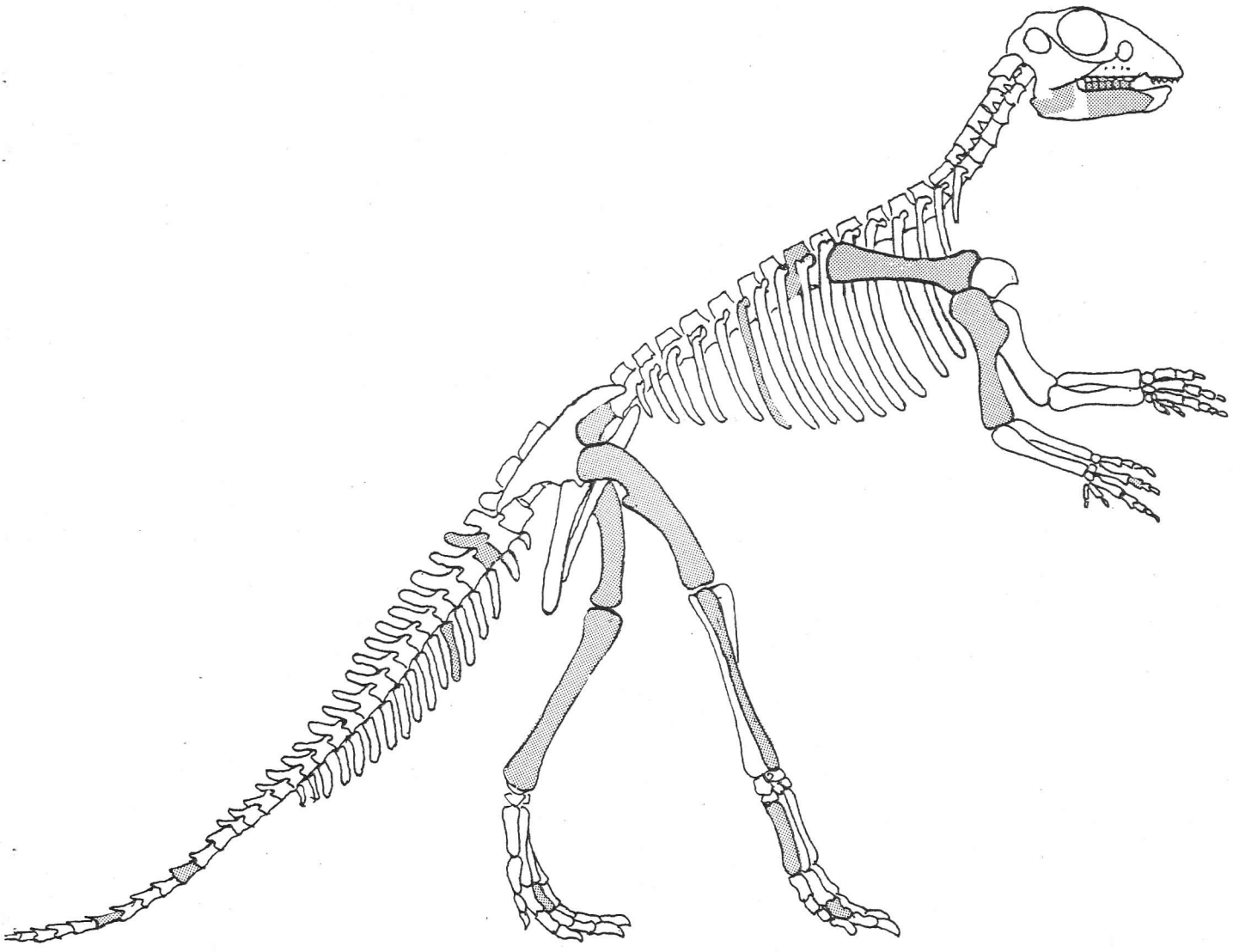
Dig at Dinosaur Cove

1986



Cover: Outline of an ornithopod dinosaur skeleton approximately one-fifth natural size. Remains of herbivorous dinosaurs of this type are the most common fossils found at Dinosaur Cove. The parts of the skeleton known from fossils found there are shown in grey.

Excavation at Dinosaur Cove, 1986

Summary

Background

With the completion of the excavation at Dinosaur Cove in March, 1985, two field seasons had been put in the area excavating fossil remains of terrestrial vertebrates about 105 million years old. The results were the collection of about 400 pieces of fossil bone and teeth plus the discovery of two sites not originally known when work began in 1984.

At this stage, one of the previously unknown sites, Dinosaur Cove West, had been exhausted and the second one, Slippery Rock, had yet to be worked. The original discovery site in Dinosaur Cove, Dinosaur Cove East, in 1985 turned out to be more extensive than previously thought. It was found to extend out onto the shore platform. It was much easier to uncover the fossiliferous rock on the shore platform than working in the tunnel where the first excavations at this site occurred. Consequently, it was possible to uncover an area of 35 square metres of fossiliferous rock during the final fortnight of the 1985 excavations. In contrast, about four weeks were required to uncover five square metres of fossiliferous rock in the original tunnel.

With the discovery of an ornithopod jaw at Dinosaur Cove East as well as the extensive fossiliferous layer there, the major thrust of the 1986 excavation was intended to be the exploitation of the opportunities there. In addition, Slippery Rock was to be thoroughly sampled in order to establish whether it was a rich enough site to be excavated on a massive scale.

Removal of the 7 tonnes of fossiliferous rock from Dinosaur Cove accumulated during the 1985 excavation did not take place until August, 1985. It was only then through the offices of the Hon. Race Matthews, that the Victorian Police helicopter aided by the Victoria State Emergency Services helicopter was able to provide the assistance necessary. Because of this, in 1986, a major innovation was to be to install a flying fox capable of removing fossiliferous rock from the shore platform to near the top of the slopes on the eastern side of Dinosaur Cove.

The Excavation

Because I was overseas from early October, 1985, until late

Excavation at Dinosaur Cove, 1986

January, 1986, the initial organising of the 1986 excavation was done by Mr. Michael Whitelaw and Ms. Elizabeth Thompson. When the fieldwork formally began on 9 January, Mr. Whitelaw together with Ms. Keryn Walshe supervised the work at the sites in Dinosaur Cove. This arrangement continued upon my joining the party at the end of January.

The greatest initial problem was setting up the flying fox. The length of cable was 305 metres in which distance the load was raised 70 metres from the shore platform almost to the top of the east side of Dinosaur Cove. The work was carried out principally by Messrs. John Herman, Ray Blandford, and John Carpenter with advice from Gerry Alkin. The basic components were a winch provided by Atlas Copco, cable from the S.E.C. and a tripod and wire basket fabricated by John Herman. Once set up, there were of course teething problems but they were rather minor, particularly in light of the fact that no one associated with the project had ever attempted to rig up a flying fox of such a size before. It worked quite reliably through the entire dig.

Work was carried out alternatively at Dinosaur Cove East and Slippery Rock all during the period of the fieldtrip from 9 January to 2 March. All the fossiliferous rock exposed at the end of the 1985 season beneath the shore platform at Dinosaur Cove East was collected by the end of the excavation. Numerous bones were found while doing this together with an isolated upper cheektooth of an ornithopod dinosaur. This specimen proved critical in establishing that there is a different ornithopod at Dinosaur Cove from the one known solely by its upper dentition from Point Lewis, a few kilometres east of Cape Otway.

As more fossiliferous rock was removed from the shore platform at Dinosaur Cove, the problem of flooding of the site by the sea became more acute. Cracks were exposed which allowed water to enter the excavation beneath the line of sandbags that was erected in an attempt to keep the site dry for longer periods of time when the tide was coming in. This problem of flooding is becoming great enough that some way of stopping up the cracks will have to be found if the excavation is to be extended still closer towards the ocean in future.

The work at Slippery Rock revealed that it was a significantly richer site than Dinosaur Cove East. About four times as many bone fragments were recovered there for every 100 kilogrammes of rock processed. More important, however, was that there seems to be pronounced differences in the size of the fossils found as well as the taxa present. At Slippery Rock, the fossils were generally smaller. In addition, turtles remains were much more prevalent. Two tiny teeth turned up there, one of which may be that of another ornithopod markedly smaller than that known from Dinosaur Cove East and West. The other at this point can only be characterised as 'peculiar'. Nothing like them has been found at anyother site in Dinosaur Cove or elsewhere in Victoria.

Excavation at Dinosaur Cove, 1986

Previously, the only fish remains known from the Otway Group were a few isolated lungfish teeth. On practically the last day of the 1986 excavation, a partial skeleton of a boney fish was discovered at Slippery Rock, another indication of the unusual nature of the site within the context of the Otway Group.

Such uniqueness suggests that when most of the material from Slippery Rock has been prepared, the assemblage from there will differ significantly from that known from elsewhere in the Victorian Cretaceous deposits.

By the end of the 1986 excavation, 1023 specimens had been collected at Dinosaur Cove. This was three times as many as was collected in 1985 during an equal period of digging. The better result was owing to two factors. First, the fossiliferous rock collected over an area of 35 square metres at Dinosaur Cove East was about three times as extensive as what had been taken from there in 1984 and 1985. Second, fossils are more numerous at Slippery Rock than at anyother site worked at Dinosaur Cove.

Once the fossiliferous rock from Dinosaur Cove has been broken up into fist-sized pieces or smaller in the search for fossil bones and teeth, it is laid out to weather for a number of years in the hope that more material will be found after some of the rock has broken down by this natural process. The material from the 1984 excavation now rests on concrete slabs at my home in Emerald provided by the Friends of the Museum of Victoria. Unfortunately, there is not enough room there to accomodate the much greater tonnage of material collected in 1985 and 1986. That material has now been laid out on the ground near the camp at Dinosaur Cove. It is unfortunate that it could not have been laid out on cement or bitumen but repeated efforts over the past two years have failed to secure a location where the matrix can be laid out on such a surface. It will mean that in future, there will be much more work involved in finding the fossils because rocks from the surface of the ground where the matrix is laid out will be incorporated in the sample to be gone through.

The following persons participated in the excavations at Dinosaur Cove in 1986.

Trevor Almeida	Ray Blandford	Leo Dwayne
Gerry Alkin	Mark Blows	Alan Fraser
Rebecca Askew	Sue Bourton	Craig Garrett
Aiden Banfield	Helen Brown	Doris Gerald
Gavin Bastienz	Chris Brynes	John Herman
Antoniette Beuche	Michelle Colwell	Allan Hey
Steven Birch	Martin Cook	Graeme Hird

Excavation at Dinosaur Cove, 1986

Robert Hodge
William Hopkins
Katy Humble
Peter Jobson
Dawn Kanost
David Kennedy
Wendy Knight
Lesley Kool
Jozica Kutin
Joan Lamond
Penny Love
Jennifer McEwen Mason
Robert McEwen Mason
William McInnes
Greg McNamara
Hilary Manning
Jennie Mills
Luke Molyneaux
Mark Morrison
Catherine Moyniham
Helen Padadimitrio
Neil Padbury
Thomas Rich
Natalie Schroeder
Keith Scilley
Nick Seddon
Herman Siebert
Steven Siebert
Frank Steuart
John Stockfield
Debby Thiele
Elizabeth Thompson
Robert Tranter
Constance Trumbull
Dane Truscot
Vincent van der Zee
Sanja van Huet
Nick van Klaveren
Barbara Wagstaff
Keryn Walshe
Michael Whitelaw
Thomas Whitelaw
Kathryn Wilson

Many people, although not formally expedition members, helped make the work a success. Without their cooperation and assistance, it would have been much more difficult if not impossible to accomplish the results achieved.

John Angel
Peter Burns
John Carpenter
David Denney
Winsome Denney
Jeff Farey
Glen Fenton
Peter Featherstone
Judy Forrester
Arnis Heislers
Terrance Lawrence
William Loads
Percy Pynes
Alan Rampel
Phil Reichelt
Ian Smith
Glen Wallace
Chris Wilkinson
Joy Wilkinson

Sponsorship

Many different organisations helped to make the excavation at Dinosaur Cove possible in 1986.

Atlas Copco: loaned the mining equipment and permanently donated two Cobra 148 rock breaker-drills

Mobil Oil: provided all diesel fuel

Friends of the Museum of Victoria: purchased a caravan

Council of the Museum of Victoria: provided funds for the purchase of food and equipment

Melbourne Metropolitan Board of Works: Loaned caravan and portable toilets

National Geographic Society: provided funds for purchase of food, equipment, and salaries

Otway Shire: provided gravel to improve the track to the site

Earthwatch: provided nine volunteers and funds for purchase of food, equipment, and payment of salaries

The Earthwatch Experiment

As a trial, during the last fortnight of the 1986 expedition, nine Earthwatch volunteers participated in the excavation. Earthwatch is an organisation which arranges for interested amateur volunteers to participate in scientific expeditions. The volunteers select to join an expedition and support it both by their labour and by making a financial contribution.

The experiment was an unqualified success. The nine volunteers worked extremely hard and quickly became an integral part of the party. From the feedback I have received, they seemed to have enjoyed participating in the work as much as the rest of the party and myself enjoyed having them.

As a result of this, in future Earthwatch volunteers will be invited to join in the dig as a matter of course.

Equipment

In previous years, the air compressors were the most reliable items of equipment on site. This year, however, both compressors had problems relating to the fuel system. Despite these difficulties there was almost no down time owing to a lack of compressed air. As at least one was working at all times, by moving the functioning compressor between the two stations where it was needed, compressed air was always available. All the

other equipment functioned with no serious problems.

Security

In the early hours of the morning of 16 February, about A$530 worth of tools and other equipment were stolen from around the winch site of the flying fox. The most peculiar item taken was the jockey wheel from one of the compressors. Fortunately, there was no deliberate vandalism of the equipment. The people from National Parks aided the party by permitting us to close the gate across the track to the winch site. Whether or not this prevented further thefts is not know but it would have forced any thieves to hand carry stolen items almost one kilometre.

Earlier, there was a theft of about half a drum of diesel fuel.

Results of North American trip

With the assistance of the Council of the Museum of Victoria, I was able to visit a number of museums in North America between mid October, 1985 and early January. This enabled me to make detailed comparisons of the teeth of the Victorian ornithopod dinosaurs as well as less extensive comparisons of the femora of these same animals.

On the basis of this visit, it now appears that the teeth recovered through the 1985 excavation at Dinosaur Cove are unique in their morphology. Although distinct at the species and genus level, they clearly belong to one of two families of ornithopod dinosaurs, the Hypsilophodontidae or Camptosauridae and most probably the former. These animals were bipedal or two legged forms which were herbivorous.

All these dinosaur teeth come from the Otway Ranges, In the Strzelecki Ranges have been found a number of ornithopd femora that appear to be unlike any of those known from the Otway Ranges. However, they are similar to some known from the opal field at Lightning Ridge, N.S.W. and also bear an uncanny resemblance to the corresponding bone in Othnellia rex. O. rex is a small ornithopod dinosaur known from two skeletons found in the western United States. Being latest Jurassic in age (145 million years before present), O. rex is considerably older than the 119 to 113 million year age assigned to the fossil vertebrate sites in the Strzelecki Ranges. Another typical late Jurassic North American dinosaur with a close relative in the deposits of the Strzelecki Ranges is the carnivorous dinosaur Allosaurus. Further detailed study of other bones in the collections from the Strzelecki Ranges may corrorborate the presence of O. rex there in which case the anomaly presented by the late record of Allosaurus in Australia will be found to be repeated.

Study of other reptilian teeth from Dinosaur Cove confirmed that a plesiosaur was present in the fauna. Although most plesiosaur remains are found in a marine context, there have been previous occurrences of their fossils in freshwater deposits.

While in North America, there was a great deal of interest in the fauna being recovered from Dinosaur Cove and elsewhere in Victoria because of their high latitude of the area at the time the dinosaurs lived. Being only about 10 degrees from the south pole of the day, presumably they would have had to cope with several months of continuous darkness annually.

An idea that has gained wide acceptance in the past half decade is that the dinosaurs may have become extinct owing to the effects of a dust cloud produced by the impact of an asteroid or comet. Presumably, a dust cloud that was dense enough would cause photosynthesis to cease for a long enough period of time to kill adult plants. This would cause the foodchain to collapse and bring about the extinction of many groups of animals which were unable to adapt to these unusual conditions.

Accepting at face value the evidence that dinosaurs regularly survived a number of months of continuous darkness each year as they apparently did in southern Victoria, some interesting details can be added to this picture of dinosaur extinction. Either the dust cloud must have persisted for a period significantly longer than the three to six months of continuous darkness that prevailed in southern Victoria 105 million years ago. Or there must have been other effects caused by the dust cloud besides simply cutting off the light. One suggestion made for other reasons has been a significant decrease in temperature. Or many elements of the Victorian Cretaceous fauna must have migrated 1500 kilometres each way annually in order to occupy a region with some sunlight every day. This latter alternative seems unlikely in the case of animals such as freshwater crocodiles which are not noted for such behavior today.

Future Work---1987

The discovery of tantalising, smaller vertebrate fossils at the Slippery Rock site is a strong reason to return there in order to attempt to find more useful material. Such specimens may help identify many of the enigmatic fossils we now have. Among these are the two small teeth mentioned earlier. At Dinosaur Cove East, more elements of the skeleton of a small ornithopod dinosaur best known from its teeth have been found. One particularly striking specimen discovered this year which probably is referrable to this animal is a scapula or shoulder blade. Such isolated bones recovered over the past three Summers at Dinosaur Cove East are gradually giving us a picture of this animal. For these reasons, continued excavation at both Dinosaur Cove East and Slippery Rock is warranted.

Excavation at Dinosaur Cove, 1986

At Slippery Rock, the fossiliferous sandstone is immediately underlain by a mudstone. The technique employed to excavate there in 1986 involved first digging out a space in the mudstone. Then the fossiliferous rock would be broken down into the space made available. Unfortunately, this required doing a considerable amount of horizontal rock drilling at head height or higher. In future what seems to be appropriate would be to hire professional miners to excavate a tunnel above the fossiliferous layer at Slippery Rock using the most appropriate techniques they can devise. Once a section of tunnel is excavated, the palaeontologists (museum staff and volunteers) can remove the rubble and then dig up the fossiliferous layer that will be on the floor. In the same way, tunneling could also be carried out at Dinosaur Cove East. Thus, the miners could alternate between the two sites. While they were working at one, the palaeontologists could be working the other. As the miners were working, one of the palaeontologists main jobs would be to collect enough in the most recently exposed areas to be sure that the tunnel was over fossiliferous rock.

A test pit a few metres to the northwest of the 1985 excavation at Dinosaur Cove East failed to encounter the fossiliferous layer. This implies either that the original edge of the deposit occurs in those few metres or a significant fault exists in which the fossiliferous layer was displaced vertically. Fossils are frequently concentrated close to the edges on the inside of the bends of former stream channels. This is because, in such areas, the current speed is lower than elsewhere in the stream and the sediment load [including future fossils] tends to be dropped there. Therefore, one thing that will be done in 1987 will be to link up the test pit with the 1985 excavation to see if the natural edge of the fossiliferous deposit can be found. If it can, it will be followed as far as practical.

In light of these considerations, for 1987, it is proposed to have another expedition of seven weeks duration beginning in the first week of January. A crew of twenty persons will be sought.

Thomas H. Rich and Patricia V. Rich
15 April 1986

Excavation at Dinosaur Cove, 1986

A preliminary budget to carryout this work is as follows

A$4 000	Food for 20 people for 7 weeks
A$35 000	Hire of mining equipment
A$2 750	Consumable supplies
A$3 020	26 drums of diesel fuel
A$20 000	Salary plus expenses for two miners, 7 weeks
A$150	Telephone calls
A$3 500	7 tents for Earthwatch volunteers @ A$500
A$650	15 stretchers for Earthwatch volunteers
A$3 000	Accomodation and meals for 30 Earthwatch volunteers one night on arrival and one night on departure
A$3 500	Gratuities for field assistants
A$10 000	Salary for preparator
A$1 110	Three electrical miner's lamps with recharging units @ $370/lamp
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A$86 680	