

ISSUE 9
RRP \$19.95



A U S T R A L I A N AGE OF DINOSAURS



THE ANNUAL PUBLICATION OF AUSTRALIAN AGE OF DINOSAURS
MUSEUM OF NATURAL HISTORY

- **Tracks Below the Tide** - The dinosaur tracks of Broome
- **Lovellea** - Flower of the forest
- **Yabbies of Yore** - The Cretaceous crayfish of Victoria
- **Hailstones of Glass** - Tracing the origin of Australasian tektites
- **Lost Serengeti of the Sea** - The marine megafauna of Beaumaris

EDITORIAL

An unexpected letter arrived in the mail in June this year. Posted from Broome, WA, the letter detailed the concern held by a group of local residents for the future of dinosaur tracks along the shoreline north of their town. A portion of the area containing the tracks had been flagged for industrial development and the letter pleaded for support in obtaining Natural Heritage listing for the trackways.

While it is not the role of Australian Age of Dinosaurs to become embroiled in controversy, the letter did tug at our heartstrings. The protection of Australian natural heritage is, in effect, the core business of AAOD and although we were not closely associated with the Broome dinosaur tracks, we were well aware of their significance. It was impossible to ignore and a letter to the Australian Heritage Council requesting that protection of this natural phenomenon be considered was soon on its way.

Although a story on the dinosaurs of Broome wasn't planned for this year's journal, the whole situation made me think. Located on the northern coastline of Western Australia, Broome is a long way from anywhere and, in spite of the significance of the dinosaur tracks,

very few Australians know much about them. If they were on the east coast they would doubtless be a national icon – a major tourist attraction with palaeontologists crawling all over them. But Broome! Way out in the middle of nowhere?

It took no time to boil the whole thing down to two simple questions: Does isolation lessen significance? Does ignorance equal irrelevance? The answer to both was obvious. We concluded that although there might not be much we could do about the isolation of Broome's dinosaurs, there was certainly something we could do about our ignorance of them. With that decision behind us, we set about planning how we might get this story together in time to beat the publishing deadline of *Australian Age of Dinosaurs*.

As soon as we delved into the history of the Broome tracks, I realised how little I knew about so much. Although I was aware that they had formed part of the Aboriginal people's Dreamtime Stories for (possibly) many thousands of years, I was amazed to learn just how much scientific work had been done on them. I had no idea that there were so many tracks of so many different kinds of dinosaurs – or that each track was woven into the context of so many different palaeo environments. It quickly became evident that what I believed was an artefact of national importance was in fact an icon of international significance. And yet the average person knows very little about it ...



AUSTRALIAN
AGE OF DINOSAURS
WINTON Q.

For me, covering the Broome story has been an eye opener, and it joins a fascinating range of topics in this year's journal – from the humble 105-million-year-old yabby fossils of Victoria to a cataclysmic event in south-east Asia that caused a glass hailstorm to rain on our continent 800,000 years ago. The articles are engaging, informative and interesting – in many cases representing the scientific research of very dedicated people including palaeontologists, students, geologists, botanists and everything in between. Some are famous for their work, others virtually unknown – it simply doesn't matter. What does matter is that their research is understood and appreciated by everyday people because without this acceptance much of it could well be futile. It is imperative that we, as a nation, acknowledge their science and its relevance to our natural history because only then will we be able to truly devote our energies to preserving it. We may not always be able to change things for the better, but there is no excuse for not trying!

David Elliott



OUR COVER

A large sauropod dinosaur leaves its footprints across the mud flats of an intertidal zone on the edge of the ancient continent Gondwana. Tracks made by these Early Cretaceous giants 130 million years ago are preserved in what is now the Broome Sandstone of the Dampier Peninsula in Western Australia.

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Typesetting and Design by
Action Graphics
17 McCosker Drive, Dalveen, Qld 4374
Email: info@action-graphics.com.au
Ph: (07) 4685 2266

Printed by **APN Print**,
Kenilworth Street, Warwick, Qld 4370
Published January 2012

Australian Age of Dinosaurs Limited:

Chairman – David Elliott

Directors – Bruce Collins, Scott Hocknull, David Strang, Bill Wavish, Ailsa Leacy, Ed Warren, Carol Trewick

Secretary – Judy Elliott

Patron:

Her Excellency Ms Quentin Bryce AC, Governor-General of the Commonwealth of Australia

Acknowledgements

Front cover: Laurie Beirne

Blacksoil: Susannah Thomsett, Jenny McPhee, Dr Alex Cook, Dr Scott Bryan, James Greentree, Maree Corkeron, Dr Tom Rich, Prof Pat Vickers-Rich, Jenni Brammall

Diary of an Australian Dream: David Elliott, Judy Elliott, Carol Trewick, Grant Hansen, Trish Sloan, Leith Wavish, Doug Miller, Dr Brant Bassam, Travis Tischler

Features: Maria Zammit, Joanne Wilkinson, Prof Anthony J. Martin, Peter Haines, Dr Erich Fitzgerald (see articles for further acknowledgements)

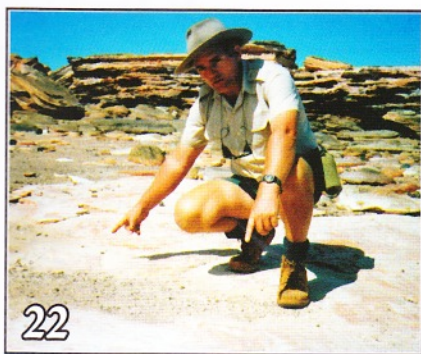
Palaeo-Profile: Robyn Molan

Science Behind the Scenes: Dr Steve Poropat

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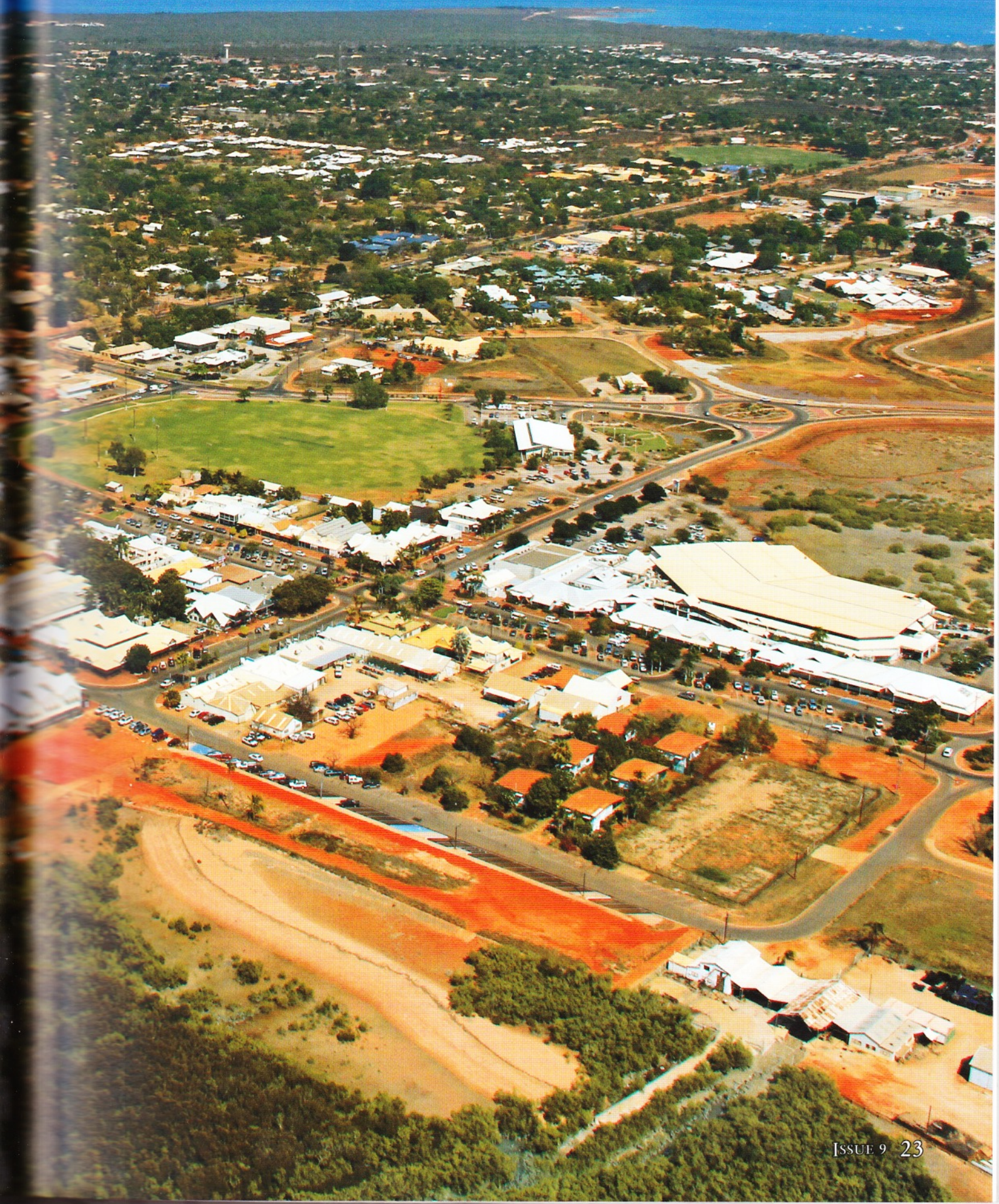
Tracks below the

Story compiled by
Maria Zammit and David Elliott

Situated on the far north-western coastline of Western Australia, Broome is famous for its 120-year role in the pearling industry. Proudly producing the world's finest pearls, this small, multicultural community continues to uphold its traditions, and pearling remains one of the town's major industries. Today, other industries such as tourism play a role in sustaining the town and its inhabitants. The discovery of widespread dinosaur footprints over the past 25 years has helped to create a significant tourism drawcard, earning Broome the title 'Gateway to Australia's Dinosaur Coast'.

Photo © Julia Rau

Tide



Walking along the shoreline of Western Australia's Dampier Peninsula in the late afternoon, you cannot fail to notice the total tranquillity of a pristine wilderness. To the west the sun dips onto a turquoise sea, its final rays rebounding off blood-red banks that fringe the coastline like broken walls of an ancient fortress. Below them, a weathered sandstone outcrop tumbles out into the sea, disappearing and then reappearing in the ebb and flow of a rising tide.

In the *Bugardagara* (the Dreaming) a Creation Spirit 'Marrala' the Emu Man, walked these shores, creating the land as he meandered along the coastline. Marrala travelled the Song-cycle, bringing the creation stories, ceremonies, laws and rituals, and the understanding of right and wrong to the Aboriginal people.

Legend has it that at Minyirr (now known as Gantheaume Point), Marrala encountered seven Naji Women – Yinara and her six daughters – who were spirits of the sea. Yinara had forbidden her daughters to watch anyone on the land, but they disobeyed and watched the Emu Man. When Marrala reached out to touch them, Yinara turned herself and her daughters to stone. The seven stone pillars are now known as Yinara, and at Gantheaume Point, Marrala's three-toed tracks can still be seen on the rocky platform of the beach. The local Aboriginal people still sing a song about Marrala's experience with the Naji Women.

Marrala's three-toed footprints hold a very special place in Aboriginal Dreaming, but it wasn't until after the turn of the 20th century that their presence became known by the broader community. The earliest record of the footprints suggests that they were discovered by girl scouts who encountered them when exploring Gantheaume Point in the mid 1930s. In 1945 a short article, which included a photo of a plaster cast, was published in *The Western Australian* newspaper. The article reported that the cast – evidence of a dinosaur from Broome – had arrived at the Western Australian Museum for scientific study.

The first scientific study of the Broome tracks (albeit a very basic one) was carried out by Ludwig Glauert, Curator of the Western Australian Museum in the late 1940s after being sent the cast of a footprint. Although Glauert was unable to visit the site, he managed to glean enough information from reports and drawings provided by Broome locals to ascertain that dinosaur footprints were present



in the area. Glauert consequently published a brief report in which he identified the track maker as a tri-dactyl (three-toed) dinosaur, and suggested that it was either Cretaceous or Jurassic in age.

In 1964, Professor Edwin (Ned) Colbert, then one of the world's foremost scientific authorities on dinosaurs, visited Australia. At the time very little dinosaur material had been discovered in Australia, so he had visited specifically with the intention of finding some. Following a lack of success along the east coast, Colbert eventually ended up in Perth where he met with Western Australian Museum palaeontologist Duncan Merrilees. In the absence of dinosaur bones, he decided to settle instead for dinosaur footprints and, joining forces with Merrilees, planned a detailed study of

the dinosaur tracks at Broome.

Flying into Broome in late May, Colbert and Merrilees commenced a hectic field trip measuring, photographing, and casting the fossil prints at Gantheaume Point and nearby Riddell Beach. They soon identified a couple of trackways headed in different directions which suggested two-way traffic rather than a random scattering of footprints. The animals appeared to have been walking and so, in an attempt to determine their size, Colbert and Merrilees set about measuring individual prints and the distance between them.

Timing was critical as, of the 20 or so footprints they identified, many were found close to the low tide mark. The tidal range around the Broome area is one of the highest in the world and some tracks on the outer range of



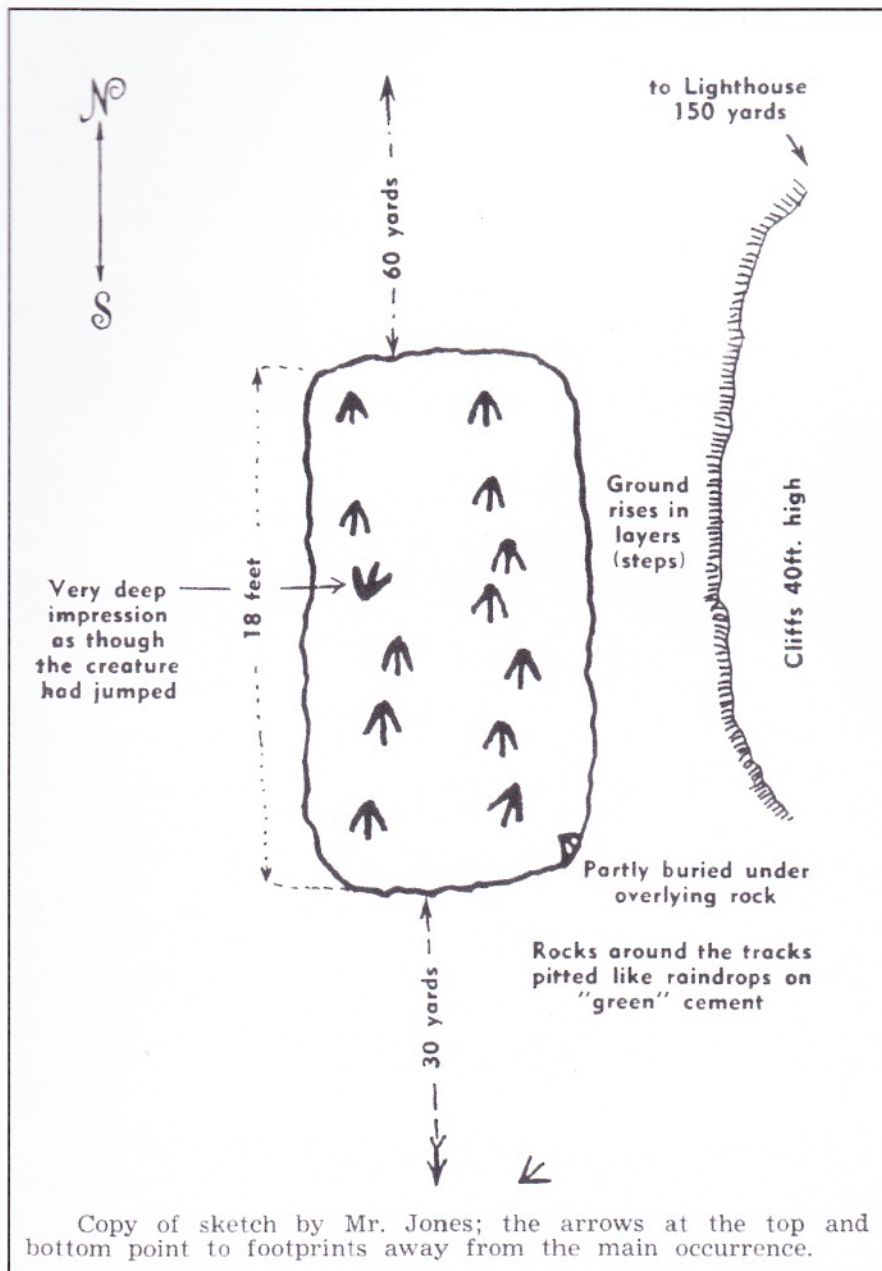
Louise Middleton walks in the footsteps of deep time as she follows the broken remains of a huge sauropod trackway (above). Dinosaur tracks are widespread throughout the weathered outcrops of Broome sandstone, with new discoveries of footprints being made on a regular basis. Sites containing tracks have been found over a distance of 200km along Broome's isolated coastline with at least 16 different types of tracks now having been identified.

Photo Nigel Clarke

the shore platform are only exposed for a very short period of time each month. Drawing on the local knowledge of Broome residents, Colbert and Merrilees discovered that some of the better tracks they wished to replicate would be out of water for about one hour on the day of an extreme spring tide, meaning that making casts of them would require precision timing and a disciplined approach. Enlisting the support of local Broome residents John and Edgar Tapper, Mo Gower and Edgar Truslove, they selected the tracks to be copied and devised a fast and efficient scheme to ensure that they could be cast as quickly as possible. On the due day, a frenzied 45-minute window of opportunity saw the hurried location of the designated tracks, which were then dried and cast with a quick setting mould-

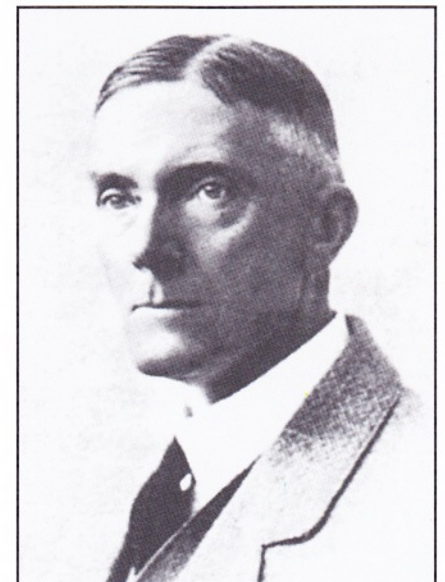
ing compound commonly used in dentistry. This process proved to be very successful, and the team managed to cast and retrieve the moulds from three tracks at Gantheaume Point and one track at nearby Riddell Beach before the tide returned to reclaim them.

By comparing the 37cm long, three-toed footprints with the foot structure of known dinosaurs, Colbert and Merrilees concluded that the tracks from Gantheaume Point and Riddell Beach were consistent with that of a theropod dinosaur similar to *Allosaurus* or *Megalosaurus* – the foot measurements suggesting that they belonged to an animal five to six metres long. A new ichno-name, *Megalosauropus broomensis* meaning 'Megalosaurus-like foot from Broome', was consequently assigned



The first scientific study of the Broome tracks was carried out in the late 1940s by Ludwig Glauert, Curator of the Western Australian Museum (below). Unable to visit the site, Glauert relied on information sent to him by a Broome resident, including the drawing (left). He consequently published a brief report in 1952 where he identified the track maker as a tridactyl (three-toed) dinosaur.

Images courtesy Trustees of the Western Australian Museum



to the tracks and published in 1967. Although this name refers to the footprints and not the animal that made them, *Megalosauropus broomensis* was the only fossil evidence of dinosaurs in the entire western half of the continent for a further 25 years.

It wasn't until the late 1980s that Paul Foulkes, a Broome resident with an avid interest in the dinosaur footprints, started searching further afield. Working closely with the local Aboriginal people, Foulkes began to accumulate a comprehensive knowledge of the coastline north of Broome, and eventually recorded numerous places where dinosaur tracks were present. Extending his search far beyond Gantheaume Point, he discovered footprints along the western coast of the Dampier Peninsula to beyond James Price Point – a distance of about 80km. He was the first person to recognise that strange rounded pads through the

Cretaceous sandstone were actually sauropod tracks, and went on to record numerous different footprint types. Foulkes' dedication to this task is inspirational, particularly when one considers that he had no formal geological training and often worked alone among a lethal assortment of estuarine animals, such as the occasional saltwater crocodile, sea snakes, sharks and shoals of near-invisible toxic jellyfish that visit the coast near Broome.

Late in 1989, Foulkes sent photos of his discoveries to Dr John Long, Curator of Geology at the Western Australian Museum. Although working within the confines of a tight budget, Long managed to scrape up money for a week of fieldwork, and in mid-1990 arrived at Broome to document the new tracks with Foulkes and his colleagues Louise Middleton and John Martin. Long was astounded at the quantity and variety of the

dinosaur footprints discovered by Foulkes, and set about photographing, measuring and recording them. As with Colbert and Merriells, they had to time their visits with the tides, relying on the lowest tide at the right time of day to be able to find the prints. Photographs, measurements and casts had to be taken very quickly, and Long was constantly challenged to make latex peels of the tracks that would dry sufficiently before the return of the incoming tide. One experiment he tried was to use a waterproof silicon roof sealant to mould the tracks – an idea that worked well enough although the subsequent print was considered poor quality. Another problem they encountered was the lack of time available for good quality photography of the tracks. Although the best time to photograph them is when the sun is low and shadows highlight the tracks, this is not possible in the



Photo Nigel Clarke

In May 1964, Professor Ned Colbert and Western Australian Museum palaeontologist Duncan Merrilees began a detailed study of the dinosaur tracks at Broome. Identifying the tracks of a large theropod dinosaur at nearby Gantheaume Point (above), Colbert and Merrilees set about obtaining casts of the footprints, some of which were only visible during low tide. Enlisting the support of Broome locals and racing the incoming tide, Colbert and Merrilees managed to cast three tracks at Gantheaume Point and one track at nearby Riddell Beach (right) before the tide returned to reclaim them.



Colbert, E. H. 1980. *A Fossil Hunters Notebook. My Life with Dinosaurs and other Friends*. E.P. Dutton & Co. N.Y.