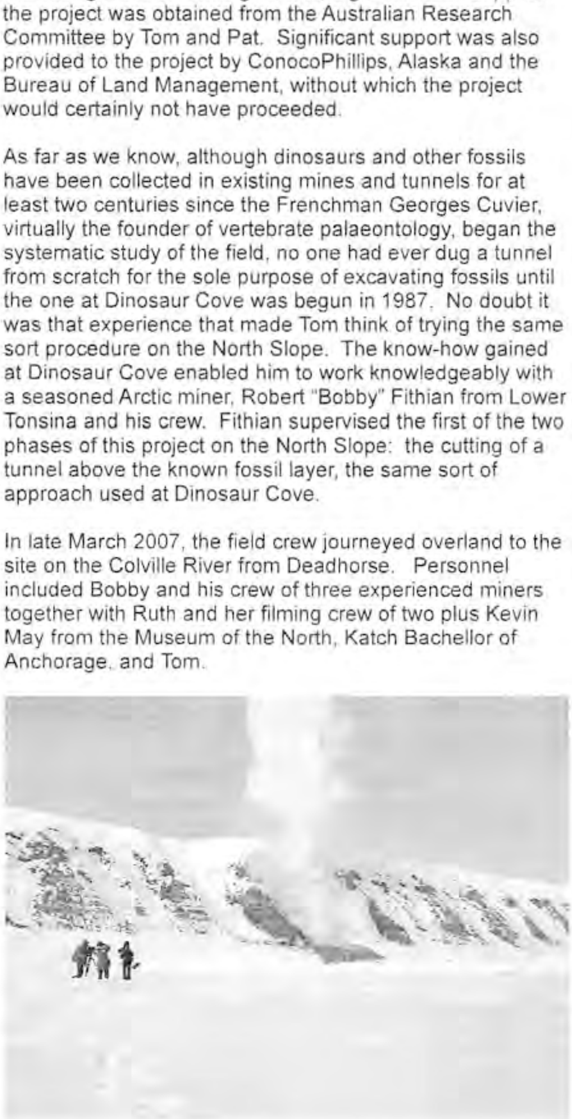
To overcome these three problems, it occurred to Tom that off-the-shelf procedures that Alaska miners had long used to excavate tunnels into permafrost elsewhere could be employed to uncover dinosaur bones. Then, to recover the fossils, procedures used previously to excavate dinosaurs elsewhere in the open together with those used in the tunnels at Dinosaur Cove, Victoria, Australia, were to be employed. On the initial trial, the plan was to innovate as little as possible in order to maximize the probability of success. The insights thus gained could then be used to formulate novel procedures of recovering fossils from such circumstances suggested by the initial experiment. In practice, this would mean having some tools and procedures that inevitably might not prove useful. Only firsthand experience would sort the wheat from the chaff in these regards.

From the outset, the objective in trying to excavate this tunnel was solely to test whether this technique would be useful to other palaeontologists working in similar circumstances in the High Arctic. Basically, they wanted to provide a new tool kit to enhance recovery of Alaskan polar dinosaurs. Such progress could only benefit the understanding of the polar dinosaurs of southeastern Australia.

After this initial inspiration to dig a tunnel, there was the little matter of money! Carrying out tunneling in the Arctic was not going to be cheap. Working with Roland Gangloff of the Museum of the North, University of Alaska, Fairbanks, most of the next 18 years were spent in one futile attempt after another seeking support for what was regarded as an outlandish project by conventional funding agencies. Tom, Pat, and Roland had all but given up ever doing this test excavation when Tom happened to be working with Ruth Berry. An Australian, too, she was making a documentary entitled, "The Terrible Lizards of Oz". Tom happened to casually outline this Alaskan project to her while traveling to a site for a film interview. Her response to his plan was, "That would make a good documentary." Tom never expected to hear anything more about this from Ruth, but was quite wrong. By dint of much hard work, she put together a consortium of media interests in the United States, Australia, and Europe to gain sponsorship for the making a documentary about the High Arctic work as well as to fund the tunneling itself. Once she had done that, on the strength of her funding results, a grant to also support the project was obtained from the Australian Research Committee by Tom and Pat. Significant support was also provided to the project by ConocoPhillips, Alaska and the Bureau of Land Management, without which the project would certainly not have proceeded.

As far as we know, although dinosaurs and other fossils have been collected in existing mines and tunnels for at least two centuries since the Frenchman Georges Cuvier, virtually the founder of vertebrate palaeontology, began the systematic study of the field, no one had ever dug a tunnel from scratch for the sole purpose of excavating fossils until the one at Dinosaur Cove was begun in 1987. No doubt it was that experience that made Tom think of trying the same sort procedure on the North Slope. The know-how gained at Dinosaur Cove enabled him to work knowledgeably with a seasoned Arctic miner, Robert "Bobby" Fithian from Lower Tonsina and his crew. Fithian supervised the first of the two phases of this project on the North Slope: the cutting of a tunnel above the known fossil layer, the same sort of approach used at Dinosaur Cove.

In late March 2007, the field crew journeyed overland to the site on the Colville River from Deadhorse. Personnel included Bobby and his crew of three experienced miners together with Ruth and her filming crew of two plus Kevin May from the Museum of the North, Katch Bachellor of Anchorage, and Tom.



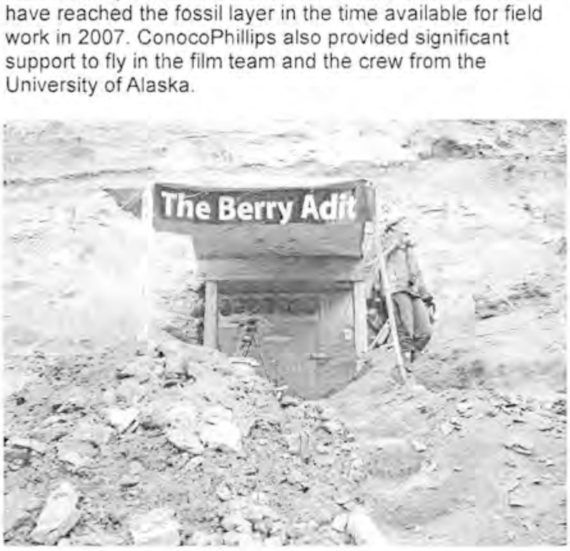
Blast in tunnel and avalanche

The tunnel was cut into the bank to a depth of eight metres, and a snow shed or portico was constructed at the front of the tunnel to keep the temperature inside the tunnel below freezing in the summer. This was done by the construction of two insulated walls, one inside the other. The presence of a portico meant that if debris slid down the slope above the entrance of the tunnel, it would not fall on someone entering at that moment nor blocking the portal, but accumulate on the roof instead. The portico was closed at the end of the March/April excavation in anticipation of a return to the site in August. At that time the plan was to excavate the fossils from the floor of the tunnel, the tunnel itself having been deliberately cut above the known level of the fossil layer to avoid damaging the fossils by the use of explosives.

Unpredictably, in June 2007, the Colville River was unusually high. The tunnel flooded. So when the diggers returned to the site in August, the first task was to remove tons of rock debris that had fallen on the snow shed from the bank above.

Clearing debris from the portico

Once the tunnel was opened, 75 cm of a "witch's brew" of ice welding large floated timbers and sunken trash was found to be covering the floor. Within the ice was about 15 cm of slush, an added complication. It took nearly a week to remove all of that. This was only possible in that short period of time because air tools {jack hammers and chipping hammers} were on site. It was possible to use Atlas Copco air tools on site because ConocoPhillips, Alaska, had flown in an air compressor to the site along with the fuel to operate it. Without the air tools, we would never have reached the fossil layer in the time available for field work in 2007. ConocoPhillips also provided significant support to fly in the film team and the crew from the University of Alaska.



The Berry adit ready for floor excavation

Once the "witch's brew" was removed, a protective structure was constructed in the tunnel to prevent any permafrost on the ceiling from falling on people who were collecting fossils below. Then, at last the fossil collecting began. Once this stage was reached, the fossils could be collected in much the same way as outside and this was done. Because this work was done in summer, care had to be taken to keep the tunnel cool. At one stage work had to be suspended for a day in order to maintain safe working conditions, so as to prevent the dreaded thawing.

Fossil ribs in situ

The method utilized to collect fossils from the floor of the tunnel was to dig through the fossiliferous clay with hand tools, expose individual bones, measure their orientation, and collect them. In the cold confines of the tunnel, this work went much more slowly than it would have outside. The crew grew very cold in carrying out this meticulous task and had to wear electric hand and toe warmers after being in the tunnel for a few hours, even with hourly sojourns outside to get warm. As a consequence of this, they were only able to reach a depth of about 30 cms into the approximately one metre thickness of the fossil layer. As it is known that most of the bones in the fossiliferous layer occur towards the bottom, the quantity of fossils recovered in 2007 was not great. However, they did demonstrate the important fact that their preservation was far better than those recovered in previous years from the active layer above the permafrost because they had not been repeatedly thawed and frozen. For this reason the staff of the Museum of the North plan to return to the site in future and excavate the remainder of the fossiliferous layer.

In 2003, together with Lesley and Gerry Kool, David Pickering, Sarah Edwards, Mary Walters and John Wilkins, Tom and Pat had excavated fossils from an oil shale mine near Gladstone, Queensland, Australia by cutting out blocks about 40 cms square with a rocksaw. That technique has proven extremely successful in recovering very complete data. Encased in a jacket formed of Hessian strips dipped in plaster of Paris,These blocks were subsequently opened in Melbourne and prepared there under laboratory conditions. Because the orientation of one block relative to others was recorded and mapped, it has been possible to join together a single bones that crossed from one block to another. Such collecting facilitated the recovery of tiny bones, the sampling of microfossils, the precise mapping of bone orientation both horizontally and vertically, in other words, allowing the collection of much more detailed information than could have been gathered by conventional, excavation of under field conditions.

Anticipating the difficult conditions of excavating fossils from the floor of the permafrost tunnel based on experience collecting in the tunnels at Dinosaur Cove, it was Tom and Pat's plan to collect at least half of the exposed fossiliferous rock from the Colville in blocks to be studied under laboratory conditions. Subsequently, the micro-excavating and detailed recording of data could take place in the laboratory, after the field work was complete. The other half was to be collected by Kevin May and Amanda Hanson of the Museum of the North together with volunteers in the conventional method described above. However this did not happen because it was thought by some that the cut would destroy a small percentage of the fossils, a value judgment entirely contrary to the previous experience Tom and Pat had with their excavations in the Eocene of North Queensland and the Cretaceous of Victoria. Because of this decision, in the end, staff and volunteers of the Museum of the North carried out all collecting of fossils from the floor of the tunnel in a conventional manner and no blocks were removed intact. Hopefully, in the future removal of blocks will be permitted and meticulous analysis of the micro-sedimentology, as well as recovery of tiny fossils under controlled laboratory conditions, can be carried out.

The Colville tunneling operation was a pioneering project involving unique procedures and unfamiliar concepts to most of the people involved with permitting and funding the project. It was understandably difficult for many of them as well as fellow palaeontologists, to grasp the rationale for what was proposed to be done and therefore make realistic judgments about it. But it did, indeed, work!

fossil site in adit

On the other hand, the encouragement and support for this innovative venture over the years by many people, particularly the BLM and Army Corps of Engineers, the Alaska State Government, the National Geographic Society, the Museum of the North, and other organizations, both in Alaska and elsewhere, and in particular ConocoPhilips, was most gratifying. We were grateful for the interest and input from the Inuit communities of the North Slope. Our connection with them resulted in us being able to provide educational materials for several schools on the North Slope together with posters from Melbourne's Monash Science Centre for public spaces in Barrow and Anaktuvic Pass connecting the polar dinosaur faunas of the North and the South (Alaska and Australia)- a cross-cultural dinosaur exchange!

The successful execution of this work in northern Alaska in 2007 has shown how it is possible to cut a tunnel into permafrost and recover very well preserved dinosaur bones from such deposits. It is no longer just a plausible conjecture that fossils collected deep underground are better preserved than those from the active layer of permafrost. It is now a well established fact. The objective of this project conceived eighteen years ago has most certainly been accomplished.

The opportunity was taken to collect matrix and bone samples for microbiological analysis from the undisturbed permafrost within the tunnel. These samples will be analysed by two groups, one in Australia and one in North Carolina, USA.

Serendipity came into play as it often does on a fossil dig. Kevin May found a small disk of rock rest on the river bank just outside of the entrance to the tunnel. On it was a fragment of a skull of what appears to be a pachycephalosaurian or "dome-headed" dinosaur. Although apparently belonging to that group, it has features of the teeth unlike any other pachycelphalosaurian or any other dinosaur for that matter. So it seems to be the first record of a group of North American dinosaurs that may have been restricted to the Arctic regions. All other known Alaskan dinosaurs belong to genera known further south in Alberta, Montana and Wyoming.

A documentary on the project provisionally entitled Dinosaurs on Ice, should be released to a number of television networks early in 2008 including the ABC.

Bear tracks around the camp

Intrepid dinosaur hunters have to keep the bears at bay too

When the tunnel was finally finished in April, Tom thought to himself that this would be not only his second fossil tunnel but his last. Upon return to Australia, Sarah Martin who is writing a Ph.D. dissertation under Pat about two Mesozoic Australian insect assemblages, expressed an interest in returning to the Koonwarra fossil site only about 20 km northeast of Inverloch. She wants to reopen it in order to collect more insects with an eye towards recording taphonomic data not available with the historical collections of insects from there. Tom considered doing the same thing about twenty years ago. The only practical method he could come up with then, given the circumstances at the site, is, you can guess, to tunnel. At least there seems to be a progression here that is favourable. The first tunnel at Dinosaur Cove was the most difficult one. The Colville River site was easier. And, if it goes ahead, the Koonwarra tunnel will be the easiest of the three, he thinks.

Tom Rich and Pat O'Neill discussing future plans for the Koonwarra site, South Gippsland, Victoria

EXCAVATION REPORT

by Nicholas van Klaveren

The Flat Rocks fossil locality was excavated for a period of six weeks, from late January to early March 2007. This period was chosen to coincide with the university holidays and to avoid the tourist season at Inverloch.

All the fossil material was collected under permit number 10003392 of the Department of Sustainability and Environment, Victoria. Excavations this year targeted basal contact conglomerate in the main pit area north of the fault and once again continued at Bridge East.

Excavation Methods

The excavation method this year continued with the use of large iron wedges and sledge hammers to remove the bulk of the fossil layer from the targeted areas. Exposed specimens were removed with a diamond saw blade equipped Stihl TS460 Cutquik.

The unfossiliferous overlying sandstone overburden at Bridge East was removed with the two Cobra petrol driven jackhammers. Once the majority of the overburden was removed, the method was then switched to sledge hammers and wedges so as to provide greater control to protect the underlying fossil layer from damage.

Equipment

No new equipment was used this year and thanks go to John Wilkins for refurbishing the sump pumps for this years field season.

Excavation Areas

Area 1

More commonly known as Norman's Hole, this area was considered to be inadequately tested and a number of days were spent digging up a large sample. The target was local thickening of channel units or a basal pond deposit, however neither of these were found and the area yielded only minor fossils.

Area 2

The very thin conglomerate at the bottom of the basal sandstone was tested for any increase in thickness and incidence of fossil material at the start of this years season, but yielded no fossils.

Area 3

The Bridge, Bridge East deposits and Bridge East lower channel were extensively worked this season and provided the majority of fossil finds. The interpretation that the Bridge was an area of low palaeochannel stream velocity and Bridge East high was strengthened by large ankylosaur armour plates being found at East. The Bridge East lower channel was found to be a lens of sand banked behind a now coalified log. This sort of situation at Dinosaur Cove once yielded an entire turtle shell, but no fossils were found in conjunction with the phenomenon this time. The lens persisted for approximately 0.6 metres and was wholly removed.

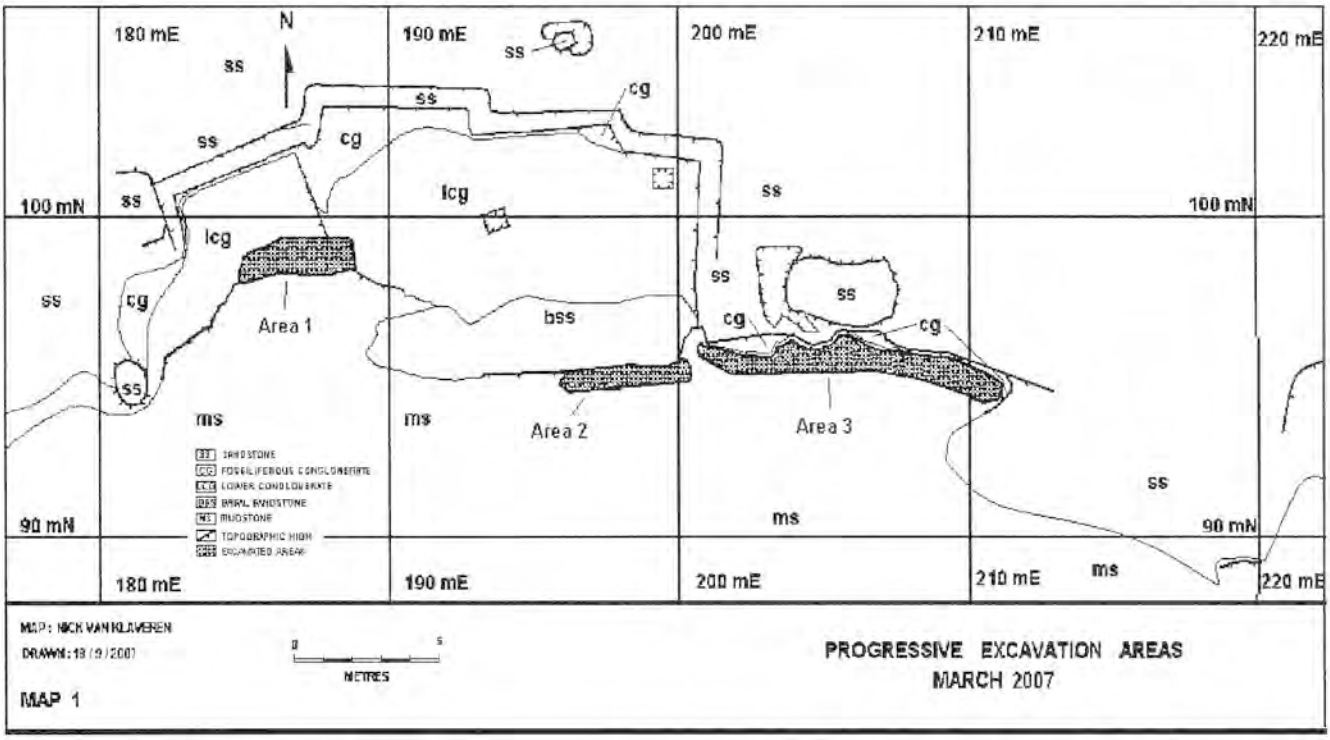
Future Plans

Bridge and Bridge East will continue as the target of future excavations and it is recommended that temporary low sandbag walls be built and small sumps constructed with the increasing depth of these excavations. (Map 2).

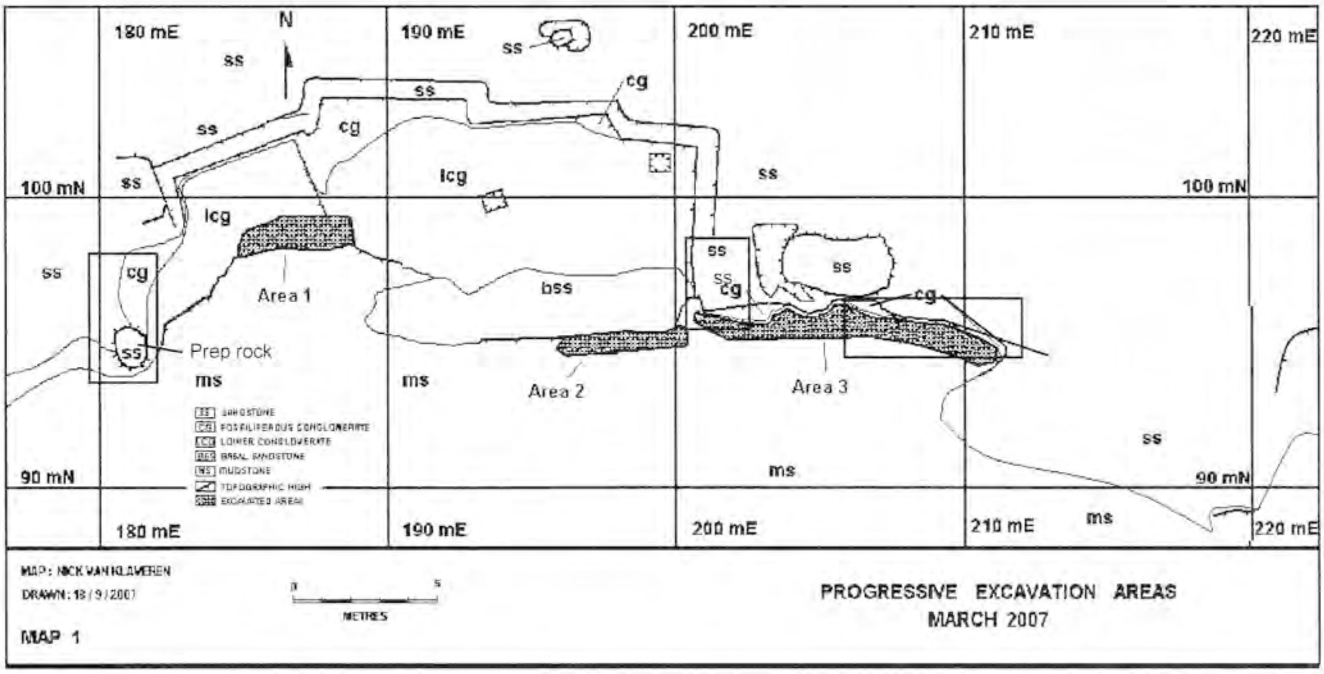
The western portion of the main pit area toward the cliff, under the Prep Rock, still has potential in that local thickening of the middle conglomerate unit may occur. See Dale Sanderson's report.

The thickened palaeochannel south of the fault (99 mN, 188.5 mE) in the lower conglomerate unit was not extensively tested in 2005 due to increasing depth and lack of infrastucture. This area will require a large sandbag wall to be constructed wide enough for sumps to be progressively constructed on the eastern side of the excavation due to local deepening in the palaeochannel.

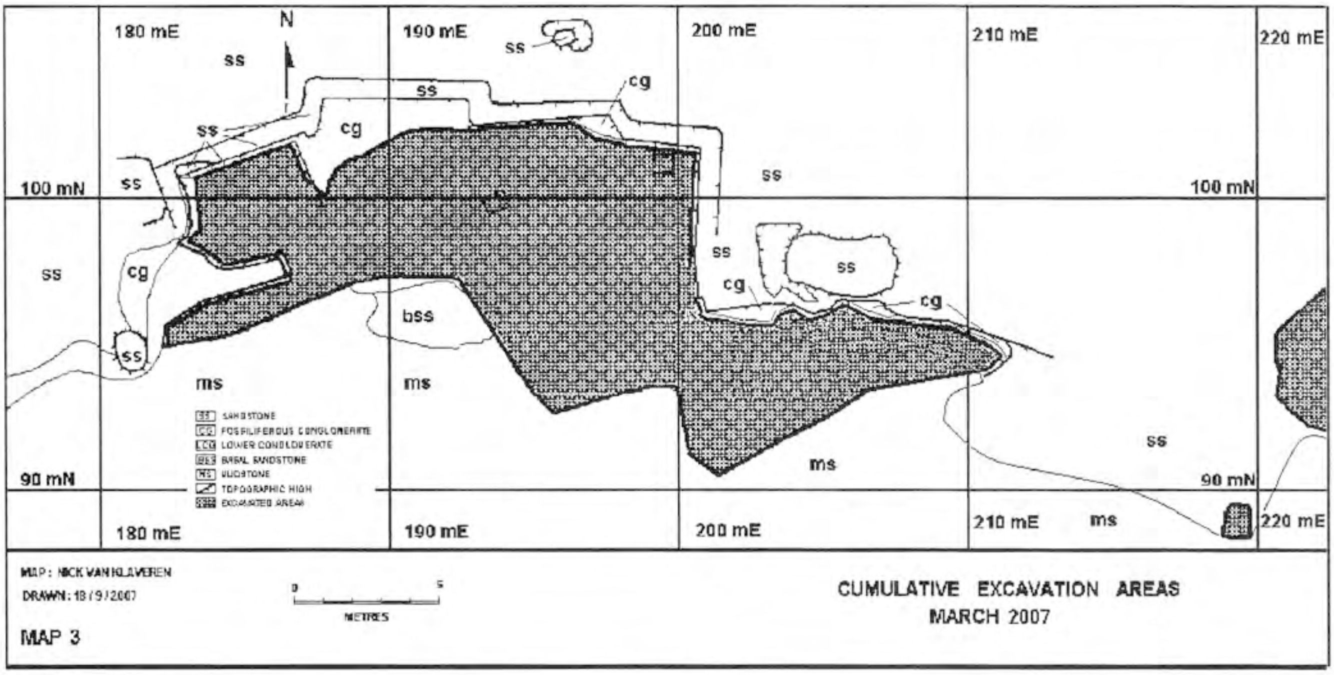
Tom Rich and Nicola Sanderson cutting the special 10th anniversary cake at the end of dig party.



Map 1 - Progressive excavation ares



Map 2 - Projected excavation areas



Map 3 - Cumulative excavation areas

Mary Walters, ace-fossil finder and discoverer of the only Early Cretaceous mammal jaw from the Eric the Crayfish site, was our "Celebrity Fossil" on Friends Day 2007.

Sedimentology Report

By Doris Seegets-Villiers

BRIDGE EAST AREA

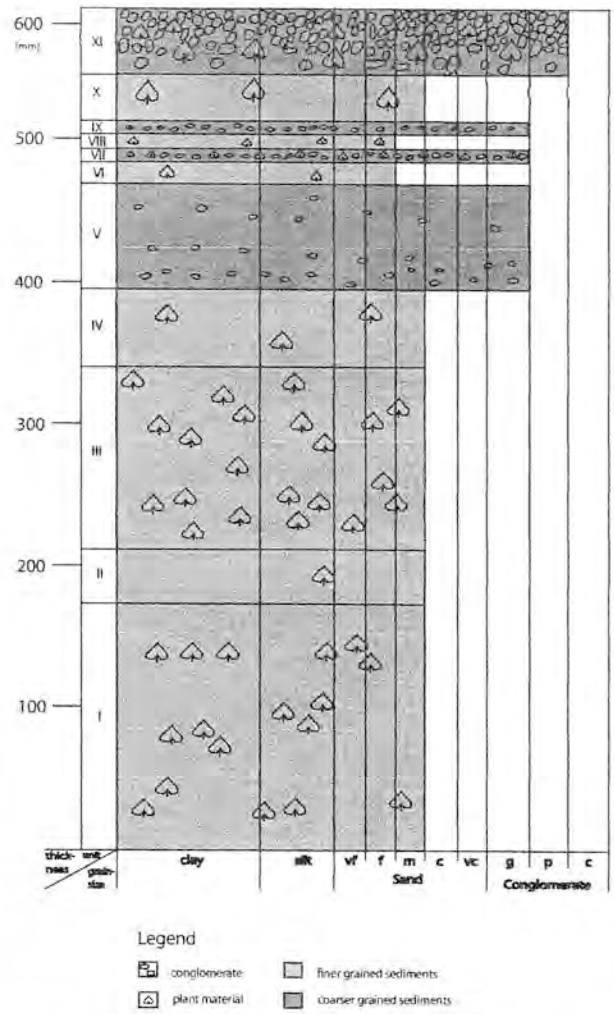
The Bridge East has, as in previous years, proven to be a very interesting excavation area. There are not only the obligatory bones of various sizes and shape but also what seem to be fresh water mollusks. The latter always occur in what we call the "corky material". This material is in contrast to the other sediments of the area; very friable or soft. We are not sure why this material is always as soft as it is and why all the other sediments have consolidated or hardened. We are also still trying to find out if this Bridge East area is connected to the main channel or not. There are indications (such as the corky material occurring within the top layer of the uppermost conglomerate in the main excavation area) that sediments in both areas were deposited at the same time by the same pulse but unless the area that "connects" the main excavation hole with the Bridge East area is dug up, we can not be certain. What seems to be quite certain is that the Bridge East was deposited in either a much shallower channel (if there is no connection) or towards the edge of the river channel (if there is a connection). We can conclude this because the thickness of the individual pulses that make up the stack of sediments is much thinner in this area than it is in the main channel. The corky material does not seem to derive from within the actual channel. If the material is soft now it would have been soft during the Early Cretaceous as well. Water carrying sand and also clasts would have been too energetic for the fine corky material to be preserved within the active channel. It would have been simply washed away. An origin from slightly outside but very close to the active channel is more likely. However, the area had to be constantly under water in order to allow the freshwater mollusks to survive.

STRATIGRAPHIC LOG

In order to capture outcrops or rock units in 2D on paper there are usually two ways employed. The first is a full sketch of an outcrop, roughly to scale and depicting different layers and outstanding features such as coal layers, bones, joints, faults etc. (see Dale's report for detail). The second is a much faster, more localized way. It only depicts features within a very close range of each other (usually within a few centimetres), providing a snapshot of localized features rather than an overview of features of an area. It is much like a core description where only a small area is viewed. It is employed when time is scarce and observations have to be made quickly.

A stratigraphic column or log is shown in Fig. 1. The data was taken during the field season 2002. The investigated area had a strike of 40°. Since the data was taken 5 years ago the area might look very different today. Wave action working on the rocks up to twice a day causes constant erosion. Therefore what is shown in the stratigraphic column below might be truly gone by now.

In order to create a stratigraphic column a geologist will take field notes describing grain size, rounding, colouring, take measurements of thickness of layers, size of e.g. clasts and much more. At the same time quick sketches are made and photos taken. When transferring data onto paper, symbols, instead of words, are used to describe the data in a brief concise way. Changes in lithology, plant type and content… can be easily identified at a glance. What can also be seen in this particular log is inverse grading. Normally in a pulse deposited by a fluvial system, coarse grained material is deposited at the base, followed by successively finer grained material and topped by the finest, the mudstone. Here, the column sets in with the finest material, followed by various sandstones and topped by the coarsest material the conglomerate. Since no tectonic forces have overturned the sediments, it can only be assumed that the stack of sediments was deposited in several episodes or that the energy of the fluvial system progressively increased.



Stratigraphic columns are a much easier way of giving an overview of features than reading through the original descriptions below:

Unit I: Base consisting of carbonaceous mud (mud with small plant material).
Unit II: Medium sandstone of moderate to well sorting with plant material of varying size.
Unit III: Massive, moderately to well sorted medium sandstone with very little plant material
Unit IV: Medium, moderately to well sorted sandstone with plant material of varying size and higher percentage than in Unit II.
Unit V: Unit is subdivided into smaller units of varying grain size. Generally, the lower section is made up of very fine to fine sand "sections", the upper section is medium sandstone. No plant material.
Unit VI: Mud supported (mud clasts do not touch each other) conglomerate, no plant material. Maximum clast size: 2 mm. The matrix is consisting of medium size sand.
Unit VII: Fine carbonaceous sand with little plant material.
Unit VIII: Mud supported conglomerate with little plant material. Maximum clast size: 3 mm. The matrix is consisting of medium size sand.
Unit IX: Fine sand carbonaceous sand.
Unit X: Mud supported conglomerate, no plant material. Maximum clast size: 3 mm. The matrix is consisting of medium size sand.
Unit XI: Medium carbonaceous sandstone.
Unit XII: Basal section consists of mud supported carbonaceous sandstone. Maximum clast size 5 mm. Top section is almost clast-supported (mud clasts are in contact with each other). Maximum clast size 6 mm. Matrix within

the entire section: medium sandstone.
As Dale points out in his report, it is important for our work to identify the units that are most likely to contain vertebrate fossil material. Right from the beginning of excavation at the Fossil Site it was clear that the most prolific lithology (rock type) for dinosaur and other bone material were the conglomerates in association with the sandstones. There are several different types of conglomerate to be found, however, each of them containing sufficient bone material to make identification important. Judging by the stratigraphic column the best areas to find further vertebrate material are the uppermost layers, the ones that contain various amounts of conglomerate. Unfortunately, no bone material was encountered whist collecting data for the column. However, bones had been found previously and have been found ever since thanks to the force of erosion.

Geological Report

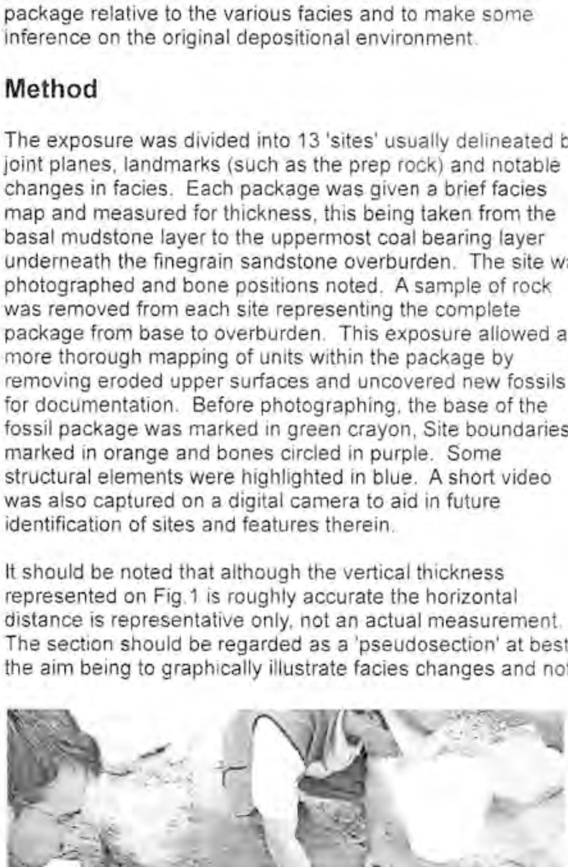
by Dale Sanderson

During the 2007 Dinosaur Dreaming field season a brief investigation of potentially fossiliferous units to the immediate north and west of 'Area 1' (see Nick van Klaveren this volume) was conducted by Roger Close and Dale Sanderson. The aim of this investigation was to attempt to analyse the variation in facies type and thickness as we traversed east toward the 'main' fossil sites. We were also hoping to catalogue the abundance and location of bones discovered within the package relative to the various facies and to make some inference on the original depositional environment.

Method

The exposure was divided into 13 'sites' usually delineated by joint planes, landmarks (such as the prep rock) and notable changes in facies. Each package was given a brief facies map and measured for thickness, this being taken from the basal mudstone layer to the uppermost coal bearing layer underneath the finegrain sandstone overburden. The site was photographed and bone positions noted. A sample of rock was removed from each site representing the complete package from base to overburden. This exposure allowed a more thorough mapping of units within the package by removing eroded upper surfaces and uncovered new fossils for documentation. Before photographing, the base of the fossil package was marked in green crayon, Site boundaries marked in orange and bones circled in purple. Some structural elements were highlighted in blue. A short video was also captured on a digital camera to aid in future identification of sites and features therein.

It should be noted that although the vertical thickness represented on Fig.1 is roughly accurate the horizontal distance is representative only, not an actual measurement. The section should be regarded as a 'pseudosection' at best; the aim being to graphically illustrate facies changes and not to precisely measure each feature.



Dale Sanserson (left) and Roger Close marking out the sites at Prep Rock

Facies Descriptions

M.D: Blue grey mudstone/siltstone +/- very fine sands. Western basal unit.
M.S: Black to deep grey/brown carbon rich mudstone. Usually lacking fine sands and often covered by a layer of sheet-like, compressed black coal. Basal package unit for Sites E through M. Contains fine coal seams in Site M.
S.S: Fine, well sorted, well rounded, light grey sandstone (quartz arenite/sublitharenite?). This unit is recognised as the primary overburden across site, although also occurs locally within packages as sandy lenses.
S.C: 'Normal', texturally mature sandstones (as above) also containing thin coal (<5mm) beds and isolated larger coal fragments. This unit typically comprises the majority of the fossil package.
C.C: Similar to S.C above but containing far coarser and more extensive coal deposits.
C.G: Matrix supported (diamictite, polymict) fine mudstone clast conglomerate. Matrix is compositionally similar to S.S above and generally contains less coal than S.C. 'Mudstone' clasts <5mm, well rounded and are highly variable in colour from brown through grey. Prospective fossil layer, especially on upper and lower contacts (*see discussion below).
G.V: As per C.G above, with clast size >5mm (usually <20mm). Clasts are elongate to well rounded, tending toward brown colours. In some rare instances in the upper beds this unit becomes clast supported. Prospective fossil layer, especially on upper and lower contacts.

Site Descriptions: see figures 1 and 2

Site A
Description: The first site, "Site A" was defined as a package 90cm across, starting as a line perpendicular to bedding bearing 339(159?) degrees, at a distance of 372cm, depth of -120cm below the reference point (the SW most flag hole). This site displayed a thin layer of basal conglomerate (<20mm) overlying grey sandy silt/mudstone. Overlying the C.G was a coarser layer of leaf litter and coal. On this contact we recovered a small turtle limb bone.

Site B.
Description: Site B is approximately 90cm across and resembles Site A, aside from a slight increase in fossil layer thickness to ~30cm. Basal C.G unit remains ~20mm.

Site C.
Description: Contains ~40cm of coal bearing beds. Contains a distinctive lobate lens of basal mudstone that is relatively higher (appearing to "intrude" on the S.C layers) than the compositionally identical basal mudstones. This may indicate an uneven scour into the basal muds, leaving an apparent 'high' in the mudstone. Such a scour could have originated from a smaller feeder channel, represented by the sandstones situated on the western basal edge of the Site. Conglomerate lens here was ~30mm thick and was positioned above the mudstone lens. Bones uncovered included a 20mm fish bone on the upper coal rich S.C and S.S interface, and another 20mm bone on the upper C.G/S.C contact.

Site D.
Description: This site contained several layers of conglomerate; an upper fine (<10mm) C.G and a 60mm thick lower C.G unit (clasts <20mm). Overall package thickness was 46cm, and contained a dense (probable fish) fragment and a Hypsilophodontid tooth (recovered by Nicola Sanderson after initial extraction). Both fossils were situated on the upper fine conglomerate/sandstone contact.

Site E.
Description: This site shows a marked thinning in the fossil package (~18cm in middle) and a change in the characteristic basal mudstone from a fine sandy siltstone to a darker carbon rich fine mudstone. Immediately above this layer were

sheetlike layers of compressed muddy coal, followed by a fine C.G layer 30-40mm thick. This layer lensed in and out across the site and contained a 25mm turtle XS.

Site F.
Description: A thin, unremarkable site similar to E, with the replacement of the S.C. layer with a S.S layer. Package thickens to the East where a smaller, upper C.G (15mm clasts) lens appears. The contact with the upper C.G unit yielded a kaolinite(?) infilled vertebrae ~20mm in width. A small, solid limb bone, also with internal kaolinite replacement was recovered on the upper contact of the basal S.C unit. The upper contact of the basal C.G unit produced a 10mm diameter hollow shaft (roughly oriented N/S).

Site G.
Description: This site sees a rapid thickening in the fossil package and the introduction of a coarser G.V unit. This polymictic unit displays ~25mm, elongate, grey/brown clasts and was criss-crossed with several sets of rocksaw 'scars' representing outcropping bone removed to extract fossils in previous years.The upper G.V unit produced some 12 bones (during break up onsite) from around 5kg of rock, making it a highly prospective unit. These bones included Mary Walter's "shapely limb" bone from the lower G.V contact.

Site H.
Description: This site contained several joints or minor faults along which water flow has produced an oxidised 'rusty' orange appearance. The upper C.G units here are moderately weathered and differ from those previously described in that they are uniformly grey, well rounded M.S clasts, and that the unit is clast supported. The main find of significance from this site was David Pickering's oxidised limb bone. This relatively large fossil was partially revealed by the cross cutting joint that delineated the Eastern site H boundary. Its awkward position in the weathered, jointed corner in the basal S.C unit was eventually resolved with some creative rocksaw work. The long axis of the bone was roughly N/S.

Site I.
Description: This site represents the S.W face underneath the 'Prep Rock'. It also contains an upper C.G unit similar in character to that described for Site H, above. Total fossil package thickness here is approx. 45cm true width. Both this site and site J display a ~2cm thick coal bed above the basal mudstone layer.

Site J.
Description: This site represents the S.E face under the 'Prep Rock'. This site is bounded on the eastern edge by a sinstral fault (trending 290) that vertically offsets the basal mudstone roughly 4cm. The offset is also traceable in units above this, but given sporadic lateral extent of some facies it is easier to trace the basal unit and some coal seams. This site also illustrates well an apparent trend across all sites - the basal conglomerate sequences tend to be comprised of finer clasts than those higher in the sequence.

Site K.
Description: Importantly, this site sees a rapid apparent thickening of the fossil package (~1m). Additionally three continuous conglomerate packages are deposited here with a notable coarsening up sequence. Here again the basal conglomerate layer displays fine, very well rounded clasts. The more chaotic medium sized clasts of the middle conglomerate were also liberally interspersed with medium to coarse coal fragments. At least four fossils were visible on the exposed surface of this layer (as well as rocksaw cuts) indicating its potential. It also contained Mike Cleeland's "absolutely guaranteed mammal tooth!*" (*not likely, according to Dave Pickering). The upper conglomerate is very coarse (<30mm clasts) and displays more elongate than rounded clasts, of various colours. It was also one of the most fossiliferous packages onsite, containing a very high abundance of bones when broken down offsite including larger turtle vertebrae, cross sections and dermal ossicles. Whilst these three layers were relatively continuous, it should also be noted that several smaller conglomerate lenses pinched in and out throughout the package, and individual mud clasts were common in all beds. This trend seemed to increase in the Eastern sites, making tracing individual beds more problematic. The Eastern margin of this site consists of a set of strong joints, trending 290 and 340 degrees. There were no visible drag structures or bedding truncation to indicate offset along the joints.

Site L.
Description: Although time did not permit a detailed study of this site, superficially it appeared very similar to site K, with perhaps a slight thickening of the fossil package (possibly linked to a minor flattening in bedding dip?). This unit also contained the highly fossiliferous coarse upper conglomerate present in Site K. Fine coal seams were also visible within the lower mudstone sequence.

It is also likely that given the dip of the bedding, greater erosion of the western sites is obscuring some of the more prospective fossil layers here.

Fossil layer below the Prep Rock exposed

Discussion:

It has long been recognised from previous Dinosaur Dreaming Dig field seasons that one of the most prospective facies, in terms of quantity of bones recovered, appears to be the mudstone 'conglomerates' (also sometimes affectionately referred to as "chunder layers"..) that occur in various forms across the site. The findings of our brief investigation agreed with this paradigm and were most apparent at sites G, K and L that displayed the coarser G.V units. Given the apparent importance of these conglomerates it may be prudent to examine the possible origin these facies in slightly more detail.

The clasts of the C.G and G.V facies do not appear to be the same material as the basal mudstone facies (given they are frequently brown and less carbon rich / sandy than the basal sequences). This infers that are not produced from a simple scour effect and subsequent reworking of these basal mudstone sequences. If these were basic interformational mud clast conglomerates (sourcing the mud clast material from within a basin, rather than transporting pebbles from outside it) we could expect to find angular/subangular mud clast conglomerates representing a short transport time (Boggs, S., Jr 1995). These conglomerates can form after the subaqueous rip up of semiconsolidated muds from a tidal flat, for example and are not necessarily produced in fluviatile systems. Combined with the fact that our clasts onsite are almost universally well rounded this explanation does not seem likely.

It would seem likely that these deposits are most likely channel deposits referred to as *lag deposits*. This facies is "composed of coarse material that the river can only move at maximum stream velocity during flood stage. These deposits include coarse bedload gravels, together with waterlogged plant material and chunks of partly consolidated mud eroded from the channel wall" (Walker & Cant, in Boggs, 1995). It is likely that during normal stream flow, bones came to rest on the low stream velocity channel walls, as did finer mud and silt particles. The bones and partially cemented muds were then remobilised during peak water flow and reworked as a

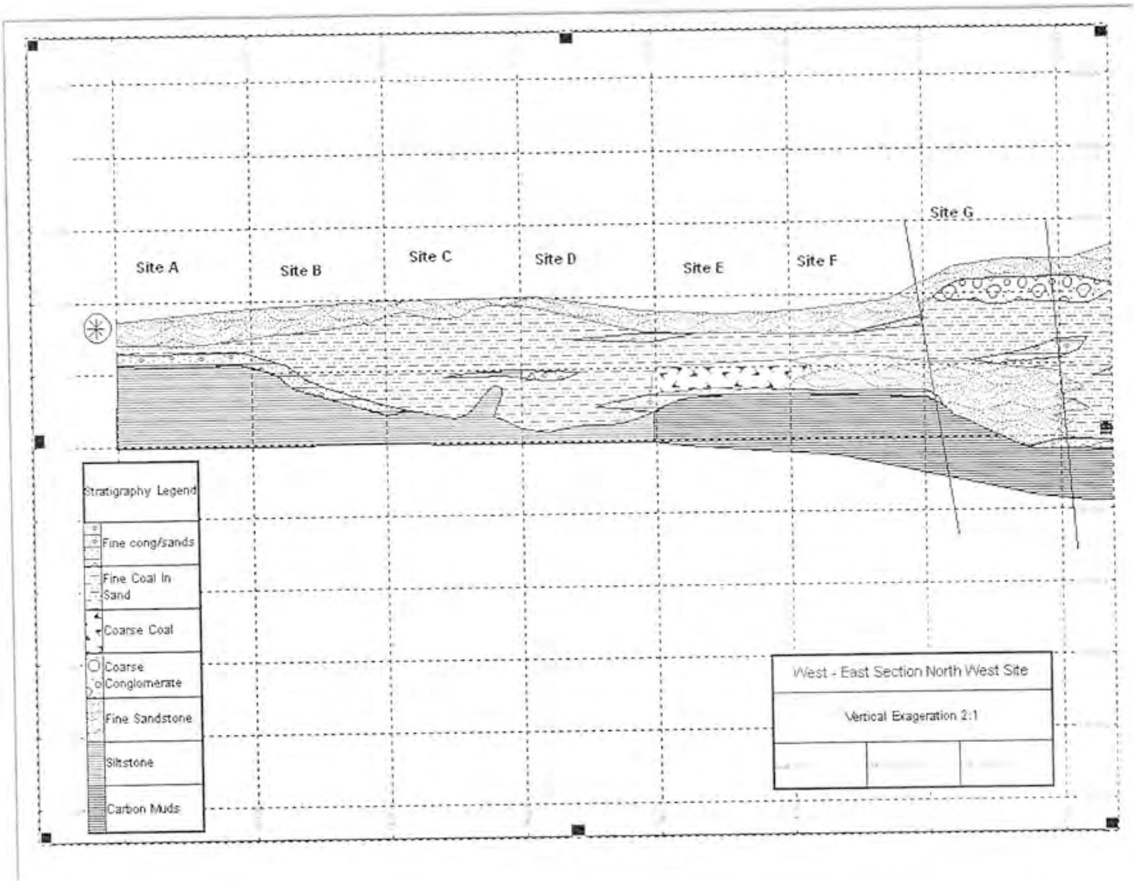


Figure 1 "Prep Rock" - sites A-G

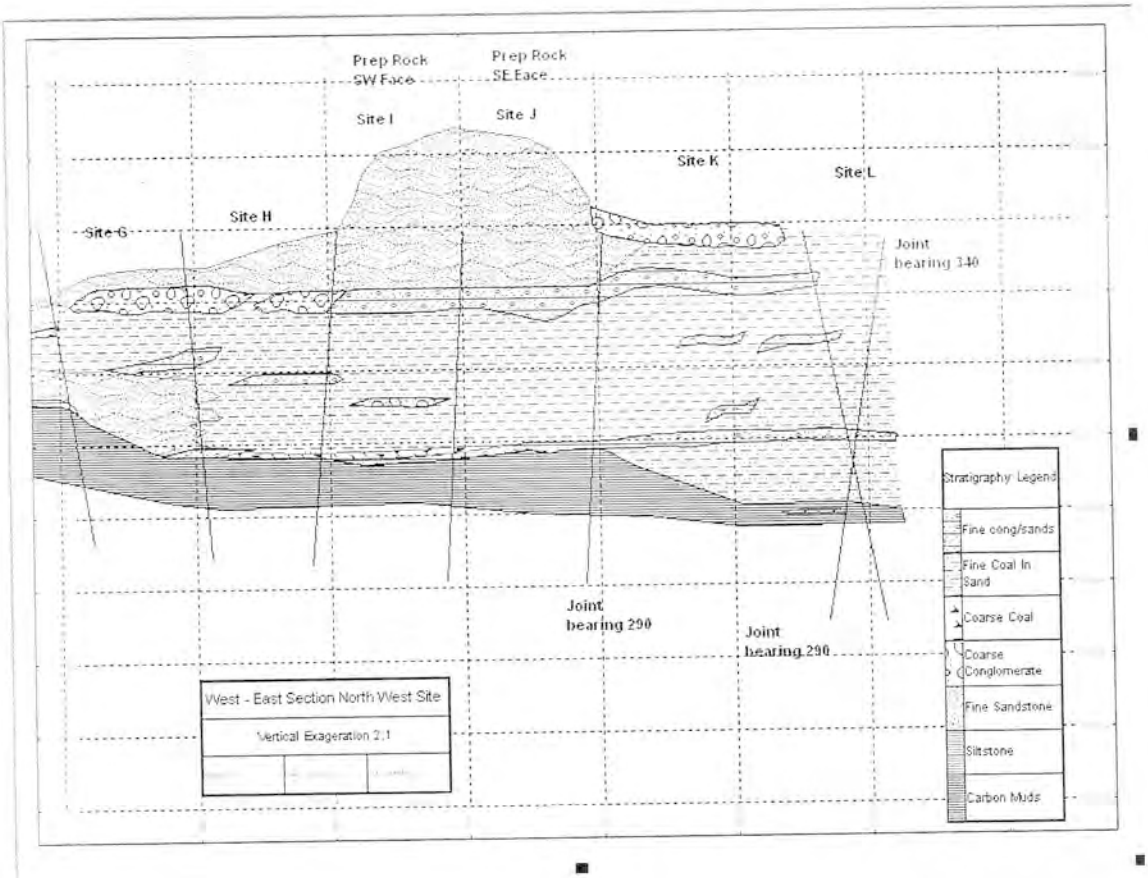


Figure 2 - "Prep Rock" - sites G-L

concentrated lag deposit as the flood event waned. This lowered the energy in the stream from a point at which it could transport the bone to a point where the bone and other coarser material (such as coal and the semi-consolidated mud clasts) originally from the channel walls settled out of suspension to the base of the channel. For such material to become preserved it is assumed that rapid burial under the S.S or S.C units then occurred. This mechanism of deposition is a specific kind of interformational conglomerates described above, although the implication for the original provenance of the fossil material (i.e. channel banks) may be significant. Although these lag deposits are more commonly associated with meandering river systems (as opposed to the current interpretation of the Flat Rocks site as a higher energy braided river system) it should be remembered that these two classifications are really end members of a continuum, and that overlap between the two is expected. It is possible that a decrease in stream slope as we progress away from the basin margin is resulting (at least locally) in meandering channels.

Along with lag deposit mud clast layers there was also enough circumstantial and anecdotal evidence to suggest that upper and lower facies contacts are more prospective than the middle of the unit itself. From our brief record of bones uncovered during site classification, almost every single site produced fossils on facies contacts. Usually this was C.G/S.C contact, although fossils were also recovered from S.C/S.S, S.C/M.S and S.C/C.C contacts, even from sites with a relatively thin fossil package. This would seem to follow from the logic that an upper or lower lithology contact should represent a flux in stream velocity, altering the maximum particle load of the stream current.
It is also worth noting the sandstones that occur on site as they are the most dominant facies and are thus likely to provide us with useful palaeoenvironmental information. If similar to other grey sandstone units nearby, these 'Feldspathic Arenites' contain very approximately 30% feldspar grains, 65% quartz and 5% chloritc lithic particles (NVK pers. comm). Given that feldspars usually weather and decompose rapidly whilst in the sediment cycle, this would seem to indicate only a short amount of time spent in the river from erosion to deposition. Compositionally they would be considered 'immature' or 'submature'. However these sandstones also display many characteristics that would classify them as texturally 'mature' to 'supermature'. They appear very well sorted, well rounded and usually do not contain clay particles. All these features point to a lengthy period within a sediment cycle or possible reworking of an older sandstone. How can we reconcile this difference? I would suggest two likely reasons for this discrepancy. Firstly, very rapid erosion (indicating high vertical relief or humid climate) of a feldspar rich unit such as a granite inland can supply a large enough volume of feldspar to the sandstone that it will be retained during deposition. From what we know about other units in the area (e.g. coarser San Remo conglomerates and sandstones) this scenario seems likely as part of the Cretaceous rift basin marginal setting the Flat Rocks lithology represents. Secondly and more interestingly, cold or arid climates also inhibit the chemical weathering processes that destroy feldspars. Given the known palaeolatitude during the time of deposition and the presence of probable cryoturbation features on site, this cold climate is also highly likely to have affected the slower decomposition of feldspars prior to deposition. Either of these explanations, or perhaps a combination of both may have resulted in the retention of feldspars in a sandstone that has spent long enough in the sediment cycle to become texturally mature.

Conclusion:

If these conglomerate facies represent lag deposits it is possible that facies representing low energy, consolidated muds of channel walls would also be prospective for smaller fossil remains as this would be the original resting place of the fossil material. It also possible that material deposited here is not buried quickly enough for good preservation unless reworked as a lag deposit. The fossil richness of the conglomerate layers seems to indicate that the process of deposition concentrates fossils within these packages. There is no evidence to support a change in fossil layer targeting; the current method of targeting the conglomerates layers was supported by this study. The coarser upper conglomerates yielded the most fossil/kg, and the overall fossil package thickens noticeably to the east where an increase in conglomerate lenses is also recorded, making these sites more desirable from a fossil prospecting perspective.

Possible suggestions for future studies could include:
i) Attempting to catalogue and correlate recovered fossil size with adjacent clast and coal fragment size to allow more selective targeting.
ii) Assessing the potential of facies contacts for fossil recovery.
iii) Seeing how many chocolate brownies you can eat before you are no longer able to move.

Credits:

Some thanks go out to everyone at DD2007 including (but not limited to) Roger Close who performed the site studies and listened to my shonky explanations. John Wilkins for tireless hitting/cutting/digging/smashing/cleaning stuff and his Roborally enthusiasm. Nick Van Klaveren for site maps, real geology and making of cat flaps. Lesley Kool for being the preparatory equivalent of an omnipotent being. Mary Walters for breaking up our amazingly unprospective rock onsite, her winning smile and letting us share her beach house. Dave Pickering for Japanese pancakes and fossil ID work beyond the call of duty. Oh and my sincere commiserations to everyone who has seen Ghostrider since DD2007 - now you know what we went through.

Walker, R. G., and D. J. Cant., 1979, Facies Models 3. Sandy Fluvial Systems in Boggs Jr. S., 1995, Principals of Sedimentology and Stratigraphy.

Prospecting in the Otways and Strzeleckis

by Mike Cleeland

Perhaps the most interesting finds from the 2007 prospecting season have not been of bones, but of other fossil forms, most notably those covered under the heading of Ichnology, the study of fossil tracks and traces.

The year started in spectacular fashion with Tyler Lamb's discovery of the large footprint only a proverbial stones throw from the main dig site. In retrospect it's a wonder successive seasons of volunteers had not worn it away by unwittingly walking on it, blissfully unaware of its significance!

Several prospecting trips during the February/March dig season explored sites in the eastern sector of the Strzelecki coast. A party visiting Shack Bay struck a bone layer to the south of the access point which brought to light the first bones from that layer, and added significantly to the only one bone hitherto found from the whole of Shack Bay. Further work at that time covered more ground between Harmers Haven and Inverloch, searching for tracks and traces.

A trip to the Otways in April resulted in the recovery of a fine hypsilophodontid femur exposed in pure sandstone near Grey River. Not only was this the first and only bone find in this area, but was also one of the very few bone finds in any sediment other than the characteristic carbonaceous grit channel deposits that have produced the majority of the finds. Three days of rock breaking at ... River site produced 14 bones and while none as interesting as the hypsilophodontid jaw from the ... season, the exercise demonstrated that this accessible and easily workable site may have future ...

... Cove was revisited in April as part of the CAVEPS ... field trip, with some of the party finding bone in the erratics remaining on the boulder beach west ...

... Dr Tony Martin made his eagerly awaited visit and ... who joined him for a week of fieldwork were not ...ted. Good burrow structures were noted between ... Beach and Black Head among other places in the ... Group. The Otways part of the trip confirmed ... positive impressions about the dinosaur footprint ... located at Knowledge Creek, as well as ... everyone else's trepidation of the gruelling trek ... out of the site!

... Cleeland and Tony Martin took a group to Knowledge ... in July 2007

... burrows were noted near the Eric the Crayfish site, as ... as possible crustacean burrow entrance mounds near ... Efforts to relocate the Skenes Creek footprint site ... yet again defeated, the suspected site remaining deep ... intertidal sand. On a brighter note a different type of ... structure was noted there, comprising multiple ... infills some 4cm diameter covering wide areas. ... structures have since been noted west of Black ...

... the year notable bone finds included a well preserved hypsilophodontid femur exposed in the cliff adjacent to the main dig site after a slab of rock fell away, ... an interesting bone from San Remo which was first assumed to be labyrinthodontid but is now thought to be possibly an abelosaur astragalus.

Dinosaur Dreaming Research Projects - 2007

by Anthony J. Martin
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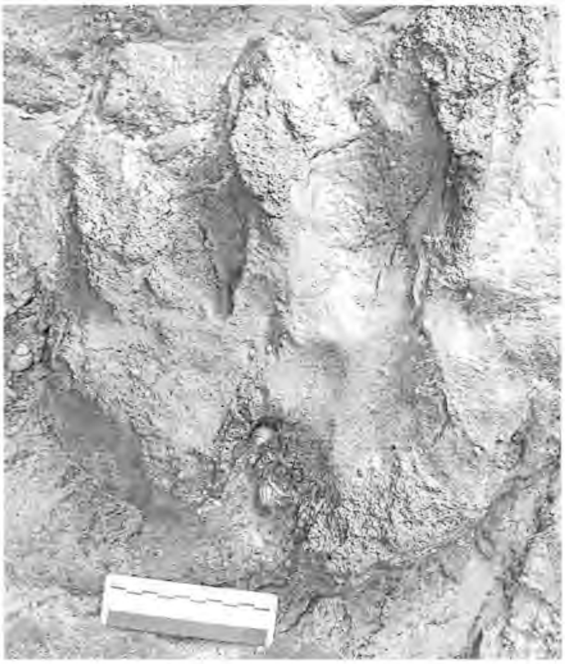
... summary reports on my continued investigations of trace fossils in the Strzelecki and Otway Groups of coastal Victoria. The trace fossils I am mainly interested in studying ... interpreted preliminarily as invertebrate burrows, which ... first discovered at the Flat Rocks site in February 2006 (see the 2006 Dinosaur Dreaming Report). This discovery led to inquiries about body fossils representing possible tracemakers, as well as other localities with outcrops that might contain trace fossils. As a result, in July 2007 I scouted several outcrops of the Strzelecki Group west of Flat Rocks (e.g., Eagle's Nest), and outcrops of the Otway Group just west and east of Apollo Bay. These scouting trips were facilitated very ably by Lesley Kool, Gerry Kool, Mike Cleeland, and a small army of volunteers, many of who had experience working at the Flat Rocks site in February 2007. During our field outings, I trained some of the volunteers on how to recognize trace fossils, and I verified some suspected trace fossils found by Lesley Kool and other volunteers during the Dinosaur Dreaming 2007 dig season.

One of the more exciting finds by a volunteer was a single, large theropod track, discovered during the Dinosaur Dreaming 2007 dig season at the Flat Rocks site. In February 2006, I found two probable dinosaur tracks (also from large theropods) at Flat Rocks, the first identified from the Strzelecki Group. Accordingly, these tracks served as search images for similarly preserved tracks in the Strzelecki Group at Flat Rocks, and Lesley Kool had instructed volunteers to be aware of their possible presence at the site. Indeed, the third track found by a volunteer (Tyler Lamb) in February 2007 was only about 15 m from the active dig site, a most serendipitous place to find it!

As mentioned previously, all three tracks from Flat Rocks were most likely made by large theropods, thus comprising important corroborating evidence of their former presence in Cretaceous polar environments of this area. Previous evidence for large theropods was based only on a single allosauroid astragalus and a few ornithomimid (*Timimus*) limb bones. Still, dinosaur tracks are seemingly rare in both the Strzelecki and Otway Groups, and hypotheses for their apparent paucity were the subject of an poster presentation I gave in October 2007 at the Society of Vertebrate Paleontology Meeting (Polar Dinosaur Tracks in the Early Cretaceous of Australia: Though Many Were Cold, Few Were Frozen: co-authored with Patricia Vickers-Rich, Thomas Rich, and Lesley Kool, in Journal of Vertebrate Paleontology,v. 27, Supplement to No. 3, p. 112A).



Theropod dinosaur track found by Tyler Lamb, one of the Dinosaur Dreaming crew, near the Flat Rocks site during the 2007 field trip

With regard to the invertebrate trace fossils, I am hypothesizing that some of these discovered at Flat Rocks in February 2006 and near Apollo Bay (Marengo) in May 2006 are crustacean burrows of some sort. This hypothesis led to me to examine crustacean body fossils in Museum of Victoria collection that had originally been recovered from Dinosaur Cove in the late 1980s. Gary Poore (Museum of Victoria), Mark Schultz, and Chris Austin (both at Charles Darwin University) aided in analyses of the body fossils, and we collectively determined that these specimens likely represented freshwater crayfish. The combination of trace and body fossil evidence resulted in our proposing that the oldest known Southern Hemisphere crayfish were in Victoria, Australia during the Early Cretaceous. The trace and body fossils are the subject of a research paper that was submitted to the journal Geology in September 2007: the title is Fossil Evidence for Oldest Known Freshwater Crayfish in Gondwana, and the co-authors are (in order): myself, Thomas Rich, Gary Poore, Mark Schultz, Chris Austin, Lesley Kool, and Patricia Vickers-Rich.
More trace fossils were certainly present at most of the sites examined in July 2007, and I plan to follow up these preliminary finds with further, more detailed investigations in 2008. One of the ways I hope to fund this is through a National Geographic Research and Exploration Grant, which I applied for in June 2007. If successful, this grant will be followed by applications for other funding opportunities for future collaborations with local researchers in Victoria.

Australia's oldest bird

by Roger Close and Patricia Vickers-Rich

In 1997 an avian furcula was discovered at the Aptian (Early Cretaceous) Flat Rocks locality, Victoria Australia. It adds a new dimension to our knowledge of Mesozoic birds - which comes mainly from Laurasia, particular China and Spain. The Gondwanan record remains sparse.

In Australia only a small number of isolated avian elements have been recovered from the Early Cretaceous Toolebuc Formation of western Queensland, including the tibiotarsus of a small enantiornithine, Nanantius. Further fragmentary material thought to be enantiornithine and other more advanced ornithothoracines has been found in the contemporaneous Griman Creek Formation of Lightning Ridge in New South Wales. But, aside from these and several impression of small feathers from Koonwarra, Mesozoic birds have been otherwise unknown from Australia and thus the furcula from Flat Rocks is the oldest osteological record of birds from the Australian continent and some of the oldest avian material from Gondwana.

Dinosaur Dreaming and the Monash Science Centre Exhibitions

by Professor Patricia Vickers-Rich and Dr. Corrie Williams

Specimens collected from the Flat Rocks site near Inverloch in Victoria have travelled the World since 2000 in exhibitions constructed by the Monash Science Centre at Monash University. To date the results of the research being undertaken at Flat Rocks has been seen by more than 1.73 million people.

Specimens on display have included mammal material (*Ausktribospenos nyktos* jaw, Bishops jaw, *Teinolophus trusleri* jaw, *Kryoryctes cadburyi* humerus), dinosaur material (*Qantassaurus intrepidus* jaw, assorted hypsilphodontid femurs and teeth) and turtle material.

Dinosaurs of Darkness Exhibition

Australian Tour, Total Attendees: > 91,280 attendees

Cities visited included:

LAUNCESTON: Queen Victoria Museum and Art Gallery

HOBART: Tasmanian Museum and Art Gallery

DARWIN: Museum and Art Gallery of the Northern Territory

PERTH: Western Australian Museum

ADELAIDE: South Australian Museum

Dinosaurs of Darkness Exhibition

Overseas Tour, Total Attendees: > 1,561,273 attendees

Cities visited included:

RAPID CITY: South Dakota School of Mines and Technology, USA

MESA: Mesa Southwest Museum, USA

FUKUI: Fukui Prefectural Dinosaur Museum, Japan

SEATTLE: Burke Museum of Natural History and Culture

ANCHORAGE: Alaska Museum of Natural History, USA

TAICHUNG: National Museum of Natural Science, Taiwan

SINGAPORE: Singapore Science Centre

Dinosaurs of Darkness Exhibition in Fukui, Japan

The Land of Koalas Exhibit

This exhibition was developed in conjunction with the Queen Victoria Museum and Art Gallery in Launceston, Tasmania. The exhibit was a featured project in the Australia-Japan Year of Exchange 2006. The exhibition was displayed at the Gunma Museum of Natural History, Japan, from 15 July 2006 26 November 2006. The exhibit had an attendance of 86,000.

Wildlife of Gondwana Exhibition

This exhibition provides a "world first" display of the fossil record from Australian and South American sources and describes the Wildlife of the Great Southern Super continent Gondwana, from 3.8 billion years to the present. The exhibition showcases the research work by some of the worlds leading palaeontologists.

This exhibition is currently on display in Taiwan, and has had more than 80,000 attendees so far.

Wildlife of Gondwana Exhibition

THE FUTURE - 2008 AND BEYOND

We are hopeful that the fund raising event in November will raise the necessary funding for Dinosaur Dreaming 2008 to go ahead. We are confident that the project has so much momentum that nothing will prevent this from happening.

On returning to the Flat Rocks site in January 2008 we plan to continue excavations at the Bridge East site, as this is the area the ankylosaur osteoderms were found. We also plan to extend excavations at the Bridge locality so that Doris can determine if this is a continuation of the Main part of the fossil layer, or a separate layer.

At the end of the 2007 field season Dale Sanderson, husband of the famous Nicola and an experienced geologist in his own right, mapped the areas under the "prep rock" at the western end of the main excavations (see figures one and two in Dale's report). This is an area that has been mostly ignored for the last 14 years as it possessed a convenient sandstone stack, which was used as the collection and wrapping point for the fossil bones.

Three years ago the prep rock broke in two and it is no longer large enough to be useful as a collection point, however it is sitting on top of some very "juicy" fossil layer and is situated very close to where the first *Bishops whitmorei* mammal jaws were found in 2000. So we plan to remove the remains of the prep rock and excavate beneath it. The rock sampled by Dale and Roger during the 2007 field season have shown that the area is definitely fossiliferous, especially Site K.

As mentioned in Tom Rich and David Pickering's reports, we will be returning to the *Eric the Crayfish* site in the Otways in December for a longer period of excavation. This site has huge potential having produced amazing results from very few fossils collected so far. To find a partial dinosaur skeleton and a mammal jaw, as well as a theropod vertebra, after sampling such a small amount of rock, is very exciting and we eagerly anticipate more great finds in the future.

We now have two locations where Early Cretaceous mammals have been found; one approximately ten million years younger than the other. This has huge implications for the study of mammalian evolution over time, as indicated in Tom Rich's report.

No further exploration near Bena, north of Inverloch, has taken place this year, mainly because our chief explorer, Matthew Pankhurst, moved to Western Australia to work for Rio Tinto. But it looks like the Koonwarra site, famous for its bird feathers, insects and fish fossils, is going to be re-opened and we look forward to seeing what treasures it has in store for us.

ACKNOWLEDGEMENTS:

We would once again like to thank Dom Brusamarello and his wonderful staff at the Foodworks supermarket in Inverloch for giving us a generous discount on our grocery bill. Feeding a crew of 60 volunteers over six weeks adds up and is the major part of our expenses, so any help we can get is much appreciated.

Funding for the 2007 field season was covered jointly by the "Friends of Dinosaur Dreaming" and Museum Victoria. The old song that says " you gotta have friends" is so true, especially in our case and we extend our heartiest thanks to all our "friends" for supporting us over the years. Special thoughts go out to Margaret and Bernie Brown who have helped us out since the inception of the "Friends". Bernie has been battling illness for quite some time now and we want to wish him a speedy recovery.

Another good "friend" is Rob Huntley who makes himself and his transit van and trailer available to help us transport all the dig equipment to the rented dig house and the start of each field trip and then helps us take it all back again at the end.

Blundstone Pty. Ltd., once again generously donated steel capped boots for all the crew members. The boots are a very important safety item when handling heavy rocks and we would like to thank Blundstone for their continuing support in this area.

We would also like to thank Phillipa Blackie (Pip) for painting such an amusing and accurate caricature of some of the dig crew. Check out the back cover of the report.

Thanks go to the following people who helped discover *Eric the Crayfish* and its treasures:

November 2005
Malcolm Carkeek
Diedre Carkeek
George Caspar
Mike Cleeland

December 2005
Malcolm Carkeek
Diedre Carkeek
George Caspar
Brian Choo
Mike Cleeland
Anne Leorke
David Pickering
Tom Rich
Rolf Schmidt
Kiki Swain
Dean Wright

March 2006
Brian Choo
Mike Cleelend
Kim Davis
Sarah Edwards
Nicole Evered
Alan Evered
Mike Greenwood
Rohan Long
Alanna McGuire
David Pickering
John Swinkels
Astrid Werner
Wendy White
Dean Wright

December 2006
Paul Chedgey
Win Chedgey
Brian Choo
Mike Cleeland
Kim Davis
Sarah Edwards
Warwick Foot
Mike Greenwood
Gerry Kool
Lesley Kool
Anne Leorke
Rohan Long
David Pickering
Doris Seegets-Villiers
JohnSwinkels

This year we were organised enough to actually take weekly crew photographs, and here they are. Many thanks go to the sixty volunteers who participated in Dinosaur Dreaming 2007 and we hope to see many of them back for Dinosaur Dreaming 2008

WEEK ONE (Jan. 28th - Feb. 4th)

Back row: Sheahan Bestel, Alan Evered, Braden Verity, Mike Cleeland, Norman Gardiner, Mary Walters, Nicole Evered, Lesley Kool, Dan Timblin, Troy Radford
Front Row: David Shean, Katerina Rajchl, Tyler Lamb, Fotini Karakitsos, Andrew Langendam, Rohan Long, Anne Leorke, Nick van Klaveren
Absent: John Wilkins, Gerry Kool (photographer)

WEEK TWO (Feb. 4th- Feb, 11th)

Back row: Andrew Stocker, Mike Cleeland, John Wilkins, David Robinson, Third row: Norman Gardiner, Mary Walters, Brett Pullen. Second row: David Pickering, Nicole Evered, Alan Evered, Penny Loughran, Jaqui Tumney, Marion Anderson, Wendy White. Front row: Rohan Long, Tamar Scholte, Peggy Cole, Katerina Rajchl, Lesley Kool, Nick van Klaveren.
Absent: Anne Leorke, Gerry Kool (photographer)

WEEK THREE (Feb, 11th - Feb 18th)

Back row: Mike Cleeland, Roger Close, Nick van Klaveren, Sue Martin, Gerry Kool, Norman Gardiner, John Swinkels.
Middle Row: Nicole Evered, Terry McManus, Bernard de la Coeur, David Elliott, Ben Iaquinto, Wendy White, Kim Davis, Mary Walters, Anne Leorke, Mike Greenwood.
Front Row: Kim, Jacinta, John Long.
Absent: Alan Evered, Lesley Kool (photographer)

WEEK FOUR (Feb 18th - Feb 25th)

Back Row: Anne Leorke, David Pickering, Nicole Evered, Norman Gardiner, Alanna Maguire, Gerry Kool, Mary Walters, Nick van Klaveren, David Hocking, Catriona Millen, Fiona Mc Dougall, Front Row: Dru Marsh, Wendy White, Nicholas Hayes, Roger Close, Lesley Kool.
Absent: Alan Evered, Danielle Shean, Mike Cleeland

WEEK FIVE (Feb 25th - Mar. 4th)

Back Row: John Wilkins, Dale Sanderson, Jeremy Burton, Caroline Longmore, Roger Close, Middle Row: Danielle Shean, Nicole Evered, Alan Evered, Paul Chedgey, Win Chedgey, Nicola Barton, Mary Walters, Norman Gardiner, Lesley Kool, Gerry Kool, Danielle Mitchell, Front Row: Sheahan Bestell, Nick van Klaveren, Wendy White

WEEK SIX (Mar. 4th - Mar 10th)

Back Row: Pip Blackie, David Pickering, Darren Bellingham, Jeremy Burton, Dale Sanderson, John Wilkins, Gerry Kool. Front Row: Nicole Evered, Felicity Walker, Alan Evered, Paul Chedgey, Roger Close, Mary Walters, Norman Gardiner, Julie Cox, Jennifer Blom, Danielle Shean, Lesley Kool, Nicola Sanderson.
Absent: Anne Leorke, Win Chedgey, Mike Cleeland

DINOSAUR DREAMING 2007 WAS PROUDLY SPONSORED BY:

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Bunurong Environment Centre

Denis Hawkins, Leongatha

Foodworks Supermarket, Inverloch

Friends of Dinosaur Dreaming

Melbourne Museum

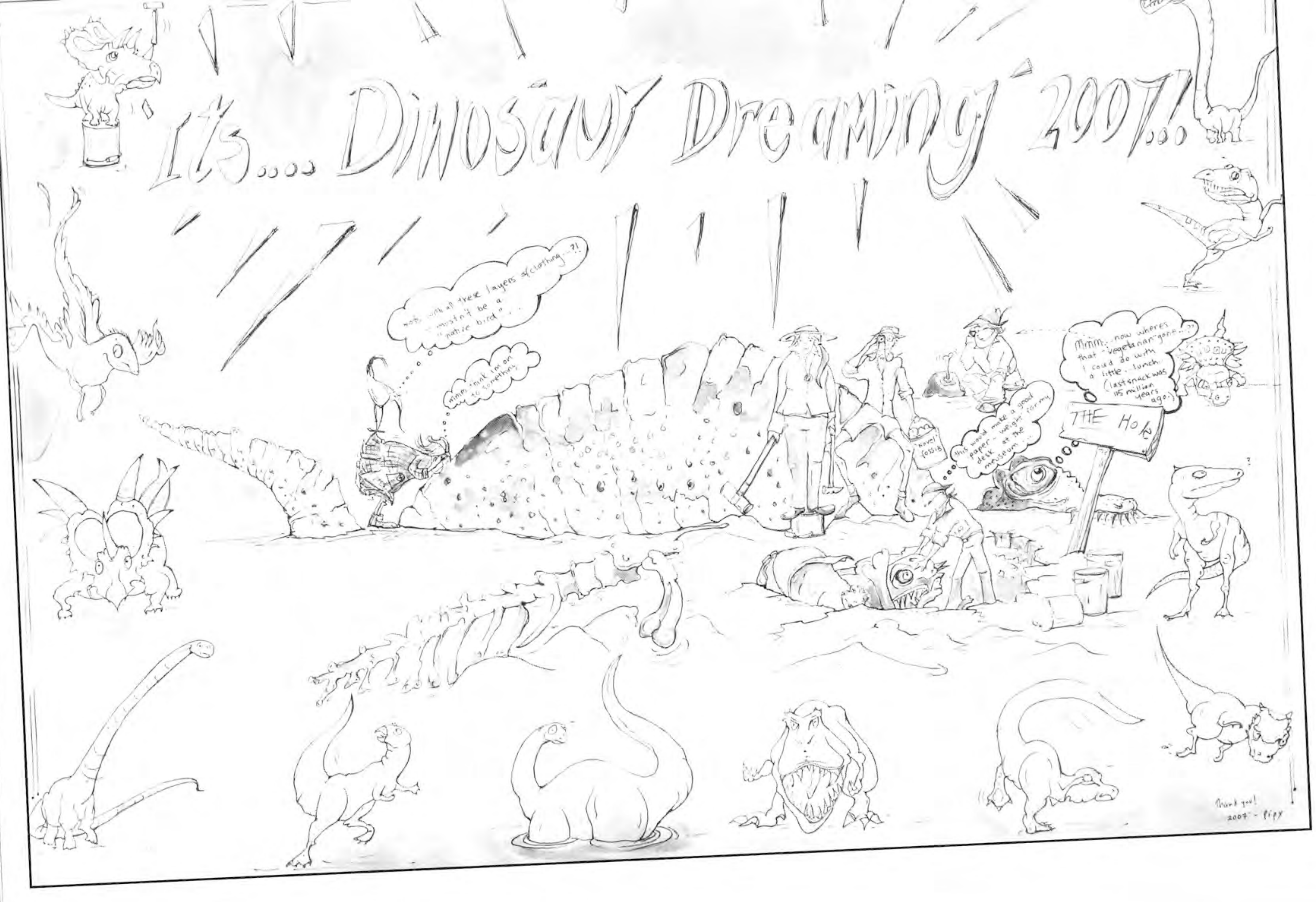
Monash Science Centre

National Geographic Society

Peter Trusler, Melbourne

DINOSAUR DREAMING 2007 FIELD CREW

Marion Anderson
Darren Bellingham
Sheahan Bestel
Philippa Blackie
Jennifer Blom
Jeremy Burton
Win Chedgey
Paul Chedgey
Mike Cleeland
Roger Close
Peggy Cole
Julie Cox
Kim Davis
Bernard de la Coeur
Sarah Edwards
David Elliott
Caroline Ennis
Alan Evered
Nicole Evered
Warwick Foot
Norman Gardiner
Mike Greenwood
Nick Hayes
David Hocking
Ben Iaquinto
Fotini Karakitsos
Gerrit Kool
Lesley Kool
Tyler Lamb
Andre Langendam
Anne Leorke
Rohan Long
Caroline Longmore
Penny Loughran
Alanna Maguire
Dru Marsh
Sue Martin
Fione McDougall
Terry McManus
Catriona Millen
Danielle Mitchell
Lisa Nink
David Pickering
Brett Pullen
Troy Radford
Katerina Rajchl
David Robinson
Tamar Scholte
Danielle Shean
David Shean
Andrew Stocker
John Swinkels
Dan Timblin
Jackie Tumney
Nick van Klaveren
Braden Verity
Mary Walters
Astrid Werner
Wendy White
John Wilkins



It's.... Dinosaur Dreaming 2007!..
"mustn't be a "native bird"...
mmm think I'm on to something
this would make a good paper-weight for my desk at the museum...
Novel fossils
Mmm.. now where's that "vegetarian" gone...?! I could do with a little.. lunch (last snack was 115 million years ago.)
THE Hole
Thank you! 2007 - Pipy