EXCAVATION REPORT

DINOSAUR COVE
1993 - 1994

&

INVERLOCH
1994

Dig at Dinosaur Cove 1993

Work commenced at Dinosaur Cove on 16 January and ceased on 7 April 1993. At the outset of the excavation, the objectives were (1) to remove The Pillar at the entrance of the Slippery Rock site together with taking drag cuts off the southwest corner of the Second Pillar and the south wall of the Western Extension of Slippery Rock and excavate the fossiliferous layer that was exposed and (2) to complete the excavation of the fossiliferous rock known to occur at Dinosaur Cove East.

Objective (1) was successfully completed but (2) was not because the relevant fossiliferous layer, instead of pinching out as a coring programme carried out in 1991 had led T. Rich to believe, quintupled in thickness to more than 1 metre and for the first time at Dinosaur Cove East, yielded two clusters of associated fossil bones instead of only isolated specimens.

Introduction

Dinosaur Cove was discovered in December, 1980, towards the end of a two field season effort to locate fossil tetrapod sites on the well exposed shoreplatform outcrops of the early Cretaceous Otway Group. Because the outcrop discovered at that time was at the base of a cliff, it was evident that to exploit that deposit would require underground tunnelling. What few fossils could be collected there were only water worn bone scraps. For those reasons further exploration for additional fossil vertebrate sites in the hope of finding one that would be easier to work and was known to yield identifiable material continued for another three years.

As no such additional sites had been found by 1984, so at the instigation of the newly formed Friends of the National Museum of Victoria, a trial excavation was undertaken at Dinosaur Cove that year. A sixteen day effort by sixty-five enthusiastic volunteers established that significant fossil vertebrates could be recovered at Dinosaur Cove and proved that such people could acquire the techniques necessary to tunnel into the cement-hard sandstone at Dinosaur Cove.

In subsequent years, two new fossil sites were discovered in Dinosaur Cove, one stratigraphically below (Slippery Rock) and the other (Dinosaur Cove West) above the original discovery site (Dinosaur Cove East). The technology employed gradually become more elaborate, a 305 metre long flying fox being constructed in 1986 which made getting equipment in and out and removal of specimens from Dinosaur Cove much easier. The use of explosives began in 1987. This vastly improved the efficiency of underground tunnelling, more than 99% of the area eventually excavated underground at Dinosaur Cove having been won in that way.

By the standards of classic dinosaur localities such as those on the east flank of the Rocky Mountains in North America or southern Mongolia and much of China, the yield of specimens at Dinosaur Cove has been meagre. However, as almost nothing was known about the polar dinosaurs of southeastern Australia when the work began, the effort has been scientifically rewarding. Out of it, the first evidence for the former existence of about half a dozen dinosaurs has been gained.

Furthermore, the results there encourage the continued search for new sites both on the flanks of the Otway Ranges and the Strzelecki Ranges which are east of Phillip Island. The latter was the region where the first dinosaur bone was discovered in Victoria at the turn-of-the-century by William Hamilton Ferguson, a geologist prospecting for coal deposits.

Beginning in 1986, most of the effort at Dinosaur Cove has been concentrated at the

Slippery Rock site. This was because it was richer in fossils than the other two sites as they were then known. Tunnelling there in 1987 yielded the first partial skeleton of a dinosaur found in Victoria. That encouraged further concentration of effort there which was rewarded two years later with the discovery of a second partial dinosaur skeleton.

In order to obtain access to the area which yielded those two skeletons, a column of rock, The First Pillar, had been left behind at the entrances to the Slippery Rock excavations in order to provide roof support. By 1991, drives at that site had penetrated more than 20 metres from the entrances. As a result, it was established that the concentration of fossils was within 6 metres of the openings to the tunnels. By then, the only unexcavated rock in the area of concentration was The First Pillar.

To win the fossils from The First Pillar required that first its role as a roof support would have to be assumed by some other structure. To this end, a 60 tonne concrete pillar was poured alongside The First Pillar during the 1991 field season. The concrete was allowed to cure for two years.

Also during the 1991 field season, work continued at the Dinosaur Cove East site. As a result, an adult femur of an ornithomimosaur that became the holotype of *Timimus hermani* Rich & Vickers-Rich 1994, was recovered. Within less than 1 metre of that specimen, a juvenile ornithomimosaur femur was found, presumably of the same species. These were the first ornithomimosaur remains reported by Australia and formed the basis for a restoration of that group of dinosaurs in a set of Australian dinosaur stamps issued in October, 1993. In addition to these two specimens, a steady stream of bone fragments came out of Dinosaur Cove East, making the site attractive for further work.

In an attempt to assess the limits of the fossiliferous deposit at Dinosaur Cove East, Rob Anderson carried out a coring programme there towards the end of the 1991 field season. As interpreted by T. Rich, those cores indicated that one more season's work would be sufficient to collect all the fossil-bearing rock that remained at that site. In the final days of the 1991 field season, Alaistair Blaikie using explosives, removed overburden from that area together with exposing about 5 metres^2 of fossiliferous rock at Dinosaur Cove West in the same manner.

Thus, the directions of the 1993 season were set by the work in 1991: (1) excavate The First Pillar in the hope particularly of recovering more articulated fossils like the two skeletons that had been found nearby, and (2) complete the excavation of fossiliferous rock at Dinosaur Cove East, in particular to try and recover more *Timimus hermani* material.

The Fieldwork

The two primary objectives for 1993, the excavations at the Slippery Rock site and at Dinosaur Cove East went on in parallel for the entire field season.

Slippery Rock. Removal of The First Pillar began on 18 January and was completed 4 February. This was accomplished by a series of blasts carried out by Patrick O'Neill. With the aid of Ian Jesser and other members of the crew, he then built a wooden portico to protect people working in the area of The First Pillar from falling rocks. It was unfeasible to remove all the overhanging rocks that posed a danger because dislodging one would have unstabilised more.

Work in the area that The First Pillar had occupied yielded a disappointingly low number of bones. Among those found were some fragments of a theropod? skull? However, no partial skeletons as had been located nearby in 1987 and again in 1989 were

found.

Near the end of the work in this area, a falling block of rock grazed Alan Fraser but fortunately he was not seriously hurt.

During the period when the blasting of The First Pillar was taking place, the opportunity to also blast off the southwestern corner of The Second Pillar and the southern wall of the Western Extension was taken. These areas were then excavated and only a few bone fragments were discovered. There was clearly no obvious concentration of fossil bones underground worthy of further excavation.

The only possible area of interest remaing at the Slippery Rock is immediately east of the entrance to the East Tunnel for the fossiliferous layer can be traced in outcrop for several metres. As this area is highly fractured on the surface, the attempt to reach it by driving underground eastward from the East Tunnel was abandoned in 1989 when it became evident that there, too, the ground was extremely jointed and dangerous. In the decades and centuries to come, it is an area to watch as blocks fall away from the cliff for some will contain parts of the fossiliferous layer.

Because there was nothing obvious to justify further work at the Slippery Rock site inward of the concrete pillar, the entrances to the tunnels there were sealed with concrete on 5 April, the working being supervised by Ray Blanford.

Before the final closure took place, a glass container provided by Martin Gomon was placed at the back of the tunnels at the point where the East Tunnel and the Second Cross Tunnel meet. This will serve as source of information about the site for anyone entering the tunnels in the future. Placed in the container were a number of publications relating to the work at Dinosaur Cove, both technical and popular, plus casts of ten specimens found in Dinosaur Cove and one from Point Lewis. An eleventh cast, that of what is to be the holotype of *Timimus hermani*, was too large and so rested alongside the glass jar.

The following message was left in the capsule. The text here is taken from the rough draft which is slightly different from the final one but there is no significant difference between the two.

Dinosaur Cove
Lavers Hill, Victoria
Australia

4 April 1993

To Whomever next reads these lines, Greetings.

The Glass container holding this note was sealed in the northeast corner of a series of tunnels on this date. The system of tunnels was excavated between 1987 and 1993 in search of fossil vertebrate remains, particularly dinosaurs. The site was known as Slippery Rock and was one of three within what is known as Dinosaur Cove. The other two sites, known as Dinosaur Cove East and West, are both located to the west of the Slippery Rock site. Dinosaur Cove East is about a 70 metre walk from the Slippery Rock site and Dinosaur Cove West, about two hundred metres further walk beyond Dinosaur Cove East.

In this container are a number of papers relating to the work carried out here. Also included are casts of a number of specimens collected from Dinosaur Cove plus one specimen collected to the east about 20 kilometres at a site called Point Lewis. Below is a listing of these casts. The left hand column with numbers from one to eleven (1-11) correspond to numbers printed in yellow on the casts. At this writing it is not certain whether the container will be large enough to accommodate specimen 5, the large femur which will become the holotype of *Timimus hermani.*

1. Femur of the small hypsilophodontid *Leaellynasaura amicagraphica*, NMV P186004 (NMV = Museum of Victoria).

2. Femur of medium-sized hypsilophodontid, NMV P186333.

3. Large hypsilophodontid femur, NMV P186326.

4. Femur of juvenile ornithomimosaur, *Timimus hermani*, NMV P186323.

5. Femur of adult ornithomimosaur, *Timimus hermani*, NMV P186303, holotype.

6. Turtle femur, NMV P185852.

7. Plesiosaur tooth, NMV P182822.

8. Mandible of the hypsilophodontid *Atlascopcosaurus loadsi*, NMV P182967.

9. Isolated tooth of the hypsilophodontid *Atlascopcosaurus loadsi*, NMV P177934.

10. Theropod tooth, NMV P186343.

11. Maxilla of the hypsilophodontid *Atlascopcosaurus loadsi*, NMV P157390, found at Point Lewis, Victoria, Australia.

We cannot know what circumstances were that led you to read this note but we wish you well.

/s/ Thomas H. Rich

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At the last stage of pouring concrete into the entrance to the East Tunnel, a marker carved in black granite was placed that is visible to visitors to Dinosaur Cove. It reads as follows:

SIGNIFICANT FOSSILS WERE
DISCOVERED AT THIS LOCALITY,
DINOSAUR COVE, IN 1980.
FIELD PARTIES COMPOSED
PRINCIPALLY OF VOLUNTEERS
FROM MONASH UNIVERSITY,
THE MUSEUM OF VICTORIA

AND EARTHWATCH COLLECTED
DINOSAURS AND OTHER
VERTEBRATE FOSSILS FROM
THREE SITES WITHIN THIS COVE,
1984 - 1993. MAJOR SUPPORT CAME
FROM THE NATIONAL GEOGRAPHIC
SOCIETY, ATLAS COPCO, I.C.I.,
THE DEPARTMENT OF CONSERVATION
& NATURAL RESOURCES, AND
THE AUSTRALIAN RESEARCH
GRANTS COMMITTEE

Donated by A. Giannarelli & Sons, Fitzroy

Dinosaur Cove East. The first thing done at this site was to drop potentially dangerous overhanging rocks with explosives. Unfortunately, in one instance, there was a blowout which cracked what had previously been a solid plate of rock. This and some other potentially dangerous rocks had to be propped with Arco jacks supplied by Jedd Edwards of Colac and monitored for movement. They could not be brought down because as was the case at the Slippery Rock site, to do so would have unstabilised other rocks. Fortunately, no movement was observed nor were there any rock falls.

Excavation at this site yielded a small but steady stream of isolated fossils, amongst them being a theropod vertebra, an ornithischian ischium and several hypsilophodontid teeth.

Quite unexpectedly, the fossiliferous deposit, instead of pinching out to the north as anticipated from the coring done in 1991, quintupled in thickness so that it was more than 1 metre thick with the bottom not seen. As a result, the bottom of the excavation was more than 2 metres below the surrounding shore platform and flooding was a constant problem. Sandbags held in place by steel rods inserted into the shore platform and wire mesh proved adequate to prevent sand from being swept into the excavation and filling it at each high tide. However, nothing could prevent the high tide flooding the excavation site with water. Not only did the water go over the top of the sand bags but cracks in the rock permitted large quantities of water to flow in even before the top of the sandbags was reached by a rising tide. Attempts to seal these cracks were not successful.

That the fossiliferous deposit quintupled in thickness to at least 1 metre plus the possible presence of clusters of associated bones instead of just isolated ones, made the permanent abandonment of the site at the end of the 1993 field season as planned an undesirable course of action. The palaeoenvironmental interpretation of this region of thicker fossiliferous rock although far from certain, would appear likely to be that it was an area where the water depth became deeper when the sediments were laid down. Depending on why the water depth increased, under a number of different possible scenarios, such an area might be expected to have accumulated bones at a different rate than the thinner deposits encountered at Dinosaur Cove over the past decade. Bones could be expected to have rolled into such a depression, and the energy of the flowing water may have been insufficient to move them further.

Dinosaur Cove West. There was no intention of making a major effort at Dinosaur Cove West. However, some of the 5 metres^2 exposed by the blasting in 1991 was excavated. A few fossils were found, enough to justify obtaining the rest of the area exposed in 1991 at

some time in the future but not enough to make it urgent to do so.

Shutting Down. Early in the field season, on 3 February, an on site meeting was held with a number of persons from the Department of Conservation and Natural Resources: Ted Bailey (Lavers Hill), David Nugent and Bill Fox (Colac) Alan Rampel (Apollo Bay). The purpose was to establish what needed to be done at Dinosaur Cove once the site was permanently shut down at the end of the 1993 field season as was anticipated at that time.

Besides agreeing to plug up the entrances to the tunnels at the Slippery Rock site, it was also decided to remove all the steel bolts and other steel in the rocks except for some mesh near the Eastern Tunnel and a few split sets at Dinosaur Cove East which are stabilising the rocks. These things were carried out before the end of the 1993 field season.

Later, Ted Bailey gave permission to leave the tripod of the flying fox in place for the time being when it became evident that work might continue for some time yet as a result of the outcome at Dinosaur Cove East.

Repair of flying fox. Owing to ineptitude, the towing cable of the flying fox was broken. Fortunately, no one was hurt. Also fortunately, the break occurred near one end of the towing cable so that it did not need to be replaced. Two days were required to repair it.

Mapping of Dinosaur Cove. Richard MacNeill and two associates from R.M.I.T., Adrian Churkovich and Christine Morriss, made a detailed map of Dinosaur Cove including the tunnels at the Slippery Rock site before they were sealed. In addition, they placed benchmarks which are located on the map.

Participants in the Fieldwork at Dinosaur Cove, 1993

Without the aid of numerous people who assisted the excavation, most of whom received no remuneration, the work at Dinosaur Cove could not have proceeded. In 1993, these people were the following.

Marion Anderson
Julie Aulenbach
Kevin Aulenbach
Daren Bellingham
Ray Blandford
Adrian Churkovich
Graeme Hird
Rene Hofheins
Ian Jesser
Ivan Kobiolke
Lesley Kool
Marilyn Laframboise
Fionna McKenzie
Richard MacNeill
Donald Manning
Michelle Colwell
Rachel Coulter
Sally Cowan
James Daniels
Boadie Dunlop
Alan Fraser
Michael Marmach
Gregory Miller
Christine Morriss
Patrick O'Neill
David Pickering
Barry Poole
Roz Poole
Patricia Rich
Thomas Rich
Pauline Schokman
Matilda Griffith
Yoshikazo Hasegawa
Chris Hastings
Spencer Herd
John Herman
Nina Herrmann
Natallie Schroeder
Owen Shebbeare
Rupert Shebbeare
Christopher Short
Frank Stewart
Ian Stewart
Nicholas van Klavern
Mary Walters
Noel Watkins

Others who provided assistance

Critical assistance was provided by many persons who helped by making available equipment and services needed to carry out the excavation at Dinosaur Cove. In 1993 these included the following.

John Angel	Gregory Denney	Jack Mackenzie
John Crook	Winsome Denney	Sandor Mokos
Malcolm Davidson	Jedd Edwards	Phil Ryan
David Denney	John Giannarelli	Dennis Smithers

Palaeolatitude Determination

In the early Cretaceous when the dinosaurs whose remains are found at Dinosaur Cove, elsewhere on the flanks of the Otway Ranges and on the flanks of the Strezelecki Ranges, were living animals, southeastern Australia was located much further south than it is today. Precisely how far south had important biological consequences for the animals. If they lived within the Antarctic Circle of the time, then the closer they were to the South Pole, the longer the duration of continuous darkness each Winter that they would have had to contend with.

During the past thirty years, utilising palaeomagnetic evidence, several estimates have been made as to the palaeolatitude of southeastern Australia. Although all placed southeastern Australia far to the south, there was a considerable difference of opinion as to exactly how far south it lay at that time. Therefore, Michael Whitelaw, formerly of Monash University and now at the University of Texas, El Paso, carried out an extensive sampling programme in the Otway and Strzelecki groups in December, 1992, and January, 1993. His preliminary results suggest that the Aptian Strzelecki Group sites were located at about 77.8°S. and the Albian Otway Group sites, at 66.8°S. (Whitelaw, M.J., 1993. Paleomagnetic Paleolatitude determinations for the Cretaceous vertebrate localities of southeastern Australia-high latitude dinosaur faunas. Abstracts of Papers, Fifty-Third Annual Meeting, Society of Vertebrate Paleontology, New Mexico Museum of natural History and Science, Albuquerque, New Mexico, October 13-16, 1993. *Journal of Vertebrate Paleontology*, vol. 13, supplement to Number 3, p. 62A.)

Presumably, Australia did not move much during the time span between the Aptian and Albian. Therefore, it is likely that the difference in these two polar positions is exaggerated in these results. But it must be remembered that the results are of a preliminary nature. In any event, they strongly suggest that southeastern Australia at the end of the early Cretaceous was located within and close to the Antarctic Circle of the day.

Sponsorship

Whitelaw's work on the palaeolatitude determination as well as the excavations at Dinosaur Cove were supported by a grant from the Committee for Research & Exploration of the National Geographic Society. Atlas Copco provided the compressed air equipment needed to carry out the work at Dinosaur Cove.

The Future

Because of the unexpected outcome at Dinosaur Cove East, a quintupling of the

fossiliferous layer to a thickness of at least 1 metre, a thickness never seen before in a dinosaur-bearing unit in the Otway or Strzelecki groups before, it was decided to continue the work there in 1994 for six weeks in order to assess whether the greater thickness might be associated with a high yield of fossils than has previously been the case. The amount found in this area in 1993 was not sufficient to determine whether the apparent greater quantity of fossils was simply a random fluctuation or indeed, indicated a significant change in the quantity of material that could be recovered.

In 1992, a test excavation at the Flat Rocks locality in the Strzelecki Group near Inverloch, yielded between 40 and 60 specimens per day from a readily accessible palaeo-stream channel deposit. This high yield from a site about 10 million years older than Dinosaur Cove, made it the intended primary objective for the 1994 field season before the work at Dinosaur Cove in 1993 had even begun. Rather than delay work there any further although a full field season will be carried out at Dinosaur Cove in 1994, there will be a full season at the Flat Rocks site as well that year.

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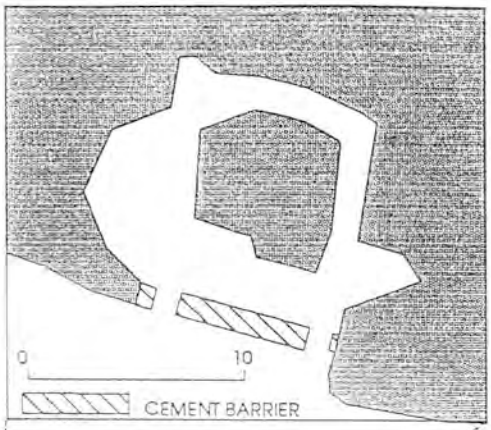
28 December 1993

DINOSAUR COVE



DINOSAUR COVE EAST
(LAKE COPCO)

DINOSAUR COVE
WEST

SLIPPERY ROCK

PM1

DINOSAUR COVE

PM2

GRID NORTH

BASE OF CLIFFS

ROCK LEDGES

0 50 100

METRES

PM1;PM2: PERMANENT MARKS (BRASS PLAQUES)

PERMANENT MARK	EAST	NORTH	LATITUDE	LONGITUDE
PM 1	708965.1	5 704 617.6	-38°46' 56".28	143°24' 20".54
PM 2	709 002.1	5 704 529.1	-38°46' 59".12	143°24' 22".16

SURVEYORS: R. MACNEILL, C. MORRISS, A. CHURKOVICH.

DRAWN: MACNEILL

29/6/93

RMIT DEPARTMENT OF LAND INFORMATION

Digs at Dinosaur Cove and Flat Rocks 1994

Flat Rocks

Introduction

The Aptian (early Cretaceous) fossil tetrapod site in the Strzelecki Group found at Flat Rocks near Inverloch, was discovered in 1991 by Lesley Kool, Michael Cleeland and colleagues. The day after a major storm, they happened to be reprospecting an area yet once again after having been there on a number of previous occasions. Their persistance was rewarded on this occasion by the discovery of a palaeostream channel deposit with between 15 and 30 bone fragments exposed owing to the high waves generated by the storm having removed temporarily the sand that normally covered them.

In 1992, a trial excavation over a period of about ten days yielded between 40 and 60 fossil bone fragments or teeth per day.

The 1994 Excavation

Under the direction of Lesley Kool, excavations were carried out at the Flat Rocks site nearly Inverloch, 31 January - 26 February 1994. Five tonnes of fossiliferous rock were excavated and sixty fossil bones plus twenty isolated dinosaur teeth were recovered which were clearly of scientific value together with several hundred fossil bone scraps, some of which will undoubtedly prove to be of significance once fully removed from the surrounding rock.

Results

Whereas a decade of effort at Dinosaur Cove had yielded only a single tooth of a dromaeosaurid, the small, agile carnivorous dinosaurs portrayed so vividly in *Jurassic Park* where they were referred to as "Raptors", eight of these teeth have now been recovered from the Flat Rocks site. This greater yield promises that whatever the nature of the Victorian branch of the dromaeosaurids, significantly more will be learned about them in the four remaining years of work planned at the Flat Rocks site than has been the case at Dinosaur Cove.

One of the major systematic problems with the hypsilophodontid dinosaurs from Dinosaur Cove is that there are so many of them. While the teeth and femora of *Leaellynasaura amicagraphica* are known, there are two other hypsilophodontids from there in which the association between the teeth and femora is unknown. All the hypsilophodontid teeth not referred to *L. amicagraphica* from there are rather similar to one another and have to date been all regarded as *Atlascopcosaurus loadsi*. On the basis of the femora, however, there are clearly two more hypsilophodontids in addition to *L. amicagraphica* at Dinosaur Cove. In Rich & Rich (1989, *National Geographic Research* 5:15-53) one is named "Victorian Hypsilophodontid Femur Type 1" and the other erroneously referred to as *Fulgurotherium australe*. Presumably, one of those two femoral types is *A. loadsi* and the other, a species yet to be recognised. The problem is making the association between the teeth and the femora.

The fact that thus far only one hypsilophodontid femoral type has been recognised at the Flat Rocks site may provide the key to solve this problem at Dinosaur Cove. If no more than one type of hypsilophodontid femora is ever found there, then because they are so abundant, it will be a safe assumption that probably all the hypsilophodontid teeth from that site are a single species as well. Because the hypsilophodontid femora from the Flat Rocks site resembles the one erroneously referred to as *Fulgurotherium australe* at Dinosaur Cove, a comparison of the hypsilophodontid teeth from Flat Rocks may then make it possible to recognise subtle differences between the teeth now all placed in the single species

Atlascopcosaurus loadsi at Dinosaur Cove that might mark them as belonging to two different species.

The Future

An estimated minimum of thirty-five tonnes of accessible fossiliferous occurs at the Flat Rocks site. At five tonnes per month, the plan is to recover what remains by the end of the 1998 field season. Two additional years should be sufficient to see out the preparation and study of all the fossils recovered together with completion of the ancillary studies in fields as diverse as palaeobotany, palynology, palaeomagnetics, geochemistry, and sedimentology. The goal is to submit for publication by 31 December 2000, a monograph on the Victorian dinosaur fauna together with studies in related areas.

Personnel

The following persons assisted with the work at the Flat Rocks site in 1994.

Marian Anderson	Robert Hodge	Jenny Monaghan
Phil Anderson	Patricia Komarower	Kerry Olsen
Mark Burrows	Amanda Kool	Brian Sheehan
Michael Cleeland	Lesley Kool	Patrick Sheehan
Andre Coffa	Beverley Lamrock	Sanja Van Huet
George Dobolovski	Gary McWilliams	Mary Walters
Nicole Evered	Helen Mitchell	Corrie Williams
Lois Hodge		

Dinosaur Cove

Introduction

During the last month of excavations at Dinosaur Cove in 1993, the fossiliferous rock at the Dinosaur Cove East site quintupled in thickness over what had ever been found there previously. Not knowing what this meant in terms of either the potential for producing more or better specimens as well as the interpretation of this thicker unit as regards the environment of deposition, it was decided to continue work for another field season.

The 1994 Excavation

The operations in 1994 were led by Nina Herrmann, a volunteer on the 1993 excavation and an undergraudate student at the University of Copenhagen with professional training in both geology and vertebrate palaeontology.

Great technical difficulties were encountered and overcome by Ms. Herrmann and the volunteers who assisted her. The excavation was in cement hard sandstone and involved the removal of more than 60 metres^3 of rock, the floor reaching a depth of 3 metres below the surrounding shore platform and thus 3 metres below sealevel. Cracks in the rock caused a constant inflow of water even when the tide was low enough that it did not to pour in from the top.

Results

In the end, about 250 specimens were collected at Dinosaur Cove East, the same yield as had previously been recovered in former years at this site from similar areas of rock exposed. However, because of the greater depth to the bottom of the fossiliferous layer,

about ten times as much effort was required to recover each specimen. As the quality of the specimens was no better than in previous years and the effort to obtain them so much greater, the decision was easily made to shut down large scale operations at Dinosaur Cove permanently.

This decision does not mean that there are no fossiliferous deposits remaining at Dinosaur Cove, merely that the effort to obtain further material using present technology in balance against the likelihood of a significant return of additional knowledge, with one exception, does not justify further work there at present. The exception is a small body of fossiliferous rock at Dinosaur Cove West. This can be collected with little difficulty in the next few years with an effort by a few people over two or three days using a petrol powered jackhammer. There is undoubtedly more fossiliferous rock at Dinosaur Cove East if one is prepared to dig further below sea level than the 3 metres reached in 1994. At the Slippery Rock site, fossiliferous rock is known to occur to the east of the existing tunnels there. However, the decision to proceed no further in that direction was taken in 1989 because of the fractured nature of the rock makes tunnelling in that direction unsafe. The thickness of the fossiliferous rock exposed to the east of the tunnels at Slippery Rock on the cliff face is not as great as that in the area excavated between 1987 and 1993 and therefore the quantity of fossils that might be collected from such an effort could well be disappointly small.

Preparation of part of the 1994 collection from Dinosaur Cove East has already revealed two specimens which add significant knowledge about the dinosaur fauna from there. Owing to the great depth to which the sediments were buried prior to their uplift and exposure in the recent geological past, many bones suffer from significant crushing. Femora of the best known dinosaur from there, *Leaellynasaura amicagraphica*, were particularly prone to this. In contrast to all previously collected femora of that species, one collected in 1994 for some reason escaped this. As femora are among the most diagnostic elements in the skeleton of ornithopod dinosaurs, this new specimen will provide further critical information regarding the relationships of this species.

A large frontal bone also recovered in 1994 at Dinosaur Cove East, indicating the presence of an ornithopod larger than any previously found there.

Andrew Constantine of the Earth Sciences Department, Monash University, who has carried out a detailed sedimentological investigation of all the Victorian Cretaceous tetrapod sites, interpreted the thicker fossiliferous rock at Dinosaur Cove East as representing the main channel of the ancient stream in which the fossil bones and teeth were buried. The thinner units which had been worked between 1980 and 1993 were lateral to the main channel and probably a point bar deposit. That the main channel was no richer in fossils than the lateral deposits could not have been predicted *a priori*.

With no more major excavations planned at Dinosaur Cove, the tripod of the flying fox, the air and water hoses, and most of the steel inserted into the rocks was removed. Only those pieces of steel that it would be dangerous to remove were left in place.

Personnel

The following persons assisted with the work at Dinosaur Cove East in 1994.

Peter Ascot
Ray Blandford
James Daniels
Coral Delarus
Nina Herrmann
Ivan Kobiolke
Andrew Kos
John Langford
Gary McWilliams
David Pickering
Barry Poole
Thomas Rich
Natallie Schroeder
Cain Sidon
Naomi Sullivan
Nicholas van Klavern
Geoff Wright

Sponsorship

The work at both the Flat Rocks locality and at Dinosaur Cove was funded by *The Age*. In return, the curator wrote a liftout for the *Education Age* of 28 March 1994 entitled "Victoria's Dinosaurs" together with an invited opinion piece as to the direction of Australian science published in October, 1993.

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8 July 1994