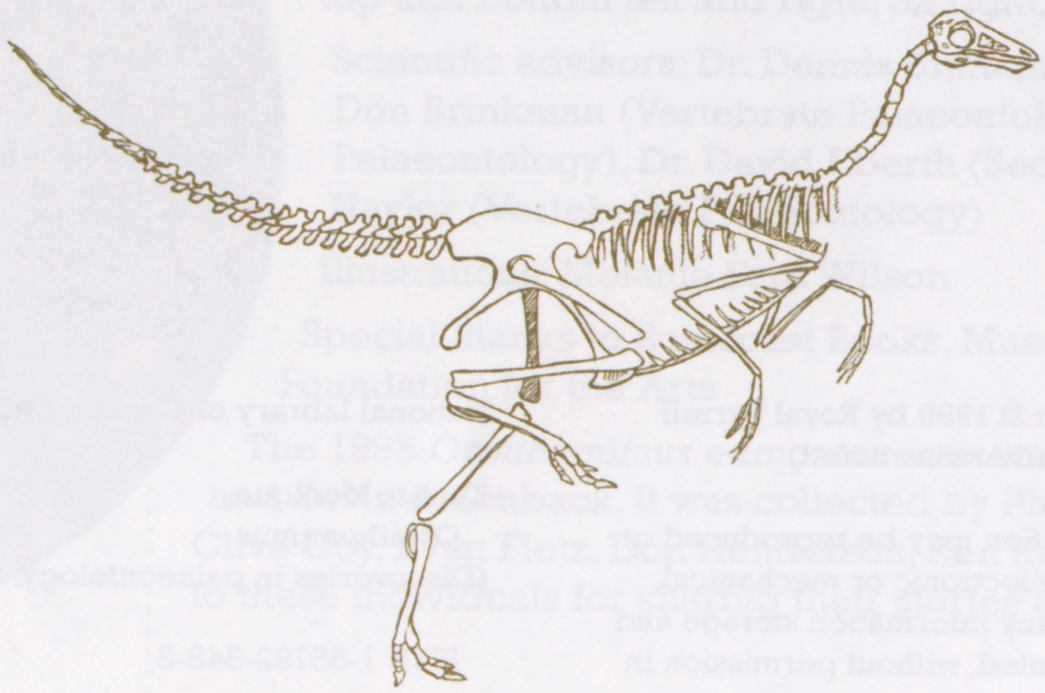
Discoveries in Palaeontology

# ORNITHOMIMUS

## Pursuing the Bird-Mimic Dinosaur



MONIQUE KEIRAN

ROYAL TYRRELL MUSEUM

RAINCOAST BOOKS

*Vancouver*

# 1. Discovery

## Dinosaur Fossil Grounds

**Dinosaur Provincial Park** is so rich in **fossils** that in some places a person cannot walk without stepping on dinosaur bones.

With every rainfall and snowmelt, the remains of ancient animals are brought to light in the badlands that twist through Alberta's Red Deer River valley. The 76-million-year-old fossils emerge from hills and coulees as the ground is washed away.

Every year, scientists discover and collect **specimens** in the park that are the envy of museums and research facilities around the world.

**With every rainfall, dinosaur bones emerge from the hillsides and coulees of Dinosaur Provincial Park.**

Dinosaur Provincial Park is famous for fossils of dinosaurs that lived 74 to 76 million years ago, during the Late **Cretaceous** period. More than 40 dinosaur **species** have been discovered there in the 100 years since **palaeontologists** first came to the area. Of these discoveries, almost 500 are complete or nearly complete skeletons. This is an astonishing number — most dinosaur fossils found elsewhere are single bones, parts of bones or jumbled bones of many animals.

Because of the variety, number and quality of preservation of bones found there, many palaeontologists believe the park to be the best dinosaur-fossil site in the world.

However, Dinosaur Provincial Park, so rich in dinosaur bones, is poor in other fossils. It has scant record of what many dinosaurs ate. Plant fossils such as leaves, seeds and twigs are rare in the park, the result of an environment that did not preserve delicate plant material, but protected heavier, more durable bones.

The park is especially poor in fossils of flowering plants.

That's why Kirk Johnson's discovery one summer day in 1993 is all the more amazing.

A plant palaeontologist from Colorado's Denver Museum of Natural History, Johnson was hiking through the park as part of a field tour. From the road that winds through the park's restricted zone, he recognized a layer of greenish grey rock in a nearby hill. In the badlands of Montana where he spends summers

collecting plant fossils, this kind of shale often contains remains of ancient plants.

Curious to see if this was the case in Dinosaur Provincial Park, Johnson investigated.

In the rocky hillside, as expected, he discovered the fossil of a single, perfect leaf from a plant that had grown and flowered there 76 million years ago.

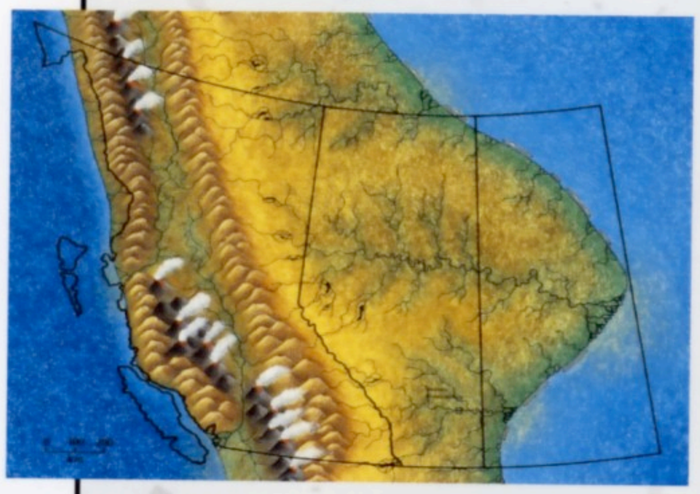
He dug into the hillside. Impressions of gingko leaves, sycamore leaves and even fossilized seeds came to light.

Prompted by Johnson's discovery, palaeontologist Dennis Braman surveyed the site further. Braman is curator of ancient plants at the Royal Tyrrell Museum of Palaeontology, located 80 kilometres upriver in Drumheller, Alberta, and home to many of the fossils discovered in the park. He found a treasure trove of plant fossils. Their abundance and preservation promised discovery of previously unknown kinds of Late Cretaceous flowering plants, as well as extraordinary display specimens for the museum.

**Johnson (left) and Braman found many leaf impressions of Late Cretaceous flowering plants (top left) in the fossil bed, as well as remains of other kinds of plants, such as ginkoes (top right) and sequoia-like conifers (fossil of cone, bottom right).**



# Ancient Worlds Beneath Our Feet



**Drifting continents, receding sea levels and four recurring ice ages have changed the look of western North America in the 75 million years since dinosaurs lived here.**

**French explorers travelling through South Dakota in the 18th century called the twisting, eroded landscape of the region's river valleys *les mauvaises terres à traverser* — bad lands to travel through — leading to today's term "badlands."**

Today's landscapes are built on the remains of ancient environments. Dinosaur Provincial Park is made of remnants of a vast, 74-million- to 76-million-year-old coastal plain. As sand, silt and mud washed down from western highlands toward the sea, layers of **sediment** formed and reformed on the plain, covering and uncovering bodies of dead dinosaurs, tree trunks and other debris. Millions of years passed and hundreds of metres of sediment piled up, pressing down to turn the layers into the sandstone, siltstone and mudstone we see today.

Cut and eroded by water and wind, the rocks provide scientists with a picture of what the area was like when dinosaurs made their homes there.

Soils made of ancient sediments supported complex systems of life. Stands of trees sheltering ferns, horsetails and early flowering plants dotted a warm, temperate landscape of marshes, streams and open plains. There were only two seasons in a year — hot and humid, and cool and drier.

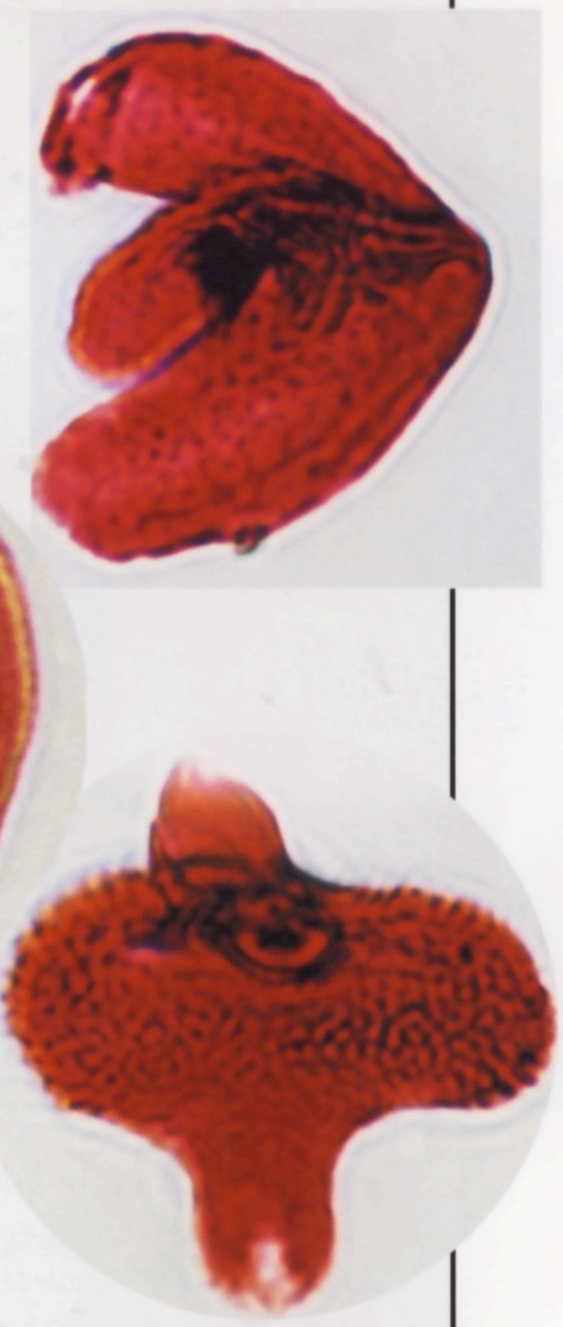
Flying reptiles and **birds** nested in trees or hid in bushes. Small **mammals** scurried about, searching for seeds, fruits and insects. Turtles and crocodiles lived along the banks of streams and ponds.

This was the dinosaurs' world. Horned and duck-billed dinosaurs grazed and browsed on plants, watching for hungry **tyrannosaurs** [tigh-RAN-oh-sors]. Smaller dinosaurs such as ***Troodon*** [TROH-oh-don], ***Dromaeosaurus*** [DROH-mee-oh-SOR-us] and ***Ornithomimus*** [orn-ITH-oh-MIGH-mus] hunted smaller **prey**. Armoured **ankylosaurs** (an-KIGH-loh-sors) kept to high ground.

We know these animals once lived in the park because we find their teeth and bones in the rocks that form its hills and valley walls. We know the area supported diverse and abundant plant life because the animals could not have survived without plants to feed on or to find shelter among. Evidence comes from a coal seam found near the top of the valley walls, from petrified wood entombed in the rock, and from the fossil **pollens** and **spores** that Dennis Braman, **palynologist** at the Royal Tyrrell Museum of Palaeontology, isolates from the park's sediments.

Braman has found approximately 300 kinds of these tiny fossils. Only 50 of them can be linked to modern plant families, leaving scientists searching for other ways to identify the plants. Often, the only way to establish exactly what plants existed in a place millions of years ago is to find their fossilized leaves, needles, seeds and twigs.

The discovery on the hillside in Dinosaur Provincial Park was significant — it could provide important new information about the different environments in which Alberta's dinosaurs lived.



**Pollens and spores are tiny capsules of genetic information plants make and use to reproduce. They are almost indestructible in environments such as rivers, streams and swamps: their outer casings are fortresses against time, water and the pressure of millions of tonnes of rock. By analyzing small samples of sedimentary rocks, Braman (below) can identify thousands of fossilized pollens and spores.**

## Bird-Mimic Chronicles:

# Hunting

The clamour of just-awakened birds announced the coming day. As the sky paled, hundreds of birds darted through the air, their wing beats flashing on the pond's silver surface.

At daybreak, land, sky and water came alive.

The young dinosaur snapped at a passing fly and halted, listening for threatening sounds and watching for danger in the half-light. Although almost full-grown, it was the first time he had ventured so far from his family. He resumed picking his way through the horsetails and ferns toward the pond's edge, planting each step carefully and quietly.

Rings of ripples shivered across the water where fish surfaced to harvest the early-morning flurry of insects.

A sudden shaking in the brush caught the dinosaur's attention. He froze. The movement stopped. Alert, he watched, slowly extending his long neck toward it.

There, again. Something was darting through the ferns and horsetails — something small and quick. Plant stems rustled against each other, then stopped.

The dinosaur pinpointed the spot. He tensed and crouched close to the ground, watching, waiting, listening …

There! A tiny quivering, right there! In a lightning-quick burst, the young dinosaur pounced, slamming his long, three-fingered hands onto the ground where the animal should be.

Almost! His fingers brushed a tiny, furred, fleeing leg. The dinosaur gave chase, jabbing at the creature with hungry mouth and hands. His jaws snapped, but again he missed, feeling the skinny tail flick his chin as the animal disappeared down a hole and into the damp soil.

The young dinosaur slid to a stop. Head cocked, he peered through the ferns at the hole, trying to see the snack hiding within. Frustrated, he poked at the tiny hole with his long, straight claws; he rarely caught these creatures — time and again, they dashed down holes or into tangled undergrowth out of his reach.

A soft squawk sounded behind him. Turning, he saw his sister approach, her hide gleaming in the growing light. He bobbed his head at her and, leaving his unreachable prey, resumed his careful approach to the pond. Together, they trod the muddy, weed-covered shore, peering into the water for frogs or small fish to grab and gulp down.

A light, early-morning breeze sprang up, wafting across the water toward them. A gnarled log drifted slowly from the far edge of the pond.

Splashing into the shallow water, his sister thrust her head in and pulled out the limp body of a dead fish caught among the floating plants near the bank. The young dinosaur tried to grab it from her. Swiping him with her claws, she stumbled into deeper water. The young dinosaur started after.

Suddenly, the drifting "log" rose out of the water and lunged at the female, jaws wide.

She shrieked, dropping the fish. The jaws of the crocodile snapped around her small body, and she disappeared under the thrashing water, her cries drowned in blood, foam and bubbles.

The young dinosaur leapt up the bank, calling in alarm.

**Perched on the side of the hill, 100 metres above the valley floor, the crew had to dig through four metres of rock to get to the layer containing the plant fossils.**

## July 1995

Before Braman and his field crew could collect the plant fossils, the hillside above the layer of rock in which the leaves were preserved had to be removed. Technicians Kevin Aulenback and Jean Thompson hauled a jackhammer to the site and began cutting into the hill.

It took three long, hard days of digging and shovelling for Braman and the technicians to remove rock down to a level near the plant impressions.

Early on the fourth morning — July 12 — Aulenback was operating the jackhammer. Suddenly, Thompson noticed brown dust spilling out of the hole around the jackhammer bit.

She grabbed a rock fragment, looked at it, and then jumped up.

"Kevin! Stop!" she shouted. "Bone! You're hitting dinosaur bone!"

Aulenback stopped the jackhammer, and silence descended on the **quarry**.

"You're hitting dinosaur bone!"

He bent down to examine a rock slab that had broken loose.

Sticking out of two sides were pieces of the neck bones of a small **theropod** — a hollow-boned, meat-eating dinosaur.

"Oops. It's **articulated.**"

Articulated dinosaur skeletons — skeletons with the bones positioned as they had been when the animal was alive — are rare. Articulated skeletons of theropods are almost never found.

# Finding Dinosaurs

Palaeontologists search for new specimens by looking for fossils sticking out of the ground and for bone fragments washed short distances by rainfall. Trails of fragments are followed back to their sources.

By assessing what part of a skeleton is exposed and how it lies in the rock, palaeontologists estimate how much more may be present.

Sometimes, fossil exposures lead to little. Sometimes, they lead to parts of skeletons. Very rarely, they are the first bones of complete, articulated skeletons that are found.

Dinosaur Provincial Park is famous for complete, articulated dinosaur skeletons, but, even there, fewer than 500 such fossils have been discovered in the past century.