

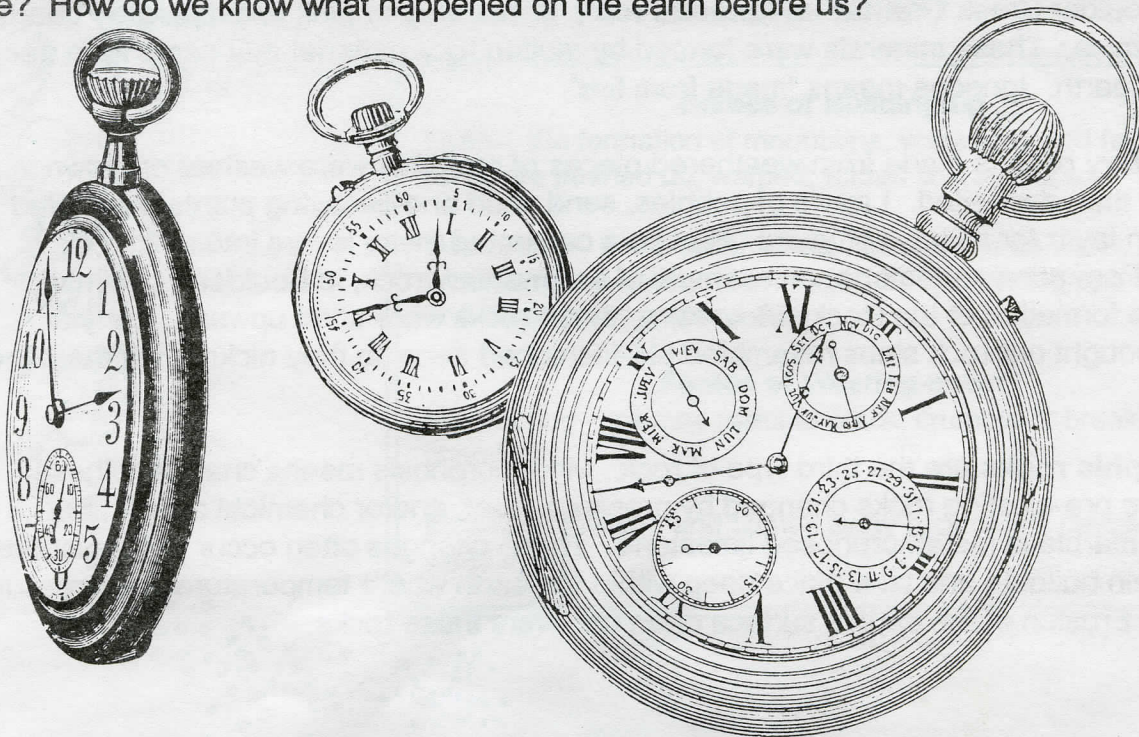
# NATURE DETECTIVES

## The Ever-Changing Earth

Has Colorado always looked like it does today? The answer is no. In fact, Colorado has been through lots of changes over the years— millions of years that is. Let's take 325,000,000 years and shrink it down into 12 hours. Here's what would have happened beginning at noon and ending at midnight.

Between noon and 1:45, the Ancestral Rocky mountains were uplifted and eroded. Around 1:45, the climate became very dry and windy. Sand dunes were formed. From 3:45 until 5:00, a shallow sea flooded the area. A few sand dunes developed. At 5:00, the Jurassic Era began. Small lakes and slow streams divided this dinosaur habitat. By 7:00, another shallow sea had flooded the area. Between 9:45 and 11:00, the Rocky Mountains were uplifted and eroded.

It's midnight now. Ever since 11:00, glaciers and streams have continued to erode the mountains. At 11:53, the first humans evolved. We haven't been around very long, have we? How do we know what happened on the earth before us?

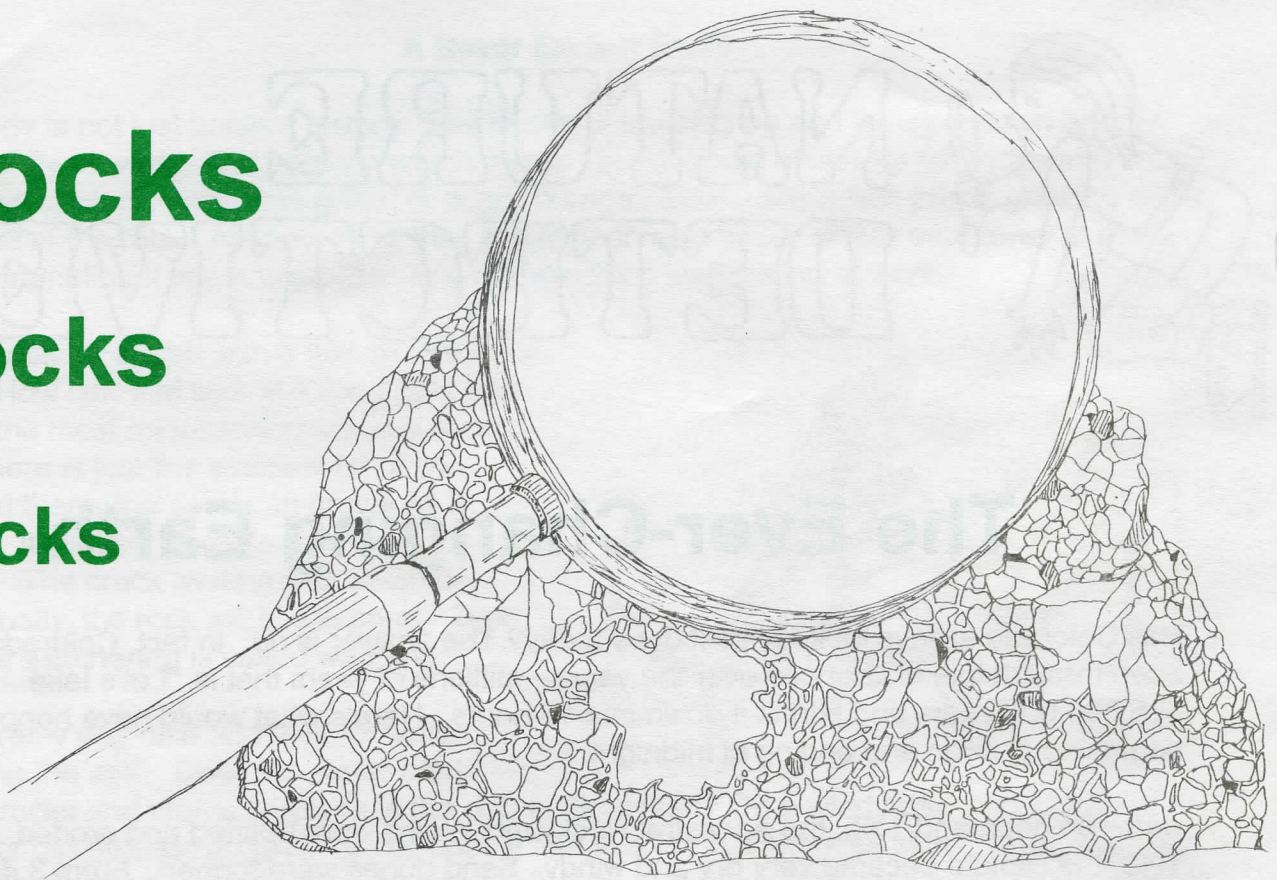




# Rocks

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Geology includes the study of rocks and rocks are good story tellers. Geologists have identified 3 types of rocks based on how they were formed. Knowing these 3 basic types helps you to read the earth's story.

The oldest rocks in Boulder County were first discovered in the canyon along Boulder Creek. Boulder Creek Granite, an **igneous rock**, is made up of pink feldspar, gray quartz and dark mica. These minerals were formed by molten rock material that came from deep within the earth. Igneous means "made from fire".

**Sedimentary rock** is made from weathered pieces of rock that were washed or blown away and then deposited. Layers of pebbles, sand, mud and decaying plants were piled layer upon layer for millions of years. Pressure cemented these layers into solid rock. Fountain Formation sandstone, an example of sedimentary rock, is Boulder's landmark. During the formation of the Rocky Mountains, these rocks were tilted upward. Early settlers thought our rock slabs resembled old-fashioned irons so they nicknamed them the Flatirons.

**Metamorphic rocks** are the third type of rock. Metamorphosis means change. These rocks were pre-existing rocks changed by pressure, heat, and/or chemical action. For example, marble is metamorphosed limestone. These changes often occur with episodes of mountain building and take place deep within the earth where temperature and pressure are high. Erosion of the earth's surface often uncovers these rocks.





## What goes up must come down!

Have you ever built a big sand castle and then poured water slowly over the top? What happened? Most likely, part of your castle collapsed while other parts were carved away by the water as it made its way to the bottom.

Imagine that the mountains of Colorado are like giant sand castles. Over time, gravity, streams, and glaciers carry rocks and dirt downhill towards the plains. We call this erosion. Just like your castle, parts of the mountains can collapse creating big piles of debris. Other parts are carved away by water and ice, forming valleys.

Of course, mountains are not made by people using buckets and shovels. They are formed by forces beyond our control. Deep inside the earth, there are rocks so hot that they have melted into a liquid, called magma. This magma pushes up towards the earth's surface causing the earth's crust to wrinkle. These wrinkles are the mountains that we see.

You can create and destroy a sand castle all in one day. However, the Rocky Mountains have taken millions of years to become what they are today. This cycle of uplift and erosion has occurred many times. And, even though the mountains seem to stay the same, they are always changing.

## DICTIONARY

### Forces of Building-up

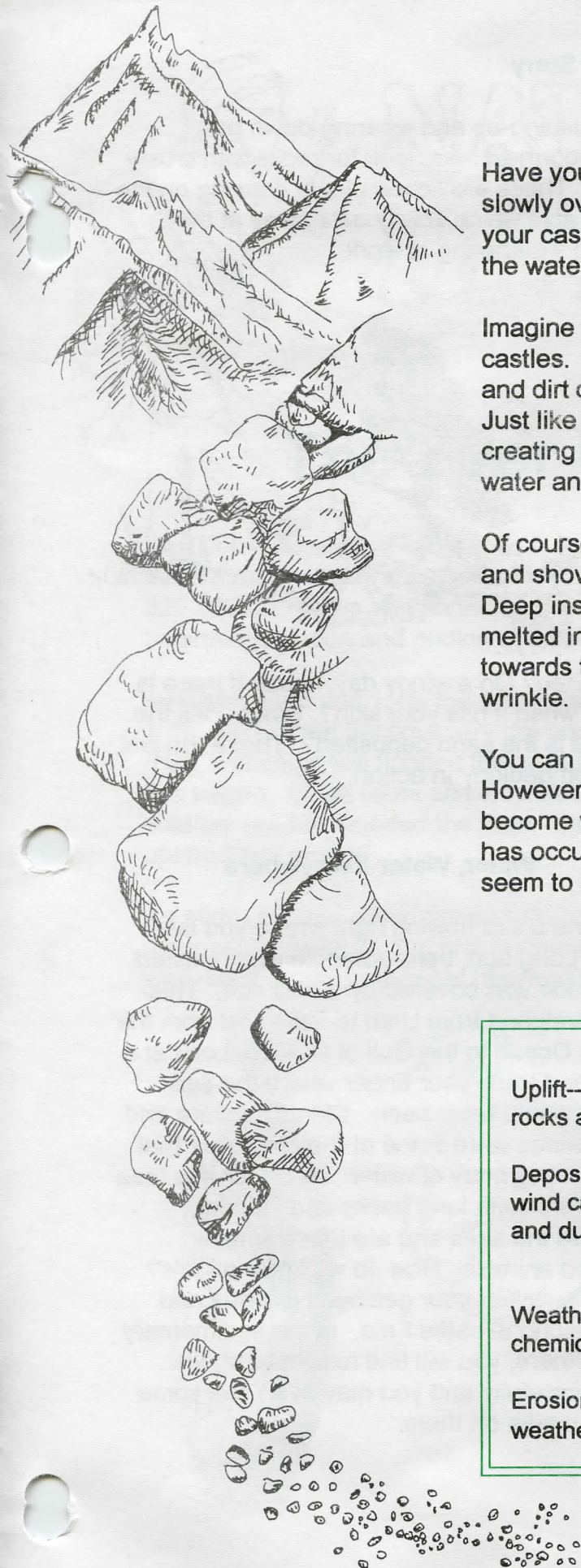
**Uplift**-- the formation of mountains, volcanoes and faults as rocks are pushed up, warped, folded and fractured.

**Deposition**-- the creation of new land forms as water, ice and wind carry the sediment produced by weathering and erosion and dump it somewhere else.

### Forces of Wearing-down

**Weathering**-- causes rocks to crack, crumble or break down chemically.

**Erosion**-- loosens and carries away rock debris caused by weathering.

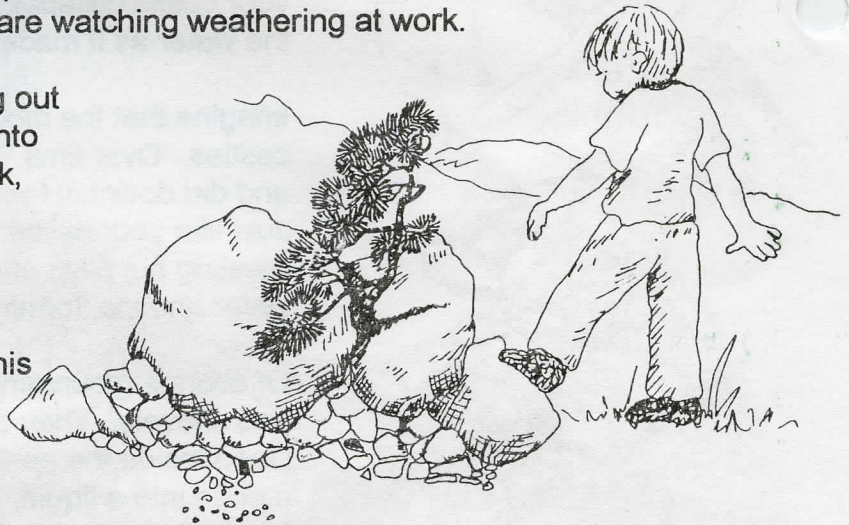




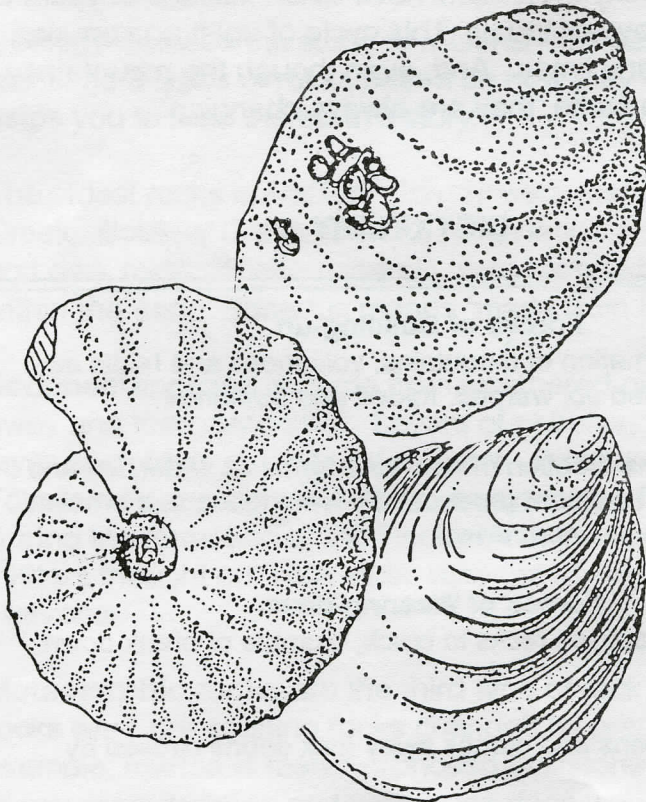
## A Never Ending Story

Geology is not just ancient history. The forces of building-up and wearing-down are constantly at work. And you can watch them! On your next hike, look for rocks with crusty patches of black, gray, lime green or bright orange. These are lichen plants growing on the surface of the rock. As they grow, they produce an acid which slowly eats away at the rock, crumbling it into tiny pieces. You are watching weathering at work.

Then look for a rock with a tree growing out of it. How can that be? If a seed falls into even the most minuscule crack in a rock, and there is just the smallest bit of soil lodged there, the seed can grow. As it grows, it pushes its roots down into the crack. The crack widens and deepens. Eventually, the rock will break apart. This type of weathering is called wedging.



Try a rainy day hike and look for water eroding the soil. Does the water carry away rocks and plants? Where is the debris deposited? On a windy day, notice if there is sand or dirt blowing around. What does it feel like when it hits your skin? What does the wind-blown sand do to the rocks in its path? Where is the sand deposited? These are just a few of the questions that you can ask as you watch geology in action.



## Water, Water Everywhere

Imagine a sea flowing right where you live now. Long ago, before people even existed, Colorado was covered by a vast sea. This sea stretched from Utah to Iowa and from the Arctic Ocean to the Gulf of Mexico. Look at a map and trace your finger where the sea-shore would have been. Clams, oysters and ammonites were some of the creatures that lived in this body of water. Dinosaur-like "sea monsters" with long necks and flippers, roamed the seas and ate these smaller shelled animals. How do we know all this? Fossils. Wear your geologist glasses and walk along Six-Mile Fold. In the sedimentary shale there, you will find fossilized shells. Look carefully and you may even see some teeth marks on them.