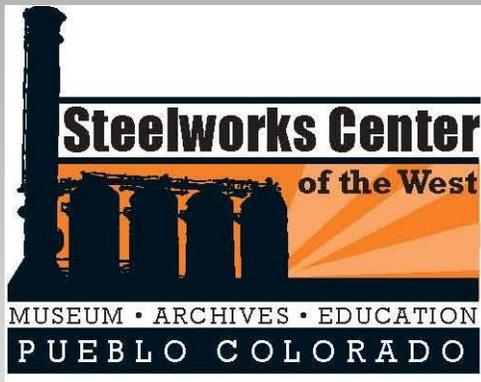




Benny Blast's guide to Understanding Rocks and Minerals



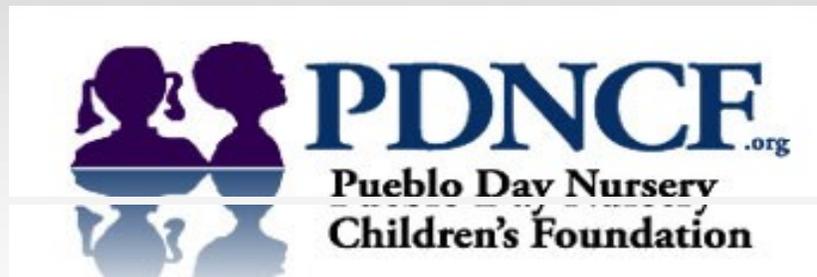
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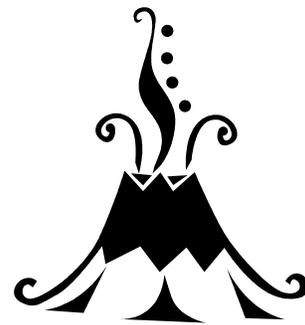
Studying about Rocks ROCK!

Where do rocks come from?



Even scientists who have studied rocks and minerals for years don't have all the answers, but they do know where rocks come from. There are three big groups of rocks. They are called igneous (ig-nee-us) , sedimentary (sed-e-men-te-ree) and metamorphic (met-a-more-fik).

Igneous rocks start out as melted rock deep underneath the surface of the earth. Sometimes the melted rock comes to the surface in volcanoes. It pours out the top as lava, then it cools. When it cools, it hardens and forms rocks.



Lava flowing from a volcano



A fossil

Sedimentary rocks are formed when wind, rain and snow erode mountain tops, causing the mountains to crumble. The crumbled rocks fall down the side of the mountain and settle in lakes and rivers at the bottom. These bits of sand and rock are called sediments. Sedimentary rocks are special because they often contain fossils. When animals or plants die in marshes or swamps, they can get sandwiched in between the layers of sedimentary rocks. Then they then turn into stone.

Metamorphic rocks are rocks that have “morphed” or changed into another type of rock. When the Earth moves and shifts, it causes heat to build up. The rocks get squeezed together so tightly that the heat and pressure causes them to change. Metamorphic rocks were at one time igneous or sedimentary rocks but movements in the earth's crust caused extreme heat and pressure to change the rocks over time.



Gneiss rock

Rocks versus Minerals: What's the difference?

It makes a lot of difference!

A **mineral** is a natural substance that has its own distinctive structure and may have its composition expressed with a chemical formula. Some examples are hematite, calcite, and galena.

A **rock** is usually made up of two or more minerals. Examples of rocks are limestone, sandstone, granite, or shale.

There are about 3,000 known minerals on Earth.



Hematite (above) and Calcite (below) are minerals you can see when you visit the Steelworks Museum.



So what?

Minerals are used for many purposes in our every day lives. Everything we have and use every day either is mined out of the ground or is grown. The items are used for many different purposes. Some minerals are used to build houses, roads, buildings, and schools. We use other objects every day and don't even think they used to be minerals. Can you match the mineral to the object?

Kitty litter
Crayons
Telephone wires
Cake Frosting
X-ray shields
Pencils
Soda Cans
Toasters
Steel beams

Clay
Chromium
Galena
Gypsum
Talc
Gold
Hematite
Graphite
Aluminum



Just as you need ingredients to make a cake, you need ingredients to make steel. The Colorado Fuel and Iron Company (CF&I for short) used special recipes for more than 100 years to turn minerals into steel products. They used coal to heat big furnaces which melted iron ore (also called hematite), turning it into pig iron. Added to the pig iron were other minerals such as fluorite, calcite, limestone and dolomite. They were needed to make the final steel products hard and long lasting.

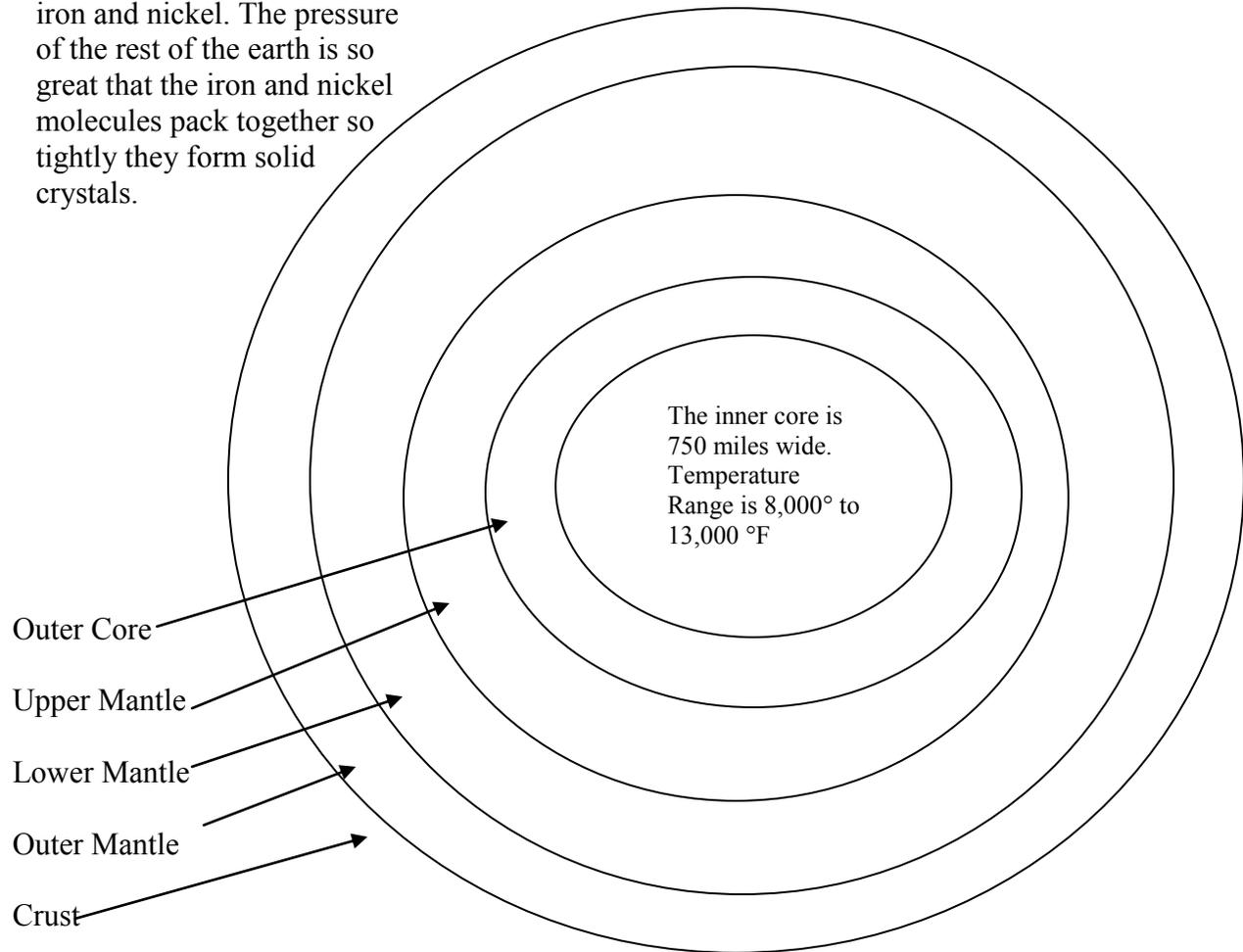


Fluorite was one of the "ingredients" used in the steel making process by CF&I

The Earth's Layers

The Earth is about 7,928 miles in diameter. Most scientists believe that the Earth is divided into five layers. The inner core is solid iron and nickel. The pressure of the rest of the earth is so great that the iron and nickel molecules pack together so tightly they form solid crystals.

The deepest any human has ever drilled into the earth is 7.5 miles (12 kilometers). The heat of the Earth ruined the drilling equipment, so the drillers had to stop!



The Outer Core is 1,400 miles thick and has a temperature of 8,000 to 11,000°F

The Upper Mantle is 400 miles thick and is made of semi-melted rock.

The Lower Mantle is 1,400 miles thick and has a temperature range of 1,600-8,000 °F

The Outer Mantle is 750 miles thick and is 8,000-13,000 degrees

The crust is 2-75 miles thick. Much of the solid surface of the Earth's crust we call soil. Other materials that make up the crust are clay, gravel, rock, sand, and silt.

How soil is formed

Soil forms over a long, long period of time (like millions and millions of years) when rocks are broken down into rock and mineral particles. The freezing and thawing of rain, snow and ice breaks down the rocks even more. Sometimes wind carries other rock particles which hit the newly formed soil to break it down even more. Simple animals and plants, such as lichens, live on decomposing rocks. As they die, living matter begins to collect among the particles of rock. As the soil develops, layers begin to appear. The top layer, called topsoil, is rich in organic matter. Gradually, the top soil becomes rich enough to support plants.

You can Do it!

Design a three part poster based on what you have just read. Be creative! You might want to use real bits of rock, sand, soil or plants on your poster, or you might use bright colors to paint the layers of soil.



Layers of the Earth model



What you will need:

- 1 glass jar with a lid (such as the kind baby food or mayonnaise comes in)
- Sand
- Powdered tempera paint in different colors
- Spoons
- Empty Shoe boxes (one for each color)

Step one: Mix sand with powdered tempera paint in a shoe box with a spoon.

Step two: Pour different colored layers of sand very carefully into the glass jar, one on top of each other.

Step three: Add some layers on an angle or gently press a spoon around the edges to create waves.

Step four: Keep putting a new color on top and see how layers form on Earth.

Scientists compare the colors, fossils and thicknesses of the layers in other parts of the world, and teach others about the history of the Earth.

Rocks and minerals are tested by hardness

In 1822, a German scientist named Friedrich Mohs (**Free**-drik Moze) developed a table for determining the hardness of minerals. This gives a very quick and easy field test for hardness. It is very useful for scientists who study minerals to help discover what an unknown mineral might be. In the Mohs Scale, the higher the number, the harder the mineral.

There are many different aspects of materials which could be used as a measure of hardness. The aspect of hardness in Mohs scale is how easily it can be scratched. Hardness can mean resistance to scratching, bending, or breaking. It is easy to confuse durability or toughness with hardness. Try thinking about a glass ball and a rubber ball. Glass is harder than rubber, but rubber is more durable. If you bounced both on a hard floor, the glass ball will shatter and break, but the rubber ball will bounce.

Look at the scale below. Which two minerals can be scratched by calcite?

_____ and _____

1	2	3	4	5	6	7	8	9	10
Talc	Gypsum	Calcite	Fluorite	Apatite	Orthoclase	Quartz	Topaz	Corundum	Diamond



Minerals with a hardness of 6 or higher on the Mohs Scale will scratch glass



You can test the hardness of a mineral at home!

Fill in the blanks below to discover if your mineral is hard or soft.

Color _____

Put a check after the tool that can scratch the mineral you are testing.

_____ fingernail _____ penny _____ paperclip

I think this mineral might be _____

What is Coal and how was it formed?



Coal is a black material that is found deep within the Earth. It is different from most rocks because it is organic—that means it was alive at one time. It is sometimes also called a fossil fuel. Coal was formed from the remains of trees, leaves, ferns and other plant material that died during ancient times.

Large coal deposits were formed about 350 million years ago. Plants grew in swampy areas. As these plants lived and died, they absorbed and stored energy from the sun. The dead plants created “peat” deposits. These deposits built up over time and were buried by layers of sand and silt. After millions of years, the pressure and heat under the Earth’s surface compressed the peat to form coal.

Coal is very special material because it can be burned and used for fuel. It has been mined for thousands of years, but only in large quantities since the 1800s.

Types of Coal

There are four types of coal. The harder the coal, the more efficient it is as a fuel source.

Lignite

1

Lignite coal contains a large amount of moisture. It crumbles easily. It is brownish black in color and is mainly used to make electricity to light and heat our homes.

Sub-bituminous

Sub-bituminous coal is mainly used to produce steam for making electricity, cement and other industrial uses. It is also very soft like lignite coal.

2



Bituminous

3

Bituminous coal is medium hard and is used to make electricity. It is also used to make coke, which is used to make steel.

Anthracite

Anthracite coal is the hardest type of coal. It is mainly used to heat people’s homes in fireplaces and stoves.

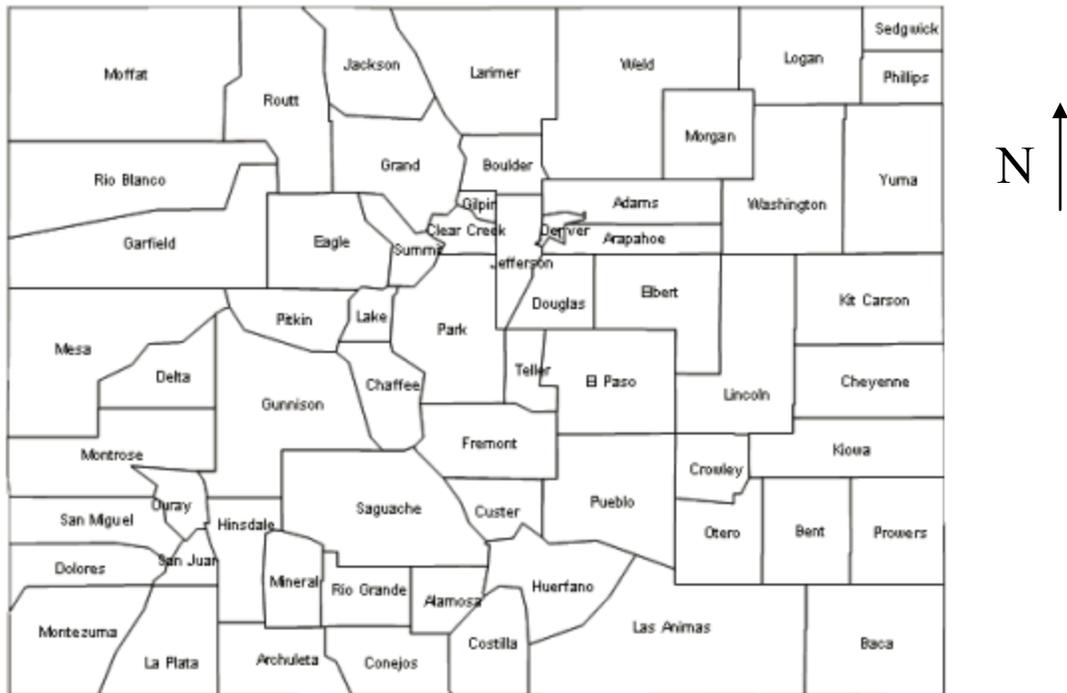
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Coal Mining in Colorado

Mining for coal in Colorado began after the first settlers and miners arrived along the Front Range in the early 1800s.

In the 1880s, coal was also discovered in southern Colorado. Miners with Colorado Fuel and Iron Company discovered several coal deposits in Pitkin, Garfield, Weld, Gunnison, Fremont, Huerfano and Las Animas Counties. They brought the coal to Pueblo where it was turned into coke, which was used as fuel to make steel. Find the counties that produced coal for steel making purposes. Color those counties red. Beginning in the 1970s, the steel mill began using recycled materials to produce steel, so coal was no longer needed.

Today, coal is mined in eight Colorado counties. Colorado coal is among the cleanest, highest quality fuel found anywhere in the world. It is mined to produce electricity for people all over the state. Today, the counties where coal is mined are: Moffat, Rio Blanco, Routt, Garfield, Delta, Montrose, Gunnison and La Plata Counties. Color these counties blue.



Which area of the state produces the most coal today?
_____ northern _____ eastern _____ southern _____ western

Colorado Makes a Special List!

Not every state has an official state mineral, rock and gemstone. Colorado is one of only eight other states with all three. When you put Colorado's geologic family together, they represent the colors red, white and blue, the same colors that are in the United States flag.

Colorado's state mineral: Rhodocrosite (adopted in 2002) (red)

Colorado's state rock: Yule marble (adopted in 2004) (white)

Colorado's state gemstone: Aquamarine (adopted in 1971) (blue)



Rhodocrosite (rō'də-krō'sīt')



Yule Marble (Mahr-bul)



Aqua Marine (Akwa-mur-eene)

Facts about Marble

The town of Marble is in the Western Slope district of Colorado, in Gunnison County. The marble quarried here was used to create many important buildings and monuments in the United States including the Lincoln and Washington Monuments and the Colorado State Capital building. It was also used to create the Tomb of the Unknown Soldier in Washington D.C. in 1933.



Calling all amateur rock hounds!

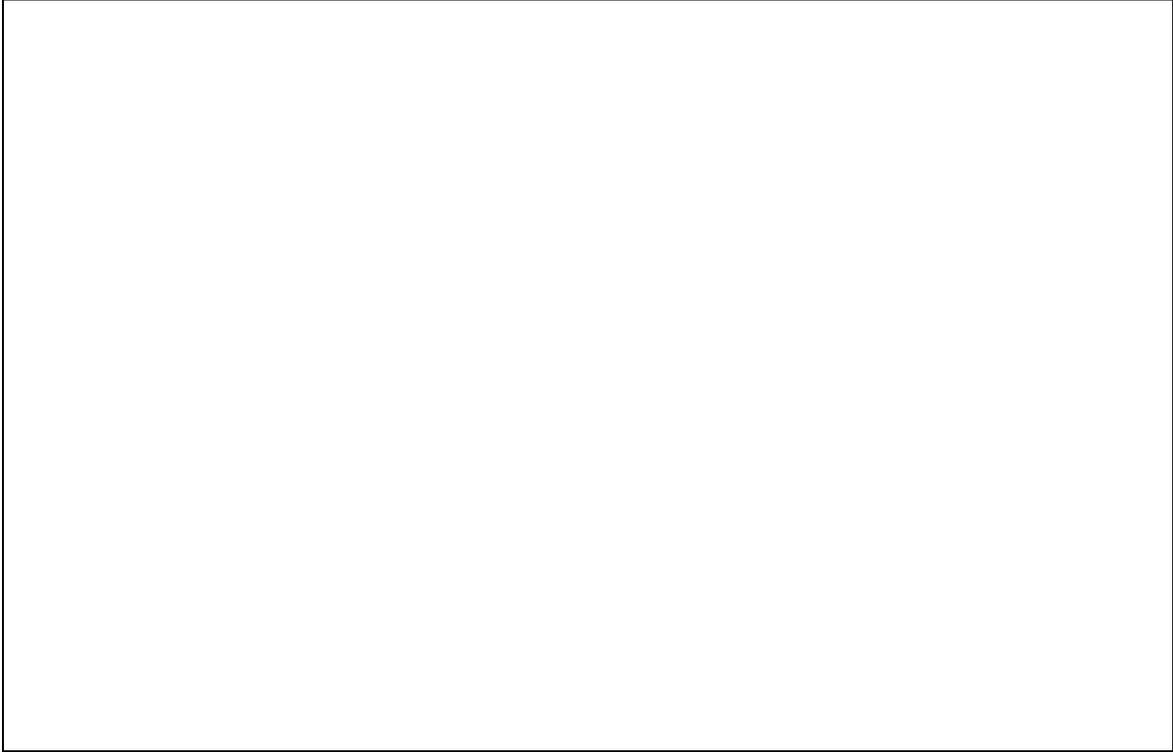
The largest aquamarine specimen ever found in North America was discovered by amateur rock hound Steve Bruncato in 2004 while hiking near Mount Antero, located in the central mountain range of Colorado. The specimen has more than 100 aquamarine crystals inside. It measures 37 inches by 24 inches. It was given to the Denver Museum of Nature and Science where it is on display in the Coors Gem and Mineral Hall. Maybe one day you will find a mineral that will be displayed in a museum.

Kids can make a difference!

Kids can make a difference to change state history. In 2002, a group of high school students made a proposal to the State's General Assembly to adopt Rhodocrosite as Colorado's official state mineral. The mineral is found all over the world, but one of the best collections of the red crystals is found in the Sweet Home Mine near Alma, Colorado. A girl scout troop from Lakewood suggested that the Yule Marble be Colorado's official state rock in 2004. Several years earlier, a high school class from Canon City also suggested that the Stegosaurus become the official state fossil. If you were to make an addition to Colorado's official state list, what would it be?

Mapping Colorado

Directions: Draw a map of Colorado in the space below. Don't forget to include major cities, rivers, mountains and other major landmarks. Then write about our state. On the lines below, write facts or other information you have learned about Colorado, rocks and minerals.



Mineral Seek and Find

Can you find the hidden mining terms?

G F O E X L Q Y Q O R S M S D
X F S H N Y C O T B E R O G M
Y T W A E K K U R D J E H D E
S U O N I M U T I B D N S N H
E G Z P E J A M S E F I S P L
V T D T I J E T T T I M C I Z
O B I E R N N S I I C J A V E
S H D C T A I D D T H I L U H
T F L A A G U O I E E U E P U
C J R B O R L Q U N Z F J S X
P Y X L E O H N Z G N K U P L
P P O H M G V T H A H F A R M
Y E T I C L A C N M F G P E Z
G S T B C O L O R A D O V L M
R E J Y W Y I Q D L H U Z I S
L I M E S T O N E O F L U X V

Anthracite
Colorado
Bituminous
Dolomite
Magnetite

Miner
Geologist
Calcite
Hematite
Quartz

Sedimentary
Mohsscale
Miner
Limestone
Flux