Rocky Mountain

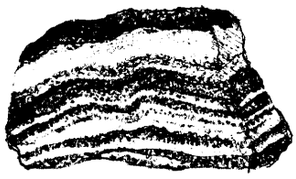
National Park Service
U.S. Department of the Interior

Rocky Mountain National Park

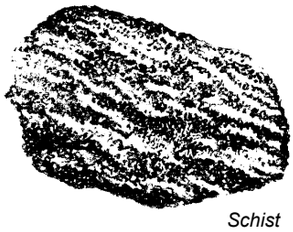
Geology

Rocky Mountain National Park is, in many respects, a huge outdoor geology museum. Spectacular vistas of nature's handiwork are readily accessible from your automobile and along more than 346 miles of trail. The park offers classic examples of geologic uplifts, erosion, and glaciation. Rock formations in the park are among the oldest in the United States. Mountain tops flattened by the relentless forces of erosion dominate a landscape of steep slopes, U-shaped valleys, crystal clear lakes, and moraine deposits left by glaciation.

Ancient Rocks



Gneiss



Schist

Granite

The park's oldest rocks were formed when crustal plate movements subjected deeply buried sea sediments to intense pressure and heat. The resulting metamorphic rocks—schist and gneiss—are approximately 1.7 billion years old. Schist and gneiss were later intruded by magma which cooled some 1.4 billion years ago to form crystalline igneous rock— mostly silver plume granite.

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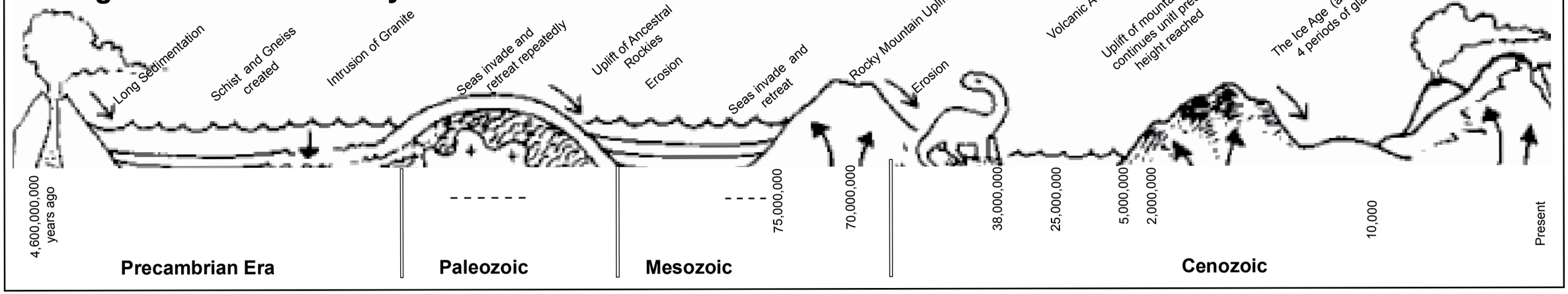
Uplift and Erosion

About 70 million years ago there was an era of uplift. Giant blocks of ancient crystalline rock, overlain by younger sedimentary rock, were fractured and thrust upward. During the uplift, wind and water erosion continued, moving loosened particles of rock to lower areas. After the sedimentary rocks were mostly gone, erosion continued to remove some of the ancient Precambrian rocks until only a few isolated remnants projected above the gently rolling landscape. The gentle slopes seen along Trail Ridge Road and Flattop Mountain are examples of this pre-glaciated landscape.

Some 25 million years ago volcanic deposits of igneous rocks and windblown ash settled on the older Precambrian formations. The igneous rocks can be seen in the park's Never Summer Mountains and on Specimen Mountain. Metamorphic volcanic ash forms can be at Lava Cliffs along Trail Ridge Road.

Faulting and upwarping continued to lift the Rocky Mountain Front Range as much as 5,000 feet. By about two million years ago, current elevations were in place. Erosion continued to carve the landscape. Sedimentary layers on the eastern plains had tilted with the uplift of the mountains. Stream erosion of these tilted rock formations produced hogback ridges near the towns of Lyons and Loveland. Differential movement along geologic faults caused mountain height variations and creating waterfalls and large valley areas such as in Estes Park and the Kawuneeche Valley.

Geologic Timeline for Rocky Mountain National Park



Glaciation

While uplifts and volcanoes provided the major geological building blocks of the park, glaciers sculpted today's marvelous landscapes.

About two million years ago, the Pleistocene "ice age," began and the climate cooled. Deep snow accumulated on the lee side of the highest elevations. As snow compacted glaciers formed, flowing downward, forming deep V-shaped cuts and widening streams. These rivers of ice flowed into lower elevations where the ice melted and dropped debris scraped from the mountainsides above. Debris deposits along valley sides are called lateral moraines. Material left at the farthest extension of the glaciers are terminal moraines.

During the most recent time of major glaciation, starting about 28,000 years ago, glaciers from Forest Canyon, Odessa Gorge, and other tributary valleys all flowed together to form a large glacier which melted in the area now called Moraine Park. This massive glacier left distinct lateral moraines that define the south and north sides of Moraine Park and a terminal moraine against Eagle Cliff Mountain to the east. Similar glaciers melted and left moraines in areas now called Glacier Basin, Horseshoe Park, and the Kawuneeche Valley. Bear Lake and Grand Lake were formed by terminal moraines.

Present Landscape

Today, Precambrian granites and metamorphic rocks dominate in the central and eastern sections of the park. A few remnants of sedimentary rock are found among the volcanic formations of the Never Summer Mountains along the park's northwest boundary.

Steep-sided, semicircular scars (cirques), often snow-filled, form the tops of U-shaped, glaciated valleys. Chasm Lake, below the east face of Longs Peak, rests in such a cirque. Numerous cirques are visible from Trail Ridge Road. Glacial erosion also left scratches or striations, grooves, and polished surfaces on some bedrocks. Now, the few small glaciers and stationary snowfields in the park that occupy the tops of glacial valleys only hint at Ice Age landscapes. Andrews Glacier shows evidence of down-valley movement, but it melts back during dry years. Global warming could have a significant impact on the glaciers and snowfields. No definitive research has been done to verify whether glaciers in the park are advancing or retreating.

A recent theory has suggested that "rock glaciers," conglomerations of rock and ice, are part of active glacial complexes in the park.

Some areas of the park on the high mountaintops and at lower altitudes were not glaciated. The Twin Owls and Gem Lake Trail areas had coarse-grained granite rounded into interesting shapes by millions of years of non-glacial erosion.

Rocky Mountain National Park occupies only a small part of the 200 mile-long Front Range of the Rocky Mountains, but the park's mountaintops show the spectacular effects of ancient erosion, while many of its valleys display classic features of glaciation.

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