

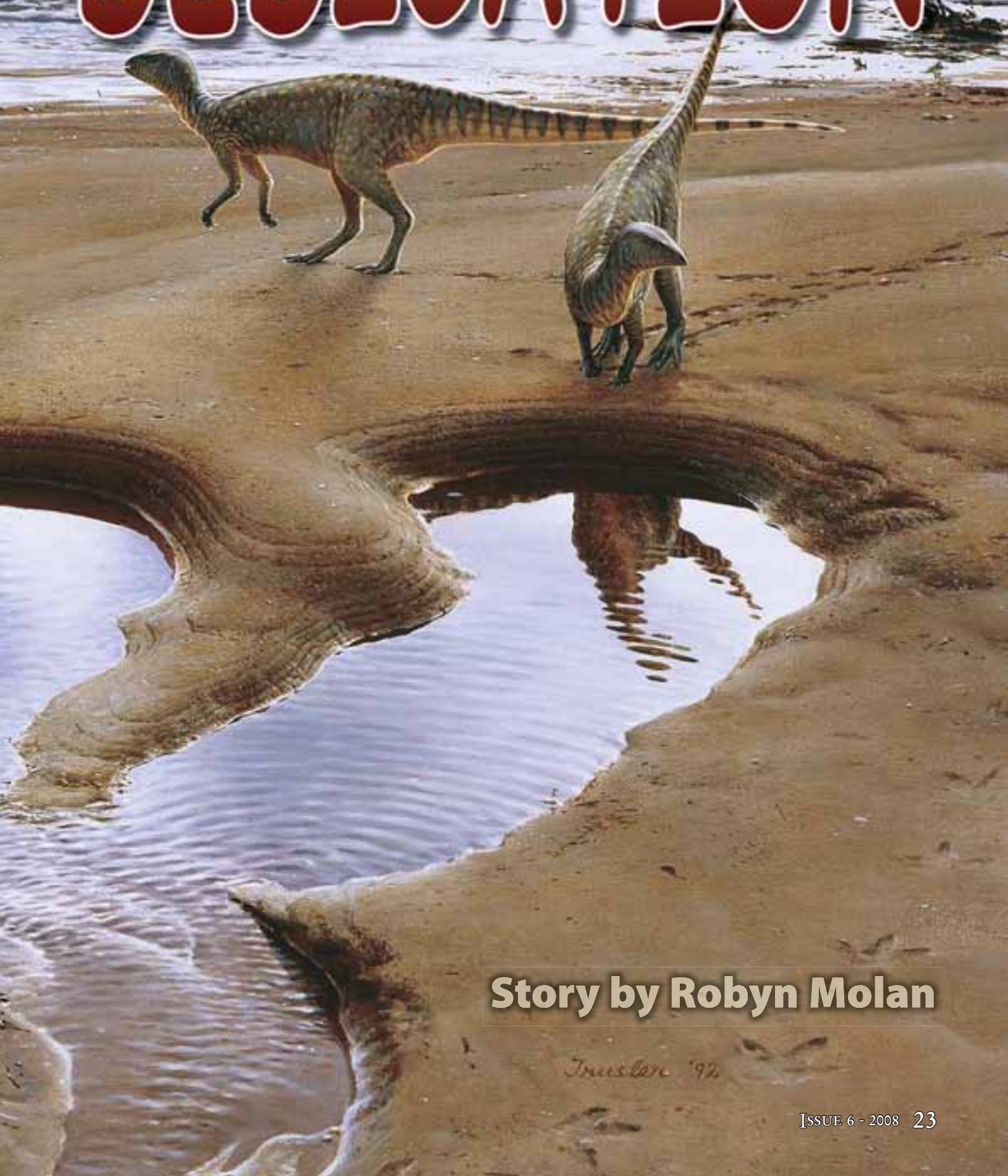
# A DECADE OF

## The Digs of Dinosaur Cove

*The excavation of Dinosaur Cove on the Victorian coast of south-eastern Australia was a ground-breaking project which, for the decade between 1984 and 1994, was to consume the lives of palaeontologists Tom Rich and his wife Pat Vickers-Rich, their two young children and a host of dedicated volunteers. This is a story of hard work, unwavering commitment and personal sacrifice that, in the face of extreme hardship, was to see the discovery of several new dinosaur species and open our eyes to the incredible former world of Australia's polar dinosaurs.*

**Image by Peter Trusler**

# DEDICATION



**Story by Robyn Molan**

*Molan '92*

Located on the Otway Coast 220km west of Melbourne, Dinosaur Cove is a beautiful rugged place, with only the pounding Southern Ocean between it and Antarctica. Before its discovery no systematic, large-scale dinosaur digs had ever been carried out in Victoria. David Pickering, former volunteer and current Collection Manager of Museum Victoria, describes Victoria's dinosaur discoveries until this time as largely sporadic and the result of serendipitous prospecting.

Australia's southern coastline has special significance in its geo-history, as it was here that the continent was once joined to Antarctica as part of Eastern Gondwana. Australia began to tear away 100 to 120 million years ago, after which time it drifted very slowly north to its present location. During the late Early Cretaceous period, south-eastern Australia was located close to where Antarctica exists today. Consider what this meant for the dinosaurs living there ... their world would have been one of cold winters with months of darkness, lit only by the lights of Aurora Australis and, for a fortnight each month, by the glow of the moon as it waxed and waned. The possibility that dinosaurs survived in such extreme conditions is awe-inspiring enough, but the Dinosaur Cove story reveals something even more incredible: Not all of the polar dinosaurs appear to have hibernated. Their story is itself remarkable, but even more remarkable is that they were discovered at all.

Australian-American palaeontologists Tom Rich and Pat Vickers-Rich (see AAOD #5 *Palaeo Profile*) migrated to Australia in 1973 so that Pat could complete her post-doctoral Fulbright Fellowship at the then National Museum of Victoria in Melbourne. Tom secured a position as Curator of Palaeontology there soon after, and before long they were searching for fossils in southern Victoria. Palaeontology students Tim Flannery (Australian of the Year 2007) and John Long had succeeded in finding fossils on the south Gippsland coast east of Melbourne. This prompted Tom to focus on similar rocks in the Otway Ranges, to Melbourne's west.

So it was that in 1980 a small party found itself at the base of a coastal cliff face, later to earn the name Dinosaur Cove. Tim Flannery and Mike Archer – a faculty member of The University of New South Wales at the time – were the first to find bone fragments.

"They were nattering away like a pair of magpies," Tom and Pat recall, "when a whoop went up and they were both on their hands and knees."

Within minutes, the group members found themselves staring at a small fossil deposit which had once formed an ancient stream channel. They soon realised, however, that the majority of the deposit lay inside the vertical cliff face and not on the shore platform. It was reluctantly assigned to the too-hard basket.

Thanks to a group of dinosaur enthusiasts called Friends of The



*The isolation and rugged beauty of Dinosaur Cove (above) was perhaps the greatest challenge facing palaeontologists Tom and Pat Rich and their team of volunteers in 1984. A sloping trail and near-vertical cliff face had to be negotiated to get to the shore platform. Apart from occasional helicopter assistance, this path was the only way of getting equipment to and from the dig site in the early years and was just one of many hardships endured in the first year of digging. Living standards were also basic and luxuries nonexistent. Nicknamed Dinoville (below), the campsite was a makeshift affair of old army tents and a bush barbecue in a farmer's field, 2km from Dinosaur Cove.*

Photos Roz Poole





*The inaugural dig at Dinosaur Cove in February 1984 (above). Later renamed Dinosaur Cove East, this site extended into the cliff face and consisted of a 106-million-year-old fossiliferous sandstone band; the ancient bed of a small stream channel. Installation of pneumatic equipment and a wooden portico to protect workers from falling rocks enabled tunnelling into the cliff face to commence. This involved drilling a series of holes with a jackhammer (left) and then splitting the rock using a technique known as plugs and feathers; a system of three wedges, where two (feathers) are placed in each hole and a third (plug) driven between them.*

*Photos Roz Poole*

National Museum of Victoria, Dinosaur Cove was not to lie dormant for long. The group had a few thousand dollars to spend, and their desire to spend it on a dinosaur dig was unshakably strong. Tom could do nothing to convince them otherwise. Eventually, in 1984, he agreed to take them to Dinosaur Cove.

Having committed to the dig, Tom now faced the daunting prospect of an overnight career change to underground mining. Exposing enthusiastic amateurs to the nightmarish risks of rock tunnelling from the base of a steep cliff being pounded by the sea was not a proposal that was accepted lightly by the authorities. Tom and Pat describe their search for expert advice as “a matter of groping

blindly”, with the typical response being dire predictions of catastrophe. Despite the negativity, Tom mastered the “vitally important art of deciding whose advice to listen to” and bravely went where no palaeontologist had gone before.

Tom and Pat knew that Dinosaur Cove was capable of high seas and strong winds. For this reason, they chose to conduct the first dig (and most subsequent ones) in summer, when conditions were more likely to be favourable. In February 1984, the initial 16-day dig got under way. Among the volunteers was Michelle Colwell (now Hird), the only volunteer to return every year over the next 10. She recalls that their camp, nicknamed ‘Dinoville’, consisted mainly

of “ratty old army tents and a bush barbecue.”

To get to the dig site, volunteers had to walk the 2km from Dinoville to the trailhead, descend a sloping trail and then inch their way down the 90m vertical cliff face. “I was gobsmacked when I saw the cliff,” says Michelle. “It was terrifying.” Victoria’s Surf Life Saving helicopter airlifted the heavier equipment to the shore platform, but the lighter gear had to be carried down convoy style. A rope attached to a star picket eased the descent and assisted the slippery, sandy climb back up to the top.

Before long, a protective portico had been built over the prospective work area and drilling of the rock face commenced. Mining tools had

been generously supplied by Atlas Copco and although initial progress was slow, the team forged ahead in true pioneering spirit as they struggled with learning to operate the equipment and experimented with techniques. The technique of choice was to drill holes in the rock using a rock drill, then drive wedges between the holes to split the rock using a hydraulic-pneumatic device called a darda. Unfortunately, the darda was plagued with leaking and bursting hydraulic lines, and more often than not, the volunteers resorted to using sledgehammers in a back-breaking but time-tested manual technique known as plugs and feathers. Another

immediate headache was that the compressor, which was located at the top of the cliff, failed to deliver sufficient air pressure along the 200m hose to the working face.

That first year, Tom's life seemed to be plagued by teething problems, technical breakdowns, cost overruns and administrative obstacles. The repair, replacement or upgrading of equipment invariably necessitated the arduous return climb up the 90m slope to camp, and more often than not a 220km midnight trip to Melbourne.

Fortunately for Tom, help was at hand. Bill Loads, manager of Victorian operations for Atlas Copco, promptly

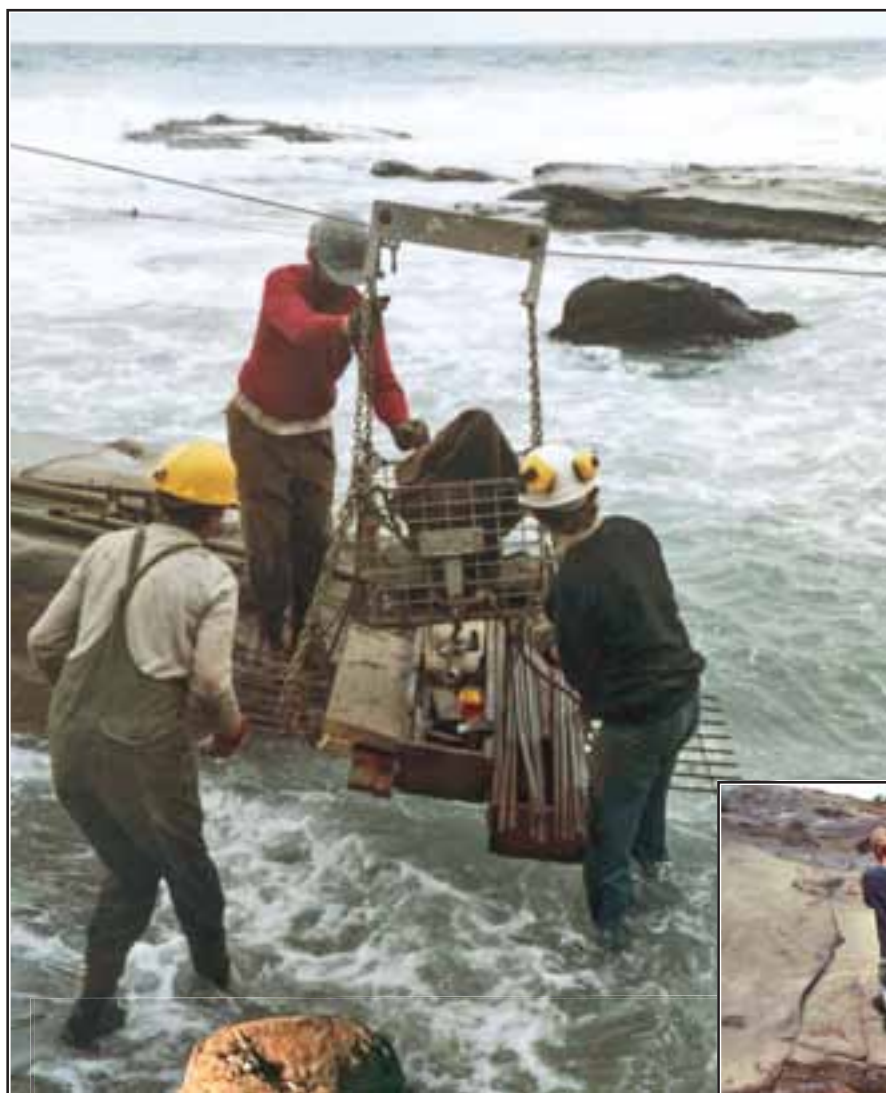
solved the problem of insufficient air pressure with the introduction of an air receiver. Located at the working face, this top-up tank enabled a continuous supply of high-pressure air to run the tools. Not only was Bill's ongoing support unwavering, but he also took it upon himself to ensure that the first year's gear hire never had to be paid for.

David Denney was another individual whose support was invaluable. As the farmer on whose land the camp was situated, David was to prove a resourceful troubleshooter and a constant source of tools and spare parts. Another ingenious volunteer was John Herman, whose boundless energy, generosity, mechanical know-how and stockpile of old machinery were to repeatedly come to the rescue.

"John is a man of many talents," notes Pat Vickers-Rich, adding that any offhand suggestion of improvements would prompt John to "show up a few weeks later, unannounced, with just such structures on his truck, all ready

*The 1986 field season saw an improvement in working conditions at Dinosaur Cove, the most welcome being the installation of a flying fox aerial tramway. Designed and built by John Herman, this steel mesh basket was suspended on pulleys below a cable running from the top of the cliff and anchored to the rocks below (left). A back-breaking job that had previously taken hours (below) was now able to be done in six minutes.*

*Photos courtesy Museum Victoria*



for assembly in an hour or two."

High tide was the most worrying time in Dinosaur Cove, with the ever-present risk that workers could be washed off the rocks. To make up precious time that first year and to enable all volunteers to use the equipment, Tom introduced round-the-clock drilling shifts. This practice was hastily abandoned, however, when an unusually high sea washed away the wooden portico and all the equipment, including the precious air receiver, located on a ledge high above the entrance. Geology student Mick Whitelaw recalls that no one was on site at the time. "Thanks to equipment failures we had downed tools early that night," he says. "We awoke to find jackhammers strewn 150m up and down the beach." To everyone's relief, the gear was salvaged and the air tools revived with a flush of oil. Nonetheless, it was a sobering lesson.

In a decade of working at Dinosaur Cove, no one was able to work out just what the tides were going to be. The direction and intensity of the wind played a large role in determining the height of the sea. A searing blast from the north could mean waters as calm as those of a mill pond, with no

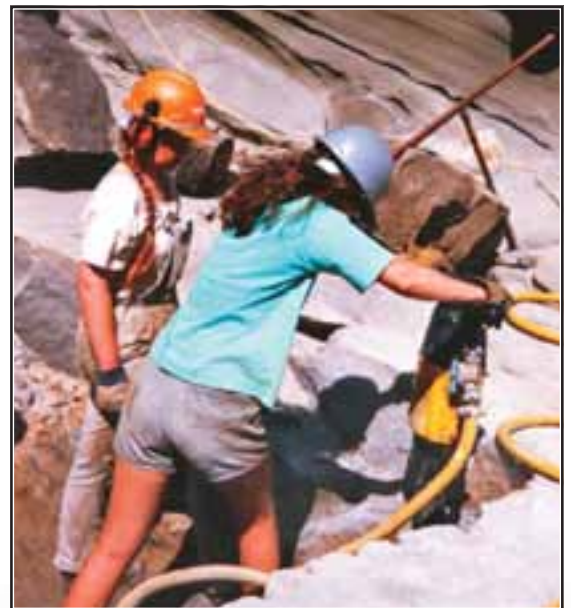


*With the realisation that fossil-bearing deposits at Dinosaur Cove East stretched onto the shore platform, excavations were concentrated in that area during 1985. Named Lake Copco, the swimming-pool-sized hole (above) flooded with every high tide and had to be pumped out before work could start. Fossil material was removed by drilling with jackhammers (below right) then driving wedges to split the rock. The operation of heavy equipment was shared by all volunteers, with women working equally as hard as the men.*



*The excavation of Lake Copco was to continue through to 1994 and saw the discovery of some very exciting fossils including this beautifully preserved ilium of a hypsilophodontid (above).*

*The most significant find from Lake Copco and the largest bone to be retrieved from Dinosaur Cove was the femur of *Timimus hermannii* (below). This specimen is shown just under its actual length of 43cm and is the only known Australian ornithomimosaur.*



Photos D. and J. Elliott





Photo Don Manning

noticeable rise or fall over the course of an entire day. On the other hand, if a howling gale accompanied by rain and grey, scudding clouds blew in from the southwest, the sharp crack of the sea pounding against the rocks could be heard from camp 2km away.

The learning curve during the 1984 dig had been steep, and progress had been slow. Despite the setbacks, the team had advanced the tunnel by 1.3m, sufficient to expose the axis of the ancient stream channel which had flowed parallel to the rock face. This tunnel site was to be renamed Dinosaur Cove East, when a second, more exposed site was discovered by Pat to the west of the entrance. By the end of the first dig, equal quantities of fossils had been collected at both sites, approximately 100 in all, including plenty of fish and turtle fragments, several ornithischian limb bones and a tooth.

The year 1985 saw a smaller operation with much less fanfare than the pioneering dig the year before. Instead of helicopters, bamboo poles slung over the shoulders of up to six people were used to transfer the heavy gear down the cliff. A major breakthrough was the discovery of a lower fossiliferous layer at Dinosaur Cove East that stretched out onto the shore platform. The swimming-pool-sized hole subsequently created by



Photo © Peter Menzel

digging this more accessible material came to be known as Lake Copco. "It flooded with every high tide and had to be pumped out before we could start work," recalls Mick Whitelaw. Another milestone was the identification of a pattern to the rock strata, which led Mick to discover a third site to the east of the tunnel, nicknamed Slippery Rock.

That year was student volunteer Natalie Schroeder's first year at Dinosaur Cove. Lured by Tom Rich's line, "We can't pay you but we can feed you," Natalie was so impressed by the experience that she went home and made the decision to become a

palaeontologist. "One season and I was hooked," she enthuses. Natalie says every dig she has been on since, including those in Antarctica, have been Sunday school picnics in comparison to Dinosaur Cove.

By the end of the seven-week dig, the 1985 team had recovered several hundred bone fragments and collected 368 bags of fossil-bearing rock. Offers of helicopter assistance to airlift the bags to camp were not forthcoming, but Tom Rich eventually secured the police helicopter for the job. In an ironic case of overkill, when it finally arrived it was escorted by the State Emergency helicopter and no



*Work commences on the cliff face at Slippery Rock in 1987 (left). The introduction of explosives was a major breakthrough that saw the blasting of two tunnels and cross tunnels into the cliff at this site. A number of miners were to assist the dig crew with this stage of the project and support was provided by many people including Dave Denney (foreground above). As owner of the property on which 'Dinerville' was situated, Dave was an invaluable contributor to the digs.*



Photo © Peter Menzel

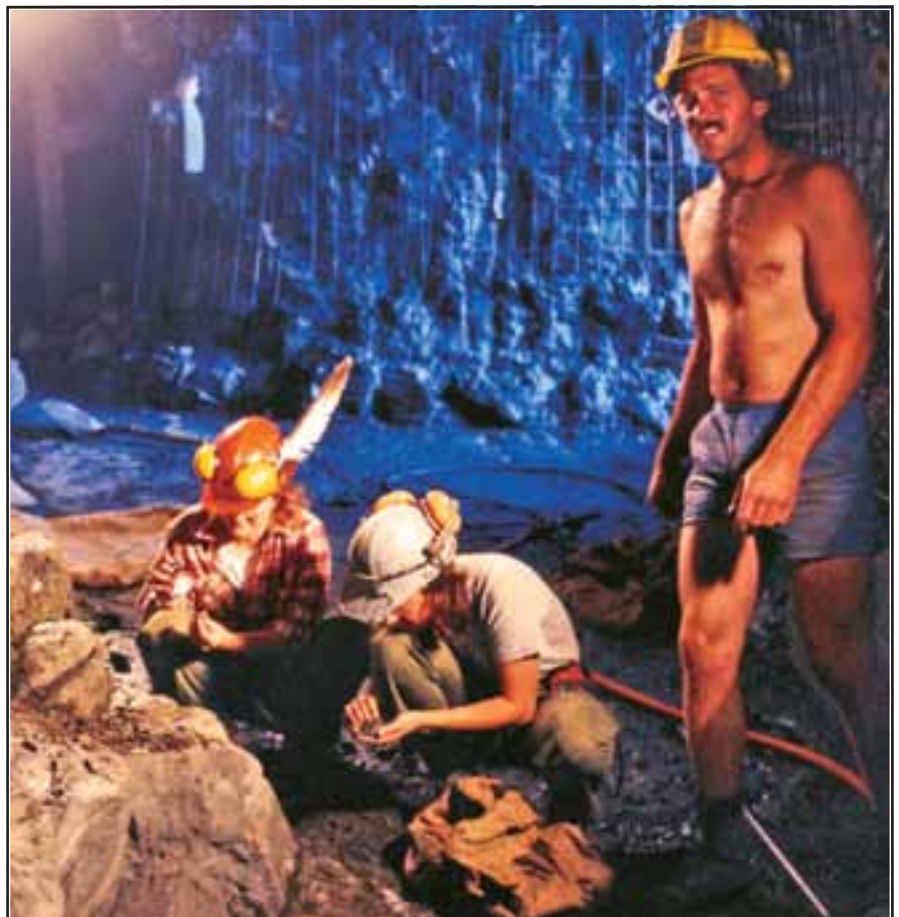
*Nick van Klaveren removes fossil material with a rock saw in the Slippery Rock tunnels (above). Drilling holes for explosives (bottom left) and clearing rubble following blasting was an exhausting, dirty job that had to be done to gain access to the fossil-bearing layer at the tunnel base (below). Slippery Rock was to prove the most productive of all Dinosaur Cove sites and was the main focus of excavations between 1987 and 1993.*

less than three media choppers!

Tom was rapidly becoming overrun with fossils in need of preparation. Fortunately, volunteer Lesley Kool was looking for a career to complement the raising of her young family. She quickly took to the delicate art of fossil preparation. Largely self-taught, Lesley became a mainstay of the Dinosaur Cove project over the next decade, working all year round from a laboratory at Monash University. She describes using electric and pneumatic vibrating tools to remove the hard sandstone conglomerate. "Fortunately, the fossil bones from Dinosaur Cove were well preserved, which meant that the rock would come away cleanly," she says.

Because many of the specimens were from small animals, Lesley found she needed to work under a microscope or magi-lamp. Final detailing often required removal of sandstone grain by grain, using a sharpened tungsten

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# Dinosaur Cove

## 1984-1994



Dinosaur Cove

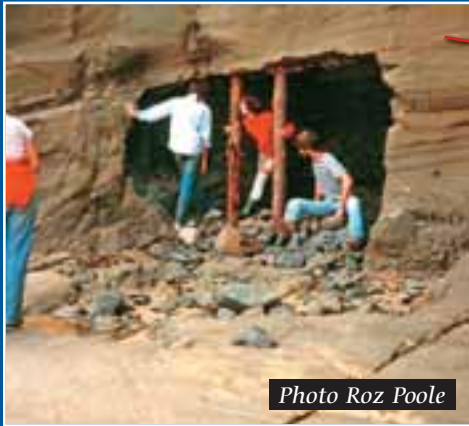


Photo Roz Poole

Dinosaur Cove East in 1984. A layer of fossil-bearing rock led to the excavation of a shallow cave into the cliff face.



The breaking area at Dinosaur Cove West in 1985.



Photo Don Manning

Unloading the flying fox at Dinosaur Cove.

Tom Rich (standing) at Dinosaur Cove East in 1985 as volunteers cool off in Lake Copco.



Dave Pickering, Natalie Schroeder and Nina Herrmann digging at Lake Copco in 1994.

### A decade of digging

1984: The inaugural dig. Volunteers advance 1.3 metres into the cliff at Dinosaur Cove East before relocating to Dinosaur Cove West.

1985: Digging resumes at Dinosaur Cove West until fossil layer is depleted. Work commences at Lake Copco and Slippery Rock is discovered.

1986: Digging continues at Lake Copco and Slippery Rock. Building of a flying fox aerial tramway from the cliff top to the shore platform.

1987: Explosives introduced to Slippery Rock site and tunnelling into cliff face commences. East and west tunnels are blasted and connected with a cross tunnel. Discovery of *Leaellynasaura amicagraphica*.

1988: No digs held. Preparation and scientific analysis of *Leaellynasaura* and other fossils is prioritised.

1989: Dig resumes at Slippery Rock. Both tunnels are extended and cross tunnel is widened. Construction of platform scaffolding.

1990: East and west tunnels extended at Slippery Rock and blasting of a second cross tunnel. Storage shelves are fitted in barren east tunnel.

1991: Discovery of *Timimus hermanii* at Lake Copco. Excavation of western chamber and construction of concrete pillar at Slippery Rock.

1992: Blasting of overhang near new concrete pillar.

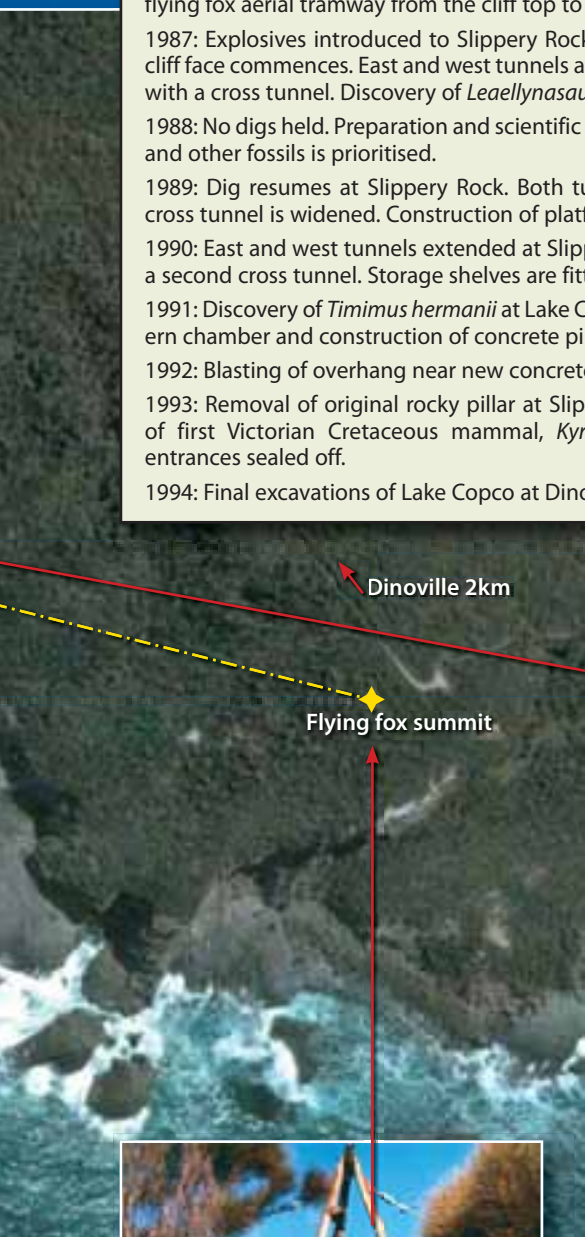
1993: Removal of original rocky pillar at Slippery Rock site. Discovery of first Victorian Cretaceous mammal, *Kyroryctes cadburyi*. Tunnel entrances sealed off.

1994: Final excavations of Lake Copco at Dinosaur Cove East.

*Tom Rich and storage shelving in the east tunnel at Slippery Rock, 1993.*



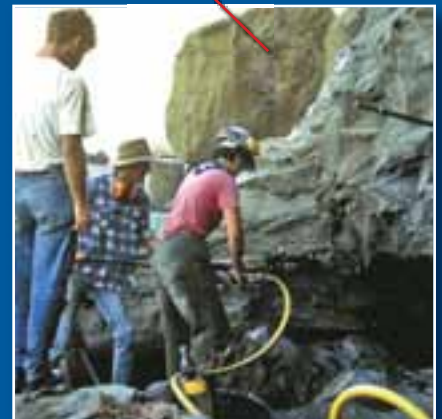
Photo courtesy The Herald and Weekly Times Ltd



*The flying fox base on top of the cliff above Dinosaur Cove.*



*Volunteers excavating fossils in the tunnels at Slippery Rock.*



*Drilling the cliff face at Slippery Rock in readiness for blasting in 1987.*

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carbide rod mounted in a pin vice. When she first started, Lesley used contact cement to glue bone fragments together, and Vinolak or Butvar to harden the bones (now superseded by superglue and Paraloid). Tom Rich came to rely on Lesley to such an extent that she recalls, "When we found a promising specimen, Tom would say "Let's wait till it's been Lesley-ised."

The 1986 season attracted a range of volunteers from both Australia and abroad. The result was a camp comprising an eclectic mix of personalities from all walks of life; a mix that was to be a recipe for both competition and camaraderie. In addition to the original Friends of the National Museum of Victoria and Monash University students, the team now included paying participants from Earthwatch, an American organisation for enthusiasts interested in scientific fieldwork.

Earthwatcher Bill Hopkins, an Alaskan now in his seventies, who put in two seasons at Dinosaur Cove, recalls, "None of the Aussie university students knew what to expect of the Yanks." It wasn't long, however, before the Americans had endeared themselves to the Aussie 'kids', especially when it came to outings to the local pub. The Earthwatchlings each took it upon themselves to 'adopt' a student, because as Bill put it, "University students everywhere have more appetite than money."

A recruitment poster at Monash University prompted young student, Helen Brown (now Wilson) to pack her doona and frilly pillow and head for a summer holiday at Dinosaur Cove. Helen recalls getting lost *en route* and, recognising a Monash University truck at a nearby township, she stopped to ask for directions. The dirt-covered, khaki-clad, Indiana Jones lookalike (later to be

identified as Mick Whitelaw) took one look at Helen's flower-pants and apricot T-shirt and rolled his eyes in a 'what have we got here?' look. "He lead-footed it out of town at 140km an hour and I burned after him in my little Toyota," she recalls.

This introduction was to set the scene for the next eight weeks, with Helen learning to give as good as she got. "Basically the fittest, strongest, smelliest and loudest rose to the top," she says. "The women worked as hard as the guys, jackhammering, drilling and lifting heavy equipment." Bill Hopkins saw it this way: "All the girls and women seemed to love working with the noisy tools. All the boys and men loved watching them do it." Within a matter of days the 'green' young Helen had learnt to blow the dust out of her nostrils bush hanky style and her trendy clothes had been exchanged for army disposal pants and oil-stained T-shirts.





*Pat Rich with baby Tim on board (left) at Dinoville's main water supply; a water trailer consisting of three 200 litre drums that were filled every few days at Lavers Hill School. Like much of the infrastructure at Dinosaur Cove, the water trailer was the invention of volunteer John Herman – nicknamed Mayor of Dinoville for his untiring efforts in upgrading living standards and camp life in Dinoville (below). Many people from all walks of life volunteered their services over the decade of digging at Dinosaur Cove. In spite of numerous hardships and back-breaking work, their dedication and sense of humour ensured that there was never a dull moment (far left), with some volunteers returning year after year to participate.*

Because the Earthwatch participants were financially contributing to the dig, an effort was made in 1986 to improve camp conditions. A cook shed and covered dining area was erected and a cook employed. Prior to this, everyone had taken turns to cook and not all were worthy of the title. Refrigeration was variable and the food budget tight. Helen Wilson recalls blue meat, occasional food poisoning and 'toilet tennis' from the early years. Comments Michelle, "There were times when the food situation was dire! Coles or Woolies would often rescue us and donate a heap of stuff – usually tins with dents or no labels and there were times when tuna and rice was the staple meal ... recycled day after day. We were even served rice pudding one night that had the odd chunk of tuna still visible!"

The situation reached crisis point when a three-day-old mutton stew was found bubbling of its own accord without a heat source. Bill Hopkins decided it was time to take matters into his own hands, and offered to carry the pot of stew from the cookhouse to the dining tent. "The next minute we heard a banging and bellowing coming from the bush," remembers Helen. "It was Bill yelling, 'I've been ambushed by a vicious marsupial and he's taken the stew!'. As everyone raced for their cars to head to the pub, a volunteer strolled into the cook tent announcing, 'I've just come across a kangaroo in the paddock with his fingers down his throat!'" Bill chuckles as he recalls "Everyone was ready to elect me president that night."

In Dinoville, it was a challenge to stay warm and dry, with tents and caravans vulnerable to storms, wind and mildew. On one occasion, condi-



tions became so unbearable that all of the volunteers had to move into a local farmhouse for a few days to dry out. "When it was miserable, it was very, very miserable," recalls Natalie Schroeder. "The shop in Apollo Bay did a roaring trade in warm clothes – newcomers just didn't appreciate how wet and cold an Aussie summer could get."

Coping with overflowing portaloos was another ordeal. Helen Wilson sums up people's reactions to the living conditions as ranging from "indifference, to complaining, to shock and hysteria. We were stripped down to our bare souls – it was just like a real-life episode of *Survivor*," she says. Thanks to John Herman, conditions continued to improve over the ensuing years, so much so that he was nicknamed Mayor of Dinoville. The porta-loos were replaced with lime outhouses, and more waterproof caravans and demountable buildings

were acquired to house people and gear. The first van had a dinosaur painted on the side and was affectionately christened 'The Dinovan'.

Despite the ups and downs, spirits in camp were high and at least five marriages eventuated. Among them were Michelle Colwell who wed fellow student Graeme Hird, and Helen Brown who married Earthwatcher John Wilson. Helen, who volunteered for five seasons in all, recalls, "There was never a dull moment. When we weren't drilling we sat around like a chain gang splitting rocks, eating chocolate, telling jokes, reciting poems and singing silly songs."

There were endless pranks and practical jokes. No one owned up to being the midnight Mini Minor movers, but the camp awoke to find the little car in the dining tent with a tablecloth over it and the breakfast cereals laid on top. Likewise, the local road sign was mysteriously modified to depict dino-



**Positioned several metres west of the Slippery Rock tunnels and seemingly clinging to the rock face, a spidery-legged scaffold platform (above) built by volunteer Graeme O'Brien in 1989 proved to be strong enough to withstand the roughest seas. Accessed by a set of stairs, this structure was invaluable for storing equipment safely above the pounding waves of the Southern Ocean.**

Photo © Peter Menzel



saurus rather than kangaroos for the next 5km. Mick Whitelaw recounts the cruellest prank of all, played on Tom Rich. Not long after Tom had grilled the students about safety, he peered over the cliff to see a pair of legs emerging from beneath a rock. "Tom went nuts for a bit," recalls Mick, "until he realised it was a pair of stuffed trousers with boots on."

There is universal agreement that spirits were highest in the evenings. Some volunteers played guitars and banjos while Graeme Hird played the lagerphone (an instrument he made from beer bottle tops). Helen Wilson remembers lying on blankets in the paddock and stargazing. Natalie Schroeder chuckles, "We *definitely* drank too much!"

Down at the coalface, the 1986 season saw welcome technical improvements, not least of all the installation of a flying fox/aerial tramway, the brainchild of – you guessed it – John Herman. His contraption was to do away with the bamboo poles and helicopters for good. Supported by a steel tripod at the top of the cliff and anchored to the rocks below, a connecting cable carried a steel mesh basket which was operated by chains and pulley wheels. Controlled lowering and raising of the basket was achieved by means of a cable wound onto a drum, turned by a motor which was powered by an air compressor. A trapdoor at the bottom of the basket was released with the swift kick of a lever. Thanks to John, a backbreaking, dangerous job that had previously taken hours was now able to be done in six minutes.

Work continued in 1986 at all three fossil-bearing sites in Dinosaur Cove; the original Dinosaur Cove East, Dinosaur Cove West and Slippery Rock (located to the east of Dinosaur Cove East). By the end of the eight-week dig, three times as many bones had been found as the previous year, with two-thirds from Slippery Rock.

These finds were still only in the form of isolated bones and teeth. Disappointingly, a whole dinosaur skeleton or skull, or early mammal or bird remains, had so far eluded them. When Helen Wilson asked Tom Rich what he would give to the person who found the first mammal bone, Tom flippantly replied, "A cubic metre of chocolate." A mammal bone was Tom's ultimate prize. The original research proposal to *National Geographic* had, after all, been titled 'The Ghastly Blank' and was aimed at learning more about the origin of Australia's mammals and birds, than its ancient reptiles.

At Slippery Rock, undermining of the

overhanging cliff allowed quick exposure to bone-rich deposits. The softer claystone layer was first removed, allowing the team to drill horizontally into the overlying fossiliferous sandstone and drop it in chunks into the space below. Drilling in this awkward position was achieved by suspending the rock drill from a rope. "The drills were water-fed," says Natalie Schroeder. "Someone had to stand at the bit, so that poor sucker got totally covered in mud." Having dug in as far as they dared, the team conceded that further access would require tunnelling above the fossil layer and digging down to it. It was clear that 1987 would require a different and more daunting approach ... explosives!

The 1987 dig nearly didn't get under way. Delays in getting the explosives permit and a setback to Tom Rich's health threw the schedule into disarray. Tom placed an advertisement in the Melbourne newspaper, *The Age* (paid for by the generous Bill Loads), seeking volunteers qualified in mine management and shot firing. Suitable people were selected, overseen by Pat O'Neill, a Department of Labour Inspector. Pat was to be

yet another valuable asset to the project with his behind-the-scenes string pulling and negativity deflection. Farmer David Denney's backhoe was also an asset when it came to digging holes for the powder magazines. Unfortunately, it arrived a few days too late for some volunteers, whose blistered hands already bore witness to the rock-hard soil.

Getting enough bang to create a tunnel without simply blasting the whole rockface away proved more difficult for the shot firers than first imagined. Eventually however, progress was made on the tunnel entrances and a pattern developed. First, up to 36 holes were drilled with a pneumatic Panther drill. These were then filled with sticks of gelignite and the detonators for each hole wired together. The shot firer then sequenced the explosions using a control box and following the blast, the rubble was then mucked out. Although sometimes done by an ancient pneumatic winch-driven 'bogger', more often than not the volunteers had to resort to shovels and wheelbarrows. Their chaotic yet efficient swarming so impressed Pat O'Neill that he christened them 'The Angry Ants.'

tened them 'The Angry Ants.'

Mining proved to be a dirty, exhausting business. Showers, which could only be taken at the closest town of Lavers Hill, 20 minutes drive away, were anticipated with relish. Up to 3m of overlying rock had to be broken up with explosives and mucked out in order to reach the 10cm-thick fossiliferous layer below. When excavations neared the fossil layer, the team reverted back to jackhammers. If a fossil was seen, cuts were made around it with a rock saw, and the block chiselled out. Following its removal, this material was then painstakingly chipped and sliced to check for fossils.

This was tedious hammer-and-chisel work. Helen Wilson, who earned herself the nickname 'The Tooth Fairy,' recalls Lesley Kool's 'scientific' test for bone identification: "If your spit sinks in, it's bone!" Rewards came as infrequently as once or twice a day, but the prospect of something spectacular was enough to keep them at it for hours on end. To quote Bill Hopkins; "To split open a rock that has not seen the light of day for 106 million years and lay your eyes on a perfectly preserved fish that looks like it's been drawn by a Japanese pen and ink artist ... that is a thrill!" He sums it up even more eloquently with the joke about the optimist and pessimist twins being given a pile of horse manure for their birthday, the optimist diving in with the words, "I'm thinking that with all this horse dung there's gotta be a pony in here somewhere!"

Like the initiation to pneumatic tool work in earlier years, the use of explosives created a whole new set of problems and challenges. Finding and retaining skilled, safety-conscious shot firers and miners was not an easy task; the job description attracting some colourful candidates. Rebecca



*David Pickering, Natalie Schroeder and Lesley Kool inspect rock samples with promising bone fossils exposed (above). Following drilling and blasting of the Dinosaur Cove fossil deposits, fossil-rich rock was carried to the breaking area where it was painstakingly reduced by volunteers. Thousands of man hours were spent breaking the rock into increasingly smaller pieces, with any chunks containing tiny fossils set aside for closer inspection through a jeweller's loupe as demonstrated by Dr Tom Rich (right). Worthy specimens were then wrapped in newspaper (left) and carried to the top of the cliff ready for transportation to a Monash University laboratory for preparation.*



Photo courtesy The Herald and Weekly Times Ltd



The preparation of hundreds of tiny fossils such as this tray full of beautifully preserved dinosaur limb bones (far right) was painstakingly undertaken by Lesley Kool (right) at a Monash University laboratory. Preparation of the Dinosaur Cove fossil material revealed a diverse Cretaceous fauna including (clockwise from below) crayfish claws, small crocodile scutes, tiny lungfish toothplates and the teeth of small crocodiles. The most significant fossil to be recovered from Dinosaur Cove, however, was Victoria's first Cretaceous mammal bone – the humerus of a tiny monotreme (left).

Photos D. and J. Elliott



Photo © Peter Menzel



Norton was one such character. Helen Wilson recalls "She was so tough, it was incredible. She used to carry the sticks of gelignite between her boobs." Two unnerving incidents early in the season highlighted the dangers involved. In the first, a 100-ton block of rock sheared off the cliff face above the tunnel entrance, four-and-a-half minutes after the shot had been fired. Fortunately, the rules require one to wait five minutes before entering the site, and no one was injured. In the second incident, a lobster boat passed in front of Dinosaur Cove just as a rock from the three-metre-deep tunnel shot out across the water like a cannonball, missing it by 70m.

Over the years, a number of miners were to assist with the project before Pat O'Neill finally made the decision to certify Tom Rich as mine manager. Fortunately, the worst injury sustained during the decade was volunteer Graham King's fractured fibula, which was not mining related but occurred at the base of the cliff. Michelle Hird recalls with awe that the limping Graham was met half-way up the vertical cliff face by Ray Blandford; a retired bushie in his late 60s, who slung Graham over his shoulder and carried him to the top. "That was impressive to watch," she adds.

Hazards were not only to be found

at the dig site. Around camp, there was the wildlife to contend with. Bill Hopkins discovered that a redback spider had been sharing his bed while Natalie Schroeder recalls plenty of scorpions, bush rats and the odd copperhead snake. She also remembers a female volunteer being thrown into turmoil one night when her stash of tampons was found to have been shredded by an Antechinus (a mouse-sized nocturnal marsupial) for use as nesting material!

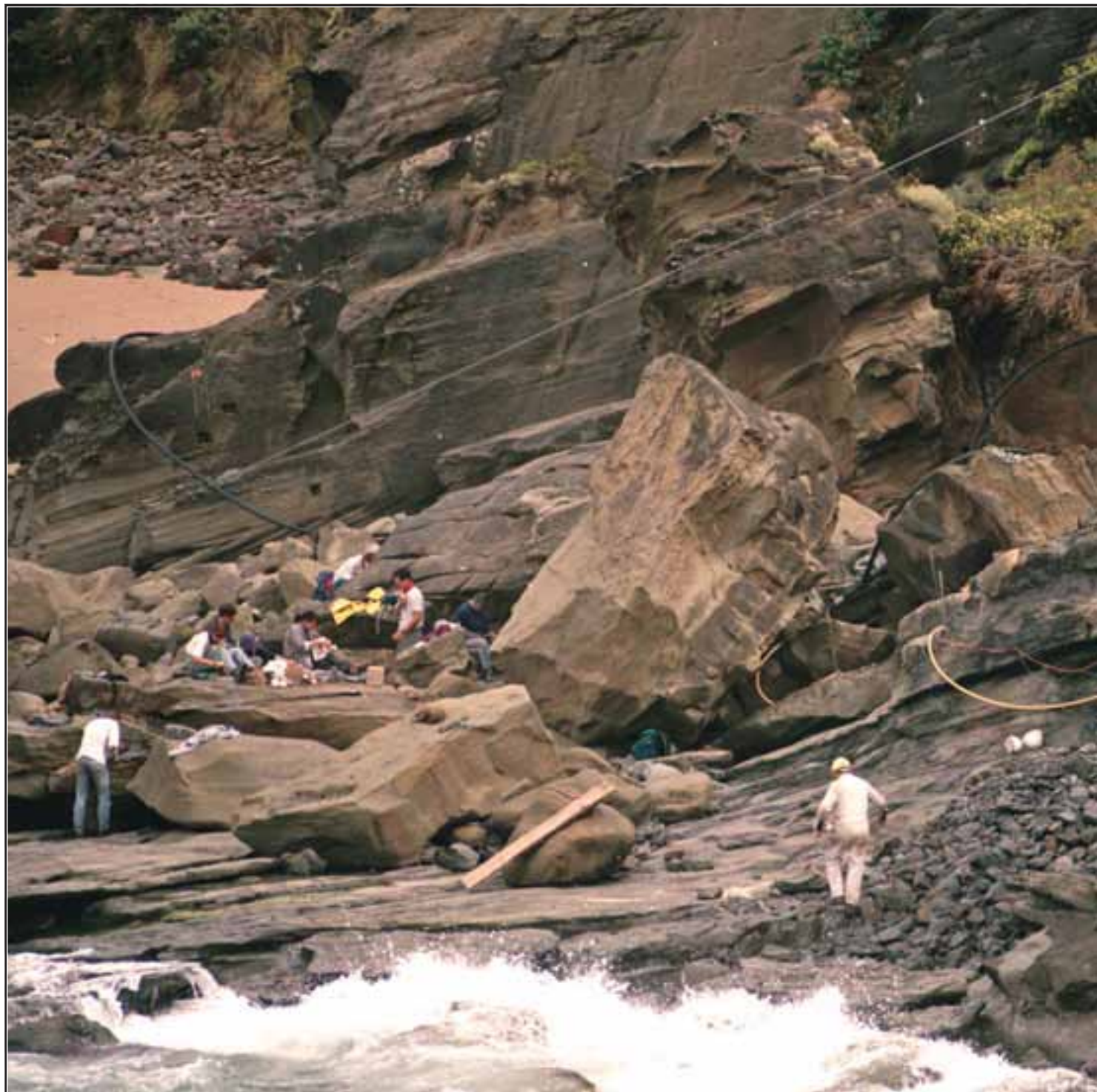
Unfortunately, Bill Hopkins's encounter with an emu was a little too close for comfort, when it came right up to his barbeque and plucked a lamb chop off the grill. Bill takes up the story: "I slapped the chop out of its beak and back onto the sizzling grill. The big bird gave me a start when it turned its attention to me ... I stood as tall as I could (eyeball to eyeball with the beast) and held my hands ... and spatula ... up high as I could, and growled. The dumb bird decided I was the bigger bully, and reluctantly backed off. The Aussie kids thought it was a hoot, but I'd begun to wonder if a lamb chop was worth getting my butt kicked by a bird with a brain the size of a marble. I don't even particularly like lamb!"



The volunteers were given one day off each week. Natalie Schroeder recalls that the highest priority was washing their clothes. "The laundromat certainly got its money's worth out of us," she chuckles, "although we probably clogged their machines up with crud." For the rest of the day they would swim at the beach, lie on the rocks, go to the pub, play tennis, go horseriding or explore the surrounding countryside.

Down at Slippery Rock, two roughly parallel tunnels were mined into the cliff, each taking a fortnight to complete. Progress in 1987 was to be plagued by adverse weather and high seas. "It wasn't uncommon to find fish stranded in the tunnels," notes Lesley Kool. As neither the east nor west tunnels yielded significant finds, Tom decided to cut a cross tunnel





connecting the two. This tunnel was set back from the entrance so that a column of rock, nicknamed 'the pillar' remained in front of it to support the roof. Once it was completed, Tom directed the team to remove the floor "where the fossils should have been." Initially disappointing, this area was eventually to reveal a jackpot ...

On the fiftieth day of the dig, an exquisitely preserved tiny skull was found. The bone was jet black with tiny teeth clearly visible. The endocast of the brain was preserved in breathtaking detail, displaying minute features such as the pineal gland, and both optic and cerebral lobes.

It was later to be identified as a

juvenile of a new species of hypsilophodontid, which would be named *Leaellynasaura amicagraphica*.

Unfortunately, in the darkness of the cross tunnel, a string of articulated vertebrae and associated limb bones found close to the skull had been assigned to the mullock heap! Michelle Hird admits to carrying out what she thought was overburden, when she saw a brownish smudge which she recognized as bone. At that precise moment she tripped and fell flat on her face. Needless to say, the prize, which fell into the ocean, was frantically retrieved. Unfortunately, a complete skeleton was not forthcoming but regardless, as Tom and

Pat noted, the find guaranteed that Dinosaur Cove would be a part of their lives for a long time to come.

The remainder of 1987 and all of 1988 were devoted to bone preparation and scientific analysis. A number of local and international scientists from a range of disciplines were to become involved. The year 1988 was to be the only year in the decade that a dig was not conducted.

In the preparator's laboratory, Lesley Kool turned her attention to *Leaellynasaura's* skull. Lesley describes the thrill of preparing the braincase: "We knew it was significant by the unusually large size of the optic lobes. We knew we had some-



thing special. It was really exciting." Indeed, *Leaellynasaura's* optic lobes were much larger than any other hypsilophodontid of low palaeolatitudes. David Pickering states, "The implications of *Leaellynasaura's* superior eyesight made big news around the world. The notion that a dinosaur had not only survived in a polar environment, but thrived and adapted to the long dark months of a polar winter really inspired the public imagination."

As the bones were prepared, it became clear that many were the hind limbs of hypsilophodonts – small bird-hipped, bipedal herbivores with high ridged teeth, and indeed almost

half of all the fossils collected belonged to this group. Lesley Kool states, "We can deduce that they were fast runners because of the curved nature of their femurs and long tibia-to-femur ratio."

*Leaellynasaura amicagraphica* was named after Tom and Pat's daughter Leaellyn, but also honoured The Friends of The Museum of Victoria (amica meaning 'friend') and the project's main sponsor, the National Geographic Society. In addition to *Leaellynasaura*, a second hypsilophodont from Dinosaur Cove was also identified as new to science, based on its dentition. It was named *Atlascopcosaurus loadsi* in honour of the Atlas Copco organisation and its ever-helpful Victorian manager, Bill Loads. Three more species were recognised, including *Fulgotherium australe*, a previously named hypsilophodont from Lightning Ridge in New South Wales.

David Pickering says, "The jury is still out on exactly how many different species there are in the Dinosaur Cove material. No complete skeletons have been found. A number of femurs of different shapes and sizes were collected, but there just isn't enough detail. Sometimes all we can say is, 'It looks like ...'." He confirms that there is some exciting co-operative research currently going on to better understand the origins of the Gondwanan dinosaurs. Likewise, a current study of the dentition of all ornithischians may shed light on the number of different hypsilophodontids represented in the Dinosaur Cove fossil collection.

The diversity of the Dinosaur Cove hypsilophodontids suggests that polar conditions particularly suited this group, but the significance of the size bias is unclear as, although scant, evidence of large dinosaurs was discovered. The tendency to dwarfism could have been a cold-climate adaptation, but then again, it may just have reflected the size of the stream bed in which the animals were buried, with smaller streams being incapable of washing larger bodies downstream.

Palaeontologist Amusuya Chinsamy confirmed that size may have mattered when it came to hibernation. She found that lines of arrested growth or LAGs were curiously absent in the bones of the polar hypsilophodontids. LAGs are microscopic dark bands which correspond with reduced bone crystal deposition, as occurs during hibernation and other stressors. Amusuya's work added weight to the theory that *Leaellynasaura*, *Atlascopcosaurus* and their small hypsilophodontic cousins had continued foraging all winter long, while the

larger dinosaurs had hibernated.

One of the burning questions throughout the Dinosaur Cove project was, "Just how cold was it when these dinosaurs lived?" Any doubts that Australia would have experienced periods of prolonged darkness were dispelled by Mick Whitelaw, now a PhD recipient, whose palaeomagnetic analysis of surrounding rocks confirmed that they were deposited within the Antarctic Circle. The climate of that time, however, could not be assumed to be the same as the Antarctica we know today. Either it was temperate with a period of prolonged darkness (a novel environment with no modern-day equivalent) or it was freezing and these animals were uniquely adapted to survive the cold.

A number of scientists including palaeobotanists, geochemists and geologists attempted to answer the temperature question from different angles. Judith Parrish and Bob Spicer's study of plants found in the fossil deposits suggested it was warmer than current environments of similar latitude. Species were more diverse and trees were taller. Plants found included ferns, cycads, bryophytes, horsetails, evergreen conifers and deciduous ginkgoes. Flowering plants were rare or non-existent. There were some clues that polar conditions may have prevailed; the leaves of the conifers had 'drought' adaptations (thick cuticles) despite signs of abundant moisture and the deciduous trees showed signs of losing all their leaves at once, possibly in response to cold or darkness.

The best temperature estimates put forward by scientists varied considerably, from  $-2^{\circ}\text{C}$  to  $+10^{\circ}\text{C}$ . That's the difference between modern-day Fairbanks, Alaska and London, England. Until we can establish with more certainty the climate of the day, we remain somewhat in the dark as to how special this group of reptiles was. If the hypsilophodontids had foraged through the sub-zero temperatures of an Antarctic winter, this feat would have exceeded the cold-tolerance of any known reptile. Even the New Zealand tuatara can only remain active at  $5^{\circ}\text{C}$  and that's provided it is able to sun itself. The question begs to be answered: "Could these little road-runners have been warm-blooded, maintaining a constant body temperature by eating all winter long, just as birds do?"

After a year's break, excavation at Dinosaur Cove was resumed with gusto. But 1989 was the year the wheels fell off the Dinovan ... literally! The salt sea air had taken

*Continued on Page 43*

# My Little Dino!

I always wanted my own dinosaur. Then my parents found one for me – deep in an Australian mine!  
By Leaellyn Rich

When I was two, I had a book called *My Little Dinosaur*. It was about a boy who found a live dinosaur in a cave near his house. I started wanting a dinosaur too. My dad worked with dinosaurs at a museum ... so I asked him to get me one. "Christmas would be a good time," I told him.

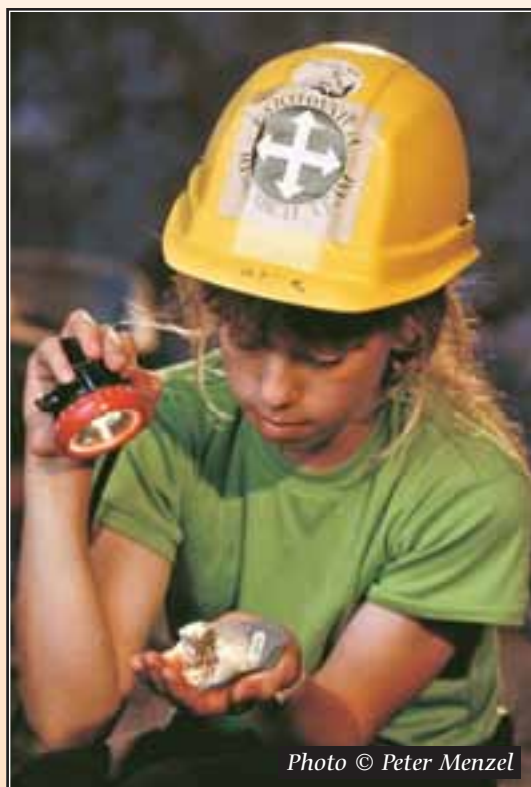


Photo © Peter Menzel

Of course, Dad couldn't really bring me a dinosaur. And as I grew up, I forgot about wanting one. I was too busy with school, sports, ballet classes and music lessons.

But my dad remembered the dinosaur. And when I started fifth grade, something great happened.

## Dinosaur bits and pieces

We live in Australia, where my parents work as palaeontologists (PAY-lee-un-TOL-uh-jists). That means they're scientists who study life from long ago. I've gone on heaps of fossil digs with them, starting when I was 10 months old. In fact, I'd been working with them on a dinosaur dig that summer before I started fifth grade. But then school began, and I had to leave.

While I was at school, my dad called to say his volunteers had found a dinosaur skull. He wasn't sure what kind of dinosaur it was. But he thought it might be one that had never been found before.

To prove it, he'd have to see more parts of the skeleton. But those parts were probably scattered around and would be hard to find. Luckily, my parents and the volunteers kept finding more bits of the dinosaur skeleton. Finally they had enough pieces to be sure. It was a new kind of dinosaur. And they named it after *me!*

## Big eyes for long nights

The new dinosaur was called *Leaellynasaura* (Lee-EL-in-uh-SOR-uh). It was little – about the size of a chicken. It had enormous eyes. And it used a bigger part of its brain for seeing than was normal.

My dad and mum think its big eyes and special brain may help prove that some dinosaurs were *warm blooded* (able to keep their bod-

Here I am with the skull of a dinosaur my parents found (above). They named the big-eyed dino after me! The painting on the right shows what it may have looked like when it hatched. As an adult, it may have lived in groups.



Image Peter Trusler © Australia Post

The story **My Little Dino** was written by Leaellyn Rich after she was approached by the publishers of **Ranger Rick**, an American children's magazine. Leaellyn was asked to provide notes about her experience at the Dinosaur Cove digs from which they would write an article for their young readers. She responded with the story as written here. The editor was so impressed with Leaellyn's story that it was published in her own words in the February edition of **Ranger Rick** in 1995.

ies warm in cold temperatures). Here's why: My dinosaur lived about 100 million years ago. Scientists think that way back then, Australia was attached to Antarctica. So the place where my dino was found would have been much closer to the South Pole than it is now.

In winter, it stays totally dark for three months of the year near the Pole. Big eyes are useful for seeing in the dark. So my dinosaur's big eyes and special brain would have been really useful in the winter – when the temperature was probably below freezing.

Dad and Mum say that the eyes and brain seem to show that my dinosaur was active in the freezing winter. No cold-blooded animal living today could survive those temperatures. So my dinosaur was probably warm blooded.

### Dinosaur Cove

My dinosaur wasn't easy to find. It was buried deep inside a cliff along the coast near Melbourne. The cliff is beside a bay-like area called a cove. We called the area Dinosaur Cove.

There, my parents found a layer of rock that they thought might have dinosaur fossils in it. So our family and some volunteers started digging near the bottom of the cliff.

At first, my parents and the volunteers dug into the rocky wall of the cliff with picks and large hammers. What a joke – that hardly cracked the rocks at all!

Then they tried using jackhammers and other power tools on the hard rocks. That worked a little better, but not well enough. Finally, they found some people who knew how to use explosives. They *blasted* their way in!

The explosives blew a huge hole in a layer of rock right above the dinosaur layer. The next step was to clear out the loose rocks and rubble. Then some volunteers used the jackhammers to dig down to the fossils. It was like working in a mine!

I was too young to use a jackhammer. But I could help with the clearing out. And once the rocks were outside the mine, I got good at cracking them open to check for fossils. I also helped around the camp – cooking, cleaning up, and getting supplies. We spent nine summers digging at Dinosaur Cove and we found many exciting fossils, including my dinosaur. I loved it there. The people were always really friendly. And there were plenty of cool animals to see – like colourful frogs and sometimes even fairy penguins.

I also liked helping out around the mine, though I didn't go into it very often. I've always been a bit uneasy in closed-in spaces. I used to dare myself to run right to the back of the mine. Then I would feel like a big hero if I could make myself stay there for more than two minutes at a time.

Even getting to the mine was tricky. The only way was to climb down that steep, 90m cliff, holding onto a rope. Once you were at the bottom, you had to watch the tides. The sea is really rough there. During high tide, the water went into the mine. So when the tide started coming in, we had to get out of the way quickly – or get clobbered by a wave. I remember scrambling up the cliffs lots of times just ahead of the water.

### What a rush!

The work we did could be frustrating at times. I could sit for hours breaking up rocks without finding even a scrap of fossil bone. Other times I found only tiny, useless bone fragments.

But when I found a good fossil, I got a rush of excitement. It was as if I'd made some strange connection with a totally forgotten being – a being that had lived millions of years before I was born, when the world was much different.

That is the most wonderful feeling. I got it no matter what fossil I found. So you can just imagine how I felt when I first saw the fossils of my very own dinosaur!

Thanks, Mum and Dad.

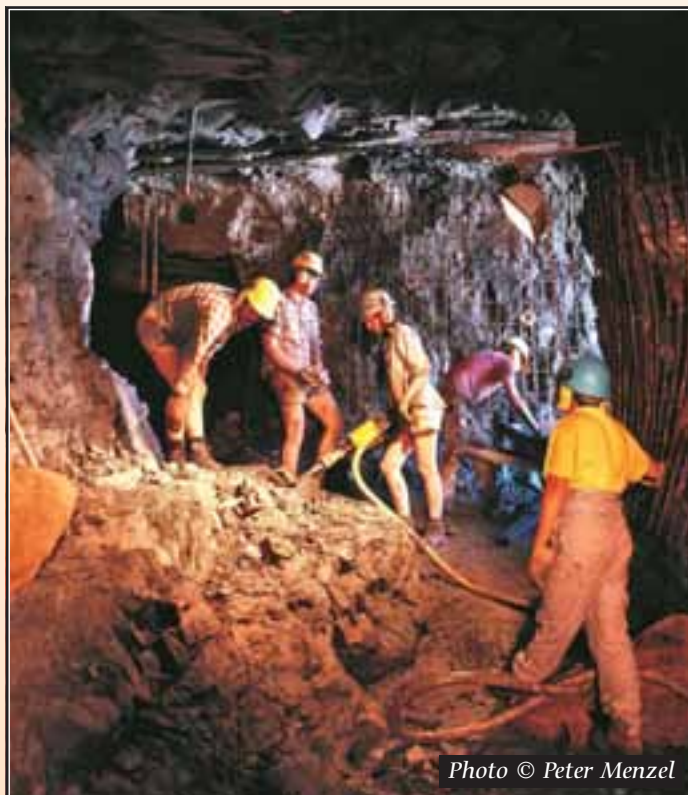


Photo © Peter Menzel

*The toughest part of the dinosaur hunt was the digging. Workers used jackhammers to break up the hard rock but they had to be careful not to destroy any fossils – or to make part of the mine accidentally fall down.*



The skull of *Leaellynasaura amicagraphica* (below) showing its large eye sockets. The top of the braincase is removed in this photo and can be seen (above) as an internal view showing the optic and cerebral lobes of the brain.



The maxilla of *Leaellynasaura* (below) was removed from the skull (above) and mounted on Carbo Wax to enable its preparation.



The semi-articulated skeleton of a hypsilophodontid (possibly *Leaellynasaura*) from Dinosaur Cove (below and right) showing one tibia affected by the bone disease osteomyelitis.



An assortment of hypsilophodontid teeth from Dinosaur Cove (right). These tiny teeth are each glued to a pin that is mounted on a cork.



The famous 'Death Scene' created by Peter Trusler in 1990. Based on evidence retrieved from Dinosaur Cove, this painting depicts the environment and circumstances associated with the death of *Leaellynasaura amicagraphica*.

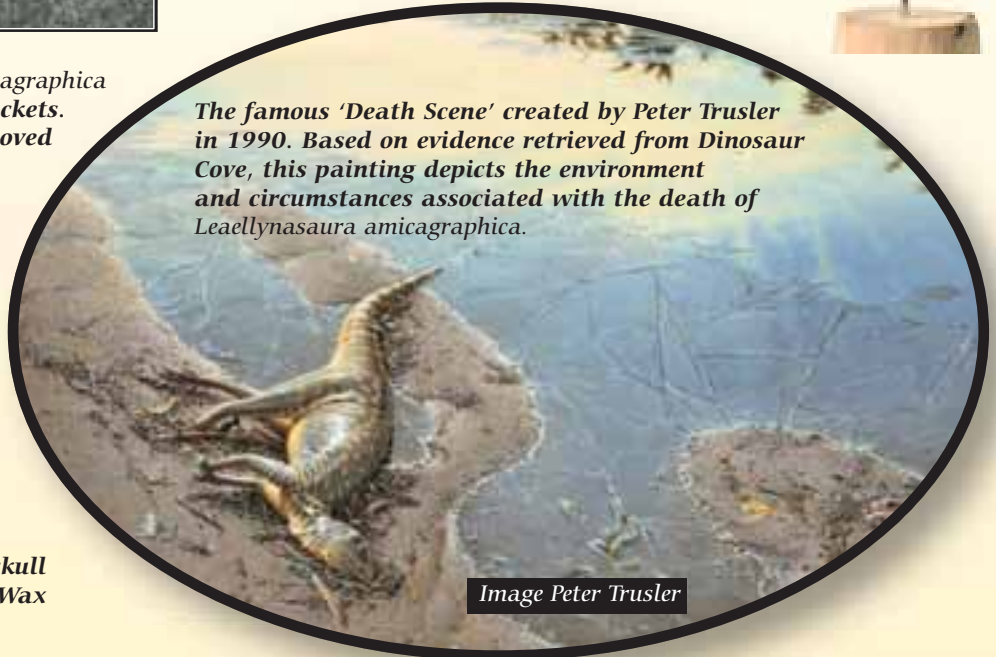


Image Peter Trusler

Hypsilophodontid femora on display at Museum Victoria in 2008 (right). Variations in these fossils could mean there are as many as six different genera present in Victoria.





**The end of an era! Although the west tunnel was blocked by boulders washed in by the sea, it was necessary to seal the east tunnel (above) with concrete following the final dig at Slippery Rock. A black granite plaque was then erected to commemorate a decade of achievement (left), and an 'Extinction of Dinosaur Cove' party was held to officially close the digs and acknowledge the contribution of individuals and sponsors. Although one further dig was held at Dinosaur Cove East, the Slippery Rock site was never revisited.**

*Photos David Pickering, courtesy of Museum Victoria*

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its toll. Thankfully, John Herman once again rose to the task, and an enormous caravan-storage shed, nicknamed 'The Temple of Janus', was soon erected. Its huge doors were simply removed at the beginning of the field season and bolted back on at the end. Not to be outdone, volunteer Graeme O'Brien constructed a precarious looking platform-scaffold, which clung to the rock face about 2m above the Slippery Rock tunnel entrances. Accessed by a set of stairs, the spidery-legged structure proved to be strong enough to withstand the roughest seas and was a useful storage area for equipment.

The 1989 season went for 11 weeks, with all efforts being centred on the Slippery Rock site. The cross tunnel was widened by blasting out a metre at a time. This area produced fossils over the entire distance between the east and west tunnels, with some quality finds uncovered. One of these was the pelvis of a theropod. "It was a fairly large carnivore," muses Lesley Kool, "but unfortunately we weren't able to describe it from the limited remains." However, the significance of another specimen found close by was not even apparent until Lesley began preparing it in the laboratory some time later. It is a find that she counts as the highlight of her years at Dinosaur Cove. "It was a block of rock with bits of bone on three sides," she says. "As I began working on it, I discovered it was in fact a partial skeleton and that it was articulated,

but that wasn't all."

Later identified as the hind part of another leaellynasaur, it was clear to Lesley that this was a pathological specimen. "It had the weirdest tibia I have ever seen," recalls Lesley "The bone appeared to have been broken and knitted, because there was secondary bone built up and it was shorter than the other tibia." Lesley continues, "Tom and Pat were away at the time so I secretly worked on it. When they returned, I had a black-cloth unveiling in the palaeo-lab. No one was expecting it. It was very exciting."

What Lesley had uncovered was diagnosed by a pathologist as osteomyelitis (a chronic bone infection), the earliest example of this disease yet found. "The difference in length between the diseased and normal tibias indicated that it had been hobbling around with a bad leg for approximately two years before it succumbed to gangrene," states Lesley. David Pickering enlarges on the implications of the osteomyelitis specimen. "Here we have a browsing, bipedal animal that relied on its speed and agility for survival," he says. "The fact that it survived as long as it did tends to suggest that it was a social animal that may have been cared for and nurtured by the group. If not, it would have been predated long before dying of a bone infection. It's circumstantial evidence, of course!"

By 1990, conditions in camp had become more civilised. Helen Wilson reports, "We still drank quite a bit, but

camp was more cultural, with journalists arriving in helicopters, sounds of ABC radio and smells of gourmet cooking." At the cliff face, there were two areas of focus. While tunnelling continued at Slippery Rock, a small team led by Nick van Klaveren, a volunteer student from RMIT University in Melbourne, dedicated themselves to Dinosaur Cove East.

At Slippery Rock, the richness of the deposits on the back (northern) wall of the cross tunnel meant that 1990 would see the east and west tunnels extended and a second cross tunnel cut deeper into the cliff (imagine a capital H with a hat on). Although the floor of the west tunnel extension was found to contain a few fossils, the second cross tunnel proved disappointing and the floor of the extended east tunnel even more barren. The latter was to be put to good use, however, by yet another inventive volunteer, Michael Marmach, who fitted it out with shelving.

The following year saw a continuation of work at Dinosaur Cove East and Slippery Rock. Dinosaur Cove East produced a steady stream of isolated bones, thanks to the dedication of Nick van Klaveren. One of these was the biggest bone to be recovered; a femur 43cm long with a juvenile of the same species beside it. It was to be identified as the first Australian ornithomimosaur (ostrich-like dinosaur) and one of the oldest species of that group. Named *Timimus hermannii*, after Tim Flannery, young Tim Rich and John Herman, this fleet-



Photo D. and J. Elliott

*"You are looking at the results of more than 20 years in man hours!" So quotes Dr Tom Rich as he displays a decade of fossil collection from Dinosaur Cove on the floor of Museum Victoria's Geosciences Facility (left). The preparation of fossils from Dinosaur Cove such as this pubic boot of an unidentified theropod dinosaur (below) still continues today, although in a greatly reduced capacity.*

*Prolific fossil deposits at the Flat Rocks site near Inverloch have now paved the way for a whole new era of digs and discoveries in Victoria. The photograph (right) was taken during a reunion of volunteers in March 2008. The reunion was held during a dig at Flat Rocks and the photo is of Tom Rich and David Pickering studying the beautifully preserved jaw of a tiny mammal found at the dig the day before. The story is far from over!*



Photo David Pickering, courtesy Museum Victoria

footed theropod would have been carnivorous. Dave Pickering states, "The find was important, not only because it was our longest bone, but also because bones of carnivores are rare, on account of the predator-to-prey ratio".

At Slippery Rock, the most daunting priority was the construction of a man-made pillar in the first cross tunnel to allow removal of the rocky pillar currently shoring up its roof. This job was to be yet another gut-buster. Getting the materials on site involved bagging sand, gravel and cement at camp, loading the bags on to a trailer, reloading them on to a mini-trailer, reloading them again into the flying fox, carrying them into the tunnel and emptying them into the electric cement mixer! As the pillar grew in height, the cement mixer was raised to facilitate pouring. The last third, however, had to be bucketed into the formwork by hand.

A month after they started the pillar, with the end in sight, Tom Rich bet every worker a carton of beer that they couldn't finish by March 2. On the last day of pouring, the beer

was on ice and preparations were made for a sumptuous feast in the rec tent. Everyone was optimistic, but what had seemed like a certainty turned out to be a close call. For the first time since 1984 (thanks to calm seas), Tom allowed work to continue after dark. The last thing he wanted was to win his bet! As 10.00pm, and then 11.00pm, came and went, the usually high-spirited crew went quiet. At 11.52pm, to the relief of all concerned, the last of the concrete was poured. Tom and Pat recall that the team was simply too exhausted to party, so it was 11 o'clock the next day before the festivities truly got under way.

In 1992, Dinosaur Cove was visited briefly to blast an overhang near the new man-made concrete pillar. Then over 18 days in 1993 the original rocky pillar was removed. The floor of the removed pillar proved to be disappointing; at least at the time of excavation. Three-and-a-half years later, preparation of a bone from this site was to see Tom putting in a call to Cadbury's for a cubic metre of chocolate ... Dinosaur Cove had produced

its first mammal at last; the humerus of a monotreme (egg-laying mammal). The bone had been labelled and logged as a 'number 5' in the field. "A 'number 1' is a tooth or a jaw," clarifies Helen Wilson. "We thought it was just a bit of turtle!"

Close examination of the bone revealed that it belonged to an animal remarkably like an echidna. As with an echidna, the humerus was twisted to a degree not seen in mammals with an upright posture, meaning that the animal presumably had a sprawling posture. Named *Kyroryctes cadburyi*, this find confirmed that at least one monotreme was capable of surviving in a polar environment. The name *Kyroryctes* means 'cold digger' and *cadburyi* is in honour of Cadbury which, with a little string pulling, eventually came good with a cubic metre of chocolate, enabling Tom to keep his word. Tom no longer makes promises that he thinks he will never have to keep!

Tom and Pat had planned to close Dinosaur Cove at the end of the 1993 dig, and the 'Extinction of Dinosaur Cove' party did go ahead as planned

in April. On the morning of the party, heavy rain cleared sufficiently to allow a helicopter to ferry media, friends and ex-volunteers to the dig site. Speeches were given and awards handed out. With that, the tunnel entrances were sealed, a granite monolith erected and Dinosaur Cove put to rest. Well, almost ...

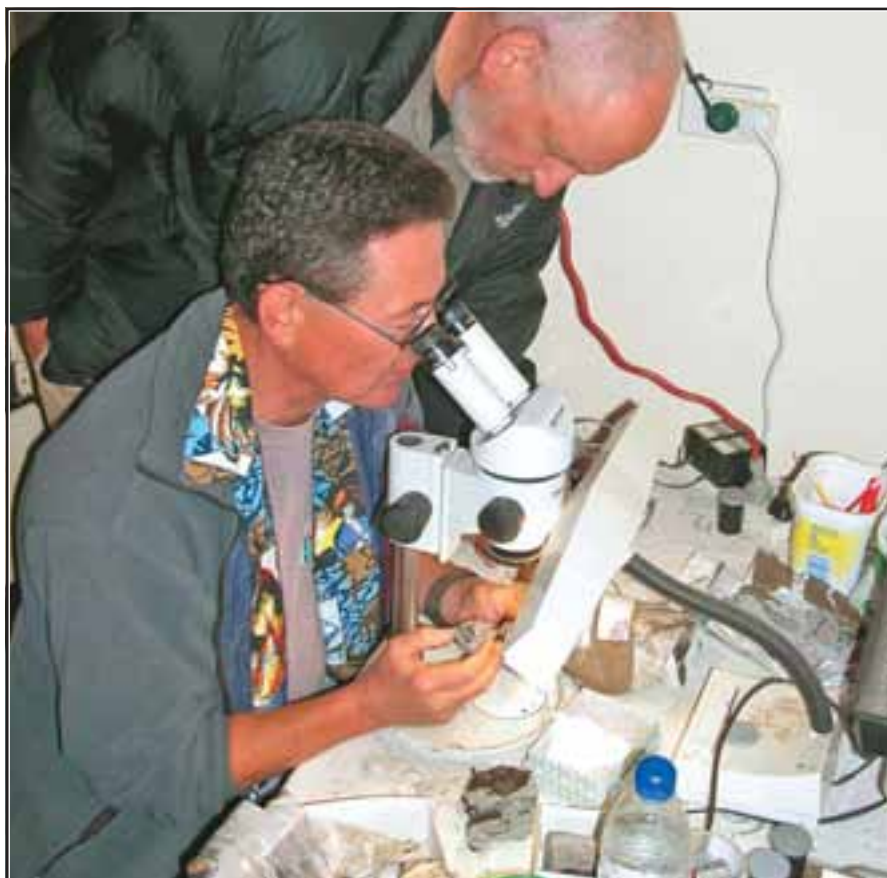
Although it was officially 'extinct', a small team led by Nina Herrmann, a Danish palaeontologist, returned to Dinosaur Cove in 1994. Their brief was to further explore a one-metre-thick downward seam of fossiliferous rock at Lake Copco. *The Age* newspaper funded the dig, which proved to be every bit as challenging as any

before. The thick seam dipped 15° downwards, so that as the dig progressed, the team found themselves working 3m below sea level and their pit constantly filling up with sand and seawater. With three pumps working continuously, the small group jackhammered and removed a massive 60 tonnes of sandstone. "It wasn't that we ran out of bones," David Pickering laments, "more that it just became too difficult to continue."

It was the end of an era. The Dinosaur Cove story had come to a close, but the polar dinosaur story is far from complete, and *'The Ghastly Blank'* still begs to be filled in. Far from gathering dust, the Dinosaur

Cove collection at Museum Victoria is still accessed frequently by researchers and interested parties. David Pickering confirms this. "We are still learning," says David. "More specimens have now been prepared and there is more co-operative research." An example of this research is the conclusion from recent studies that the family 'Hypsilophodontidae' is a paraphyletic clade; that is, they do not share a common ancestor. "This has led to the term 'hypsilophodontid' being no longer considered valid," says David, adding, "At present, we can only call them Australian ornithopods. A review of all the Australian Hypsilophodontids – that is, from Queensland, New South Wales and Victoria, is currently being undertaken by researchers from The University of Queensland and we are waiting for their findings to be published. It is an exciting time for Australian dinosaurs!"

After 1994, the focus turned to the Flat Rocks site near Inverloch (180km east of Dinosaur Cove and 10 million years older), where the conditions have been described as 'a geriatric dig' by some and 'heaven' by others. Digging continues there to this day, and significant finds have emerged, but that's a story for another issue. Tom Rich is certain that, had the Flat Rocks site been found earlier, the gruelling and dangerous work at Dinosaur Cove would never have eventuated. *Australian Age of Dinosaurs* caught up with participants at this year's 'Back to Dinosaur Cove' reunion party. All agreed the project was a case of 'right place, right time'. All agreed that they were part of a pioneering venture; that it was an amazing period of their lives ... an honour to be involved and a *hell* of a good time.



Further Reading:

***Dinosaurs of Darkness***

Thomas H. Rich and Patricia Vickers-Rich  
Allen & Unwin 2001

The most comprehensive account of Australian dinosaur exploration ever written, *Dinosaurs of Darkness* weaves decade of discovery at Dinosaur Cove into the fascinating story of Australia's polar dinosaurs. This book captures the formidable spirit and determination of palaeontologists Tom and Pat Rich and the dedication of countless volunteers who followed them.

**The Author**

Robyn Molan was born in Winton, Queensland, and grew up on a local sheep station, where finding petrified wood and fossilised mussel shells inspired an interest in Australia's past. She and her husband and two sons now live in Brisbane where she works part-time as an occupational therapist, having obtained a B. Occ Thy from The University of Queensland in 1981.



Australian Age of Dinosaurs and Robyn Molan wish to acknowledge Museum Victoria, Dr Tom Rich, Prof. Pat Vickers-Rich, David Pickering, Peter Menzel, Peter Trusler, Graeme and Michelle Hird, Lesley Kool, Helen Wilson, Don Manning, Bill Hopkins, Mick Whitelaw, Natalie Schroeder, Betty Thompson, Roz Poole and Robert Molan for their assistance with this story.