

A WHITMAN Learn About BOOK

ANIMALS of LONG AGO

Raymond Jones

59¢



An illustration of a large, dark green dinosaur with a lighter, yellowish-brown underbelly standing in shallow water. It is looking towards the right. In the background, there are three smaller dinosaurs of the same species, also in the water. The landscape is a flat, swampy area with some distant trees and a hazy, orange-tinted sky.

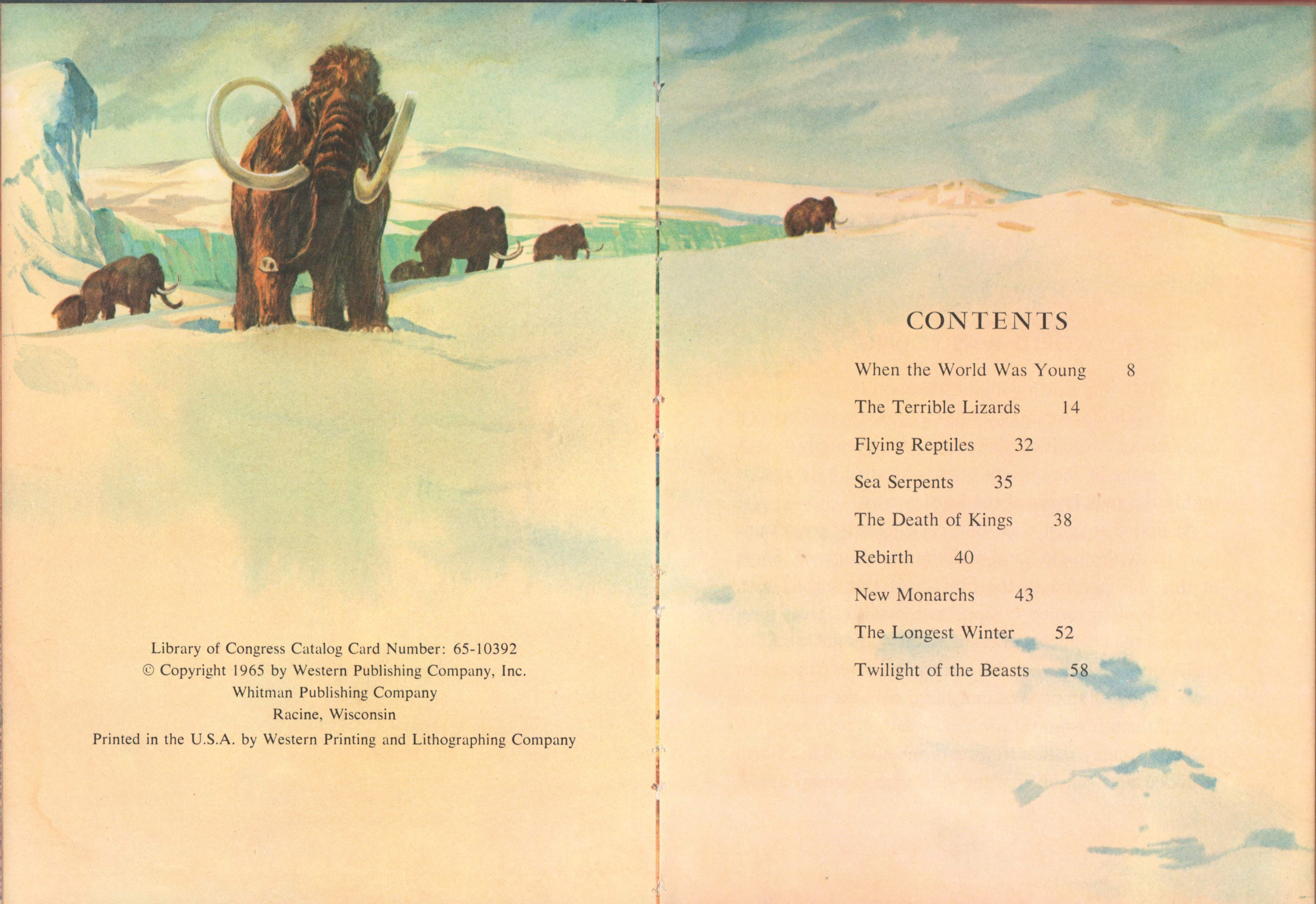
Animals of Long Ago

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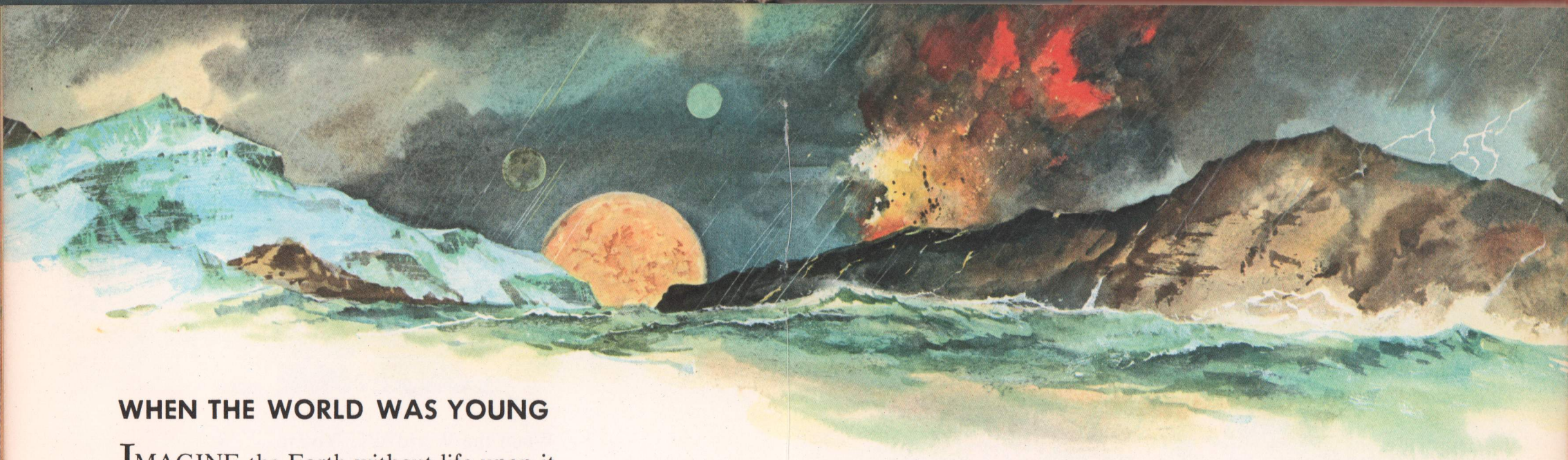
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CONTENTS

When the World Was Young	8
The Terrible Lizards	14
Flying Reptiles	32
Sea Serpents	35
The Death of Kings	38
Rebirth	40
New Monarchs	43
The Longest Winter	52
Twilight of the Beasts	58



WHEN THE WORLD WAS YOUNG

IMAGINE the Earth without life upon it.

For two billion years that was the way it was. Then, on a day about two billion years ago, life appeared.

The story of the ancient ones, who died long ago, is told in the rock layers of the Earth's crust.

At first that crust was solid rock. Slowly great rains wore away the rock. Sand and clay were formed. Some of this was carried to the bottom of the seas. There, slowly, it often turned to stone as a result of great pressure and the chemical action of water and minerals. The shells and skeletons of sea creatures were trapped in those layers of stone. We find these remains today, and we call them fossils.

During many millions of years the crust of the Earth wrinkled and shrank like the skin of a dried-up apple.

The wrinkles became great mountain ranges and valleys. Seas flooded the continents, then drew back. As the waters fell back, they left behind thick layers of sand and clay, and the remains of living things. Then land animals roamed the plains that once were seabeds, and their dead bodies remained where they fell. And once again the sea covered it all. Time after time this happened, and so great layers were built up.

These layers form a "stairway of time." We can see this stairway on the steep mountainsides of the Rockies, or in the eroded landscape of the Dakota Badlands, or in the great river gorges such as the Grand Canyon. In these layers we find clues to the life that ruled the Earth millions of years ago.

MESOZOIC

Triassic

205 to 165 Million Years Ago



The Age of Reptiles begins. Chart continues inside back cover.

Permian

230 to 205 Million Years Ago

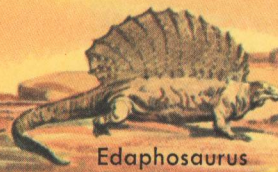
Sphenacodon



Dimetrodon



Edaphosaurus



Seymouria



Some of the amphibians disappeared completely. The reptiles appeared in great numbers, forerunners of the giant reptiles which would rule the Earth in the Mesozoic era.

Carboniferous

Pennsylvanian
Mississippian

280 to 230 Million Years Ago

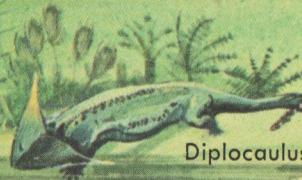
Eryops



Meganeuron



Diplocaulus



More amphibians appeared. Eryops spent most of its life on land. The first insects appeared. The first reptiles were found in the Pennsylvanian period.

Devonian

325 to 280 Million Years Ago



Spider

Lungfish



Eusthenopteron



Ichthyostega



Millipede



Scorpion



Fishes learned to breathe out of water, including the lungfish, and Eusthenopteron which moved from pool to pool on bony fins. The first amphibian, Ichthyostega, lived partly on land, partly in the water.

PALEOZOIC

Silurian

360 to 325 Million Years Ago

Jawless Fish



Sea Scorpion



Early Acanthodian

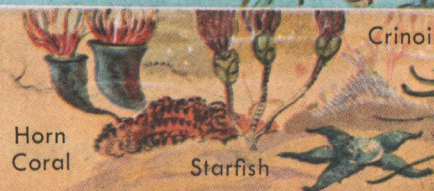


A new ruler appeared: the giant scorpion. Near the end of this period, fish developed jaws. They were the Acanthodians. Their numbers increased.

Ordovician

425 to 360 Million Years Ago

Horn Coral



Starfish

Crinoid



Giant Nautiloid

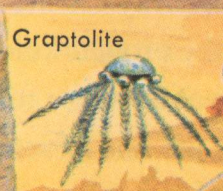
Coiled Nautiloid

Life continued in the sea. New king was the giant nautiloid. A few fish without jaws appeared. They were the first animals with internal skeletons, and they were few in number.

Cambrian

500 to 425 Million Years Ago

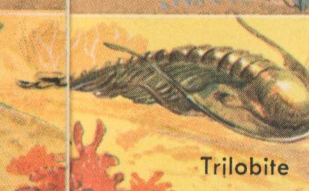
Graptolite



Glass Sponge



Trilobite



Jellyfish



Brachiopod



Life was probably found only in the sea, in all parts of the world. All animals were invertebrates—that is, did not have internal skeletons. King of the seas was the 3-inch trilobite.

PROTEROZOIC

Pre-Cambrian

From Earth's Beginning to 500 Million Years Ago



Life was limited to simple, one-celled and multiple-celled forms. Since these creatures were soft-bodied, like jellyfishes, there are few fossil remains. Only traces of carbon appear in the oldest rocks.

ARCHEOZOIC

AZOIC

You ask, How do we know the age of anything that old? There were no people to make clocks or calendars.

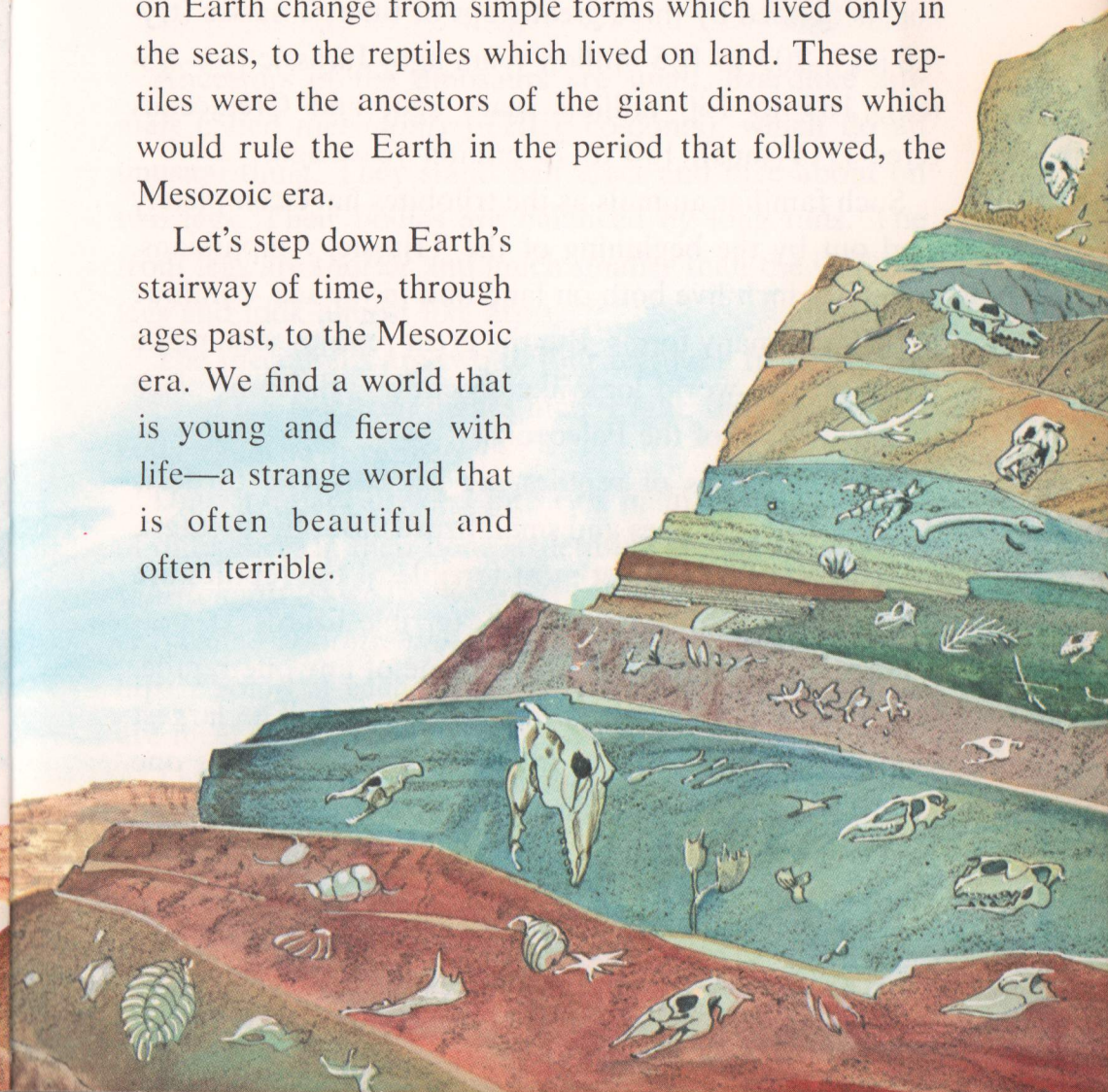
It is true, there were no people. But there *were* clocks and calendars. The Earth has a built-in clock. It is a pretty good timekeeper, considering the millions of years it has been running.

This clock is made up of radioactive elements which have been slowly decaying at a steady rate ever since the Earth was formed. Some of these elements are radium, uranium, and thorium. As they decay, they produce a certain kind of lead. By measuring the amount of lead and the amount of radioactive material remaining in a piece of rock, scientists can figure out the age of the rock.

In terms of hours or seconds these measurements are not very accurate. But they measure well enough the thousands of millions of years since Earth was born. The results of many such measurements, plus clues from astronomy, give the age of the Earth as about four to five billion years.

The steps of Earth's stairway have been given names by paleontologists (pay-lee-on-TOLL-o-jists), the men who study Earth's past. The time from the first layer until that layer in which we meet the great lizards, the animal giants of all time, is called the Paleozoic (pay-lee-o-ZO-ick) era. It lasted for 300 millions of years, and saw life on Earth change from simple forms which lived only in the seas, to the reptiles which lived on land. These reptiles were the ancestors of the giant dinosaurs which would rule the Earth in the period that followed, the Mesozoic era.

Let's step down Earth's stairway of time, through ages past, to the Mesozoic era. We find a world that is young and fierce with life—a strange world that is often beautiful and often terrible.



THE TERRIBLE LIZARDS

Triassic
205 to 165 Million Years Ago
Jurassic
165 to 130 Million Years Ago
Cretaceous
130 to 75 Million Years Ago

THE PALEOZOIC era is followed by the Mesozoic (mess-o-ZO-ick) era. This is sometimes called the Age of Reptiles, because these animals rule the land, the sea, and the air during the next 130 million years. The Mesozoic is divided by three great steps of time: Triassic (try-AS-ick), 205 to 165 million years ago; Jurassic (jur-AS-ick), 165 to 130 million years ago; and Cretaceous (cree-TAY-shus), 130 to 75 million years ago.

Such familiar animals as the trilobites have completely died out by the beginning of the Triassic. Amphibians, animals which live both on land and in the sea, continue to thrive in many forms. But the great reptiles soon make the Mesozoic world look like an entirely different place than the world of the Paleozoic.

Familiar forms of reptiles are present. The turtle is here, as well as snakes and small lizards. But the greatest, most wonderful, and yet most terrible of the reptiles are those known as dinosaurs—the “terrible lizards.”

The word *dinosaur* is not the name of any one reptile. It is a general name given to a large group. The largest dinosaurs are monsters of fifty tons or more, nearly one hundred feet in length. The smallest are little creatures, no bigger than a chicken and not really so “terrible.”

Tiny *Saltoposuchus* (salt-o-poe-SOOK-us), one of the thecodonts, appeared in Triassic times. He was to be the ancestor of giant dinosaurs hundreds of times his size.



Ancestors of the dinosaurs are small, lizardlike animals called *thecodonts* (THEE-co-donts), which do an unusual thing. They stand half erect and race about on two legs. Their bodies are balanced by long tails. The front legs are shorter and much smaller than the walking legs and look almost like arms.

The thecodonts are two to four feet long from nose to tail and ten to fifteen inches high. Light, thin bones help make them swift runners.

Dinosaurs are divided into two main groups because of differences in their bone structure. One group is called *saurischians* (sawr-ISS-kee-uns) or “lizard-hips.” The other is called *ornithischians* (or-ni-THISS-kee-uns) or “bird-hips.” Some of each group are plant eaters, and others are meat eaters.

The saurischians are the main group. Of these, *Compsognathus* (comp-SOG-nath-us) is one of the smallest dinosaurs known. He is something of a rascal. Running

swiftly and upright on two hind feet, he is no bigger than a chicken. He exists partly by stealing the eggs of larger creatures.

When we step up to Jurassic times we see that the flesh-eating saurischians have produced *Allosaurus* (al-lo-SAWR-us), one of the most terrible animals of all time. *Allosaurus* is thirty-four feet long from his nose to the tip of his tail. He stands upright and looks down from a height of fourteen to fifteen feet. His head alone is two and one half feet long. His teeth, with jagged edges, curve inward toward his throat. His lower jaw is hinged in such a way that he can open his mouth extremely wide to attack other animals or to swallow huge chunks of flesh.



Allosaurus
Jurassic Times

The fearsome teeth of the deinodonts gave this awesome group of meat eaters their name. The deinodonts lived in Cretaceous times.



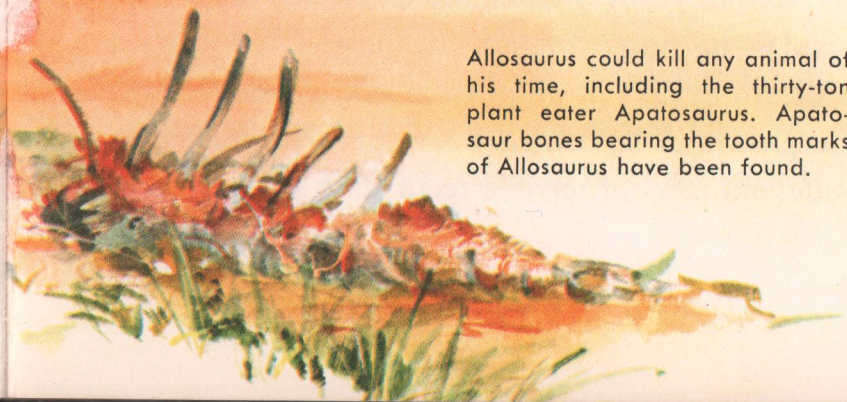
Allosaurus has a short career, however. He appears during the Jurassic and has died out by the end of the period.

During the Jurassic the climate is slowly warming and becoming more damp after the dry, icy ages that went before. Swampy jungle land returns. The great dinosaurs slosh through bogs and dense plant growth.

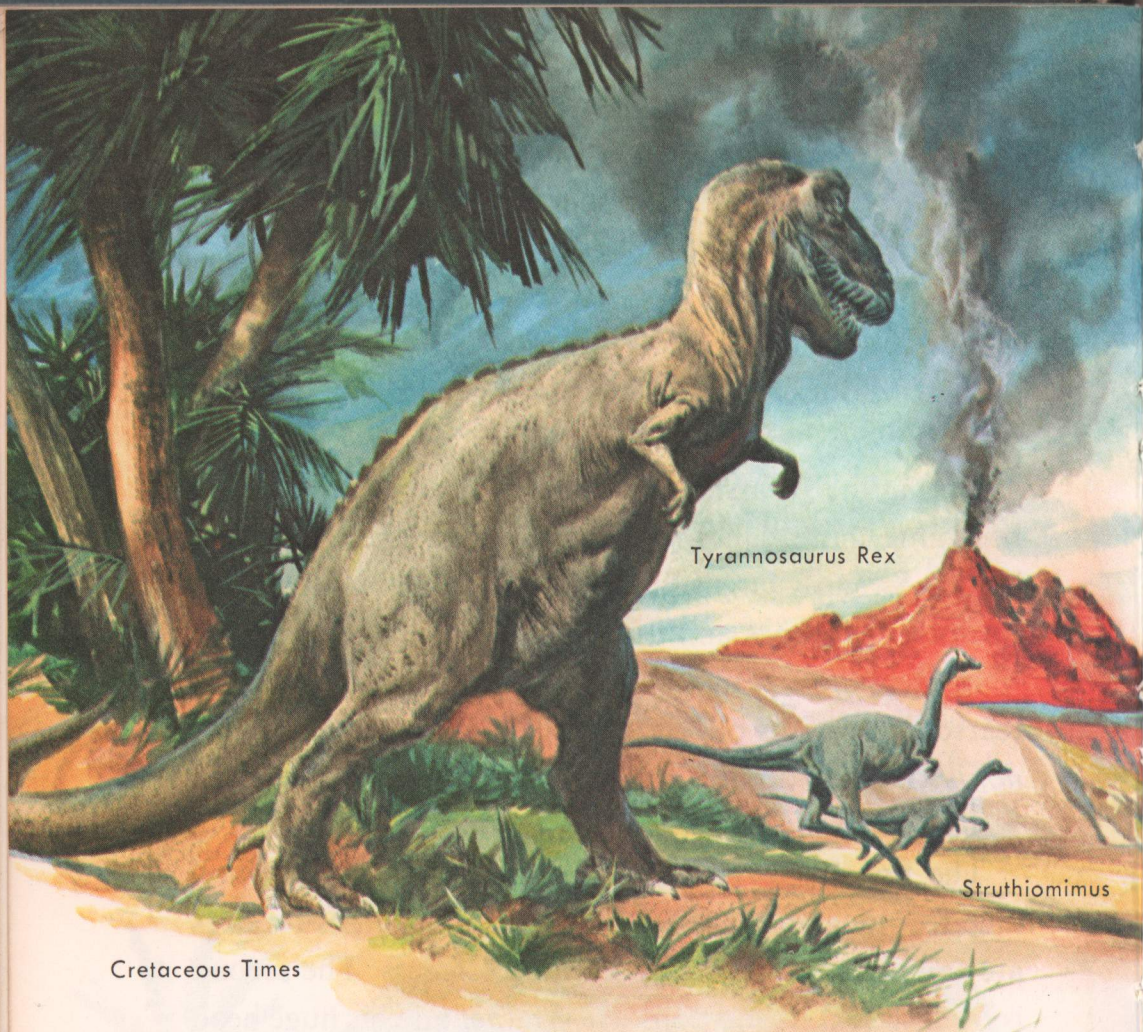
In stepping up to Cretaceous times, we meet three fearsome relatives of *Allosaurus*. They are called *deinodonts* (DIE-no-donts), which means "terrible teeth."

The name fits!

The first is *Gorgosaurus* (gor-go-SAWR-us), twenty-nine feet long and nine feet high at the hips. His forelegs are small, almost to the point of uselessness. The second is *Deinodon* (DIE-no-don). He is larger and his huge head is armed with the great, sharp teeth that give these creatures their name.



Allosaurus could kill any animal of his time, including the thirty-ton plant eater *Apatosaurus*. *Apatosaurus* bones bearing the tooth marks of *Allosaurus* have been found.



Cretaceous Times

The third, *Tyrannosaurus* (ty-ran-o-SAWR-us), is the most terrible animal that ever lived. He is forty-seven feet long, eighteen feet tall, and weighs eight to ten tons. With great strides, he hurls through the jungle, following a smaller creature. His tail whips from side to side through the undergrowth as he corners his victim. His great jaws open wide and rows of terrible teeth slash down.

His head is the great weapon with which *Tyrannosaurus* makes his bloody way through his world. His skull alone is fifty inches long, and his jaws are filled with edged teeth three to six inches long and an inch wide.

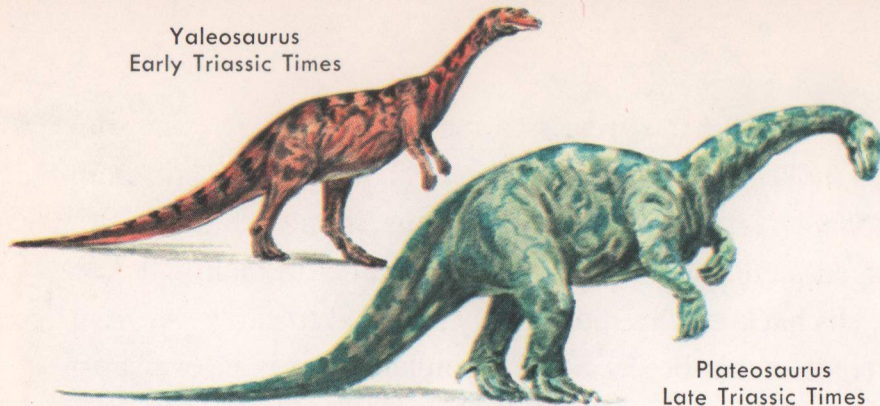
His back legs are powerfully muscled to carry the great weight of his body, but the forelegs are like very short arms. They are too small even to reach his mouth. This is no handicap to his eating, however.

Tyrannosaurus is both beautiful and terrible. The world has not seen another creature like him. No wonder his full name is *Tyrannosaurus rex*—King of the Tyrant Dinosaurs.

The Cretaceous reptile world is filled with strangely contrasting animals of the same family. A cousin of *Tyrannosaurus* is *Struthiomimus* (stroo-thee-o-MY-mus). He looks for all the world like some great bird whose feathers have been stripped away by a whirlwind. He is about six feet high. His skeleton is light and birdlike, and his jaws are most undinosaurlike. They are flattened, like the beak of an ostrich, and have no teeth at all. He eats plants for the most part, topping them off occasionally with reptile eggs or a small lizard.

A different branch of the lizard-hips family uses all four feet for walking, instead of just two. We will have to step back to the Triassic to meet the earliest of these.

Yaleosaurus
Early Triassic Times



Plateosaurus
Late Triassic Times

Yaleosaurus (yale-ee-o-SAWR-us) is his name. He is an eight-foot dinosaur who can use either two or four feet for walking, according to his whim. He is not choosy about his diet, either. He eats both plants and meat.

In later Triassic times *Plateosaurus* (plat-ee-o-SAWR-us) arrives on the scene. He is a twenty-foot dinosaur with heavier and stronger forelegs, and teeth capable of chewing only vegetation. He is a member of the four-footed group.

After this, there is a gap of many years in the fossil record of the four-footed lizard-hips. Through most of the Jurassic period there are only enough bone fragments to show that these creatures do continue. Then, suddenly, the great giants appear.

There are four of them. They are the ones, in addition to *Tyrannosaurus*, which most people think of when they hear the word *dinosaur*. They are huge, clumsy beasts

weighing many tons, with necks and tails of amazing length. But they are not such fierce fighters as *Tyrannosaurus*. They are usually peaceful plant eaters, who spend much of their time lazily munching plants at the edges of rivers and lakes.

The baby brother of this group is *Camarasaurus* (cam-a-ra-SAWR-us), who measures thirty to forty feet in length. His forelegs are shorter than the rear ones so that his body slopes down toward the front.

Apatosaurus (a-pat-o-SAWR-us), next in size, is one of a group known as *brontosaurus* or "thunder lizards." *Apatosaurus* is sixty-five to seventy-seven feet long and weighs thirty to thirty-five tons. His body is fairly short and thick. His neck is very long and flexible, but also rather thick. His great, heavy tail tapers from the thick

Camarasaurus



Late Jurassic Times

body to a long, narrow tip. His legs are like tree trunks, and carry the great body on thickly padded feet, which are as much as twenty-six inches wide.

A still longer cousin is *Diplodocus* (dip-LOD-o-cus), measuring eighty to eighty-seven feet in length. *Diplodocus*, however, is mostly neck and tail, and has a lighter body than *Apatosaurus*. He is a lightweight at about twenty tons.

The heavyweight of them all is *Brachiosaurus* (bray-kih-o-SAWR-us), eighty-four feet long, who can look down from a height of forty-four feet with all four legs planted

Brachiosaurus

Diplodocus

Late Jurassic Times

firmly on the ground. He weighs forty-five to fifty tons. His forelegs are larger than the rear ones, which gives a backward slope to his body.

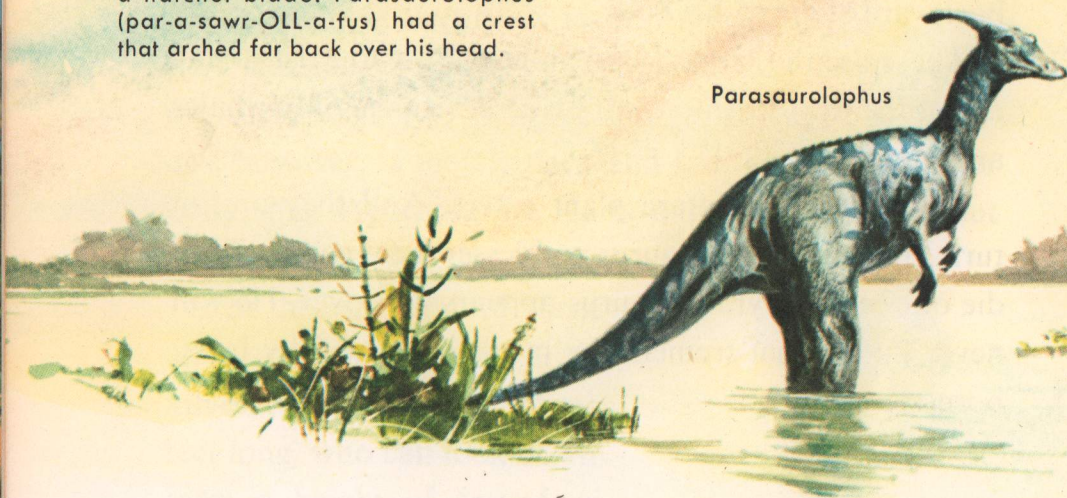
These are the largest land animals ever to exist in any age of the world. Among all living creatures, only whales are larger.

These four giants are plant eaters. And they are, in turn, the prey of *Allosaurus* and lesser meat eaters. They die out before *Tyrannosaurus* appears, however. He will never know what tremendous meals he missed by being born too late!

Apatosaurus

Some of the duckbills had amazing skull decorations. *Lambeosaurus* (lam-be-o-SAWR-us) had a hornlike extension straight back from his skull, joined to an upward growth that looked like a hatchet blade. *Parasaurolophus* (par-a-sawr-OLL-a-fus) had a crest that arched far back over his head.

Parasaurolophus



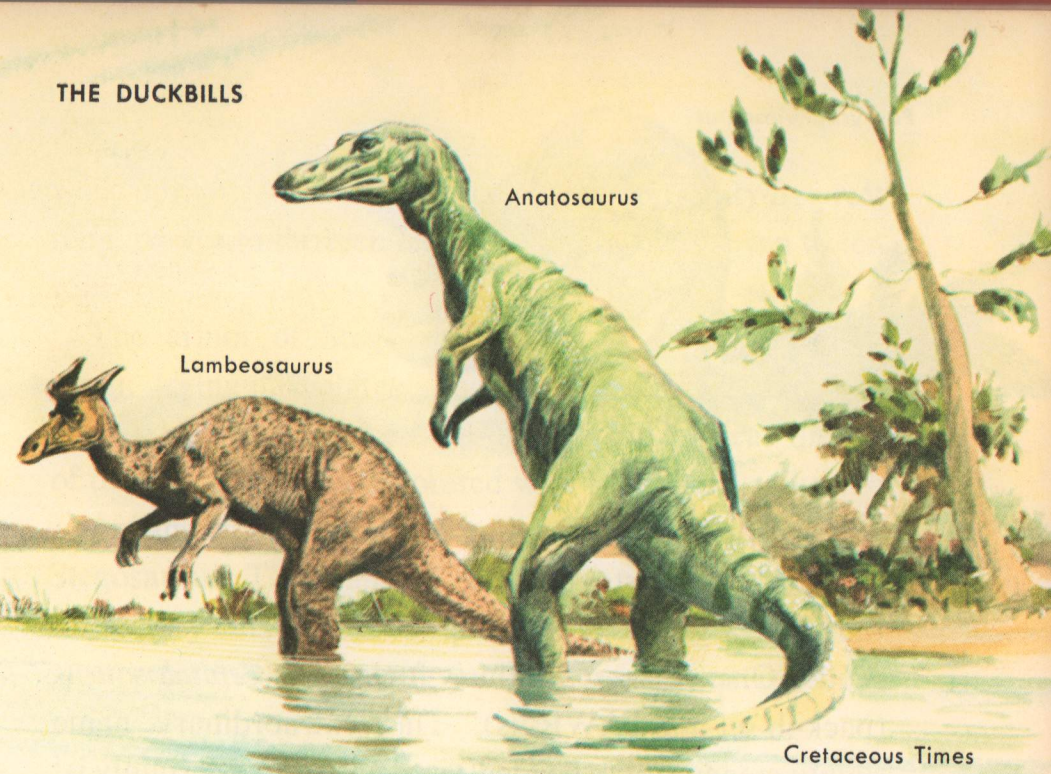
The beasts we have described spend most of their lives in the water, wading, swimming clumsily, or just munching water plants. A strange "water line" exists in the bones of these animals from the shoulders to the hips. Below the line the bones are heavy and solid. Above it the bones are lighter and contain hollows to reduce weight. This kind of structure serves, like divers' lead shoes, to keep the beasts upright in the water.

Diplodocus and *Brachiosaurus* have a clever breathing arrangement that allows them to sink underwater almost completely. Their nostrils are placed in small domes on the very tops of their heads.

THE DUCKBILLS

Anatosaurus

Lambeosaurus

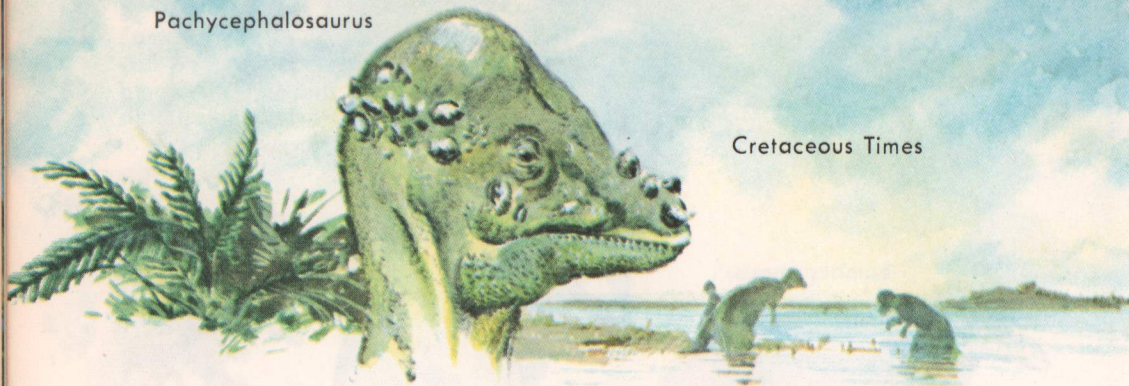


Cretaceous Times

The ornithischian or bird-hips branch of the dinosaur family has some interesting and remarkable members, also. One group of these is the duckbills. These have wide, flattened skulls ending in flat beaks, much like those of ducks. There are no teeth in the front of the jaw, but in the rear are hundreds of closely overlapping, peglike teeth. New ones push forward to take the place of worn ones, which fall out.

Anatosaurus (a-nat-o-SAWR-us) is a typical duckbill. He is two legged and walks upright at a height of fifteen to eighteen feet. His jaws hold about two thousand teeth!

Pachycephalosaurus



Cretaceous Times

Other duckbills have amazing skull decorations in the form of bony crests.

Another group of bird-hips is noted for very thick skulls. One of these is thirty-foot *Pachycephalosaurus* (pack-ih-sef-a-lo-SAWR-us). This extraordinary name simply means "thick-headed reptile." And he certainly is!

His twenty-six-inch skull is shaped like a dome with a roof nine inches thick over a tiny brain. Frightening knobs and spikes decorate the face and head below the dome. You can imagine the jokes that have been made at poor Packy's expense! He has been called the bone-headed dinosaur, the original bonehead, and several other unflattering things.

Some of the bird-hips have developed along the lines of army tanks as far as defense equipment is concerned. One of these is *Stegosaurus* (steg-o-SAWR-us), the "plate bearer." He is a four-footed dinosaur with short, thick front legs, and much longer rear ones. He is not able to

walk upright, however. He is eighteen to twenty-five feet long, twelve to thirteen feet high, and weighs seven to ten tons.

The armor of *Stegosaurus* consists of two rows of blunt, triangular plates. They stand upright along the spinal column from the base of the skull to near the tip of the tail. The tip is decorated with four sharp spikes.

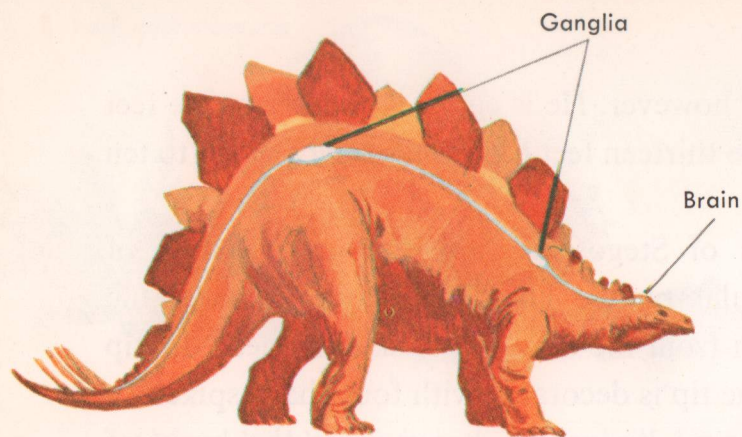
As amazing as his armor, however, is the brain of *Stegosaurus*. There almost isn't any!

His tiny skull holds two and one half ounces of brain matter to do the thinking for his several tons of body.

Stegosaurus



Early Cretaceous Times



Stegosaurus needs help in the thinking department. Fortunately, he has it. There are two large groups of nerve cells, called ganglia, in his backbone. One is over the shoulders and probably controls the forelegs. The other, a fifty-ounce group of cells, twenty times the size of his brain, is over the hips. It probably controls the rear legs and tail.

The large brontosaurs had an arrangement like this, too, for their brains were also tiny. Because of this it has been said that dinosaurs could think better with their tails than with their heads!

Even more tanklike in appearance than Stegosaurus is *Ankylosaurus* (an-kih-lo-SAWR-us), about four feet high, six feet wide, and seventeen feet long. His entire back and tail are covered with bony plates, each with a pointed knob. Bony spikes reach outward all around the



Ankylosaurus

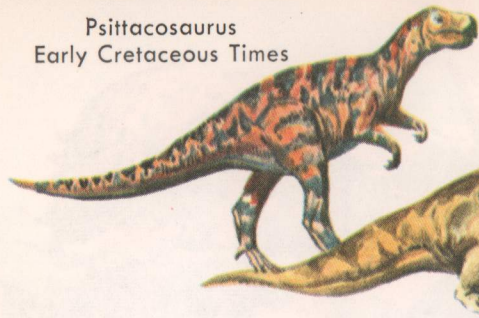
Cretaceous Times

rim of this armor plate. The tail ends in a huge war club of solid bone. Even the eyes and nostrils are protected by overhanging plates of bone.

The final group of dinosaurs is the horned dinosaurs. The earliest is *Psittacosaurus* (sit-a-ko-SAWR-us), a two-legged dinosaur about four feet long. He has a beak, somewhat like that of a parrot.

Protoceratops (pro-to-SER-a-tops), also in the Cretaceous period, but much later, also has a beak. He wears a fanlike crest of bone behind the skull which protects

Psittacosaurus
Early Cretaceous Times



HORNED DINOSAURS

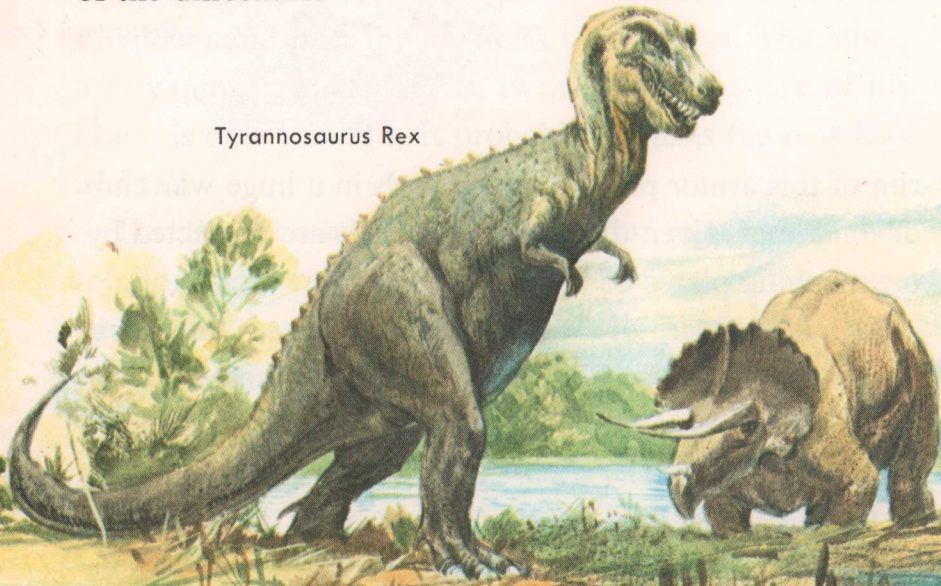
Protoceratops
Middle Cretaceous Times



his shoulders. At this time several other dinosaurs appear with beaks and frills and with nose-horns like those of the rhinoceros.

The greatest of these is *Triceratops* (try-SER-a-tops), who does not appear until near the very close of the Cretaceous period. He is, in fact, one of the very last of the dinosaurs.

Tyrannosaurus Rex



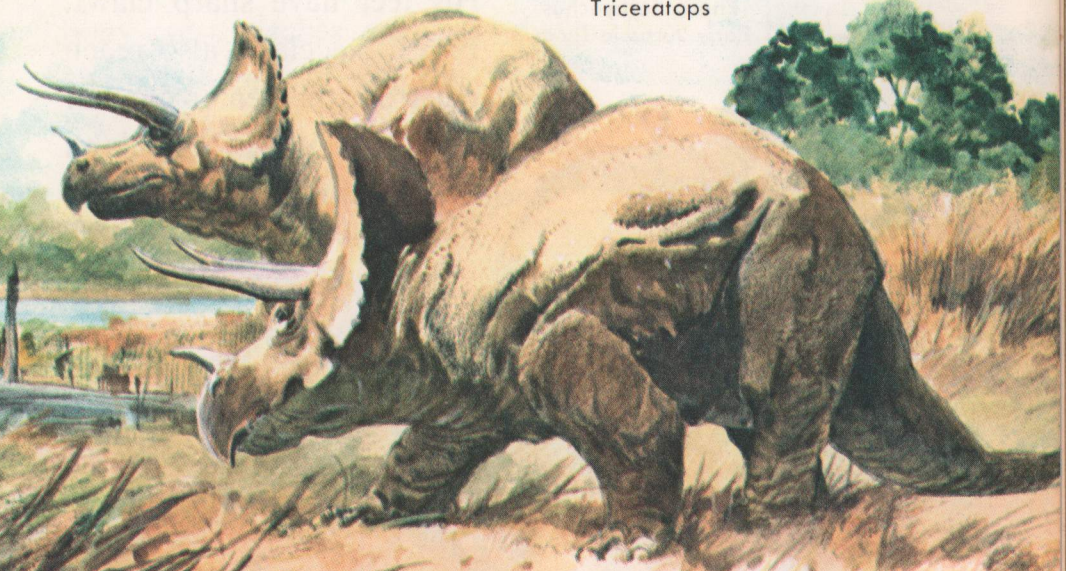
Late Cretaceous Times

Triceratops is twenty to thirty feet long, eight to ten feet high, and weighs eight to twelve tons. His great skull is eight feet long and has a huge frill that rises like a shield at the back of the skull. He has the beaked mouth like other members of his group. A short horn is placed just above the beak, between the nostrils. Two other huge horns thrust forward from thick roots just above the eyes.

Triceratops is a fairly peaceful animal. He eats plants in the meadows and forests. And his is a large family, which proves his great horns and shield are a pretty good defense against Tyrannosaurus.

But Triceratops is one of the last. After him there are no more dinosaurs.

Triceratops



Triassic
205 to 165 Million Years Ago
Jurassic
165 to 130 Million Years Ago
Cretaceous
130 to 75 Million Years Ago

FLYING REPTILES

DURING this great Age of Reptiles, the Mesozoic, the reptiles are kings. They are kings not only of the land, but of the air and water as well.

Except for insects, the first flying creatures are reptiles. We must step back to the Jurassic to have a look at the first one. He is called *Rhamphorhynchus* (ram-for-INK-us) and belongs to a group known as "the long tails."

Rhamphorhynchus has no feathers. His wings are leathery webs stretched between long, bony "fingers" and his body and legs. He has the teeth and long jaws of his lizard relatives in the jungle. He is about two feet long, and his long, slender tail ends in a leathery flap that

serves as a kind of rudder. His feet have sharp claws. Fingerlike claws also reach out from the center edge of his wings. With these claws he can climb the trunks of trees very nicely.

Dimorphodon (dy-MOR-fo-don) appears later in the Jurassic. He grows to a length of forty-two inches,

Rhamphorhynchus
Early Jurassic Times

but his long tail does not have the rudder flap. His head is thick with deep hollows in his face that give him the look of a living nightmare soaring through the twilight of Jurassic skies.

Pteranodon (ta-RAN-o-don), one of the short-tail family, is the giant of them all. We step up again to the Cretaceous to see him, and he is well worth the sight. His wings spread to as much as twenty-seven feet, more than the wingspread of any other flying creature the world will see. His body is short, only about twenty inches long, and he weighs about twenty-five pounds. His amazing head includes a three-foot beak, and sometimes a long, bony crest reaches out from the back of his head for another three feet or more.

Dimorphodon
Late Jurassic Times

Pteranodon
Cretaceous Times

These flying animals have a hard time of it. Some have legs which turn back so they cannot stand upright on the ground. They can only cling to rocks and branches. When they roost, they hang upside down. They cannot really fly in the same way that feathered birds will at a later time. They cannot rise from a flat surface. If they come down on the water they drown or are eaten by some sea creature.

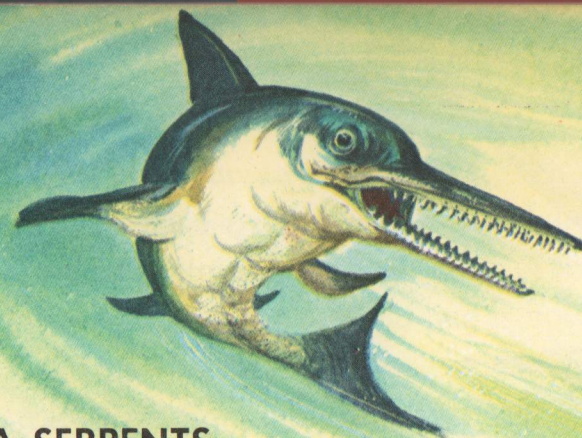
The flying of these strange creatures is mostly a kind of gliding from a tree or cliff. They can rise, once they are in the air, by flapping their wings or by making use of air currents. Food for these reptiles is mainly insects. Sometimes, dangerously, they swoop down over a lake to seize a fish.

One truly feathered bird appears in the Jurassic. He is *Archaeopteryx* (ark-ee-OP-ter-ix), about the size of a pigeon. Instead of a beak, however, he has jaws covered with scales and filled with more than forty teeth.

Archaeopteryx is a meat eater.



Archaeopteryx
Jurassic Times



The Ichthyosaurus mouth was long, narrow, and filled with needle-sharp teeth. The eyes were large. A pair of nostrils opened in the long snout just in front of the eyes.



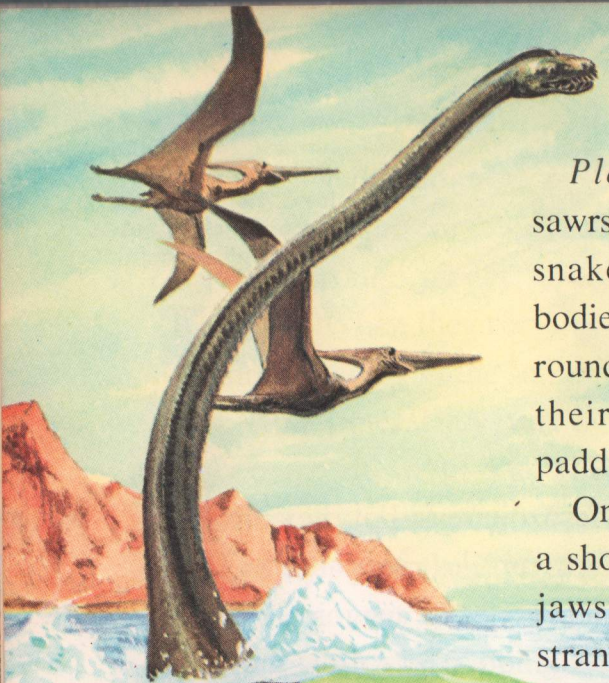
SEA SERPENTS

THERE ARE fish in the Mesozoic seas, but they are not the rulers. Fierce, air-breathing reptiles rule the seas.

The most peaceful members of the seagoing reptile family are the turtles. But in the late Cretaceous they are like no other turtles we have ever seen. The giant *Archelon* (ARK-ee-lon) is more than twelve feet long. He has a sharply hooked beak and giant flippers. He weighs about three tons. Instead of the hard shell that covers later turtles, *Archelon* has a covering of thick, tough skin.

We can stand on any of the three steps of the Mesozoic period and watch members of the *Ichthyosaurus* (ICK-thee-o-sawr) or "fish-lizard" family. They have narrow, streamlined bodies fifteen feet long. A few larger ones reach forty feet. They have fishlike tails, and a large fin on their backs. Their four legs are paddle-like flippers, which are very powerful. They are fast swimmers.

The Ichthyosaurs do not lay eggs. Their babies are born alive.



Plesiosaurs (PLEEZ-ih-o-sawrs) have been described as snakes threaded through the bodies of turtles. Their plump, round bodies have no fins. Using their legs and feet like long paddles, they are able to swim.

One group of Plesiosaurs has a short neck with long, pointed jaws. Another group has a strange, long neck and a small rounded head, and reaches a total length of fifty feet. *Elasmosaurus* (ee-las-mo-SAWR-us) is

Elasmosaurus

Late Cretaceous Times

Portheus

one of these. He could well pass as one of the mythical sea serpents. He is slow in swimming, but his long neck can arch out of the water and swing over a distance of forty feet from side to side. Fishing is not hard for him.

As Tyrannosaurus became the reptile king of the land, so his distant cousin, *Tylosaurus* (ty-low-SAWR-us), becomes king of the sea in the same late Cretaceous period of time. His body is long, with a true reptilian tail that is flattened as an aid in swimming. His four feet form powerful paddles with strong webbing between the toes. The top of his head is covered with bony plates, but the rest of his body is covered with scales. Fierce, pointed teeth line his narrow jaws. He grows to a length of thirty feet.

Tylosaurus

Tylosaurus attacked anything that swam in the Cretaceous seas, including the giant fish Portheus (POR-thee-us), "bulldog tarpon." Portheus was a true fish that grew to 15 feet in length and weighed up to 800 pounds. He had fierce teeth.

THE DEATH OF KINGS

WE TAKE a step up beyond the Cretaceous and turn to look back. All around, we see something we had not noticed before.

Death.

The great kings are dying. All over the world, on land, in the air, in the sea—the reptile kings are slowly dying and disappearing from the Earth.

The climate is becoming colder. The Earth's crust is lifting, draining away the seas and uncovering America's

plains. The Rocky and Andes Mountains are pushing their way skyward as a result of great pressure in the Pacific coastal areas. Glaciers are appearing in many parts of the world. Plant growth is changing.

Perhaps these things have something to do with the disappearance of the mighty reptiles. And yet, the reptiles have lived through violent periods as great as this in times past. We do not know the answer as we look for the last time on this world of dying monarchs and their fierce, terrible beauty. We only know that Earth will not see their kind again.

Paleocene Epoch

75 to 60 Million Years Ago

REBIRTH

WE HAVE climbed the six great steps of the Paleozoic era and three of the Mesozoic. As we look about us now we see a world almost as empty of animal life as was the Devonian period when the amphibians first crawled from the water. The land, including that which has freshly risen from the sea, is made up of great plains and thick jungles. The giant reptiles are gone. Only a few snakes, small lizards, crocodiles, and turtles remain.

We did not notice during the last 90 million years of Mesozoic time, but there were other creatures living quietly in the shadows of the monster reptiles. Keeping still, keeping out of the way, these creatures were trying to avoid being eaten. They are the mammals. They belong to an entirely different branch of the animal family. Their young are born alive and are nursed by the mother.

The world we see about us now is called the Cenozoic (seen-o-ZOE-ick). The time is the Age of Mammals, for it is the mammals who have inherited the Earth, and who will now become its rulers. We are standing on the first of seven steps in this part of the stairway of time. This first step is called the Paleocene (PAY-lee-o-seen) epoch. It extends from 75 to 60 million years ago. At the beginning of this epoch, the climate has cooled and become

Early mammals all ate insects and small grubs, as hedgehogs and armadillos do today. But during the Paleocene epoch diets began to change. The meat-eating Creodonts preceded our clawed carnivores, while the leaf-eating Condylarths developed into the hoofed grass eaters of today.



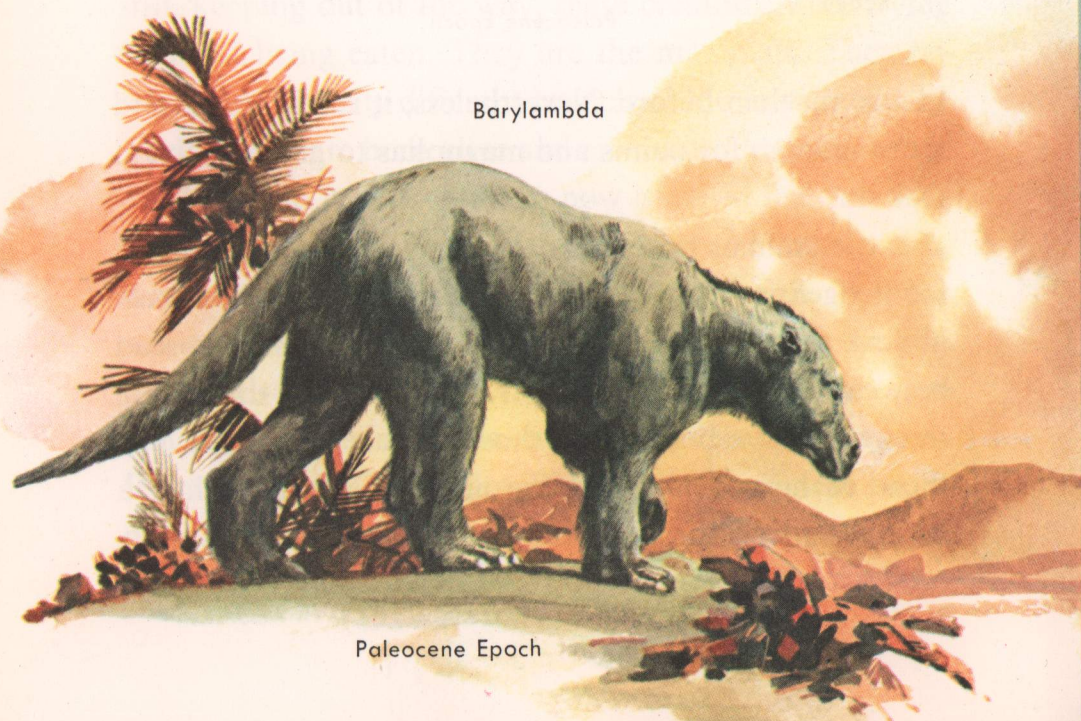
less damp than before. Nevertheless, it is still warm and moist enough for palms and magnolias to grow in North Dakota.

Little animals have inherited this near-empty land. We see hedgehogs, rodents, and armadillos. We see animals gliding through the air on broad webs of skin spread between their legs. We see strange creatures that climb trees and have bodies like those of cats and heads like those of horses. None of the animals is bigger than a large shepherd dog.

As we move toward the later years of this epoch we see the slow appearance of new creatures. They are much larger animals, strange and awkward in appearance. Most of them have thick, blunt heads, heavy bodies, and thick, bushy tails. Their legs are like logs, and they have five toes that seem halfway between claws and hoofs.

One of these great, awkward animals is *Barylambda* (bar-ih-LAM-da), who grows to a length of eight feet. He is the largest animal of his time.

By the end of the Paleocene the Gulf of Mexico is spreading northward again to the region of Illinois. The climate is mild enough for sycamores, elms, and cypresses to grow in Greenland.



Eocene Epoch

60 to 40 Million Years Ago

Oligocene Epoch

40 to 30 Million Years Ago

Miocene Epoch

30 to 10 Million Years Ago

Pliocene Epoch

10 to 1 Million Years Ago

NEW MONARCHS

THE NEXT step, the *Eocene* (EE-o-seen), from 60 to 40 million years ago, shows a great increase in the number and kind of mammals. In the jungles, *Oxyaena* (ox-ih-EE-na) appears. He is a catlike meat eater about three feet long, but his brain is much too small to match the cleverness of present-day members of the cat family.

On the plains we see the first relative of the horse, tiny, graceful *Eohippus* (ee-o-HIP-us). He is no bigger than a small dog.

There is also a strange member of the bird family here. He is *Diatryma* (dy-a-TRY-ma). His huge, thick body reaches a height of seven feet. He has a great beak and does not fly, but runs swiftly on powerful legs.

Barylambda has some cousins in the Eocene—one of them, *Coryphodon* (co-RIF-o-don), looks much like a small hippopotamus about eight feet long. He has long, sharp canine teeth. Two others are awkward giants that rise during the epoch but die out completely before its end. They are *Uintatherium* (u-in-ta-THEER-ih-um) and *Eobasileus* (ee-o-ba-SIL-ih-us).

Both are heavy in build, with thick bodies and legs. On their heads are three pairs of blunt horns. These are

actually bony growths covered with skin. One very short pair is set far forward, just above the nostrils. The second pair is longer and placed midway between the nose and the eyes. The third is still longer and is perched right behind the eyes, almost over the ears.

Untatherium is about five feet high and has a skull thirty inches long. Eobasileus stands seven feet high and

carries a forty-inch skull. The males of both animals have tusks growing downward from the upper jaw.

These giants, like the dinosaurs before them, carry little brainpower to go with their outsized bodies.

The Oligocene (OLL-ih-go-seen) epoch, from 40 to 30 million years ago, is the next step. It is a fairly short period of time, but while we are here we see great changes take place in the Earth and its inhabitants.

Eocene Epoch

Coryphodon

Diatryma

Untatherium

Eobasileus

Oxyaena

Eohippus



The Titanotheres developed until, in the Oligocene epoch, they were the giants of their age. They suffered from the shortage of brainpower common to the large animals of their time. Their brains were no bigger than that of a modern pig, and were much less effective.

Oligocene Epoch



The Alps and the Himalayan Mountains rise from the grinding shrinkage of the Earth's crust in that area. In the northwestern part of North America the land is covered by ash and lava and molten granite poured out by sudden volcanic explosions.

The climate becomes sharply cooler. Tropical plants die in the north. They are replaced by grasses and pines.

Only a few of the big animals of the Eocene survive. The Earth is left once more mostly to the little creatures—moles, hedgehogs, shrews, rodents, and rabbits.

The bigger animals that remain belong to a family called *Titanotheres* (ty-TAN-o-theers). The earliest members of this family were little animals a foot or two high, without horns. They migrated to North America from Asia during one of the early Eocene periods when there was a land bridge from Asia to Alaska.

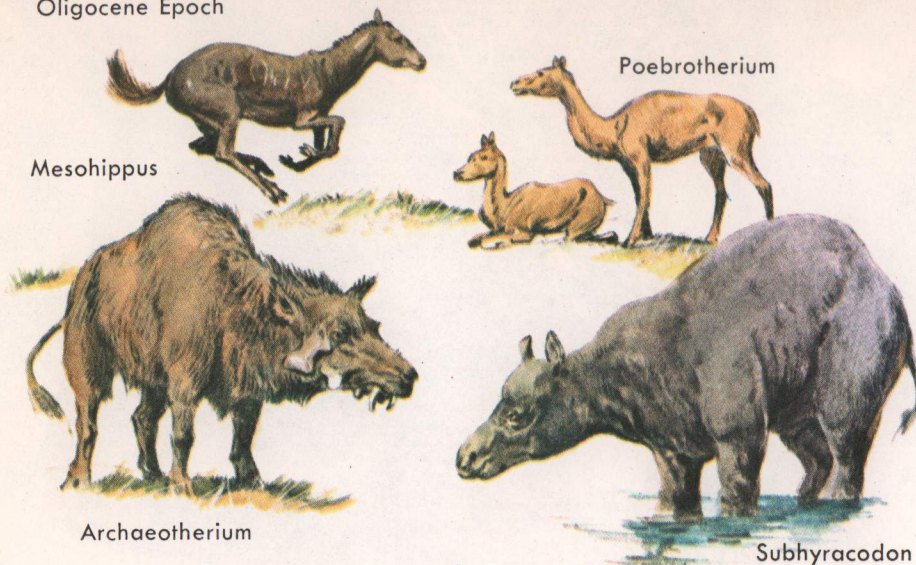


Brontops

Descendants of these early creatures continued to grow in size. They managed to exist through the Eocene and early Oligocene epochs. Now we see the result in the form of *Brontops* (BRON-tops) and *Brontotherium* (bron-to-THEER-ih-um), two giants of this age. They fail to survive beyond the middle of the Oligocene.

The Titanotheres are great, heavy beasts with thick bodies and legs. Brontops is twelve to fourteen feet long and seven to eight feet tall. He weighs four to five tons. His shoulders are humped high, and slope down to a low, flat head. On his nose is a strange pair of horns shaped like a Y, or a huge slingshot handle. These horns are covered with skin.

Oligocene Epoch



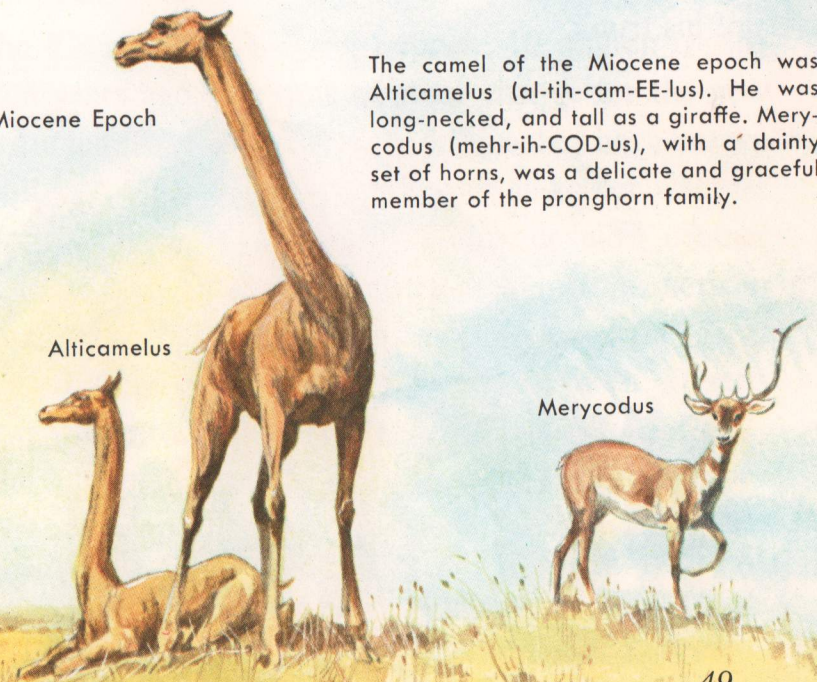
In the Oligocene, distant ancestors of most modern animals appear, usually for the first time. The animals we have seen in our journey so far are almost totally unlike those of our own time, except for some like the small turtles, snakes, rats, and rabbits.

Now we see a camel, *Poebrotherium* (po-e-bro-THEER-ih-um). He is only two feet high and does not have humps, but he is a camel just the same. *Archaeotherium* (ark-ee-o-THEER-ih-um) is an unpleasant-looking giant pig. *Subhyracodon* (sub-hy-RA-co-don) is a rhinoceros. *Mesohippus* (mes-o-HIP-us) is the horse of this age. He is as big as a large dog. The land animals are no longer strangers to us. Or not total strangers, anyway!

The *Miocene* (MY-o-seen) epoch of 30 to 10 million years ago is the golden age of the mammals. The forests and jungles have disappeared with the cooling of the climate. Endless grassy plains cover much of the Earth. The animals now roam in great herds on these peaceful plains, much as did the thundering buffalo of our own time.

The member of the horse family present at this time is *Merychippus* (mehr-ih-KIP-us). He is the size of a modern pony and roams the plains in widespread herds. Strangely enough, one of the most plentiful plains animals of North America of this period is *Diceratherium*

Miocene Epoch



The camel of the Miocene epoch was *Alticamelus* (al-tih-cam-EE-lus). He was long-necked, and tall as a giraffe. *Merycodus* (mehr-ih-COD-us), with a dainty set of horns, was a delicate and graceful member of the pronghorn family.

cooki (dy-ser-a-THEER-ih-um cook-ih), a rhinoceros about three feet high. He is as plentiful in this epoch as the bison of a much later time. But he and other rhinoceroses of North America die out soon after the end of the Miocene.

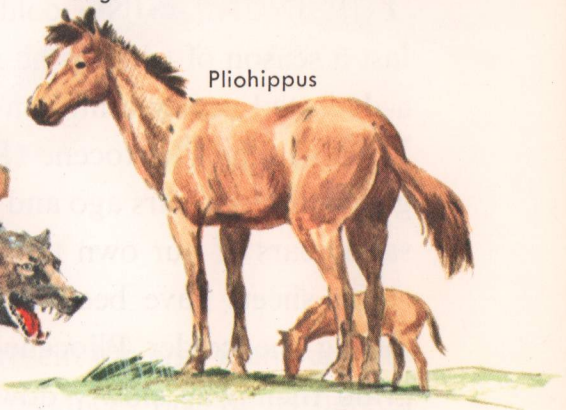
In the middle Miocene a stranger from the Far East appears in North America. *Gomphotherium* (gom-fo-THEER-ih-um) is a mastodon whose family has wandered from its home in Egypt during thousands of years. In his wanderings, he crossed Europe and Asia, and finally crossed the narrow land bridge over the Bering Strait. He is about eight feet high. His trunk is not very long, but his lower jaw is very long, reaching nearly to the end of his trunk.



Gomphotherium



In the Pliocene epoch we recognize *Pliohippus* (ply-o-HIP-us). He is a horse, familiar both in size and appearance. *Agriotherium* (ag-rih-o-THEER-ih-um) is a giant bear, standing 4 feet high at the shoulders. *Amphicyon* (am-FIS-ih-on) is a fierce, wolflike dog.



Pliocene Epoch

The *Pliocene* (PLY-o-seen) epoch, 10 million to one million years ago, is a time of great change for the now plentiful mammals. The ideal conditions they have known for millions of years slowly give way as cooler weather covers the world. The grassy plains develop coarser growth. In the southwest part of the North American continent the rainfall pattern changes over the great forests as mountain ranges push up in the West. Deserts appear where the trees once reached skyward.

The mammals seem to like the changing Earth, however. They adapt themselves to the changes and continue to grow and develop.

THE LONGEST WINTER

THE INCREASING cold of the Pliocene brought at last a season of winter, the greatest winter of all time.

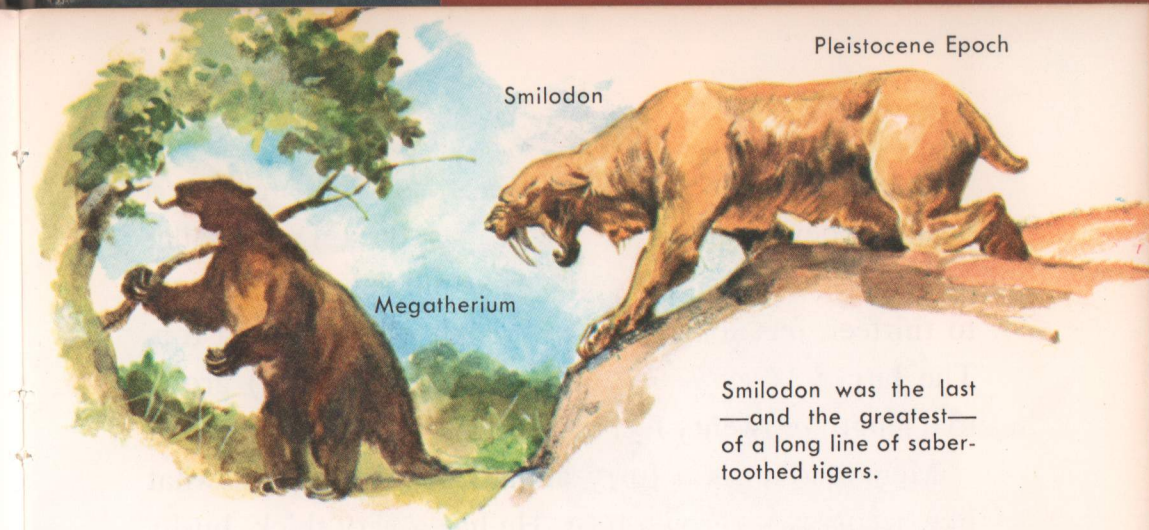
It lasted nearly a million years.

This is the Pleistocene (PLICE-to-seen) epoch. It begins a million years ago and continues to within ten thousand years of our own time. This is the Ice Age.

Ice sheets have been building up in the polar areas during the colder Pliocene epoch. Now they begin to grind their way slowly down the continents. The great mass of water frozen in these mountains of ice lowers the sea levels as much as 350 feet.

For 100,000 years the crushing ice creeps down from the poles. Then it melts as slowly as it comes. Four times during this amazing winter the ice creeps southward, then melts. The last great melting begins only ten thousand years before our own day, and is still going on. We live at the very close of this great winter—and we cannot really be sure that it is entirely over!

The Pleistocene mammals adapt themselves in remarkable ways to the Ice Age. They remind us of the great dinosaurs during the height of the reign of the reptiles. These Ice Age mammals are worthy successors to the great reptile kings.



Smilodon was the last—and the greatest—of a long line of saber-toothed tigers.

The cat family has been present through many epochs. Now, in the Pleistocene, it produces one of its fiercest members. *Smilodon* (SMI-lo-don), the saber-toothed tiger, is about three and one half feet high and much heavier in body than the present-day lion. Thick muscles give strength to his powerful legs. Unlike the lion, he has only a stubby tail.

The powerful weapons with which *Smilodon* rules in his kingdom are his six-inch fangs. These jut downward from his upper jaws like twin daggers. His lower jaw is hinged in such a way that it extends straight down when his mouth is open. This puts the lower jaw out of the way of his saber teeth, and they are free for slashing and stabbing. This is the way he attacks and kills animals far larger than himself—the giant mastodons and the ground sloths of his time.

The ground sloth is one of the animals that reaches a peak of development in the Pleistocene. The smaller *Myiodon* (MY-lo-don) is a bearlike animal. He grows up to thirteen feet long and may weigh as much as a ton. The larger *Megatherium* (meg-a-THEER-ih-um) grows to a length of twenty feet and weighs up to five tons.

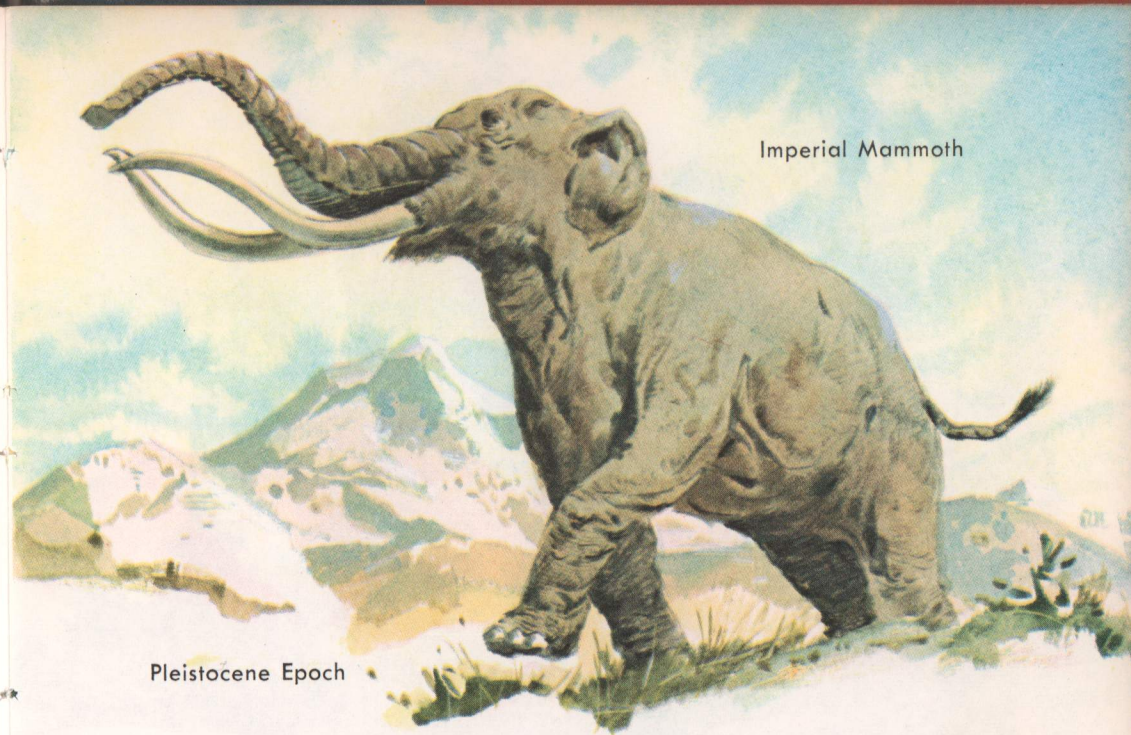
Megatherium is a furry animal that looks somewhat like a huge, overgrown bear. He has a very thick, bushy tail and can sit upright. His paws have long toes and claws which turn inward as he walks. Most of the weight of his body is carried by thick heel bones in all four feet.

Megatherium lives mostly on the leaves of trees and bushes. He doesn't bother his neighbors much, and is often prey for *Smilodon* and other large meat eaters.



Normally a peace-loving animal, *Megatherium* gave a good account of himself in a fight. His long claws and mighty forelegs packed a heavy punch as he sat up to his full height of almost twenty feet and flailed away at his enemies.

Pleistocene Epoch



Imperial Mammoth

Pleistocene Epoch

The monarchs of this last epoch, however, are the giant mastodons and elephants.

The Imperial Mammoth of North America is more than thirteen feet high at the shoulder. He is hairless, like the present-day elephant, and has great, curving tusks. He roams the southwest part of the continent as freely as the reptile giants of long ago. His smaller companion, the Columbian Mammoth, is still a giant at over ten feet, shoulder height.

The American mastodon is also about ten feet high. He is not a true elephant, but belongs to another branch of the same family.



The Woolly Mammoth stands about nine feet high at the shoulder. He is smaller than his hairless cousins, and is covered with a thick coat of grayish wool, which is in turn covered by long, coarse reddish-brown hair. With such a coat, he is able to live at the very edge of the ice sheets.

Other animal families also produce their members of greatest size and power in this unfriendly age of ice and cold. *Castoroides* (cas-to-ROY-deez) is a beaver as big

as a small bear. *Canis dirus* (CAY-nis DI-rus) is a six-foot wolf found in all parts of the continent. *Teratornis* (ter-a-TOR-nis) is a cousin of the condor. He is the largest flying bird of all time, with a wingspread of sixteen feet. The horse, *Equus* (EK-wus), is now full size.

This is the peak of the development of mammals. Powerful, present in great numbers, worldwide, able to withstand the severe cold of the Ice Age, these animals are worthy of their place as kings of the Earth.

TWILIGHT OF THE BEASTS

THE MILLION-YEAR winter finally draws to a close. The last of the great ice sheets melts back to the north. And then death comes almost mysteriously to the kings of the Earth, just as it came 75 million years before. As the reptile kings died out within a fairly short period of time, so also do the mammoths, the saber teeth, and the ground sloths.

Their dying is as great a mystery as the dying of the reptiles. All over the Earth, except in areas of Asia and Africa, the ruling mammals disappear. Only the bison, and, once again, the rodents and small creatures, remain.



And so comes to an end the millions of years during which the animals have ruled the world. It began with the trilobites and ended with the Imperial Mammoths.

It is not likely that they will rule again, for a new creature has appeared on the horizon during the later years of the Pleistocene. He is destined now to take over the kingship of the Earth.

The name of the new creature is Man.





THE AUTHOR

One of the most exciting events in the life of RAYMOND F. JONES, author of *Animals of Long Ago*, occurred when all the schools let out—the day the dinosaur came to town.

The dinosaur bones were on their way from the great fossil beds of eastern Utah to Washington, D. C., to be assembled and exhibited. "They were brought from the fossil beds," says Mr. Jones, "on great wooden wagons that creaked and groaned with the heavy weight. The bones were encased in plaster, wrapped in burlap, and crated like furniture.

"But at the railroad station some of the burlap was peeled back and the plaster removed so that teachers and thousands of pupils could get a peek at these magnificent bones that had lain encased in solid rock for so long a time.

"It was a wonderful day."

About himself, the author says, "After that there was a lot more school. Then a dozen years of meteorological work with the U. S. Weather Bureau, some work in electronic engineering, and engineering publications work in missile and space science (now and for the past seven years). During all this time there was a little writing going on in science fiction and nonfiction. Over the years a dozen books and about two hundred magazine articles have accumulated.

"But even after all this time," Mr. Jones concludes, "the day the dinosaur came to town was one of the greatest."

