

THE TIME

600 MYA — PRESENT

PEOPLE TO KNOW

Earl Douglass
David Gillette
David Madsen

WORDS TO UNDERSTAND

compress
era
erosion
excavation
fault
fossil fuel
fracture
geologist
organic
quarry
remnant
sediment

One poet described Utah's Canyonlands this way:

*Time trailing time,
Flooding shallow seas,
Iron-rich sandstone,
Fossil-laden limestone.
Uplift and erosion—
Canyonlands masterpiece.*

Utah's Geologic History

600 MYA

500 MYA

400 MYA



A Timeline of Utah's Geologic History

SOURCE: *Utah Geological Survey*

Note: MYA means millions of years ago

◀•• Precambrian Era
(85% of the earth's time period)

Paleozoic Era (570–240 MYA)

- Shallow seas cover Utah.
- Trilobites, amphibians, reptiles live in seas.
- Limestone, oil, gas, salt, potash, shale are in rock.



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Chapter 2

SETTING THE STAGE

For millions of years Utah's land was covered by warm, shallow seas teeming with small shelled animals, fish, and then reptiles. The seas came and went over and over again. During this time our oil, gas, and coal were being formed.

The seas dried and sand covered the land. Dinosaurs lived here for millions of years. Then mammals came. Mountains and plateaus were formed. Volcanoes erupted, bringing up copper, gold, and silver from deep inside the earth. Then the shivering Ice Age once again changed the land.

Today, Utah's land reads like a book of geologic history. Everywhere you look you can see evidence of the earth's changes through time.

300 MYA

200 MYA

100 MYA

PRESENT

Mesozoic Era (240–65 MYA)

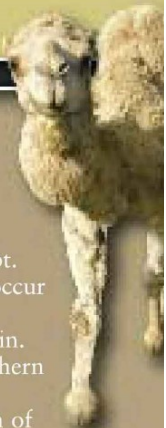
- Dinosaurs and primitive mammals appear.
- Shallow seas, then sandy deserts cover the land.
- Sedimentary rock of Utah's national parks is formed.
- River system exists.
- Dinosaurs disappear.
- Rocky Mountains begin forming.

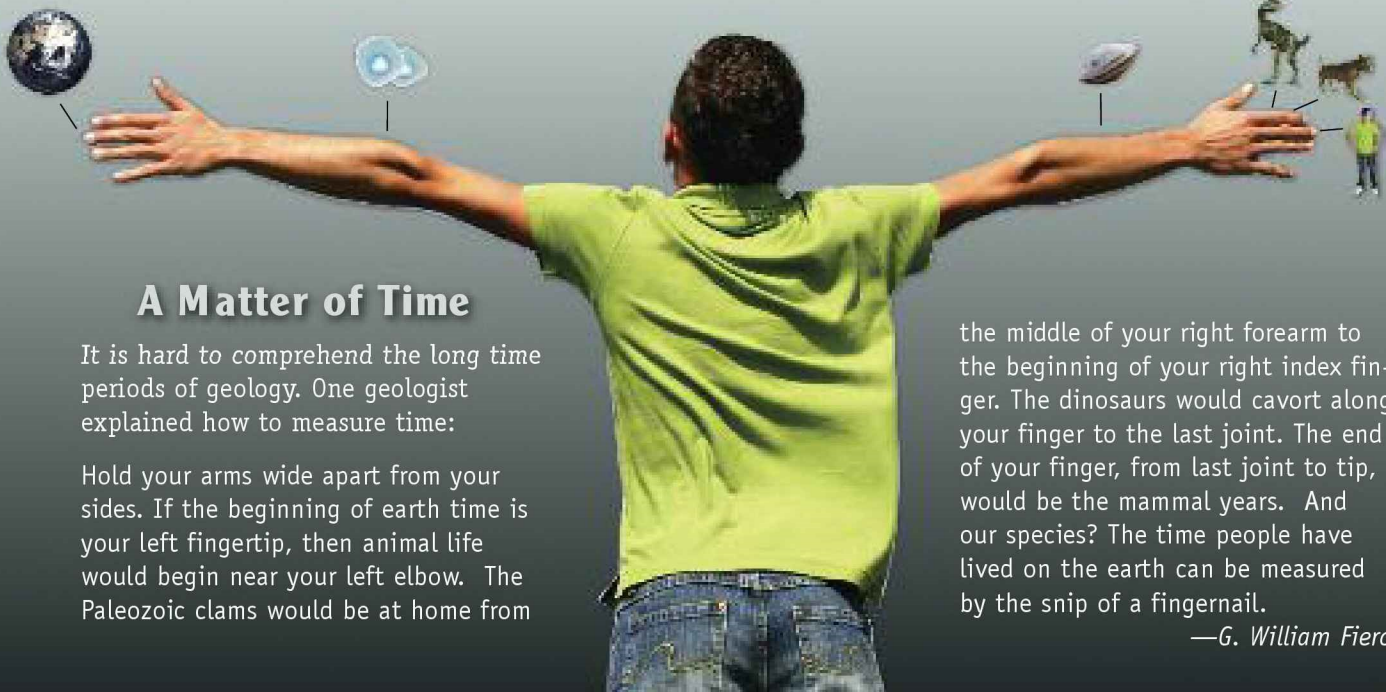


Cenozoic Era

(65 MYA to present)

- Mammals live here.
- Mountains are formed.
- Plateaus rise. Volcanoes erupt.
- Copper and other minerals occur in rock.
- Carving of Canyonlands begin.
- Ice Age glaciers blanket northern Utah mountains.
- Lake Bonneville covers much of Utah, then declines.
- Great Salt Lake gets saltier.
- Humans appear.





A Matter of Time

It is hard to comprehend the long time periods of geology. One geologist explained how to measure time:

Hold your arms wide apart from your sides. If the beginning of earth time is your left fingertip, then animal life would begin near your left elbow. The Paleozoic clams would be at home from

the middle of your right forearm to the beginning of your right index finger. The dinosaurs would cavort along your finger to the last joint. The end of your finger, from last joint to tip, would be the mammal years. And our species? The time people have lived on the earth can be measured by the snip of a fingernail.

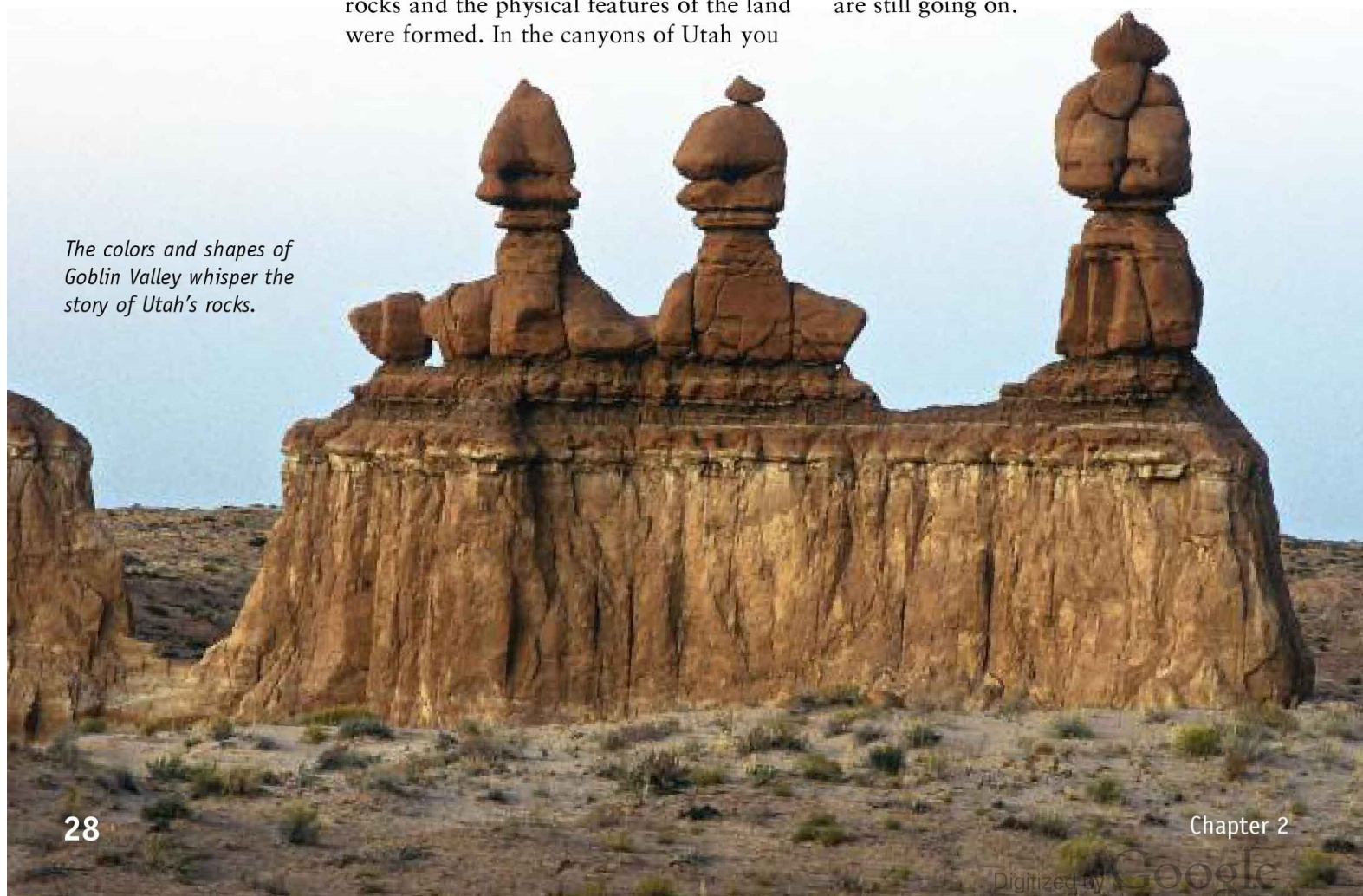
—G. William Fiero

Shaping the Land

Geologists are scientists who learn about the history of the earth by studying rocks and land formations. They try to determine how rocks and the physical features of the land were formed. In the canyons of Utah you

can see many layers of rock that give clues as to the history of the mountains and plateaus. Wind, water, earthquakes, floods, and even cold and heat have worked together to cause changes over very long periods of time. These changes are still going on.

The colors and shapes of Goblin Valley whisper the story of Utah's rocks.



Geologic Eras

From studying rock formations, geologists have divided the earth's long life into several major divisions of time called **eras**. Study the timeline of these eras on the opening pages of this chapter. Eras are based largely on events that changed the earth's crust, such as the formation of mountain ranges. Eras are also based on the kinds of plants and animals that lived at the time.

The earliest known era, the **Precambrian**, is when the oldest rocks of the continents were formed. Precambrian rock can be found on Antelope Island in the Great Salt Lake.

The **Paleozoic** era means "ancient life." It is a time that fascinates mining engineers today. This era produced the beginnings of the **fossil fuels** we know as coal, oil, and natural gas. The fuels were formed from the remains of decaying plants and animals. Utah has many deposits of these fuels in Carbon County, the Uinta Basin, and other places.

The **Mesozoic** era is the time of the dinosaurs. These large creatures roamed the land in many places on the continent. Also during this era, the Rocky Mountains were just beginning to take shape.

In the last era, the **Cenozoic**, giant mammals replaced the dinosaurs. It became colder, and much of the earth's surface was covered with large sheets of ice. Utah was not covered with Ice Age glaciers, but many small glaciers formed in the tops of our mountains.



Utah's limestone is composed of the shells of ancient sea animals. The formations inside Timpanogos Cave are made by water dripping from the limestone and other rock.



Ancient Seas and Sandstorms

During many geologic eras, shallow seas took turns covering much of what is now North America, including Utah.

Sediments made of loose sands, shells, and pebbles drifted to the bottom of the seas. In time, the sediments were forced together by heat and pressure into hard rock. As time passed, more layers of sediment were laid down. They hardened into layers of limestone and sandstone rock as thick as 1,000 feet in some places. These are important building stones today.

As the Utah region slowly began to lift above the surrounding land over time, the shallow seas washed away or evaporated. Utah then entered a period of dryness that had never been seen before or since. For thousands of years, sands from around the continent blew across the high basin that would become a part of Utah, especially in the Colorado Plateau Region. The desert sands **compressed** into mountains of sandstone thousands of feet high. These mountains can be found in Utah's five national parks and other areas.

After the ancient seas dried up, Utah had a period of dryness that had never been seen before or since. Today, Little Sahara Sand Dunes remind us of that time long ago.

Fossils

Dead plants and animals became fossils within rocks. Fossils are formed when minerals interchange with the **organic** matter of a living thing that has died. A fossil is also a trace or impression of a living thing, such as a footprint. Utah's oldest animal fossils are trilobites.





DINOSAURS



One of the most interesting geologic periods was when dinosaurs walked the earth. This was a time when there were no Rocky Mountains and no Colorado Plateau. They would not be formed for another 80 million years or so.

The different rock layers where many of Utah's dinosaur bones have been uncovered reflect the land at the time. Pebbly sandstone represents the channel of a river. It had a strong enough current to carry dead dinosaurs. Greater thick-

nesses of mudstones show that ancient rivers often flooded, spreading mud far over the low plains. Finally, rare limestone layers indicate that a few shallow lakes lay here and there. Overall, the land was a dry place, quite different from the swampy habitats associated with dinosaurs.

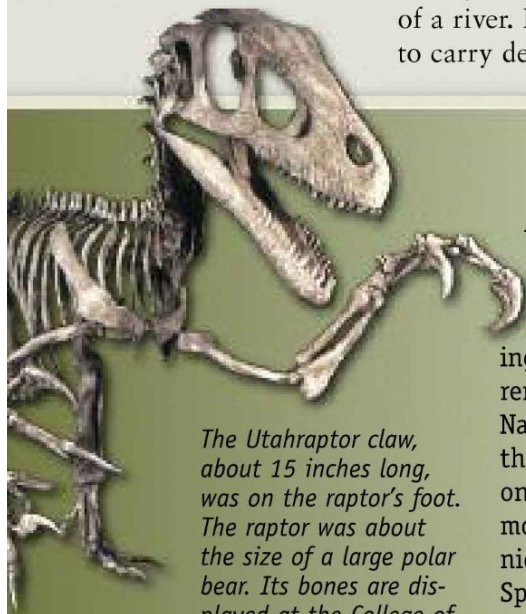
Our Dino Quarries

Some of the world's most complete dinosaur skeletons have been found in Utah. Ten new species have been discovered in the past few years. You can see the **quarries**, or digs, at Dinosaur National Monument near Vernal and at the Cleveland-Lloyd Dinosaur Quarry near Price.

The Cleveland-Lloyd Quarry has yielded over 40 allosaurs and over 12,000 other bones from its stony grip. You can see almost-complete skeletons of dinosaurs, an Ice Age mammoth, and a giant sloth at the CEU Prehistoric Museum in Price.

You can hike a trail in Mill Canyon, near Moab, and see dinosaur bones still in the ground. Rare tracks are in sandstone north of the Moab airport. The aptosaurus that once walked there had large hind feet about two feet in diameter, and smaller front feet.

Builders digging near St. George in 2000 uncovered dinosaur tracks. More than a thousand tracks have been found. They date back to 250 million years ago.



The Utahraptor claw, about 15 inches long, was on the raptor's foot. The raptor was about the size of a large polar bear. Its bones are displayed at the College of Eastern Utah in Price.

The Utahraptor

A newly discovered carnivore, called an "extraordinary killing machine" because of its huge slashing claws, was discovered in a remote region north of Arches National Park in 1992. Because the raptor closely resembles one of the dinosaurs in the movie "Jurassic Park," it is nicknamed the Utahraptor Spielbergi, after the movie's director, Steven Spielberg.

Douglass Discovers Dinosaurs

Earl Douglass was employed by the Carnegie Museum of Pittsburgh, Pennsylvania. He came to Utah's Uinta Basin to search for prehistoric mammals, not dinosaurs. He wrote in his journal in 1907:

May 31: *I want to go to Utah. . . . I wish I could go to collect fossil mammals. It is what I have wished to do for years.*

Douglass did move to Utah and began studying rock formations and looking for ancient bones. The next year the museum director came out and suggested they take a look at some older rocks in a different part of the basin. Mr. Andrew Carnegie, a very rich man in the East, had donated a lot of money to build a huge new exhibit hall at the museum in Pittsburgh. The story goes that Mr. Carnegie had said, "Fill that room with something big."

Douglass wrote in his journal about his first important dinosaur discovery:

August 12: *Went out prospecting again Found dinosaur bones but nothing good. . . .*

August 17: *At last in the top of the ledge . . . I saw eight of the tail bones of a Brontosaurus in exact position. It was a beautiful sight.*

There were many problems, however, in getting the skeleton out of the ground and moving it:

August 19: *The construction of a road to the Dino does not seem so difficult . . . but that of getting out the Dino in good shape increases. It is going to be a tremendous job. But it will be one of the greatest specimens if it is all there. . . . Of all things I must not injure the specimen by carelessness or want of skill.*

Six years after Douglass first saw it embedded in the ground, the complete brontosaurus skeleton stood in the Carnegie Museum's exhibit hall in Pennsylvania. It was truly something big.

Later, when the Carnegie Museum ran out of room and out of money for more digging, Utah's dinosaur bones were taken by wagon and train to the Smithsonian in Washington, D.C., and some were returned to Utah and displayed at the University of Utah.

Where can scientists store thousands of dinosaur bones from Utah's quarries? Underneath the tall metal bleachers of Brigham Young University's football stadium, of course!



Earl Douglass

Utah Dinosaurs

The huge creatures are divided into two groups by what they ate:

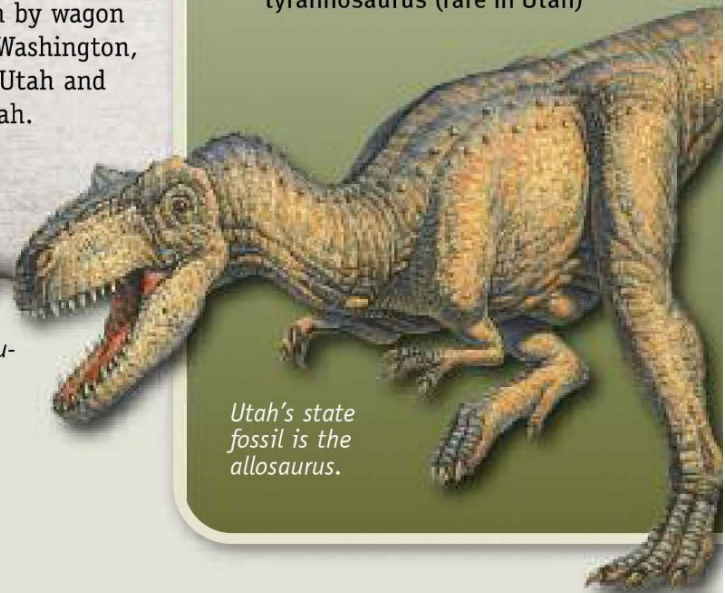
Herbivores (plant-eating)

aplosaurus
stegosaurus
camptosaurus
camarasaurus
diplodocus

triceratops (rare in Utah)

Carnivores (meat-eating)

allosaurus (most common)
Utahraptor (new find)
tyrannosaurus (rare in Utah)



Utah's state fossil is the allosaurus.

