

Dinosaurs in Mexico

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Mexico is a vast, colorful mosaic of rocks of different origins and ages, witnesses to the biological and geological events that occurred as they were forming. Some of the most outstanding studies of the different eras include the discovery of the fossils of mainland vertebrates, among them the dinosaurs of the Mesozoic era, in particular the Jurassic and Cretaceous periods. The importance of this type of fossil lies in their diversity, abundance and often excellent state of preservation, all of which makes

them key to reconstructing prehistoric environments and possible lines of origin, evolution and dissemination of the different animal groups that lived in our country in that era.¹

Until the late 1980s, paleo-geographic reconstructions of the upper Cretaceous period in North America, particularly of the Campanian-Maestrichtian ages (from 85 million to 65 million years ago, quite an important span of time), only included the southern United States and/or always depicted Mexico as covered by the sea.

Thanks to discoveries and the studies done since then in different states of Mexico, this idea has changed. Today, we can say that the

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The first dinosaur remains found in Mexico were discovered in 1926.

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Centrosaurus.



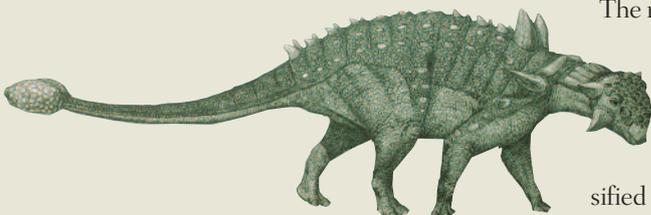
Fragments of large bones have been collected.

southeastern part of what is now the state of Coahuila was covered with broad expanses of shallow, salt-water bays linked to the prehistoric Sea of Tethys, and that dinosaurs, and the impressive flora and fauna that accompanied their existence on Earth, lived in the estuaries and islands in an environment that has now been dubbed the Cretaceous Beaches.

LOCALES OF THE JURASSIC PERIOD

Until now, no discoveries of dinosaur fossils from the Triassic period in Mexico have been reported. Finds dating from the Jurassic period, however, have been made in the Huizachal Canyon in Tamaulipas state: a few isolated teeth from Ornithischia (an order of Archosaurian reptiles made up of herbivorous dinosaurs, whose waist is similar to that of a bird), tentatively related to the Heterodontosaurids (considered the equivalent of pigs among mammals).²

The remains of another animal from the Saurischia dinosaur group (with a reptilian-type waist) have been classified as from a new species



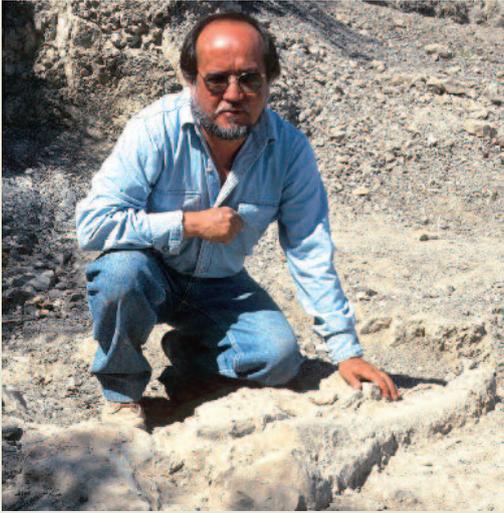
called *Mexicanum*, of the *Syntarsus* genus and *Coelophysoidea* family. It is a small carnivorous dinosaur with a slim body, averaging about 3 meters in length. Cranial matter from the *Ceratopsaurus* genus, *Abelisauridae* family, has also been identified. These were carnivorous dinosaurs about 7 meters in length.

The Huizachal Canyon area in Tamaulipas, discovered by Dr. James M. Clark in 1982, is very important for Mexico because it is there that the country's oldest remains of terrestrial vertebrates have been found, dating to approximately 180 million years ago, placing them in the latter part of the early Jurassic period.

Among these are the Tritylodontids, represented by the *Bocatherium mexicanum* genus, of the group of proto-mammals or mammal-like reptiles. In addition, at least five different taxa have been identified, that is, new groups of mammals.

Other vertebrates found are the Crocodylomorphs and at least three distinct types of Sphenodontians related to the Rhynchocephalians, two of them named *Cynospheonodon huizachalensis* and *Zapatodon ejidoensis*.

Another animal unearthed has been named the *Tamaulipasaurus morenoi*, which resembled today's Amphisbaenians, digging reptiles with very small eyes.



René Hernández participates in several paleontological digs.



Hadrosaur of the *Kritosaurus* genus prepared and pieced together in the IGLUNAM laboratory.

An important find was a flying reptile determined to be a new species of the genus *Dimorphodon*, which has been given the name *Weintraubi*. Its state of preservation was surprising since it was found in three dimensions, or “in bulk”, which is very rare since almost all Pterosaurs found have been crushed. Its anatomy, particularly the form of its foot, proves that flying reptiles or primitive Pterosaurs walked on four feet and not two as some authors suggest.

Paleo-ecological reconstruction of the area shows volcanic activity including eruptions, falling ash and mud slides, something rather similar to what happened a few years ago at the Chichonal volcano in the state of Chiapas. The animals, trapped by lava flows or the falling ash, were buried and at the same time preserved through a rather unusual process of fossilization almost unique in the preservation of vertebrates. This also explains why there are no examples of medium- to large-size animals and only small fossils have been located.

In Puebla, in the “red layers” near the town of San Felipe Ameyaltepec, fragments of large bones identified as from Sauropods have also been collected. The age of the rocks, however, is still a matter of debate. Also being researched are the quite fragmented dinosaur remains discovered in Chiapas in rocks from the Cretaceous period.

DINOSAURS FROM THE CRETACEOUS PERIOD

The first dinosaur remains found in Mexico were discovered in 1926. The remains of a Ceratopid (a dinosaur with horns on its face) were unearthed in a dig at Soledad, near Múzquiz in the state of Coahuila. Later, there were reports of the discovery of Hadrosaurs (literally large reptiles, better known as *picos de pato*) in Sonora (1942) and Baja California (1954) and Hadrosaurs and Ceratopids in Coahuila (1959).

During the 1980s and part of the 1990s, different research projects were launched to investigate the existence of dinosaurs from the Cretaceous period in Coahuila and Sonora.³

Paleo-ecological studies suggest that in Sonora the enormous herbivore dinosaurs, the Hadrosaurs and Ceratopids, must have needed enormous quantities of vegetation to survive and that the climate must have been hot, with abundant rainfall. The evidence from the kind of sedimentary rock formed by the Cabullona group reinforces this idea, given that they seem to have been deposited by vast lakes and rivers that covered the prehistoric landscape.

In late 1987, the UNAM Institute of Geology (IGLUNAM) formally began the study of dinosaurs of the Cretaceous period with a project called “First Mounting of a Dinosaur Gathered,



Prepared and Pieced Together in Mexico.” In spring 1988, 65 percent of a 7-meter-long dinosaur was gathered in the Presa San Antonio collective farm, or *ejido*, in Parras, Coahuila. It was then prepared and pieced together in the laboratory of the UNAM’s Institute of Geology museum. The dinosaur skeleton is now on exhibit at the museum’s Paleontology Room. Based on an examination of its extremities, it has been identified as a Hadrosaur of the *Kritosaurus* genus (a genus still under discussion because some paleontologists consider it identical to the *Gryptosaurus*). Curiously, the central metatarsus of its left hand are fused.

In the same excavation in which the *Kritosaurus* was discovered, parts of two other Lam-

beosaur-like dinosaurs (with crests on their heads) were gathered. These were identified mainly by their ischia, bones from their pelvic region.

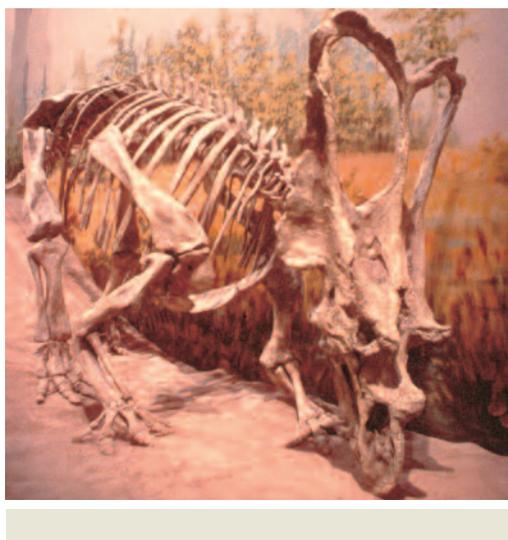
The IGLUNAM further supported the study of Mexican dinosaurs and in collaboration with the Coahuila state Education Ministry Paleontology Commission and the enthusiastic participation of renowned U.S. paleontologist Dr. James I. Kirkland, the year 1993 began with an ambitious project called “Prospecting, Recovery and Study of the Cretaceous Dinosaurs of Coahuila.” The study’s objectives are to discover the fossil potential of the state’s Cretaceous sediment, particularly for dinosaurs, in order to determine what type they are and disseminate the research results to the scientific community and the public in general through lectures, articles and books.

During the first excavations in February 1993, several important finds were made. Undoubtedly the best was the relocation of the fossil fields on the Rincón Colorado *ejido*.

Over a 40-square-kilometer area, almost 200 deposits of dinosaur fossils have been found. The most important, both in terms of quantity and their state of preservation, have been those spotted at the Hill of Our Lady, re-christened the Hill of the Dinosaurs. Some of the fossils even preserve the impression of the animal’s skin, and in other cases, the animal seems to have been mummified and then permineralized.

The largest group of dinosaurs found were the Hadrosaurs, both with and without crests, followed by the Ceratopids. Several Theropods, carnivorous dinosaurs of the same family as the Tyrannosaurs, Dromaeosaurs and Ornithomimids, have also been found, however. Among other the vertebrates gathered were fishes, particularly sharks and ray fish, crocodiles and tortoises.

Among the indirect evidence is a great quantity of fossilized excrement attributed to tortoises, crocodiles and dinosaurs. Footprints of at least two different groups, probably Theropods and Hadrosaurs, have also been unearthed.



Fossils found in different locations are important because of their diversity and excellent state of preservation.

The most abundant invertebrates found, the mollusks, belong to the genera *Ethmo-cardium* sp., *Inoceramus vanuxemi*, *Turritella vertibroides*, *Eutreohoceras* sp., and *Sphenodiscus* sp. The association of the *Inoceramus vanuxemi* and the *Sphenodiscus* indicate that they date from the late Campanian age, that is, that they lived 74 million years ago, a calculation based on the Geological Society of America's most recent time table.

A considerable quantity of fossilized fruit has also been gathered, including at least seven different types of fossilized plants related to palms, magnolias, birds of paradise, zingiberaceae and others now being studied.

The fossils have been discovered in what geologists call the Cerro del Pueblo Formation. Its sediments are composed of alternating layers of mudstone and sandstone of both dry-land and marine origin. They display plentiful marks showing ancient waves and hurricanes.

The environment in which the dinosaurs of southeastern Coahuila lived seems to have been a river delta. Some of the river's branches led into a salt-water lagoon connected to the sea, which explains finding dinosaurs, crocodiles, tortoises, fruit, leaves and marine invertebrates side by side. Sometimes the sea's influence was predominant, and sometimes, the land's: this explains the alternating layers of mudstone and sandstone.

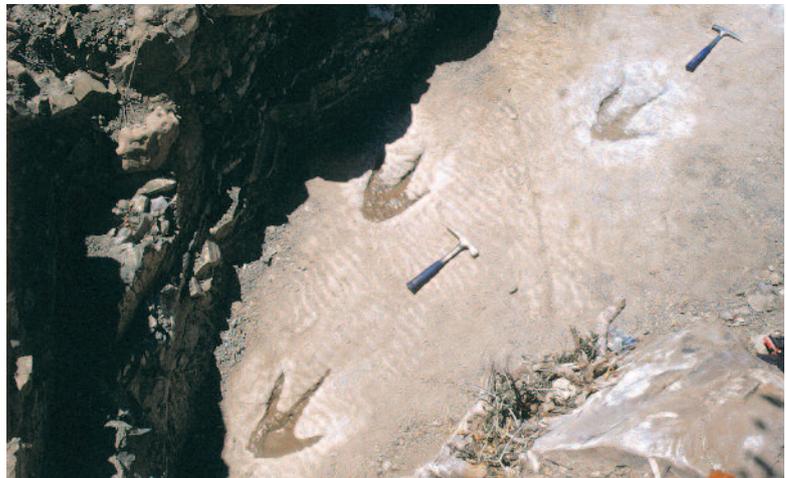
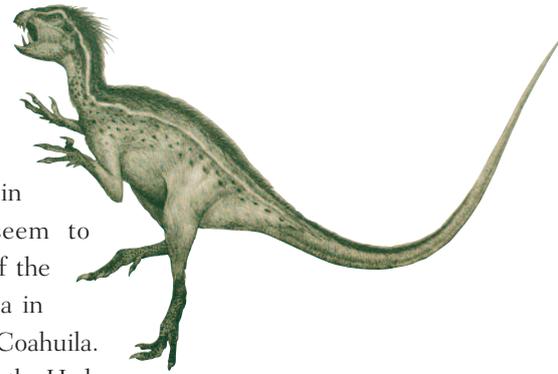
This location is considered enormously important for the late Cretaceous period because of its diversity, abundance and the excellent state of preservation of both the plant and animal fossils. It is probably unique in the world and has quite justly been nicknamed the "Cretaceous Beaches." In an analogy with today's sites, it would undoubtedly be similar to San Blas and Tobara in Nayarit or Morro de la Mancha or Coatzacoalcos in Veracruz.

Currently, research is underway to establish the distribution patterns of the Hadrosaur family during the upper Cretaceous in North America, taking into account that the Hadrosaurs were the most diverse and largest group of all the

dinosaurs: herbivorous Ornithomimids inhabited the Northern Hemisphere during the upper Cretaceous period, but they have also been documented in Argentina. These animals seem to have represented 75 percent of the total biomass of the local fauna in most cases, certainly of that of Coahuila.

In Chihuahua, dinosaurs from the Hadrosaur, Ceratopid, Ornithomimid and Tyrannosaur families have been discovered, as well as other materials currently under study.

The aim of this research project is to emphasize the provincial aspects of Hadrosaurs in a more detailed way, taking into account both the



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Recent studies of Mexican dinosaurs have begun to reveal the different species that lived here during the Mesozoic era.

geographical and physical context, that is the coastlines, climate, topographical and hydrographical barriers, biomass, etc., so as to be able to establish correlations between the different taxa and one or more characteristics of the environment.

DINOSAUR FOOTPRINTS

The study of dinosaur footprints and other vestiges is undoubtedly very important because it renders information that supplements that supplied by their bones, such as the speed at which they walked or ran; whether they were quadrupeds, bipeds, or combined both positions; whether they traveled in herds or alone; how they hunted; and many other characteristics. The problem with footprints, as well as droppings, is that it is very difficult to determine which genus and species of dinosaur produced them.

Dinosaur footprints discovered in Oaxaca have been attributed to Teropods and two families of Sauropods from the middle Jurassic period. In Michoacán, two families of Teropods and two of Ornithopods form the upper Jurassic period have been reported. And in Puebla, representatives of a family of Ornithopods and

another of Sauropods from the upper Cretaceous period have been found.

In Coahuila, footprints from the upper Cretaceous have been located in the Cerro del Pueblo Formation, attributed to Hadrosaurs and Teropods. Particularly outstanding are those spotted in February 1998 on the Rincón Colorado *ejido*, attributed to a Teropod.

These recent studies of Mexican dinosaurs have begun to reveal their diversity, the different kinds that lived in our country during the Mesozoic era; which were exclusive to Mexico, which came from elsewhere and how they were distributed. ■■■

NOTES

¹ For several years, the UNAM Institute of Geology (IGLUNAM), together with other institutions and researchers, has been developing projects on Mesozoic continental fauna, the results of which are given here, particularly the discoveries about the early Jurassic in Tamaulipas and the late Cretaceous in Coahuila.

² For example, the “tanks” of the Cretaceous were the Ankylosaurus, while rhinos are the equivalent of the Triceratopids.

³ Dr. Carlos González León has reported from the UNAM Institute of Geology IGLUNAM Northwest Regional Station in Sonora evidence of *pico de pato*, Ceratopids, Tyrannosaurs and Ornithomimids. The fossils were unearthed south of Naco, in rocks of the Cabullona group, dating from the late Cretaceous period (Santonian, early Maestrichtian), and are from 66 million to 74 million years old.