



## Geology: Building Black Canyon



The steep, narrow cliffs and roaring river below inspire curiosity. Like a large building, we want to know how it was built. How long did it take? What are the materials? Understanding local geology answers all these questions and fosters an appreciation for the forces used to construct this canyon.

### Laying the Foundation

Picture a shallow sea—like the Gulf of Mexico. The rock of Black Canyon started forming when rivers carried sediment to a sea where it was deposited. Volcanoes also blasted ash into the sea. The newly-formed rock of these

deposits was gradually buried deep below earth's surface. Great pressure and heat transformed them to metamorphic rocks: schist and gneiss. This change to form the basement rock occurred about 1.8 billion years ago.



**SCHIST:** A dark, glittery rock that looks layered. Mica, a sheet-like mineral, causes the sparkle. Sometimes distinct garnet crystals are found.

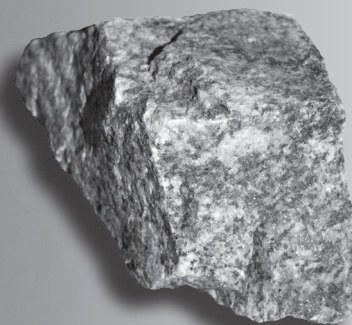


**GNEISS:** (pronounced "nice") A dark rock with light and dark bands that formed as minerals lined up from very high pressure. Gneiss is the most widespread rock in Black Canyon.

### Painting the Walls

While still buried deep in the Earth, magma squeezed into cracks within the schist and gneiss, 1.4 to 1.7 billion

years ago. As it cooled, minerals grew and formed the igneous rocks that bring vibrant color accents to the canyon walls.



**GRANITE:** Has a mottled appearance with small crystals of pink feldspar, white quartz, and various black crystals. You can step on this rock at Chasm View Overlook.



**PEGMATITE:** Composed of similar minerals to granite, this rock has noticeably larger crystals. The thin pink and white stripes in the canyon walls are made of pegmatite. See Painted Wall (far left).

## Masonry Work

By 170 million years ago, the overlying earth covering the metamorphic and igneous rocks eroded to low plains, exposing those rocks on the surface. Different environments from semi-tropical or savanna to shallow sea came and went. These environments deposited various sediments. The sediments compacted and bonded to form sedimentary rocks. As a mason cements row upon row of bricks, these deposits formed the layers which are above the rims of the Black Canyon. These layers remain on the north rim.



Fossils found in these sedimentary layers reveal a time when dinosaurs like *Stegosaurus* (left) and *Allosaurus* (above) roamed.



**SANDSTONE:** Pink-yellow or gray, sandy rock. Formed when the land supported a savanna environment.

## Jacking Up the Building

Powerful forces caused the land in Colorado to lift up some 70 million years ago. The Rocky Mountains pushed upward along with a block of rock called the Gunnison Uplift.

## Redecorating

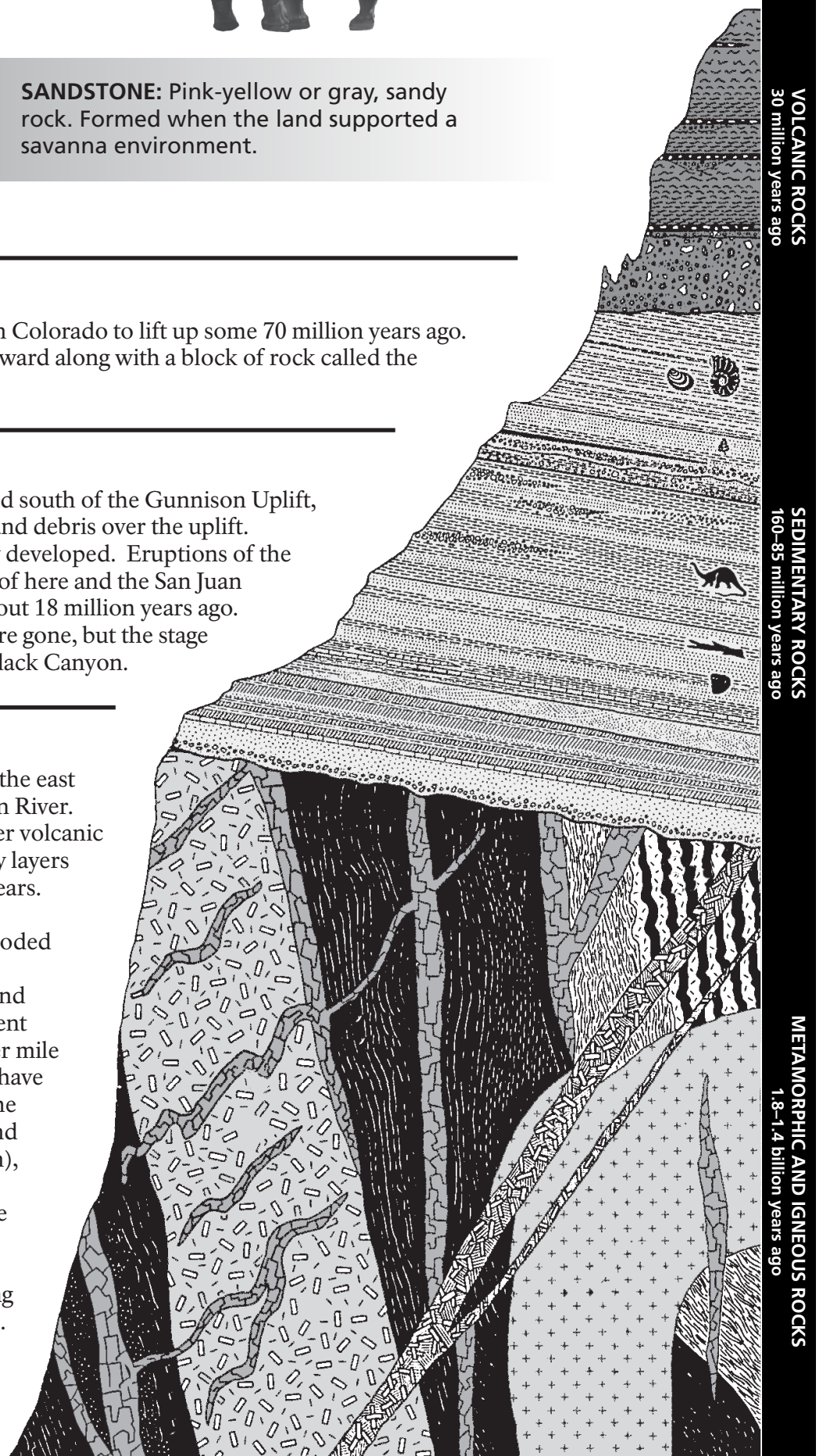
Volcanoes formed to the north and south of the Gunnison Uplift, blasting thousands of feet of ash and debris over the uplift. Sagging down the middle, a valley developed. Eruptions of the West Elk Mountains to the north of here and the San Juan Mountains to the south ended about 18 million years ago. Most of the deposits in the park are gone, but the stage was set for final construction of Black Canyon.

## Finishing Work

Snowmelt from the mountains in the east drained into the ancient Gunnison River. The river carved through the softer volcanic material and then the sedimentary layers over most of the past 15 million years.

Two million years ago, the river eroded down to the harder metamorphic and igneous rocks, getting stuck and incising downward. A steep gradient averaging 43, and up to 95, feet per mile (8–18 m/km) allowed the river to have enormous power. Compared to the Colorado River's gradient in Grand Canyon (7 feet per mile, 1.3 m/km), the Gunnison scours through the hard rock at an average rate of one inch per century.

Black Canyon and the surrounding landscape is continuing to change. What do you suppose the canyon will look like if you could come back in two million years?



Modified stratigraphic column from Wallace R. Hansen's *The Black Canyon of the Gunnison*, USGS Bulletin 1191, published in 1965.