Dinosaurs
on Alaska's North Slope

BLM

Alaska

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BUREAU OF LAND MANAGEMENT

Dinosaurs on Alaska's North Slope

1st Dinosaur discoveries

In the 1960s, the first dinosaur bones were discovered on the Alaskan North Slope, but were not excavated by scientists until the 1980s. These first discoveries belonged to a duck-billed dinosaur like *Edmontosaurus*. Fully grown, these plant-eaters typically were 8 feet tall at the hips, 25 feet long and weighed three tons. These dinosaurs likely lived in social groups or herds.

How did they survive so far north? Did they slow their metabolism and overwinter in the arctic? Did they migrate southward for food and warmer climates? Could they even hibernate?

No one yet knows the answers to these questions, but later discoveries on the Colville River cast doubt on the migration theory. Several new dinosaurs, including small meat-eaters such as *Troodon* and dromaeosaurids probably couldn't physically migrate the round-trip distance of 5,000 miles. Instead, North Slope dinosaurs may have survived year-round on the ancient river systems, which supported lush summer vegetation. Enough coastal plain vegetation may have grown during the 24-hour sunlit summers to last during the cool-to-cold dark days of winter.

Dinosaur extinction

Did a meteorite strike the earth, throw up dust to block the sun, and possibly cause the extinction of dinosaurs 65 million years ago? Maybe, but then why did certain reptiles, including crocodiles, turtles, and snakes, survive?

A few paleontologists suggest that disease may have been a factor. Others point to the possibility of climatic changes caused by increased volcanism or changing vegetation unfavorable to some dinosaurs. Current thinking is that the dinosaurs died off from a combination of causes.

Cover photo: Discoveries by paleontologists working on the North Slope of Alaska are revealing an ancient past when dinosaurs ruled the area. Cover illustration of Pachyrhinosaurus perotorum by Karen Carr.

Were North Slope dinosaurs "warm-blooded" or "cold-blooded"?

In the past, paleontologists assumed all dinosaurs were cold-blooded. Only in the 1960s, did scientists begin entertaining the possibility that dinosaurs could be warm-blooded.

The bone cross-sections of warm-blooded mammals have more blood canals while the bones of cold-blooded reptiles have fewer canals. Some dinosaur bones show a combination of both patterns, with more blood canals as juveniles, and fewer as adults. North Slope dinosaurs so far exhibit a juvenile pattern. The debate isn't settled. It may be these dinosaurs had unique metabolisms unlike animals today.

DNA studies and North Slope dinosaur bones

So far, no DNA has been found in any dinosaur bones anywhere on earth. Those from the North Slope show amazingly low mineral replacement.

Alaska's North Slope dinosaurs

Several different species of dinosaurs have been discovered on the North Slope including along the Colville River. Their bones, teeth, and footprints are found in 100 to 70 million-year-old rocks from the Cretaceous Period. New species of dinosaur are still being discovered and named!

Paleontologists excavate Late Cretaceous dinosaur bones on the steep banks of the Colville River on Alaska's North Slope.

Meat-Eaters

Saurischia (lizard-hipped)

Theropods are a group of fleet-footed, meat-eating dinosaurs that were strictly bipedal (walked on their hind legs). Most of the theropods found on the North Slope can be recognized by their distinctive sharp, serrated teeth. **Four different families of theropods** are recognized in Alaska from finds made in the vicinity of the Colville River. They date to around 69 million years ago. In addition, there is one tooth of an indeterminate theropod from the older Nanushuk Formation from around 90-100 million years ago, but what family it belonged to is unknown.

Family #1: Tyrannosauridae

Tyrannosaurids were the largest theropods that lived in Alaska. They have massive skulls and highly reduced forearms. One type known:

Nanuqsaurus hoglundi
was a smaller relative of *Tyrannosaurus rex*, but was still 20 feet long. Found in Alaska: isolated teeth and rare bones from the skull and back.

Family #2: Troodontidae

Troodontids were lightly-built, human-sized dinosaurs. They had relatively large brains and likely had feathers and slasher claws on their feet. One type known (genus known but species uncertain):

Troodon
was small, lightly built, 4 feet high at the hips, 8 feet long, weighed up to 200 pounds and is the most common theropod fossil found on the North Slope. It is mostly known from its teeth, which are up to one-half inch long and have large serrations on the front and back edges. Found in Alaska: teeth and skull fragments.

Family #3: Dromaeosauridae

Dromaeosaurids were small, agile dinosaurs usually less than 100 pounds and likely had feathers. Members of this family typically had a single, enlarged slasher claw on the second toe of their feet and long grasping forearms. Two types likely, but genus uncertain:

Saurornitholestes (?) was a very close relative to the better-known *Velociraptor* from Asia, made famous in the movie "Jurassic Park." It was less than 3 feet tall at the hips and less than 8 feet long. Found in Alaska: isolated teeth.

Dromaeosaurus (?) was a medium sized theropod and relatively rare. Found in Alaska: isolated teeth.

Family #4: Ornithomimidae

Ornithomimids were relatively small, ostrich-like meat-eating dinosaurs that walked on two legs. They had small, light heads, relatively big brains, large eyes, and long narrow toothless beaks. One type known:

Ornithomimid (genus uncertain) was up to 11-12 feet long, over 200 pounds. Found in Alaska: a single foot bone.

What did some meat-eaters look like?

The latest ideas of what some meat-eaters looked like include colorful skin or even plumage. Feathers would have helped keep them warm at a time when Alaska was even closer to the North Pole.

Nanuqsaurus hoglundi
about 69 million years old
(Skin color is speculative)

Plant-Eaters

Ornithischia (bird-hipped)

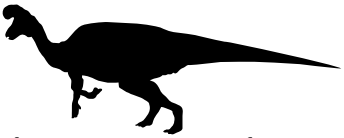
Hadrosaurids were large, plant-eating, duck-billed dinosaurs that walked on either two or four legs. Fossils found near the Colville River are around 69 million years old.

One type known (another type possible but genus uncertain).

Ungrunaaluk kuukpikensis

was a non-crested hadrosaur. It is the most common dinosaur found on the North Slope; several thousand bones of this dinosaur have been found in a single two-foot thick deposit known as the Liscomb Bonebed. Adults are typically 8 feet tall at the hips and over 25 feet long. Interestingly, most bones found in Alaska are from juveniles only one-third the size of adults.

Lambeosaurid (genus uncertain)



Lambeosaurs are crested hadrosaurs but the Alaskan genus is uncertain. Lambeosaurs can be more than 7-8 feet tall at hip height, up to 30 feet long, and weigh more than three tons; Found in Alaska: a partial skull and teeth.

Basal Ornithopods ("hypsilophodontids") are medium-sized plant-eating dinosaurs that typically walked on two legs. Two types known, a medium and small sized species:

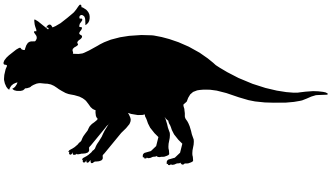
Parksosaurus

was about 3 feet tall at the hips and 7 feet long. Most of what we know about this dinosaur comes from fossils of its teeth. *Parksosaurus* was unusual among most dinosaurs in having two different types of teeth: one set of peg-like teeth in the front of the mouth, and one set of leaf-shaped teeth in the cheek region. Found in Alaska: teeth and miscellaneous bones.

Orodromeus-like

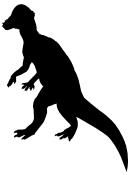
is the smallest dinosaur known in Alaska. It was only 18 inches tall at the hips and less than 4 feet long. Could *Orodromeus* have hibernated in Alaska? Found in Alaska: teeth and miscellaneous bones.

Ceratopsids or horned dinosaurs, were large, plant-eating dinosaurs that always walked on four stout legs. One type known:



Pachyrhinosaurus perotorum
was 7 feet high, 18 feet long and weighed up to four tons. It lacks the large horns typical of this group and instead has large bony protuberances or "bosses" above its nose and eye areas. The Alaskan pachyrhinosaur is a different species than those known from farther south in Alberta and Montana. Most bones were found in a bonebed deposit known as the Kikak-Tegoseak Quarry. Found in Alaska: partial skulls and bones from the limbs and backbone.

Pachycephalosaurids were unusual, small to medium sized plant-eating dinosaurs. They have a distinctive domed and thickened skull that may have been used for head- or flank-butting, for display, or both! One type known:



Alaskacephale gangloffi
was up to 3 feet tall at the hips, 8 feet long, and 150 pounds. Found in Alaska: egg-sized skull fragment with distinctive ring of ornamented bumps.

What did some plant-eaters look like?

Some plant-eaters likely had colorful skin to show off to potential mates. Although skin does not typically fossilize, impressions of dinosaur skin (probably from hadrosaurs) has been found on the North Slope.

Pachyrhinosaurus
about 69 million years old
(Skin color is speculative)

Alaska's North Slope dinosaurs are of international scientific importance. They lived in places once thought impossible for dinosaurs to survive.

Already, the numbers of different dinosaurs found on the North Slope and the amount of fossils recovered surpass all other polar dinosaur sites in the rest of the world.

Known Dinosaur Sites in Alaska

1. Western North Slope
2. Colville River area
3. Yukon River Area
4. Denali National Park & Preserve
5. Talkeetna Mountains (2 areas)
6. Wrangell St. Elias National Park & Preserve
7. Aniakchak National Monument & Preserve
8. Black Lake Area

Mesozoic Era "Age of Dinosaurs" 245-65 million years ago (mya)

Triassic Period (245-208 mya): Dinosaurs of this time as yet unknown from Alaska, but at least two types of marine reptiles are known.

Jurassic Period (208-146 mya): Dinosaur tracks of this time found on the Alaska Peninsula.

Cretaceous Period (146-65 mya): Dinosaurs of this time found on Alaska Peninsula, North Slope, Interior Alaska, and in the Talkeetna Mountains.

North Slope dinosaur finds

❶ **Western North Slope, Kuk, Kokolik, and Avingak Rivers area and other locations:** 1970s and later discoveries at various locations of isolated dinosaur tracks and skin impressions as reported by field geologists. 2001 discovery of partial hadrosaur lower leg (tibia) bones found with amber (volcanic ash beds are being analyzed to determine "absolute" age for deposits containing bones). These are the first dinosaur body fossils found on the western North Slope.

❷ **Colville River drainage, North Slope:** Dinosaur fossils were first recognized from the North Slope in the 1980s. They are mostly from the late Cretaceous Period, about 69 million years ago. 1998 discovery of numerous tracks and trackways show evidence of at least six different types of meat and plant-eating dinosaurs; the discoveries date from the middle Cretaceous, about 90-100 million years ago. Numerous dinosaur tracks are also found from upper parts of the Colville River, from older rocks, about 90-100 million years ago.

Other dinosaur finds in Alaska

❸ **Yukon River area of Central Alaska:** 2013 discovery of thousands of dinosaur tracks, estimated at 90 -100 million years old, by University of Alaska-Fairbanks paleontologists on State-owned land. The abundant remains are from a variety of different dinosaur groups, including herbivorous ornithopods, ankylosaurs and other indeterminate forms, as well as small and large-bodied theropods. This discovery underscores the fact that ancient Alaska was teeming with many types of dinosaurs for millions of years during the Late Cretaceous Period. Undoubtedly, many more new dinosaur discoveries will be made in Alaska in future years.

❹ **Denali National Park & Preserve:** 2006 and later discoveries of tracks from plant and meat-eating dinosaurs from around 70 million years ago. In 2012, tracks of a therizinosaur were announced, which is a tall, feathered dinosaur with long, sickle-like claws on its forearms. Other finds include fossilized dinosaur dung (coprolites), bird tracks, and tracks of pterosaurs (flying reptiles).

❺ **Western Talkeetna Mountains:** 1990 discovery of a skull in a creek bed of Late Cretaceous age (68-73 mya) from *Edmontonia* (a nodosaurid ankylosaur). These stocky, four-legged herbivores were covered in bony plates across the back and sides. These dinosaurs were up to five feet tall, 20 feet long and weighed 3 tons.

West-Central Talkeetna Mountains: 1994 discovery of a 90-million-year-old hadrosaur (new genus). This discovery includes the most bones from a single individual dinosaur yet found, but the skull was not found. It is the oldest hadrosaur find in Alaska and one of the oldest in North America. The specimen probably was a juvenile or young adult, four to five feet tall at the hips, nine feet long, and weighed 300-400 pounds.

❻ **Wrangell St. Elias National Park & Preserve:** 2008 discovery (published 2012) of tracks from two dinosaurs, a hadrosaur and a meat-eating theropod, from around 70 million years ago.

❼ **Aniakchak National Monument & Preserve:** 2001-2002 discovery of two tracks of a 3-toed ornithopod (hadrosaur?) (65-75 million years old) on a river estuary beach, about 420 miles southwest of Anchorage. This extends the known range of this type of dinosaur and is the first evidence of Late Cretaceous age dinosaurs from this part of Alaska.

❽ **Black Lake area on Alaska Peninsula:** 1975 discovery of dinosaur footprints. Work in 2010 revealed that these tracks were from a meat-eating dinosaur and are Jurassic in age (150 million years old), making them the oldest dinosaur fossils known in Alaska.

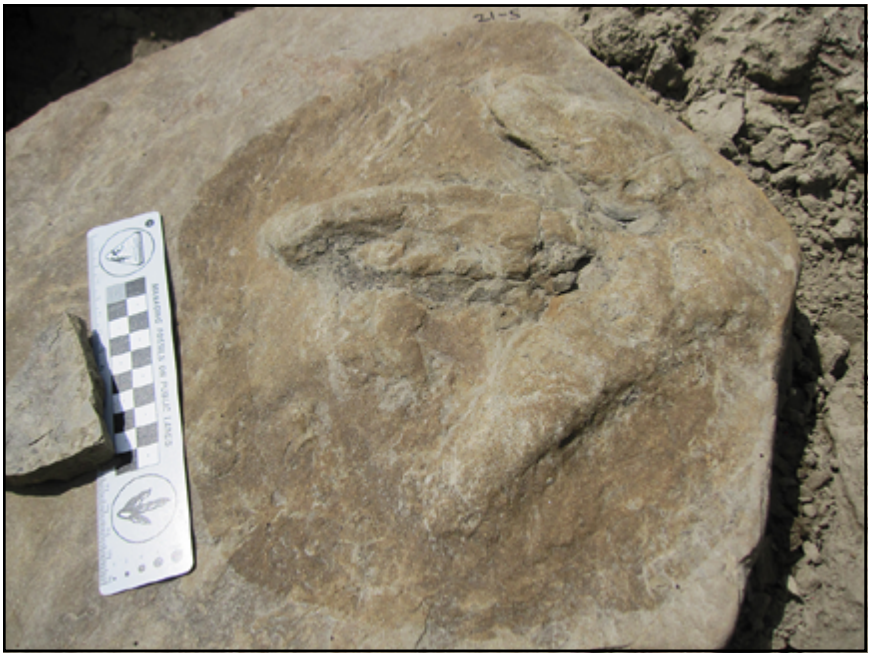


Photo: P. Druckenmiller, Univ. of Alaska Museum

A large carnivorous dinosaur footprint found along the banks of the Yukon River in central Alaska in 2013.

How to speak dinosaur

Alaskacephale
A-LAS-ka-sef-a-lee

Alectrosaurus
Ah-LECT-troh-SORE-us

Ceratopsian
SERRA-top-see-an

Dromaeosaurus
DROH-may-oh-SORE-us

Edmontosaurus
Ed-MON-toh-SORE-us

Edmontonia
Ed-mon-TOE-ne-ah

Gangloffi
Gang-LOFF-eye

Hadrosaur
HAD-roh-sore

Hoglundi
Hog-LUND-eye

Hypsilophodontid
Hip-sih-LOE-foe-don-tid

Lambeosaurid
LAMB-ee-oh-sore-id

Ornithischia
or-ni-THISS-kee-a

Ornithomimid
Or-NITH-o-My-mid

Ornithopod
Or-NITH-o-pod

Orodromeus
Ore-o-DROM-e-us

Nanuqsaurus
NAN-uk-SORE-us

Pachycephalosaurus
PAK-ee-sef-a-loe-SORE-us

Pachyrhinosaurus
PAK-ee-RINE-oh-SORE-us

Parksosaurus
Parks-o-SORE-us

Perotorum
Peh-ROW-OR-um

Saurischia
saw-RIS-she-a

Saurornitholestes
Sore-OR-nith-oh-LES-teez

Therizinosaur
THER-I-ZINE-uh-sore

Theropod
THER-oh-pod

Tyrannosaurus
Tie-RAN-oh-SORE-us

Troodon
TROH-oh-don

The Bureau of Land Management manages 245 million acres - more land than any other federal agency. These lands in Alaska and elsewhere in the USA continue to be the source of amazing new dinosaur discoveries that expand our understanding of the grandeur and diversity of life on earth in the distant past.

Other Cretaceous Life on the North Slope

Other fossils found on Alaska's North Slope indicate that Cretaceous dinosaurs lived with a variety of other animals and plant life. These animals and plants indicate a variety of small to large niches of life, all interacting, and part of the polar ecosystem, coexisting with the dinosaurs of Alaska's North Slope.

Animals

Fish fossils have been found and are still being studied to determine what kinds of fish were present.

Bird tracks have been found on both the North Slope and Denali National Park and Preserve.

Mammal fossils found are from small individuals that are identified from individual, isolated teeth. More finds are likely to be made in field and lab analysis, but here are two kinds known:

* **Multituberculate** mammals were small, covered with fur and had a tail, and probably ate foods similar to what modern rodents eat. They had a distinctive type of tooth with many bumps/ridges, hence their name Multi-(many) tuberculate (bumps).

* **Marsupial** mammals were also small, and related to today's creatures like the opossum, wallaby, and kangaroo. They were likely pouched and also covered with fur, and probably ate insects.

Plants

Petrified Wood pieces, fragments, and impressions have been found. These provide clues to the existence of polar forests in northern Alaska during the Cretaceous.

Ginkgo tree fossils are indicated by their distinct leaf patterns as seen on slabs of ancient rock along the rivers of the North Slope.

Trochodendroid – fossils of polar broad-leaved trees indicate ancient deciduous forests.

Conifer needles and cones have been found and likely were a source of food for some plant-eating dinosaurs.

Fern fossils have been found, indicating a relatively humid localized environment.

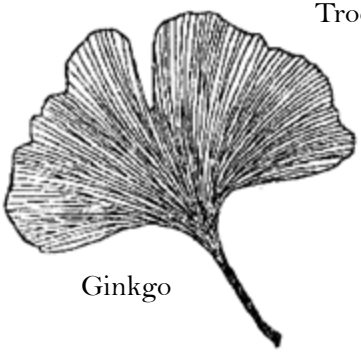
Fruiting structures of many different angiosperm fossil plants have been found or suspected from finds. These include reproductive structures like fruits, flowers, and seeds or nuts.

Angiosperm wood, leaves, and other structures have been found as fossils and may indicate forests rich with a variety of trees and related plants, including:

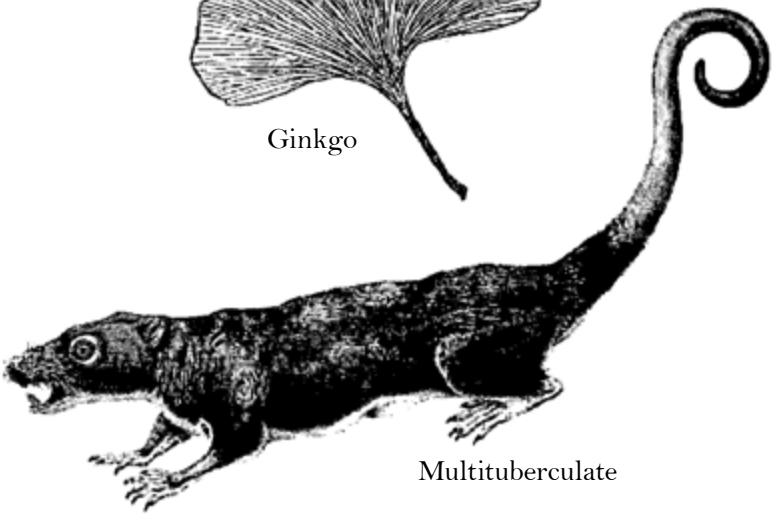
Platanoid-like angiosperms (flowering plants) are also suspected to have been growing on the North Slope during the Cretaceous, but are not yet well documented.

Conifer

Trochodendroid



Ginkgo



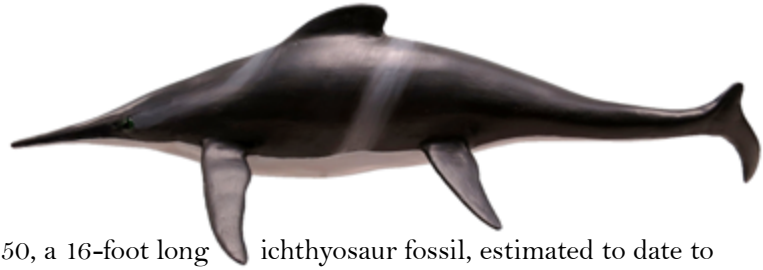
Multituberculate

Oldest North Slope Plant Fossils

During the Triassic Period (245-208 million years ago) what is now northern Alaska was submerged under deep water. It was not until the Jurassic Period (208-146 million years ago) that volcanism and geologic uplift occurred. In the Middle Jurassic (174-163 million year ago) most of the mountain ranges characterizing modern Alaska began to form. Thus, there was no dry land on what is now the North Slope until some time after this occurred. At present, the earliest known plant fossils on the North Slope date to about the same time during the Late Jurassic (163-145 million years ago) when the first evidence for dinosaurs is also found (footprints only). The earliest plants of this time, and extending later into the Early Cretaceous (145-100.5 million years ago), would likely have been varieties of ferns, ginkgoes, conifers, and other early tree forms. During the Early Cretaceous angiosperms (flowering plants) also likely appeared on the North Slope and elsewhere in Alaska.

Oldest North Slope Animal Fossils

Ichthyosaurs are large marine reptiles dating back into the Triassic Period that are known to have lived in an ancient sea located where today's North Slope is found. They are sometimes characterized as being ancient reptile versions of dolphins or whales. Ichthyosaurs are known from both Southeast Alaska and from the North Slope of Alaska.



In 1950, a 16-foot long ichthyosaur fossil, estimated to date to around 210 million years ago, was discovered about 200 miles south of Barrow in the foothills of the Brooks Range mountains. In life, this individual specimen may have been around 25 feet long while other ichthyosaurs known from other places in the world were up to three times that length. Due to the remoteness of the location and the difficulty of removing and transporting such a large fossil from the North Slope, it was left in place for over 50 years. In 2002, it was finally removed and today is at the University of Alaska Museum of the North in Fairbanks. Ichthyosaurs are amazing in that they had the largest eyeballs of any animal that ever lived - up to 11 inches in diameter!

Oldest Fossils from Alaska

While the earliest plant and animal fossils from what is now the North Slope date back only to the Late Jurassic Period (163-145 million years ago), older plant and animal fossils are known elsewhere in Alaska. During the Late Precambrian, over 500 million years ago, Alaska was covered by a shallow sea that was home to stromatolite-forming bacteria that cemented sediments into structures that are found today in parts of Southeast Alaska. By the Silurian Period of 415-435 million years ago, and the following Devonian Period that ended 360 million years ago, fossils of several different types of ancient corals are also found in Southeast Alaska.

Stromatolites in Shark Bay, Australia. Photo: Paul Harrison (Reading, UK)

These corals, like more recent types alive today, are animals that lived in colonies in shallow water. Fossil gastropods (marine snails) are also known from this early time. Yet, when alive, some of these older animals discovered in what is now Southeast Alaska lived south of where Alaska is today and were slowly transported northward to their current locations by tectonic action over the course of millions of years. Because dry land most likely didn't exist anywhere in Alaska until somewhat later than the Devonian Period, the earliest known plant fossils in Southeast Alaska are only somewhat older than the earliest ones from the North Slope. The oldest plant fossils from Southeast Alaska are similarly from early tree forms and ferns.

Another Ancient Animal Fossil from Alaska

Thalattosaurs are another type of ancient marine reptile that lived during the mid-late Triassic Period in what is now Alaska. They are not yet known from the North Slope. In 2011, a fossil thalattosaur was discovered near Kake in Southeast Alaska and represents a new species. It is a complete specimen, the first to be found in the western hemisphere. It is thought to date from around 210 million years ago and is about three feet long. Some species of thalattosaurs elsewhere in the world grew to over 12 feet in length, which included their long flattened tails used in underwater propulsion.

Where to see dinosaur fossils found in Alaska:

- Bureau of Land Management Public Information Center, first floor
  Federal Building
  222 W. 7th Ave.
  Anchorage, Alaska (907) 271-5960
  www.blm.gov/ak/st/en.html
- Alaska Museum of Science & Nature
  201 N. Bragaw Street
  Anchorage, Alaska (907) 274-2400
  www.alaskamuseum.org/
- University of Alaska
  Museum of the North
  907 Yukon Drive
  Fairbanks, Alaska (907) 474-7505
  www.uaf.edu/museum/
- University of California
  Museum of Paleontology
  Berkeley, California (510) 642-1821
  www.ucmp.berkeley.edu/
- Perot Museum of Nature & Science
  2201 N. Field St.
  Dallas, Texas (214) 428-5555
  www.perotmuseum.org/

Collecting fossils: What's legal on federal lands?

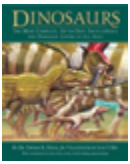
LEGAL: Non-commercial collection of small quantities of invertebrate fossils, such as fossil shells, corals, leaf imprints, and petrified wood. (Note: In some parts of Alaska, including national park units, collection of any such remains is prohibited, so check first.)

ILLEGAL: Collection, without a permit, of any amount of vertebrate fossils, including bones and teeth remains from dinosaurs, mammoths, and other ancient animals with backbones.

HOW YOU CAN HELP: If you find fossils, especially vertebrate remains, please notify the federal agency managing the discovery area. Your find may help science and the understanding of Alaska's fascinating prehistoric past!

Suggested Readings:

The Dinosauria (2007)
by Weishampel, Dodson & Osmolska
ISBN: 9780520254084



Dinosaurs (2007)
by Dr. Thomas R. Holtz, Jr. & Luis Rey
ISBN: 9780375824197

National Geographic Dinosaurs (2001)
by Paul M. Barrett
ISBN: 9780792282242

For further information on dinosaurs, visit us on the Internet at:
www.blm.gov/ak/st/en/prog/cultural.html

or contact us at:

Bureau of Land Management
222 W. 7th Avenue
Anchorage, AK 99513
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www.blm.gov/ak/st/en.html

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