The Lark Quarry dinosaur trackways stampede

95 million years ago where Lark Quarry is now was part of a great river plain, with sandy channels, swamps and lakes brimming with freshwater mussels, lungfish and crocodiles. Rainfall was over a metre per year. The surrounding lowland forest featured tree ferns, ginkgos, conifers and early flowering plants.

The site where the dinosaur footprints were found was once a stream bed leading into a lake. The water level had dropped, exposing a patch of half dried and still plastic mud, and this area retained the dinosaur footprints.

The tracks have been preserved because it rained just a few days after they were made. Sun, wind and rain destroy most tracks. Lark Quarry's trackways were fossilised because the lake rose gently and covered them with sandy sediments before the mud had dried enough to crack. The next flood buried them below a meter of sand and a meter of mud. Over time, more sediment was laid down.

As millions of years passed, the sediment layers were compressed to form rock and a low range eventually formed. The forces of erosion, wind, water temperature and gravity, cut a western edge in the range. As the edge of the range receded, isolated hills were left. One of these hills contained the trackways and further exaction might revel the beginning of the trackways, still buried under the range to the west.

Lark Quarry's fossilised dinosaur trackways are evidence of a life and death drama played out on this very spot.

Reading the trackways

Earlier that day, some 95 million years ago, a large two-legged ornithopod, about half the size of *Muttaburrasaurus*, came to the lake edge to drink, leaving prints in the mud.

Later herds of small two-legged dinosaurs came to drink at the lake. There were at least 150 dinosaurs of two different kinds - carnivorous coelurosaurs about the size of chickens, and slightly larger plant-eating ornithopods, some of them as large as emus.

The ornithopods were herbivores and moved in herds. The coelurosaurs were small, predatory dinosaurs, but too small to be dangerous to the ornithopods. They probably ate eggs, insects, and even some plants when hungry enough.

A huge meat-eating theropod, smaller than a *Tyrannosaurus,* approached the lake. It slowed, saw the other dinosaurs gathered at the water's edge and began to stalk, then turned and charged. The stampeding herd of smaller dinosaurs left a chaotic mass of footprints in the mud as they ran to escape.

How were the trackways discovered?

In the 1960s station manager Glen Seymour showed local expert Peter Knowles what he thought were fossilised bird tracks found at this site near an opal digging. Glen thought Peter was "pulling his leg" when he told him they were dinosaur tracks.

In 1971 scientists from the Queensland Museum and British Museum of Natural History were in the region looking for

Cretaceous mammals. Knowing Peter's interest in fossils, they approached him. He couldn't help them with mammals but showed them the dinosaur tracks.

The scientists traced the sediment layer the tracks were found in across to a second hill farther west. They predicted there would be more tracks at the same level, and sure enough, they were right!

In 1976-7 a team of volunteers led by Queensland Museum and the University of Queensland's palaeontologists spent 18 months removing part of the hill to expose the trackways layer. The site was very remote, the road a mere track, and camping conditions tough.

The site was named Lark Quarry after Malcolm Lark, one of the volunteers who removed more rock than anyone else. 60 tonnes of rock was removed from and area of 210 sq m. The trackways containing some 3300 footprints were cleaned, photographed and a latex mould was cast.

A few years later the trackways were sheltered by a roof built by Queensland Parks and Wildlife Service. But water runoff, dust, temperature and humidity fluctuations, wildlife and people continued to damage the trackways.

Paleontologists from Queensland Museum raised concerns about the possible loss of the trackways unless action was taken to stabilise and protect them from further deterioration. The new sustainably designed conservation building, funded by Queensland Heritage Trails Network, was erected in 2002.

How do they know it was a stampede?

Although other dinosaur trackways are known around the world, the Lark Quarry site is among those with the largest trackways of dinosaurs all doing the same thing. Once the scientists knew what dinosaurs made the tracks, how many there were and how fast they were moving, they were able figure out what actually happened here.

The big theropod's tracks initially show it walking across the mudflat with slow, measured steps at about 8-9 km/hr. After the fourth step, it slows, perhaps spotting the smaller dinosaurs by the water's edge. The stride becomes shorter, and its foot pad impressions disappear as it moves forward on tiptoe for another five steps then turns to the right. This suggests it saw the herd and tried to head them off. It took one more step and then the tracks are lost.

The little dinosaurs all ran in the same direction at the same time, 55 degrees east north east back across the mudflat, their tracks crossing those left early by the big theropod. It is a good guess that they stampeded to get away. Why did they run towards the theropod?

The small dinosaurs, seeing, hearing or smelling the theropod, may have retreated down the muddy spit. The theropod charged, and trapped against the water, the smaller dinosaurs panicked and turned. One group ran along the bank, while the other group escaped along the mudflat.

Was one caught in the lake shallows? We can't tell because the lake edge has eroded away. But we do know the others kept running for dear life.

Lark Quarry Conservation Park and Dinosaur Trackways are jointly managed by Winton Shire Council and Queensland Parks and Wildlife Service. Queensland Museum provides ongoing trackways scientific advice.