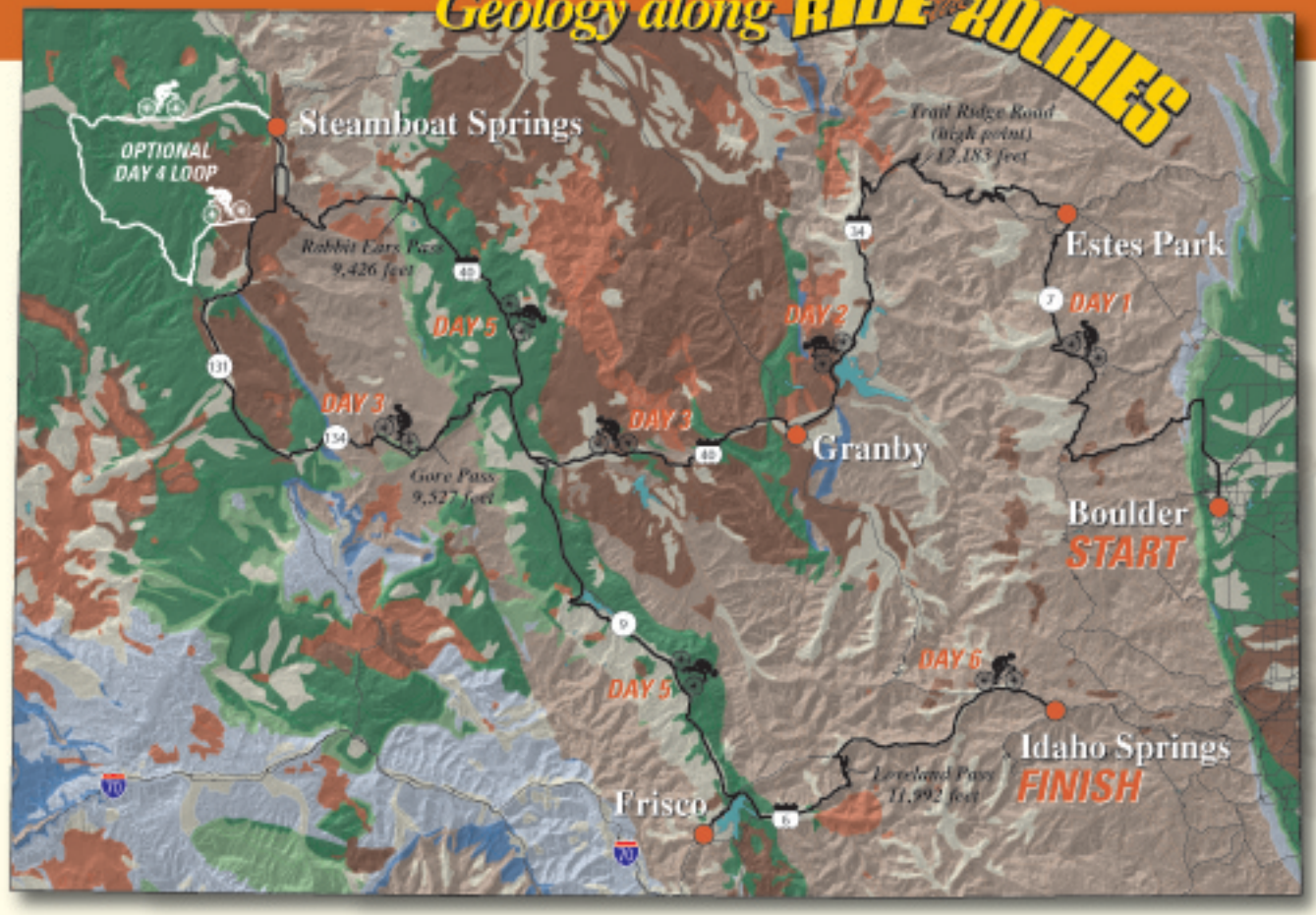
Geology along RIDE the ROCKIES



Quaternary – 0 to 1.8 million years ago

This is the period during which the present landscape formed. Glaciation peaked and waned several times, sculpting cirques and U-shaped valleys. Last major glaciers retreated about 12,000 years ago.

Includes alluvium (sand, gravel, and silt deposited by rivers and streams), eolian (windblown) deposits, glacial deposits, landslide deposits, and young volcanic rocks (basalt flows).

Tertiary – 1.8 to 66 million years ago

A major mountain-building episode, the Laramide orogeny, occurred during this period—70 to 45 million years ago. Erosion then exposed basement rocks and created a flat surface. Erosion of this surface during regional uplift—beginning 10 to 5 million years ago—shaped the present mountain landscape. Rifting (faulting) began about 30 million years ago, creating the Arkansas and San Luis Valleys.

Sedimentary rocks of Tertiary age
Includes sandstone, siltstone, shale, claystone, and conglomerate (rounded rock fragments in a fine-grained matrix).

Igneous rocks of Tertiary age
Includes volcanic rocks, such as basalt, rhyolite, and ash-flow tuffs (especially in the San Juan Mountains), and intrusive rocks with compositions similar to granite.

Cretaceous – 66 to 144 million years ago

A seaway flooded Colorado, depositing shallow marine, shoreline, and swamp sediments. Dinosaurs became extinct by the end of this period.

Includes primarily shale, sandstone, and coal, and minor limestone and conglomerate (rounded rock fragments in a fine-grained matrix).

Jurassic and Triassic – 144 to 245 million years ago (includes some rocks as old as 320 million years)

The Ancestral Rockies were eroded during this time of deserts, intermittent streams, salt flats, coastal plains, dunes, and deltas. Dinosaur fossils and footprints are found in deposits of ancient river channels.

Includes sandstone, siltstone, and claystone; minor limestone, gypsum, and conglomerate (rounded rock fragments in a fine-grained matrix).

Permian and Pennsylvanian – 245 to 320 million years ago

During this time, rocks were uplifted to form the Ancestral Rocky Mountains, which were just as high and rugged as our present mountains. Erosion of older sediments resulted in deposition along mountain flanks and in basins.

Includes sandstone, siltstone, shale, conglomerate (rounded rock fragments in a fine-grained matrix), gypsum, and limestone.

Mississippian to Cambrian – 320 to 540 million years ago

This was a time of widespread marine deposition when Colorado was intermittently below sea level.

Represented mostly by limestone, but also includes quartzite, sandstone, shale, and dolomite.

Precambrian – older than 540 million years ago (includes rocks as old as about 1.8 billion years in Colorado)

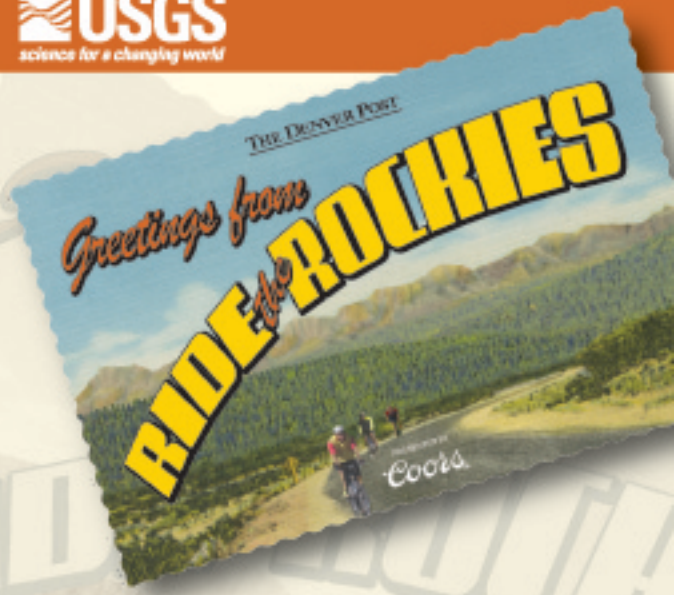
The Precambrian Era accounts for more than 85 percent of geologic time. These rocks are referred to as the basement rocks; they are exposed in the cores of major mountain ranges and in some of the deeper canyons. They are the products of metamorphism (changes in the chemistry and fabric resulting from heat and/or pressure) and igneous intrusion (emplacement of molten rock).

Includes intrusive rocks, chiefly granite, and metamorphic rocks such as gneiss, schist, and quartzite.

Lakes

0 10 20 MILES
MAP SCALE

USGS
science for a changing world



Geology Highlights of the 2004 RIDE The ROCKIES

June 20–June 25, 2004

General Information Product 2A

U.S. Department of the Interior
U.S. Geological Survey

Geology Highlights along Ride The Rockies 2004 Route

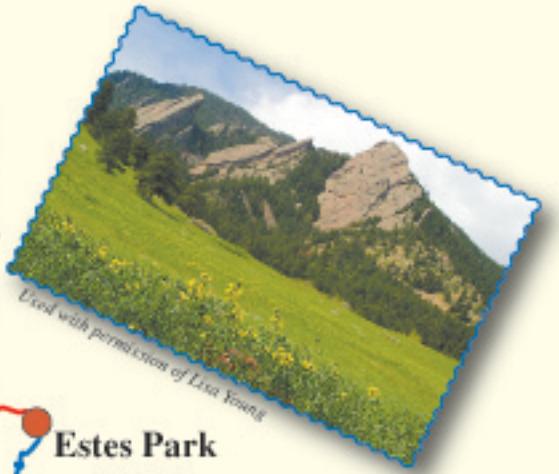
RIDE the ROCKIES

DAY 1 *SUNDAY, JUNE 20 – Boulder to Estes Park*

The Flatirons are the most prominent landform on the west edge of Boulder. The 320- to 280-million-year-old rocks of the Flatirons represent alluvial fan deposits of sand and gravel that formed when the Ancestral Rockies were uplifted and eroded. The rocks that form the Flatirons are directly on Precambrian granite that is 1.45 and 1.75 billion years old. Other sediments were laid down on top of the sand and gravel during the Cretaceous Period, the end of which marks the end of the Age of Dinosaurs (about 65 million years ago). The Laramide orogeny (a mountain-building episode 70 to 45 million years ago) and further uplift during the last 10 million years tilted these rocks, and subsequent erosion of softer surrounding rocks exposed the Flatirons.

DAY 2 *MONDAY, JUNE 21 – Estes Park to Granby*

Today's ride crosses the Continental Divide along Trail Ridge Road, the highest, continuous paved highway in the country. Glaciers carved broad flat valleys, and left behind cirques (semicircular-shaped bowls sculpted by glaciers at the heads of mountain valleys) and moraines (ridges made up of mixtures of rock material of various sizes and shapes) along the valley walls and downvalley where the glaciers ended. Above timberline, the view to the south is dominated by the major glacial valley of Forest Canyon in which ice was 1,000 to 1,500 feet thick and flowed eastward more than 13 miles. West of the Divide, the road drops into the valley of the Colorado River, which held the longest Ice Age glacier (20 miles long) of the Park.



DAY 3 *TUESDAY, JUNE 22 – Granby to Steamboat Springs*

Leaving Granby, we pedal west down the Colorado River valley into a canyon cut through a variety of rock types sliced by faults. The canyon eventually opens into Middle Park, the middle of three relatively featureless surfaces in the high mountains of Colorado. Remnants of sedimentary rocks that were eroded from the Ancestral Rockies overlie the Precambrian granite of the Gore Range. Our ride takes us through pastoral open valleys as we climb to the top of Gore Pass. Descending the west side of the pass and along the highway north to Steamboat Springs, spires or "fingers" of rock can be seen protruding from the landscape. These are volcanic necks, the hardened remains of former conduits of Tertiary volcanoes.

DAY 4 *WEDNESDAY, JUNE 23 – Steamboat Springs (optional loop ride)*

Most of today's ride is through undulating topography of Upper Cretaceous sandstone, shale, and coal of the Mesaverde Group (82 to 72 million years old), which was deposited near the shore of an ancient seaway. The Flat Tops, the aptly named mountains to the southwest, are capped by volcanic lava flows of Tertiary age.

DAY 5 *THURSDAY, JUNE 24 – Steamboat Springs to Frisco*

As we leave Steamboat Springs, we climb out of the Yampa River valley up the steep face of the Park Range through Precambrian gneiss and schist and then granitic rocks to Rabbit Ears Pass. North of the pass, you'll see the "rabbit ears" of Rabbit Ears Peak. The peak is made up of volcanic rocks that erupted between 33 and 23 million years ago from the Rabbit Ears Range to the east. Later erosion sculpted the peak into the "rabbit ears" we see today.

DAY 6 *FRIDAY, JUNE 25 – Frisco to Idaho Springs*

Leaving Frisco, we skirt the shores of Lake Dillon, the largest water-storage facility for the Denver metropolitan area. A tunnel moves water from Lake Dillon under the Continental Divide to Denver. Pedaling up to the Divide at Loveland Pass, we'll see more evidence of glaciation in the form of three cirques above Arapahoe Basin ski area. The ride east passes relics of Colorado's mining history; more than $400 million worth of gold, lead, zinc, and copper were produced from this area in the latter half of the 19th century.

Steamboat Springs

Granby

Estes Park

Boulder
START

Idaho Springs
FINISH

Frisco