Geology for Kids

by Kids

Research, Writing, and
Photographs
by the
4th Grade
Swift River School
2004-2005

Geology is the study of the earth.

Table of Contents

Things to know . . .

Rocks and Minerals

What is the difference between a rock and a mineral?

A mineral is a chemical or a combination of chemical elements. A mineral is usually known as a homogeneous, naturally occurring, inorganic solid.

Rocks are made of minerals. A few are made of one mineral and some other rocks.

The difference is that a mineral is the same all the way through and a rock has a few different minerals in it.

Mineral

Rock

Igneous Rocks

What are igneous rocks?

Igneous rocks are formed from molten magma or lava. Magma travels towards earth's surface and eventually it gets too cold and turns into igneous rock. Igneous rocks were the first rocks and are one of the three major types of rocks.

What are the two igneous rock groups?

Igneous rocks are separated into two groups: intrusive and extrusive. Intrusive rocks result when magma solidifies beneath the earth's surface. One example of an intrusive rock is peridotite. Extrusive rocks form when magma flows onto the surface of the earth or floor of the ocean then cools, and hardens. One example of an extrusive rock is basalt.

How do crystals form?

Slow cooling gives the minerals time to develop well-formed, crystals. Fast cooling forms poorly formed crystals.

White Granite

What are some common igneous rocks?

Pink Granite

Granite is a common igneous rock. It is made up of quartz and feldspar and a dark mineral such as mica or hornblende. The main color is from the feldspar and is usually pink or gray.

Other common igneous rocks include pumice, genodes, syenite, obsidian, basalt, and gabbro. Most igneous rocks have some feldspar or dark mineral such as mica or hornblende.

Metamorphic Rocks

What are Metamorphic rocks?

Metamorphic rocks are rocks that have been changed from their original state. They might have been igneous or sedimentary rocks that have been changed by pressure, heat, and chemicals. The word *metamorphic* comes from Greek and means "to change."

What are the types of metamorphism?

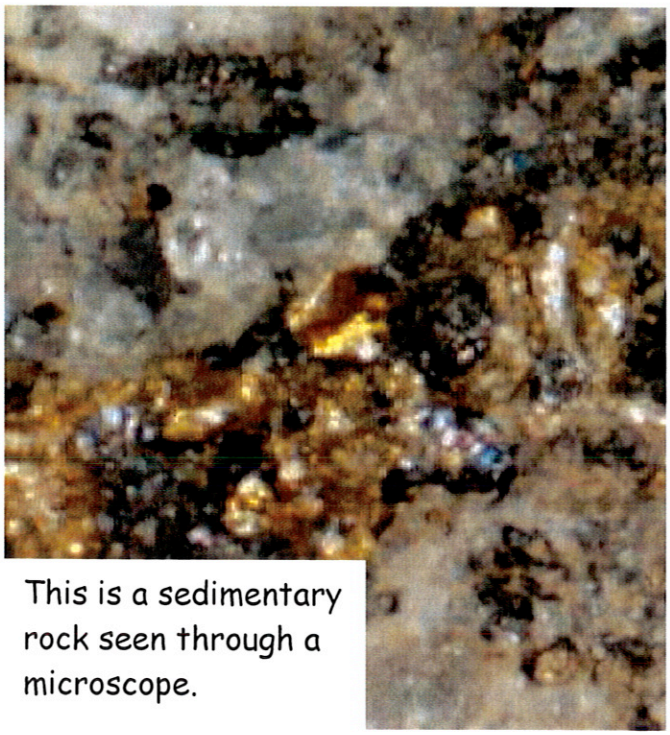
Regional metamorphism is when rocks in a mountain-building region are changed by both heat and pressure. Sometimes you can still see fossils in the rock. Slate is an example of a rock created by regional metamorphism.

Contact metamorphic rocks are changed by heat alone. This happens near a lava flow. The heat may change the minerals to make them more crystalline. You can't find fossils in these rocks. For example, limestone turns to marble at high temperatures.

Dynamic metamorphism is when large movements take place in the earth's crust. When huge masses of rock are forced over other rocks a crushed and powdered rock is formed called mylonite.

Sedimentary Rocks

Sedimentary rocks are made up of rock segments and minerals. When they form they usually form in layers. The layers are usually different colors. Different size particles make different rocks. There are three different types of sedimentary rock: clastic, organic and chemical.



This is a sedimentary rock seen through a microscope.

What are clastic sedimentary rocks?

Clastic sedimentary rocks are made from sediments such as mud, stones, rock fragments, and sand. Conglomerate is made up of gravel and smooth round pebbles. Sandstone is made by sand being pressed together. Shale is made of mud or clay.

How are clastic sedimentary rocks formed?

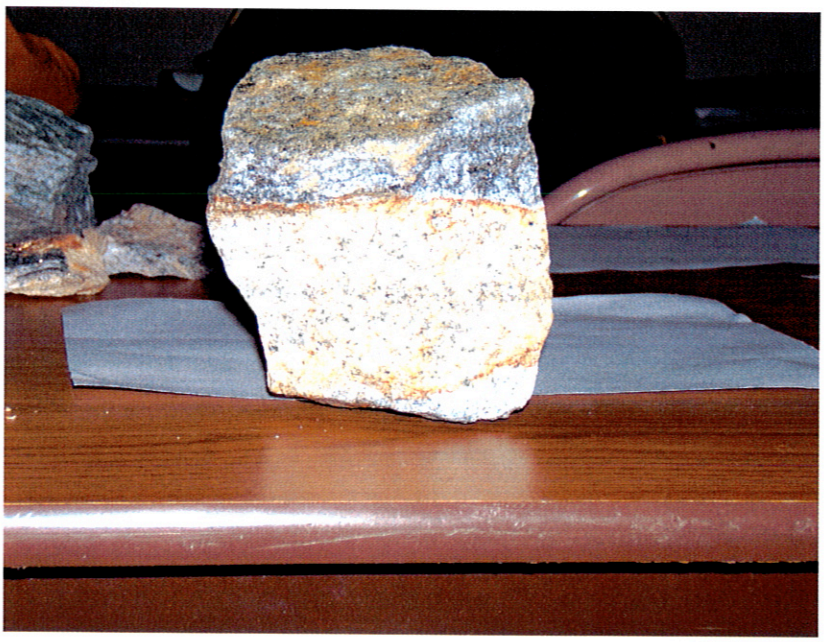
Weathering breaks up the pieces of rocks and stones. Wind or water makes them into smaller pieces and then washes them away. In calm watery areas the pieces get pressurized and they turn into rocks. The pieces at the bottom of the pile get compacted and then they get cemented together to form new larger rocks.

What makes organic sedimentary rocks?

They are made of dead remains of plants or animals. The remains are under lots of pressure and after a long time they become a rock. Coal is the most common organic sedimentary rock.

What makes chemical sedimentary rocks?

Chemical sedimentary rocks are formed when something is changed over time by liquid. Limestone is formed from water and calcite. The calcite is dissolved in seawater. Animals use the calcite to build their skeletons and shells. When they die they leave a layer that, over time, becomes limestone.



What is the Rock Cycle?

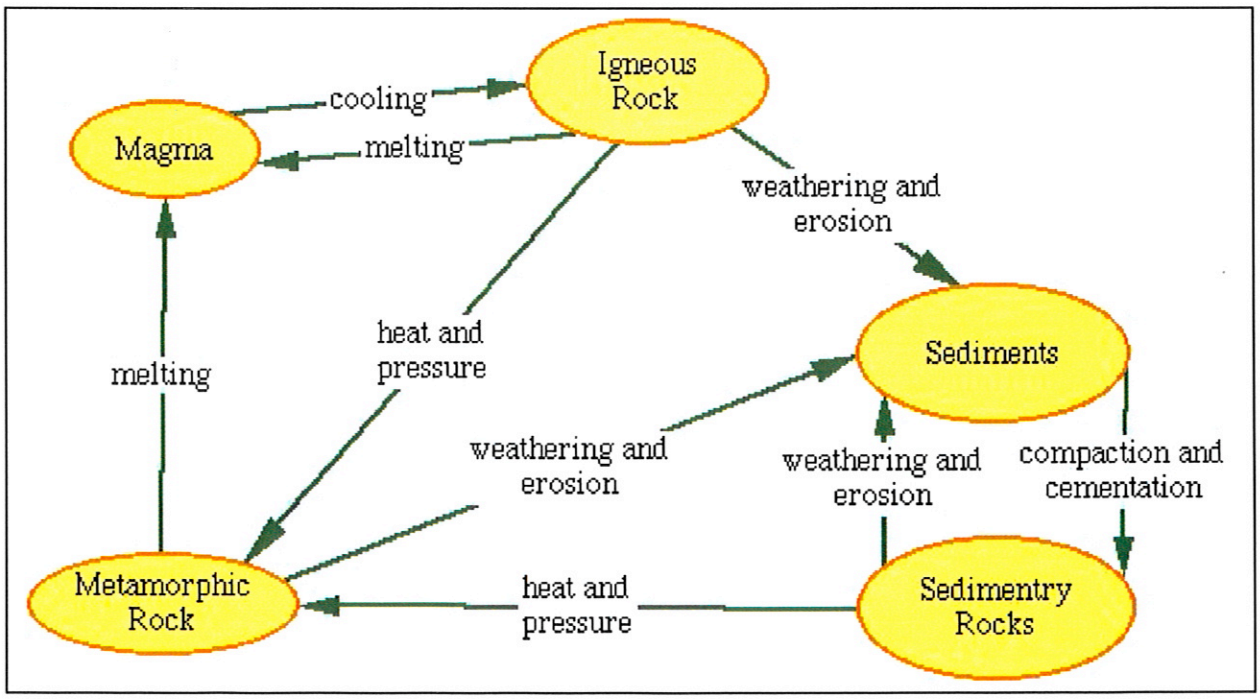
I bet you know that there is a water cycle. But did you know that there also is a rock cycle? There are three types of rocks: sedimentary, igneous, and metamorphic. These rocks change back and forth between types, but this happens over millions of years!

Magma

Magma is the substance that is in the middle of the earth. It is made of very molten rocks. When it comes out of the earth, it is called lava.

The Rock Cycle

Magma cools and turns into igneous rock. Igneous rock melts and turns into magma. Or metemorphic rock can turn into sediments by heat and pressure or by weathering and erosion. Sediments can turn into sedimentary rocks by compacting together. Sedimentary rocks can turn into sediments by weathering and erosion. Sedimentary rocks can turn into metemorphic rocks by heat and pressure. Metamorphic rock can turn into magma. Then the rock cycle starts all over again.



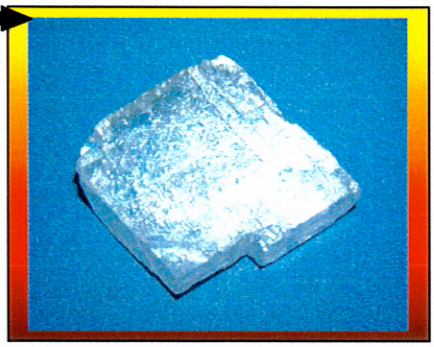
Cleavage

What is cleavage?

Cleavage is what some rocks and minerals do when they break. If something fractures, it breaks along rough edges. If something cleaves, it breaks along smooth, flat surfaces. Here are some different categories of cleavage.

<u>Perfect cleavage</u>

1 Laumontite
2 Muscovite
3 Calcite



<u>No cleavage</u>

1 Wad
2 Gold
3 Silver
4 Platinum
5 Copper

You can find some of these rocks and minerals at the Bird and Nature Club in Athol.

Luster

What is luster?

Luster is how shiny a mineral is. There are many kinds of lusters. Here is a list of some:

Luster	Mineral with that luster
1.Adamantine	Diamond or Sapphire
2.Greasy	Talc or Apatite
3.Metallic	Gold or Pyrite
4.Pearly	Opal or Talc
5.Silky	Ulexite or Mesolite
6.Vitreous	Topaz or Quartz Crystal
7.Waxy	Garnierite
8.Resinous	Thenardite
9.Submetallic	Hypersthene
10.Subadamantine	Vanadinite

Topaz

Luster makes identify minerals easier. For example, you can tell pyrite or gold by their metallic luster.

Quartz Crystal

Pyrite

Mineral Color

Can you identify a mineral by the color?

Some minerals can be identified by color. Malachite can be identified because it is always green; azurite is always deep blue; and realgar is red.

Most of the minerals cannot be identified by the color. This is because they can be all different colors. Minerals often get their color from impurities.

milky quartz

For example, white quartz can be called milky quartz.

The pink variety is rose quartz. The color comes from manganese and titanium.

Brown quartz can be called smoky quartz. It's color comes from radioactivity.

smoky quartz

Iron gives a deep violet color to the quartz called amethyst.

amethyst

Earthquakes

What are earthquakes?

Earthquakes make the earth shake. You can hear a rumbling noise and glasses shaking. You can feel a sharp jolt. Sometimes you can feel a gentle shake of the earth. A tremor is a shaking or trembling movement. Earth tremors are very common in places that often have earthquakes.

Earthquakes happen when section of earth, called plates, hit each other. The speed of this motion is a few centimeters per year, about as fast as your fingernail grows. When enough pressure builds between the plates, they slip. and there is an earthquake.

Earthquakes can go as long as four minutes! Sand and water can bubble for hours after the earthquake stops. Hills can shake.

Earthquakes can cause life-threatening disasters. They can start fires. They can shake buildings until they fall down.

It is not common for earthquakes to happen. Most of the earthquakes in the U.S. happen in the western states.

Glaciers

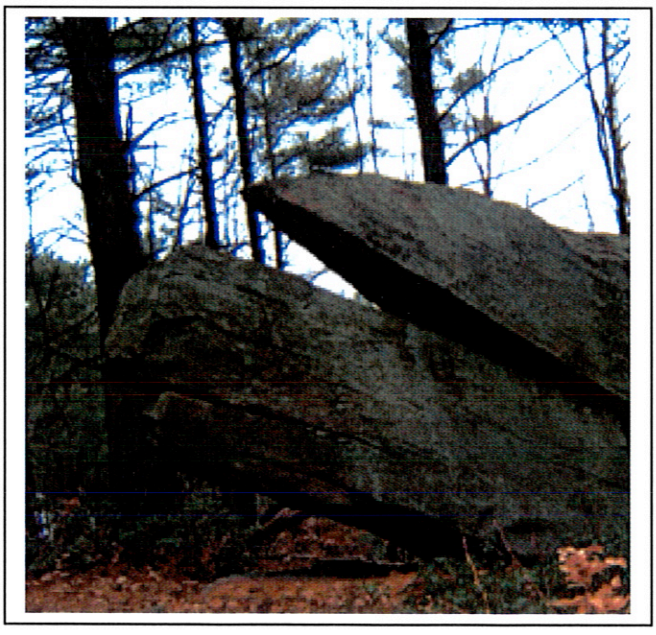
What are glaciers?

Glaciers are a thick layers of ice called ice sheets.

The ice sheet is like a rock. It starts as layers of snow, like a sedimentary rock. In a year or two, the pressure of overlying snow causes it to recrystalize and become compact glacier ice. Now it is like metamorphic rock.

Glaciers don't all move together at the same rate. Some only move a few feet per year. Others move several yards per day.

Whenever a glacier travels, even if it moves only a few inches, it changes the surface of the earth. Glaciers pluck rocks from the ground beneath them, dragging them many miles from their original location. Glaciers carry with them rocks and other materials that fall onto the glaciers' surfaces.



The Whale's Head, in Wendell, was left behind by a glacier.

Cairns

What are cairns?

Cairns are stacked rocks. They are used to guide people up mountains. Nature does not make cairns, people do. The word *cairn* comes from the Scottish. It means "pile of rocks."

Cairns are also used to keep people off the plants. You should not move the rocks from the pile or add onto the pile.

This is a cairn on Mount Monadnock.

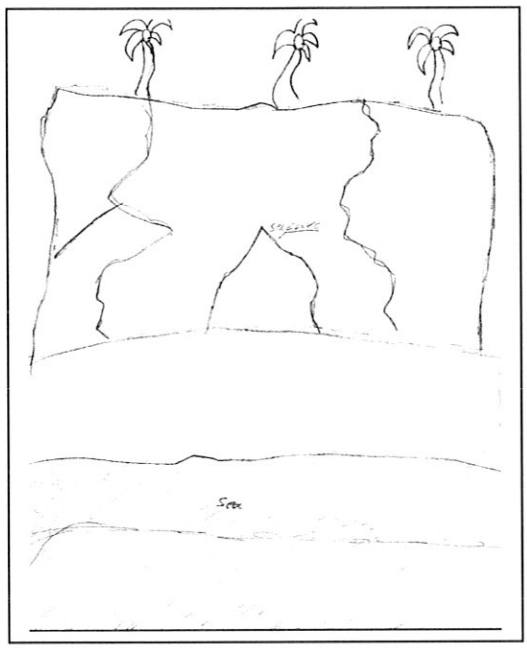
A Bates cairn is a rock pile that consists of two base rocks, a third mantle or lintel rock, and a fourth "pointer" rock that shows the hiker the direction of the trail.

Caves

How are caves formed?

Caves can be formed many ways.

Sea caves are formed by water, wind and sand grinding away. Water will go to the weakest area of a cliff . The water will cut a tunnel away and a chamber is formed. Then the hardest granite and the softest chalk will be eaten away to create a cave.



Lava tube caves are formed when volcanoes spew millions of tons of liquid rock. The lava river forms an outer layer which cools and becomes a solid that forms an inner pipe. A flow of lava dries on the floor and a tube is there.

Limestone caves are the deepest and largest caves found by men. Limestone is a sedimentary rock that formed in the sea. Limestone can be dissolved by rainwater. The rainwater flows down small cracks and then the rainwater eats away the limestone and a cavern is formed.

Fossils

What are fossils?

Fossils are bones that have turned into rocks.
How did this happen?

First the animal had to die and get covered with mud. If it didn't get covered, other animals would eat it. Even if it did get covered, it might rot. Over time, sediment covers the remains. The parts of the animals that didn't rot usually were the harder parts like bones and teeth. After a long time, water gets in the bone. When the water seeps out, some of the minerals that were in the bone seep out also. What is left are minerals that were originally in the water. The bone is now a fossil.

Lake Hitchcock

Where can you see Lake Hitchcock?

Well, you can't see Lake Hitchcock anymore. It was dammed up by ice and drained. But, you can find pictures of Lake Hitchcock and the Connecticut Valley in books. You can find out more by reading this...

How was Lake Hitchcock formed?

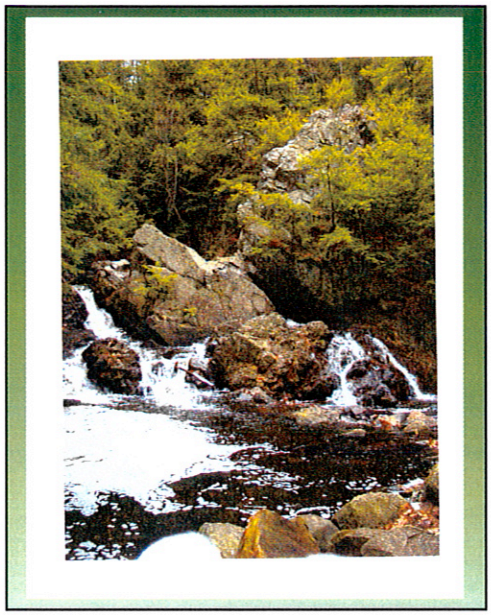
Lake Middletown was made about 18,000 years ago. When it drained, an ice delta at Rocky Hill, Connecticut dammed the Connecticut Valley. As the glacier melted back from the dam, Lake Hitchcock was made. Over the next 4,000 years, the ice sheet melted away, uncovering everything there except the northern places of the Connecticut Valley. The ice melted at average rates of about 300 feet per year and Lake Hitchcock slowly grew 210 miles from Rocky Hill, Connecticut to West Burke, Vermont.

What are deltas?

Deltas are one of nature's and the Connecticut Valley's, most interesting landforms. They are the result of stream deposition into lake water. As the deposition keeps going, the delta builds three important layers: bottomset, foreset, and topset bedrock. What is really important about deltas is that the flat topset layer is graded to the lake level. So, if you find those deposits, and you can also find the location of the old Lake Hitchcock shoreline!

Places to visit . . .

The Bear's Den



What is the Bear's Den?

The Bear's Den is a place where you can see a small waterfall, some caves, and some rock formations. The Bear's Den has a really fun place to rock hop.

In 1675 an Indian chief called King Phillip (his real name was Wampanoag Sachem Metacom) met with other Indians at the Bear's Den to plan attacks on Hadley, Deerfield and Northampton. A black bear was shot there and that's how the Bear's Den got its name.

Where is the Bears Den?

- The Bear's Den is in New Salem, Massachusetts
- From the intersection of Routes 122 and 202 in New Salem, take Route 202 south for .4 mile.
- Turn right onto Elm Street and follow for .7 mile.
- Then turn left onto Neilson Road and follow for .5 mile.
- Entrance is on the right, park on right side of road.

Where can I find more information?

Go to the Trustees of Reservations website:
http://www.thetrustees.org/pages/281_bear_s_den.cfm

Athol Bear's Den

What can you see at the Athol Bear's Den?

You can see huge boulders You can also touch them. Sometimes you can even see bears, foxes, rabbits, squirrels and chipmunks. It is not just a bear's den, but it is a good place to hike. It is a long walk and if you walk far enough you will end up right where you started.

The ledges are good examples of how southbound glaciers of 12,000 years ago crunched against the mountainside and ripped away jagged pieces of rock shelf. Some of the rocks have caves in them and animals live in there.

How do you get to the Athol Bear's Den?

- From Main Street, Athol, turn on to Bearsden Road
- Follow signs to forest

You can get the conservation commission booklet, *Lands and Water*, free at the office Town Clerk Memorial Building, 584 Main Street, Athol.

The Cascades

What are the Cascades?

The Cascades is a place in the woods with a stream down the middle with all different kinds of rocks next to it. The rocks have all different kinds of texture. Some rocks and minerals that you can see are granite, mica, and quartz.

The place where you can see most of the rocks is a short way down the stream. There is a pond at the end. That is where I saw the coolest rocks. I saw a rock that was shaped like a hexagon.

This is how you can get to the Cascades from the Shutesbury Post Office:

- Go down Leverett Road for 3/4 of a mile.
- Turn left on West Pelham Road. Go two miles until you reach Sand Hill Road.
- Travel on Sand hill Road for just about a mile and it is on the left hand side.

You can enjoy all of this and it doesn't cost you anything!!!

What is the Key Stone Bridge?

The Keystone Bridge is all made of stones. There is no cement or concrete. It is just stones, with one wedged in holding it up. That is called the key stone. Not many people see it because you can't see it from the road.

How was it made?

The Keystone Bridge was built in the year 1866. It was made by Adolphus Porter. It was built all of stone. The Swift River flows under the bridge. The bridge connects Millington (a part of New Salem) to Orange.

Where is The Keystone Bridge?

- The bridge is in the town of New Salem.
- Go to the Quabbin Reservoir, Gate 30 across from the intersection of Route 122 and Orange Road, New Salem.
- Gate 30 is open dawn to dusk.
- It is about a 45 second walk from the gate to the bridge.

Where can I find out more?

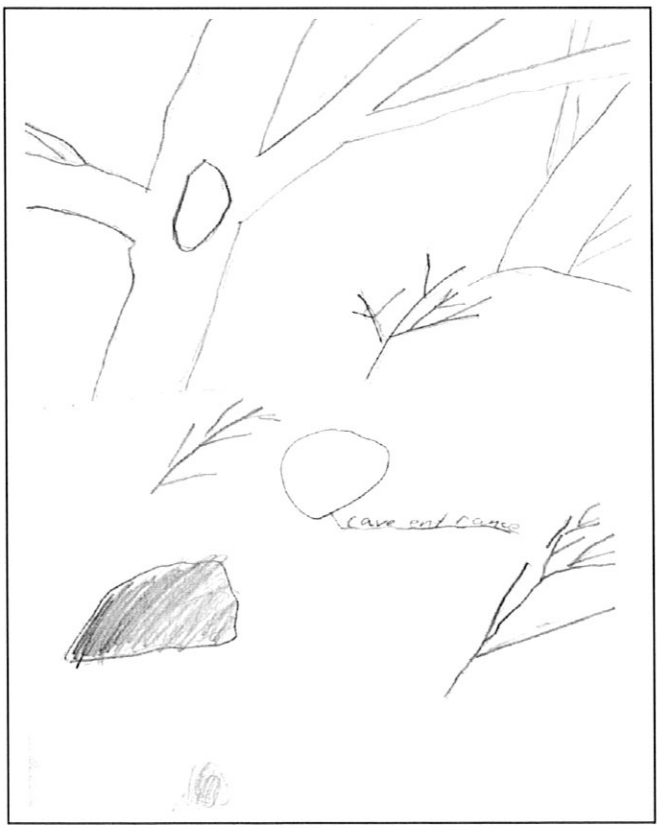
You can read *North of Quabbin Revisited* by Allen Young.

The Monk Caves

What is a monk cave?

If you like caves that are 5 feet tall, and built into a hill then monk caves are for you. You can explore the Temenos woods and have fun!

A monk cave is a cave that was build by a monk. The monks would meditate in the caves they built. The monks would be in the monk caves for months without water or food. The monk caves are 2 feet in the ground and are made of stone. The roof is one big rock. There is a small hole beneath the roof to get in.



Directions:

To get to monk cave from the center of Wendell, drive south on Locks Village Road. Follow for about 3-5 minutes. At the four way intersection take a left onto Jennison Road. Bear right at the cemetery. Take a right on Mount Mineral Road. The cave is on the hillside to your right.

The Quabbin Reservoir

What can you see and do at the Quabbin Reservoir?

You can see interesting rocks, cool cellar holes, and the shoreline. You can also do lots of cool things like hike, walk, ride your bike, take pictures, and look at the views of the sunrise.

The reason the Quabbin Reservoir is so important is because there used to be four towns there. The people of Boston were looking for a water supply. They came to the four towns and bought them. They took down all the houses, then cut down most of the trees and moved all the wood. There were also cemeteries and they moved all the people except the Indian cemeteries. They built a dam in Ware and the reservoir began to fill up with water. It took six years to fill the reservoir with billions of gallons of water.

Where can you view the Quabbin Reservoir?

One Quabbin Reservoir outlook is located on Route 202, just north of the New Salem General Store. The best way to get there is by car. You shouldn't walk there, because Route 202 is a busy road and there is no sidewalk.

The sites you can see at the overlook are mountains, the valley, and trees. There are about one million trees there.

It is free to get in. You may not want to go there on a rainy day because it is outdoors and there is no roof, unless you are in your car.

It is a carry in- carry out place. For example, if you take in a candy bar and eat it, you cannot throw the wrapper on the ground. You have to carry it out and throw it away when you get home. Here are some other restrictions: there is no hunting, swimming, camping, skiing, or fire building allowed.

Two Continents Colliding On Route 2

Why visit this site?

Not too far from where we live, is an awesome place where two continents collided. It's just off Route 2 in Athol. In putting the highway through, they had to blast, which exposed many layers of rock. The rock shows the wonderful history of this place.

What is the geological history of this site?

This is the place where two continents collided. The Eastern plate went under the western plate. The western plate was bent up by force. At the point where the two plates collided, there is a layer of magma. The magma was formed by the heat of friction, from two plates rubbing together.

Where is the site?

- It is on Route 2, 1.8 miles west of Exit 17, on the north side of the highway.
- Best viewing is from the westbound lane.

Where can you get more information about this Site?

Ask at the Athol Bird and Nature Club.

The Whale's Head

What and where is the Whale's Head?

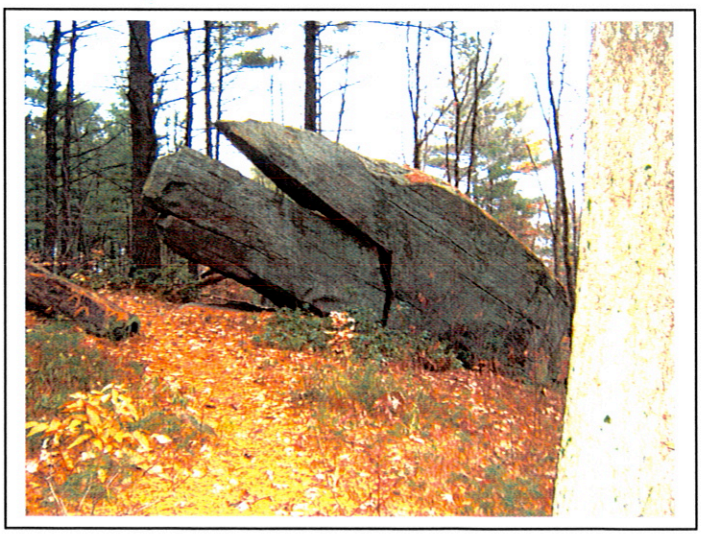
The Whale's Head is a large rock formation that looks like a whale jumping out of water, although there isn't really any water near by. The Whale's Head is in the Wendell State Forest. You have to drive for about 15 minutes from Swift River School, park and hike for about 10 minutes, you'll eventually see a rock that looks like a whale.

What can you do and see at Wendell State Forest?

You can see lots more rocks and you can hike miles of trails. You can also see a few brooks and ponds, like Wickett Pond, Ruggles Pond, and Lyons Brook. You can hike and swim in Ruggles Pond.

What is the history of Wendell State Forest?

Most of Wendell State Forest was purchased in the 1920s. The area was burned in the early 1900s. Most of the road systems were built by Civilian Conservation Corps in the 1930s.



Where can you get more information?

You can call the main office at 413 659 3797.

The Bird and Nature Club

What is the *Bird and Nature Club*?

The *Bird and Nature Club* is a group of people who go on nature trips. If you go to the building, you can see stuffed birds and mammals. They have fossils and a piece of a dinosaur bone that you can touch.

Here are some trips they go on:

Geology trips: You see mountains & valleys, mineral & rock deposits.
Ornithology trips: You see birds.
Astronomy trips: You see planets, the moon, meteors, comets, stars & constellations.
Plant trips and tree trips
Dragonfly, Butterfly and Damselfly trips

How to get to the *Bird and Nature Club*.

From Swift River school go right onto Wendell Road. Turn left onto Route 202. Stay on 202 until you see McDonald's. Then turn right at the stoplights. Stay on this road for about a mile. The *Bird and Nature Club* is on the left, in the *Millers River Environmental Center*.

Another place to get information is the Athol Bird and Nature Club website: www.millersriver.net/abnc/ Bird and Nature Club number is 978-248-9491.

What are the Glacial Potholes?

You can see many things at the Glacial Potholes. They are little (or big) holes created by nature. They are very round. They are not (!) in the middle of the road, but they are in a riverbed. Some of the rocks are still in some of the potholes. The Glacial Potholes have some amazing waterfalls!

How were the Glacial Potholes formed?

What happened to make the potholes is:

1. The water moved rocks into where the potholes are now.
2. The rocks rubbed into larger rocks.
3. The friction from the rocks made the potholes.

Where are the potholes?

- Glacial Potholes are located in Shelburne Falls, Massachusetts.
- The information center is at 75 Bridge Street.
- It will take about 40 minutes to drive there from school.
- It is a public place.
- The potholes are open 24-7 but you shouldn't go in the night, because you won't be able to see anything!
- It is free to visit the site.
- You can view the potholes from an observation deck, but you can't go down near them anymore.

Where can you get more information?

If you want more information, visit the Shelburne Falls website: http://www.shelburnefalls.com/attractpages/glacial.html.

Mount Sugarloaf

What is Mount Sugarloaf?

Mount Sugarloaf is a mountain that is 652 feet high. Walking at a good quick pace it takes 20 minutes to get to the top. There is a really good view at the top. The view includes the Connecticut River. You may take pictures at the site. You may eat at the top of the mountain.

How did it form?

At first the land was all flat. Then two of earth's plates hit and started to make a mountain. The mountain got very tall. Then a glacier and other erosion wore it down to 652 feet.

How can I visit the site?

It is 19 miles from Swift River School to the mountain. It is 30 minutes away.

Drive to Sunderland center and go north on Route 116 over the Sunderland Bridge. Take your 2nd right. The parking area is on the right.

You can drive to the top if it is not a holiday. The site closes at 6:00 P.M.

For more information, go to the Department of Conservation and Recreation website:
http://www.mass.gov/dcr/parks/central/msug.htm

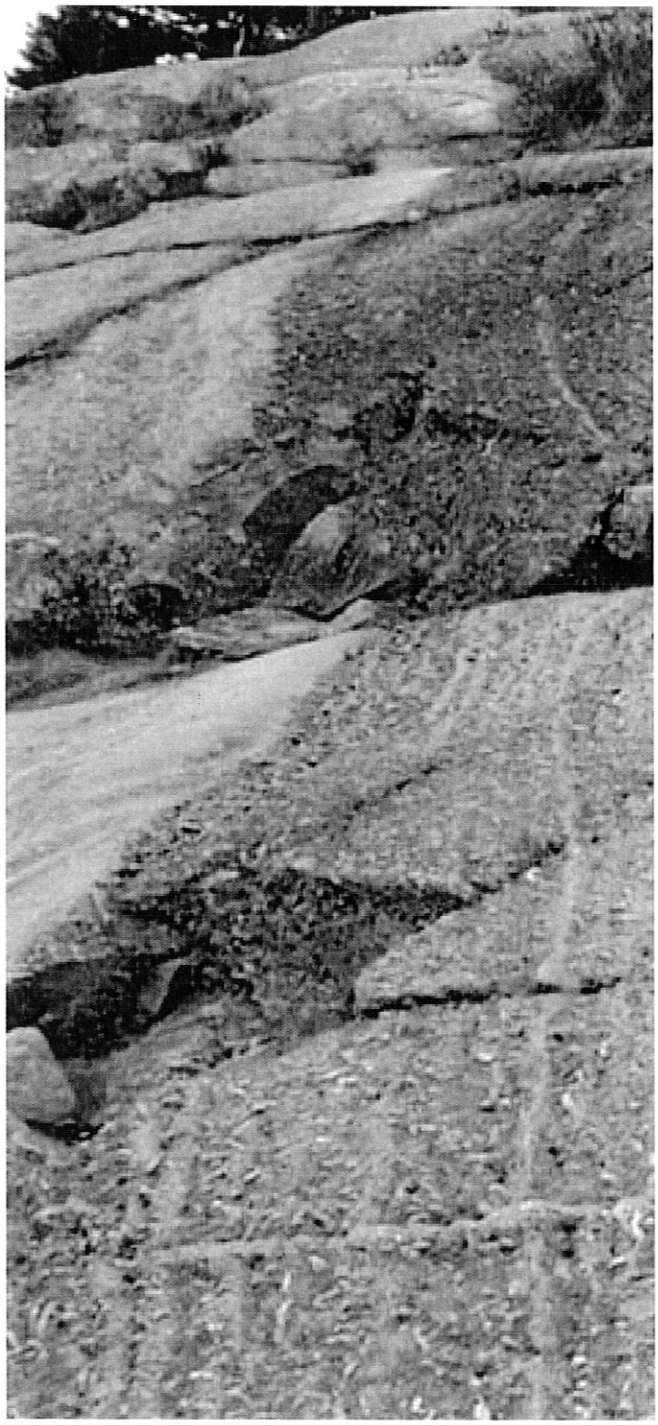
Mount Monadnock

What will you see if you visit Mount Monadnock?

It is a great place for kids and adults to climb and see cool rocks. The site is in New Hampshire, in the town of Jaffrey. From the top you can see 100 miles to Massachusetts, New Hampshire, Vermont, Maine, Connecticut, and Rhode Island. Mount Monadnock is the most popular mountain in the world, except for Mt. Fuji in Japan.

How was Mt. Monadnock formed?

- 417 million years ago an ocean covered the area.
- The water left, leaving a flat land made of sand and clay.
- A few hundred million years later, the surface of the ground moved upward and the layers of sand and clay folded and refolded.
- Heat and pressure turned the sand and clay into quartzite and schist.
- The mountain is like one great fold with seven quartzite beds.
- After the folds were made, boiling hot magma forced its way through cracks in the mountain. You can see the cracks today.



How can I get to Mount Monadnock?

- Take Route 202 North to the town of Jaffrey, New Hampshire.
- Turn left onto Route 124.
- Travel about 5 minutes, You will see the Mount Monadnock State Park sign on your left.

It is 1 1/2 hours from New Salem.

The phone number is 603-532-8862.

It is open year round.

Adults $3.00, children $1.00.

For more information, visit the New Hampshire website:
www.newhampshire.com/pages/nh-state-parks-monadnock.cfm

The Nash Dinosaur Museum

Q: What can you see there?

If you go to the Nash Dinosaur Museum in Granby you can see dinosaur footprints 200 million years old. Some are the size of your palm and some are gigantic! They have lots of cool rocks and minerals for sale.

Q: How were the footprints made?

The footprints were in mud. The mud changed into shale, preserving them. The way shale is made is by rivers overflowing during the rainy season and making layers of mud. Then over thousands of years it hardened. The reason the footprints are still around in this little area is because the glaciers did not scrape them away.

Q: Where are the footprints?

- ❖ Located in Granby
- ❖ Open 10 to 4 from Monday to Saturday and Sunday 12 to 4, when there is no snow on the ground.
- ❖ It costs $3 per adult and $2 per child.

Q: Where can you get more information?

- ✓ Phone number 413-467-9566

The Rock, Fossil and Dinosaur Shop

What can you do at the Rock, Fossil and Dinosaur Shop?

Wouldn't you just love to go mining? Well, there is a place in South Deerfield where you can! Would you like to prospect for gems? Would you like to see a fossil and dinosaur exhibit? You can do all these things at the Rock, Fossil and Dinosaur Shop.

How would I go mining at the Rock, Fossil and Dinosaur Shop?

You pay $7.00 and then they give you a hardhat with a light. You go through a door that says mineshaft. You can find rocks, shells, and fossils. You can keep what you find.

How do I visit the Rock, Fossil and Dinosaur Shop?

It is in South Deerfield between Yankee Candle & Magic Wings. From Route 91 take Exit 24. Go north on Routes 5 and 10. Go through the light at Route 116. Proceed 2 miles on Routes 5 and 10. The shop is on your left.

The phone number is [413] 665-7625

Meet the authors:

Andrew: Igneous Rocks, Whale's Head
Anna: Athol Bear's Den, Mineral Color
Cody: Illustrations
Erik: Earthquakes, The Cascades
Gabe: The Bear's Den, Cleavage
Jeremy: The Keystone Bridge, Luster
Matt: Glaciers, Mount Sugarloaf
Mike: Fossils, The Rock, Fossil, and Dinosaur Shop
Nate: The Rock Cycle
Nick: Mount Monadnock
Nico: The Nash Dinosaur Museum
Rachel: Sedimentary Rocks
Reid: Two Continents Colliding
Ross: The Glacial Potholes, Lake Hitchcock
Sam: Caves, The Monk Caves
Sky: Athol Bird and Nature Club, Rocks and Minerals
Stefan: The Bear's Den, Metamorphic Rocks
Travis: Cairns, The Quabbin