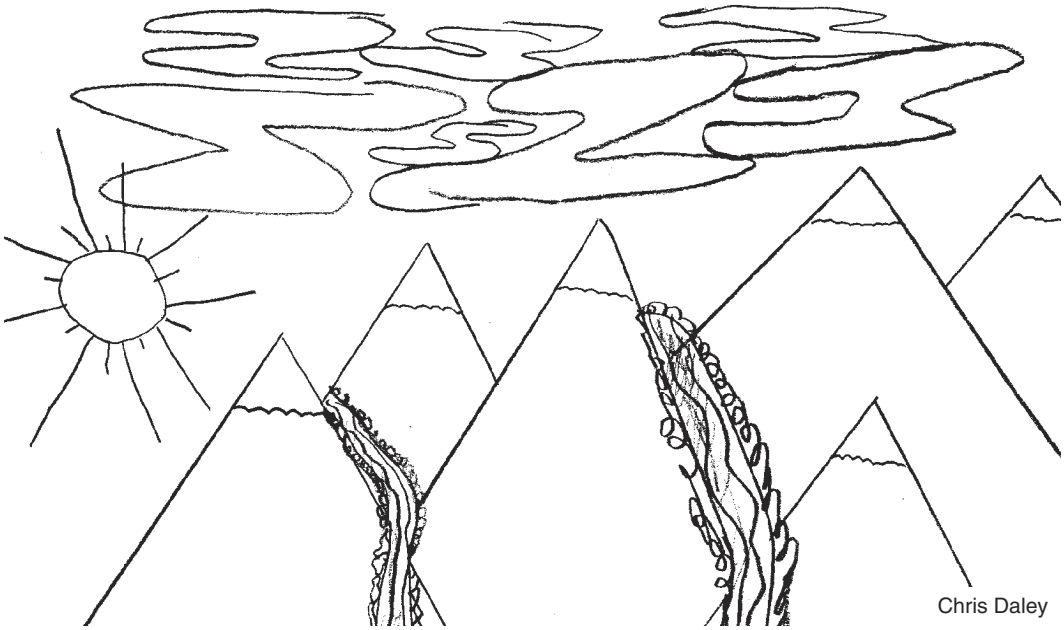
Track 1:
Mountains and Mountain Building

Directions and Background



Chris Daley

If you choose to follow this track, review all of the background, stories and activities included here. Reviewing the other three tracks is optional. Mountains and Mountain-Building begins with tribal cultural lore about the formation of the geological features of this region. You should review this information and adapt it for your use as you see fit.

It is natural that Mountain Building should be the first track in this succession of tracks. The formation of the mountains preceded the carving work done by the glaciers. The flora and fauna that occupy Glacier National Park today came after the work of the glaciers, and humans are relatively recent arrivals to the area.

With limited technology, it would have been difficult for the early tribes to understand the dynamics that were involved in the geologic formation of this area. Nonetheless, they had well developed observation skills and a kind of natural scientific method.

An important function of oral tradition in American Indian culture was to explain and speculate upon the why and how of natural phenomenon. Young Indians asked questions like, “How did the mountains get there?”. Parents did their best to give children answers. Many of the answers were based on what they knew from observation of natural phenomenon. Those observations were surprisingly accurate in scientific terms, but it was impossible for them to answer some questions. Some things just simply “were”. They were part of the Great Mysteries. Mysteries often became the source for Coyote, Creator Sun, or Napi stories. The elders attributed a phenomenon to the work of a spiritual helper and created a story to explain it. At the same time there were a number of stories that, like Bible stories, were considered to be inspired.

Over time, the stories were created to help explain phenomena and those that were considered to be inspired or revealed by a spirit had a tendency to blend together. Nevertheless, stories that explained natural phenomena or simply entertained often came close to reflecting scientific accuracy.

Many anthropologists theorise that the main ancestral source of Native Americans followed migrating herds across the Bering Land Bridge and gradually dispersed across the Western Hemisphere. Apparently this movement occurred several times beginning forty thousand years ago when sea waters were low enough to expose land. The sea was low because large continental glaciers held much of the water that ordinarily covered the area of the land bridge. Native American oral tradition was so effective that there remain a number of stories which indicate vague memories of the migration.

The migration is certainly part of Blackfeet oral tradition. At the time of the migration, the people would have had to travel south along temporary corridors between valley and continental glaciers. They may have been aware of the ice dynamics involved in the formation of topographical features. However, when the mountains were formed, there were no human witnesses to the dynamics. The origin of the mountains was one of the *Great Mysteries.*

Among the Salish, Kalispel, Ktunaxa, and Blackfeet there are a number of traditional stories involving spiritual helpers and *The Old People* which give location-specific explanations of how regional land forms came into being. The stories are characteristically a combination of observation and artistic creativity. Just how literally the people chose to receive these traditional explanations probably varied from tribe to tribe and from person to person.

It was obvious to the western tribes that the valleys had once been filled with water. The lake terracing and other evidence made this obvious to a people who were in touch with their surroundings. The Bitterroot Salish have a number of legends that deal with the formation of mountains, valleys, rivers, and lakes. These include *The Great Flood in the Flathead Country*, *Sheep Face Mountain*, and *Bluejay Brings the Chinook Wind.* Each of these stories has a Kalispel version as well. The Ktunaxa have their own version, *The Great Flood in the Kutenai country.*

In a Ktunaxa story called *The Origin of Flathead River* an immense beaver creates Flathead Lake. He dams the south end of the lake near present-day Polson but allows the water to overrun the Camas Prairie area above present-day Elmo and Big Arm. After some extremely hard winters and a subsequent warming period, the runoff from the mountains becomes overwhelming and the dam breaks through where Kerr Dam is today. The tired beaver gives up at this point but remnants of the beaver's dam and outlet channels exist today. This story is based on the interpretation of landforms that resulted from events that took place during the last Ice Age.

The following Ktunaxa story is one version of a creation story that has related versions in Salishan and Blackfeet traditions. Old Grandfather Creator, one of the protagonists of the story, is a Plateau culture equivalent of Old Man, the protagonist of the Blackfeet story that will follow. They are parallel stories that take place on opposite sides of the Continental Divide.

A Visit to the Sky World
(A west side creation story)

Among the Old People (the animal people), Muskrat was considered to be a sneaky character. When his brother died, Muskrat wanted to marry his sister-in-law. She refused him. In his anger he shot her with an arrow that could not be identified by his people. When friends came to investigate the murder, Muskrat cleverly told them that the arrow had come from the sky.

The Earth People were convinced that the Sky People had killed the woman and they were determined to go to the sky to make war on the Sky People. The Earth People shot an arrow up into a cloud and when it stuck they shot a series of arrows, each into the notch of the arrow ahead of it, until they had formed a chain of arrows all the way down to the ground. Then the Earth People began to climb up into the sky.

Wolverine, who had wanted to go on the raid, was left behind. In his anger he jerked the chain of arrows down from the sky so that the Earth People would not be able to climb down. When the arrows fell to the ground, they formed a chain of mountains to the south of Kootenay Lake.

When he reached the sky, Muskrat ran ahead of the others and constructed a large lake with many tipis around it. After the rest of the Earth People arrived, they searched the village for their enemies but were only able to find Muskrat in hiding. They killed him and returned to make their way back to the ground only to find that the arrow chain was gone. They went in search of Thunderbird who lived in the clouds. They captured him and plucked his feathers. Then they glued the feathers to their bodies and flew down to the ground.
Woodpecker, his brothers and sister, and his cousin Flicker decided to stay up in the sky and explore a little. They walked until they reached the place where the Earth meets the sky. There they sat down on the shore of a large lake to rest. As they sat, a huge wave rolled up on the shore and poor Flicker was swallowed by Water Monster.

Woodpecker and his siblings ran from bay to bay and danced until the fish came to see what was happening. Woodpecker asked them to help locate Water Monster so that he could save his cousin Flicker. The fish were only too happy to help. When they finally located Water Monster, Woodpecker tried to kick the monster but his foot only struck a glancing blow. He and his brothers chased Water Monster all the way up Kootenay River and then back to the south along Lake Windermere. At Longwater Bay the monster dug an underwater cave and hid from the woodpeckers.

Just about then, the woodpeckers saw Old Grandfather Creator of the Kutenais crawling up from the south and naming all the places as he went. As he crawled he left scratch marks on the land and rivers flowed in the furrows left by his belly.

"Quickly! Make a dam at the end of the lake to trap Water Monster", Woodpecker called to him.

Always obliging, Old Grandfather broke off a chunk of mountain, formed it with his knees, and created a portage between the Kootenay and Columbia rivers. Woodpecker was able to corner Water Monster until the rest of the Earth People came to help him slay the monster. They cut him open and out flew Flicker, a little thinner and weaker but still alive.

The animals cut the monster to pieces. They threw his ribs into the river where they formed cliffs. Then the animals dug hot springs around the area and cooked the blood and body parts until they were well done. The animals threw the parts around the land to become food for the New People.

The following Blackfeet account of *Old Man and the Beginning of the World* is one of many versions of the Creation:

Old Man and the Beginning of the World
(An east side creation story)

In the long ago, Old Man (Napi) came traveling up from the south. He was feeling lonely and a little bit bored. He needed something to do to keep him busy. As he traveled he made the mountains, prairies, and forests with birds and animals to live among them. He traveled constantly northward making the landscape as we know it today.

He made the Milk River and some fishes to live in it. By this time he was a little tired so he laid down to take a nap. Where he rested on the hill above the river you can see an outline of his body formed with large rocks.

Still a bit groggy from his nap, he started to the north again but soon tripped over a little hill. He fell heavily to his knees and this upset him a bit. Old Man clawed up the ground and piled up soil to make two large buttes which are still known as The Knees today. A little absent minded, Old Man carried some of the soil with him as he continued north. When he realized that he had the soil in his hands, he stopped, knelt, and formed the Sweet Grass Hills. When he was finished he still had a little material left over. So, Old Man reached over to the west and plopped the extra material down next to the mountains. Created as an afterthought, that little pile today is known as Chief Mountain.

So Old Man continued on his journey to the north. When he created mountains and prairies he experimented with making animals that he thought might enjoy living in those areas. If they didn't like where he put them, he would switch them around. For instance, the bighorn sheep and the antelope decided to switch places. The antelope's cousin, the mountain goat, however, decided that he wanted to stay in the

mountains. Old Man was agreeable. He just wanted all of his creations to be happy.

Old Man made grass on the prairies for grazers to feed on. In the foothills he planted trees and bushes with berries on them. He filled the soil with roots like camas, and bitterroot, wild carrots, and potatoes. He made many plants with different attributes that would be helpful to his creations. Everything that Old Man created had its own personality.

Still Old Man was lonely. He sat down beside a newly created river and began to play with a ball of mud. "Wouldn't it be nice", he said, "if there were creatures like me that I could talk to and play with." And the ball of mud in his hands began to take on a familiar shape.

Napi
Mandy Horn

The modern-day geological explanation for the origins of landforms in an around Glacier National Park is every bit as interesting as the traditional stories. Here is a story based on *Geology Along Going-To-The-Sun Road, Glacier National Park, Montana* by Omer B. Raup, Robert L. Earhart, James W. Whipple, and Paul E. Carrara:

A Geological Story of Glacier National Park

This is a story of changes over a long period of geological time. Some of the main characters in this story are Plate Tectonics, Water, Wind, and Ice. Water, wind, and ice are the principle agents for the processes of excavation, transportation, and deposition of sediments. Some folks simply call this erosion. The main plot of this story involves the force of gravity. With the assistance of the three main agents and some minor agents like humans and other animals, sedimentary material will work its way to the lowest point possible. The most efficient means of moving sediments is water.

Between about 1,600 million and 800 million years ago, the rocks of Glacier National Park were formed from sediments eroded from a North American continent with a very different shape than it has today. The sediments were deposited into a shallow sea covering present day eastern Washington, the Idaho panhandle, western Montana, and parts of British Columbia and Alberta. The Pacific Ocean was located just west of Spokane, Washington. More than 18,000 feet of sediments were deposited resulting in a down warping of the ocean floor. Depending upon the source, amount, and content of the sediments, there were variations in the amount of down warping that took place. Ultimately an interesting marble or layer cake design was formed by various colored layers of sand, silt, and limey mud. The oldest layers of rock having been deposited first were on the bottom of the sequence.

As compaction continued, deposited sediments became sandstone, siltstone, shale, limestone, and dolomite. Time, pressure, and heat associated with deep burial gradually metamorphosed these layers into other rock types. They became quartzite, siltite, shale, argillite, and recrystallized forms of limestone and dolomite. They were now much harder but

looked much the same as they had before. Between about 1000 million and 800 million years ago "pillow" lavas were extruded onto the shallow sea floor. Later magma was injected between some of the rock layers and up through faults in the formation's structure. These magma flows created sills and dikes. The igneous rocks are much darker than the surrounding limestone that has had organic matter literally "cooked" out of it. What you see today is like an Oreo cookie in reverse - the dark part in the middle with the cream filling on both sides. This igneous sill can be seen at some locations along the Going-to-the-Sun Road.

Sediment deposition continued after 800 million years ago but was not metamorphosed. These sedimentary rocks were not as hard as the older rocks. About 150 million years ago Plate Tectonics began to take an active role in the area. Two massive crustal plates began a collision that was to last until 60 million years ago. An ancestor of the present Pacific Plate moved to the east on a collision course with the North American Plate. The leading edge of both plates began to crumble and debris was pushed up at what was then the edge of the North American continent. Not much of the material could find its way down into the Earth's core. There wasn't much room. Material that did get forced down eventually heated up in the mantle, expanded, and erupted as volcanoes. In the process, numerous mountain chains developed. The battle of the plates continued until the western coast of North America extended several hundred miles to the west of where it was located before the collision began.

As the Rocky Mountains began to rise, the shallow inland sea began to drain to the east. As soon as the tops of the mountains were exposed, water, wind and perhaps some ice began to go about their work of excavating, transporting, and depositing eroded sediments to lower elevations. The sediments that were deposited on top of the present-day rock layers of Glacier National Park were eroded away. High in Glacier National Park there remain only a few sedimentary rock formations younger than 800 million years old. Much of the eroded sediment was laid down to the immediate east of the mountains and formed a relatively soft, loose bed of materials.

Fifty to sixty million years ago the pressure on the layers of uplifted rock became so great that a wedge of rock several miles thick faulted and slid more than 50 miles to the east over softer sediments. This action was a little bit like what would happen if you placed a thick layer of whipped cream on a slanted table with a layer cake on top of it. Eventually the cake would wind up on the floor. In the process, some of the cake layers would buckle into folds. This is what happened to the rock layers in the mountains. Billion year old rocks ended up on top of rocks that are less than 250 million years old. (It is just about as easy to imagine Napi doing the construction!)

Some 60 million years ago the great collision came to a virtual halt. Water and wind continued their relentless work. About two million years ago the Rocky Mountains were a bit higher than they are today, but they were rounded and cut by broad stream valleys. At this point ice became involved in the act. The Earth's climate cooled considerably and the Ice Age began.

Classroom Activities

Classroom Activity 1
Cultural "How Stories"

Objective:
Students will be able to explain the importance of cultural "How Stories". Using language arts and artistic skills to produce their own "How Stories", students will speculate creatively and scientifically about natural phenomena in their lives.

Background:
This activity is designed to get students to speculate creatively and scientifically about natural phenomena in their environment. It is best to have children choose phenomena that they have often wondered about. This is a warmup writing activity and topics need not be limited to Mountain Building. The emphasis should be on thinking about how they would explain "Mysteries" to their children if they were an elder.

After presenting the preceding cultural stories about creation of land formations and the teacher's reading or rendition of *A Geological Story of Glacier National Park,* the teacher may choose to read or relate other Bluejay, Coyote, or Napi stories about how certain phenomena in nature came about.

Materials:
Paper, Pencil, Colored pencils

Procedure:
1. The teacher gives the students some background on cultural why and how stories, asks them to think about the process that went into creating the stories, and tells them that they will be invited to write their own stories after the teacher has read a few examples to them.
2. The teacher has the students write their own "why or how" stories and illustrate them with colored pencils.
3. Editing partners should practice reading their stories to each other, make constructive suggestions for revision, and rewrite a final draft.
4. Those students who feel secure enough should tell their stories without the paper. Others could read their story to the class or have the teacher read the story for them.
5. All stories and illustrations should be collected and bound into a book by one or two of the students who would like to create a cover and table of contents.

Follow Up:
Arrange for your classes' stories and art to be displayed at a local bank, grocery store or tribal center. The students will enjoy seeing their work displayed for friends and relatives to see.

Classroom Activity 2
The Work of Water

Objective:
Students will learn that the mountains of Glacier National Park are composed of sedimentary rocks. They will also be able to describe the role of water, erosion, and sedimentation in shaping the landscape.

Background:
This activity gives the students a hands-on experience with the way water excavates, transports, and deposits sedimentary material.

Materials:
Trough provided in Activity Kit or one built from 2" x 10"s nailed together
Clay from a streambank or recycled potters clay
Soil from a garden or used potting soil
Sand
Small sized gravel from the schoolyard or aquarium gravel
Several ping pong ball sized rocks of different shapes
A two quart juice pitcher with a fairly narrow spout
A deep transparent glass cake pan

Procedure:
1. Review stream erosion as one of the major agents shaping the topographical features in the environment. Be sure to relate the formation of the ancient sedimentary rocks comprising Glacier's mountains to this activity.
2. Take the students and materials outside and guide them in constructing a river model.
3. Arrange the trough so that the lower end hangs over the transparent glass cake pan.
4. Mold a bedrock base of clay in the bottom of the trough.
5. Have students sprinkle layers of gravel, sand, and soil along the length of the trough making sure that there is a top layer of soil.
6. Push rocks down into the soil near the center and along the course of the trough.
7. As an added touch the students may want to place little twigs and pine trimmings along the course to represent trees.
8. When the model is complete, slowly pour water (or trickle water from a hose) into the top center of the trough. Allow the water to percolate gently until it begins to make its own bed down the center of the trough. Rocks in the way will create meanders in the river bed. There is no need to overdo the water. When the cake pan is nearly full of water with its sediment load allow it to settle naturally.
9. At this point you may wish to casually teach a little river nomenclature. Point out and discuss the source, the banks, tributaries, confluence, meanders, the course, delta, and the mouth of the river. Add any other vocabulary and information that you are comfortable with.

10. Allow the contents of pan to sit for several hours or until the next day. Point out how the different materials have separated themselves into sedimentary layers.
11. If possible, leave these materials out so that the students can continue to experiment with them.
12. Finally, save this model for further activities with the track on Glaciers and Glaciation.

Follow Up:

Take the small *Glacier* relief map and locate Triple Divide Peak near the west end and to the south of St. Mary Lake. Suppose that for some reason you needed to dispose of some water on top of Triple Divide Peak. Where would that water go? Use an eye dropper to deposit water on the map until it finds its way down the three drainages into the Pacific Ocean, the Atlantic Ocean and into Hudson Bay. For a writing and research assignment you might invite the students to write a story about a trip in a canoe, or as a drop of water or a stick, that begins at the top of Triple Divide. Which drainage would you take? What would you see and what would happen along the way? Where would you finally end up?"

Classroom Activity 3
Erosion and Preservation of the Water Table

Objective:
Students will learn that ground cover is of primary importance in reducing the rate of erosion in a natural environment.

Background:
Students will have a hands-on experience with the role of vegetation in retarding erosion and preserving the water table and in the slowing of erosion.

Materials:
Two large trays
A watering can with a sprinkling spout
A fresh square of sod
A bucket of sandy loam

Procedure:
1. Place the two trays so that one end is slightly higher than the other.
2. Put the clump of sod on one tray and an equal pile of sandy loam on the other tray.
3. Let the watering can rain for a period of time on each earth sample.
4. Invite the students to discuss what happened and why.
5. At the end of the activity have the group examine the two specimens for retained water content.

Follow Up:
Discuss how logging, fire management, agricultural and development in the surrounding ecosystem can help or hinder the goals of Glacier National Park. What do the trees and plants, forests and meadows of Glacier National Park do for the surrounding ecosystem?

Classroom Activity 4
Formation of Mountains and Faults

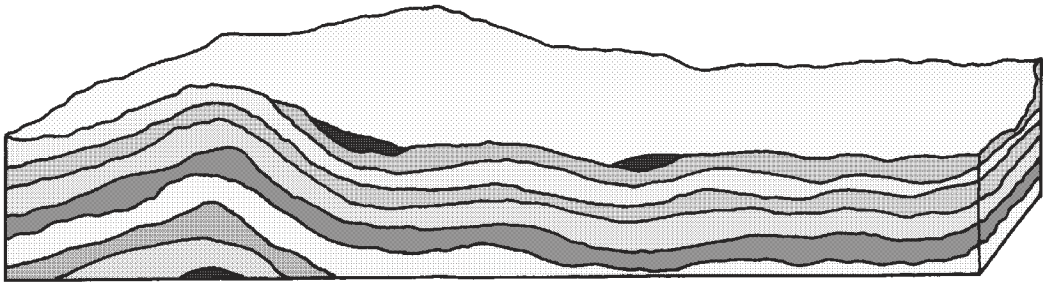
Objective:
Students will recognize geologic terms and processes related to mountain building. Students will define geologic terms including: rifting, faults, folding, batholith, etc. Hands-on involvement will help internalize these concepts.

Background:
This activity is designed to give the students hands-on simulated experience with some of the dynamics involved in the formation of mountains. Handling of materials should also help them to internalize some of the vocabulary used in discussing mountain formations.
The teacher should have read and discussed the preceding *Geological Story of Glacier National Park* and the traditional cultural stories that were related before that. Slides or pictures of Glacier National Park and exploring the U. S. Geological Survey *Glacier* relief map, will benefit students.

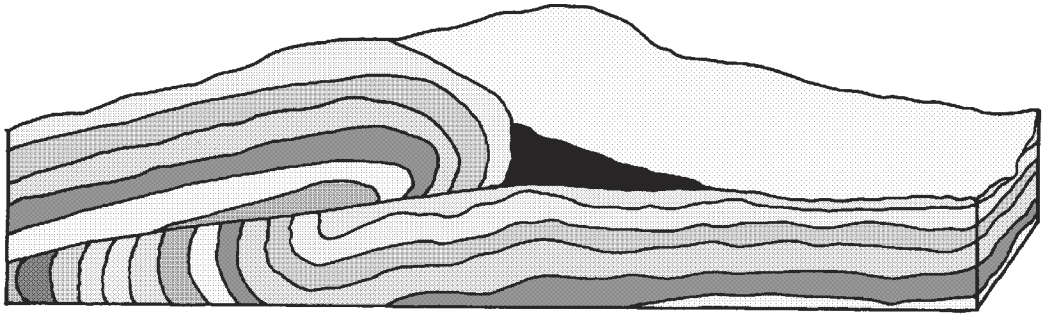
Materials:
An assortment of various colors of 12 inch felt squares
A red or orange ball about the size of a tennis ball
Several red or orange balloons
Several 30 quart garbage bags
A bucket of clean sand
Several sheets of balsa wood, or a similar material, in various thicknesses and colors
A utility knife
Standard building blocks or 2" x 4" end cuts of various lengths
An assortment of pictures or slides of various kinds of mountains
Copies of the U. S. Geological raised relief maps of Glacier National Park

Procedure:
1. After presenting a geological history of Glacier National Park in a format that is most comfortable to the teacher, ask the students to gather around a lab table for an exploration of mountain building dynamics that have contributed to the present formations in the park. (An alternate approach to this activity might include setting up stations around the room. At each station a geologic process is described on a card and students are asked to demonstrate it using the materials provided. Students would rotate through each station).
2. Ask a student to inflate a garbage bag, leaving about a third of the available air space unfilled, and tie the end tightly so that no air can escape. Lay the bag flat on the table and slowly pour sand in the center of the bag. The weight of the sand deposited like sediment will cause the surrounding area of the bag to rise while the center sinks. Pour the sand on several different areas of the bag. Facilitate student discussion of how this deposition on a shallow sea floor might affect the surrounding area.

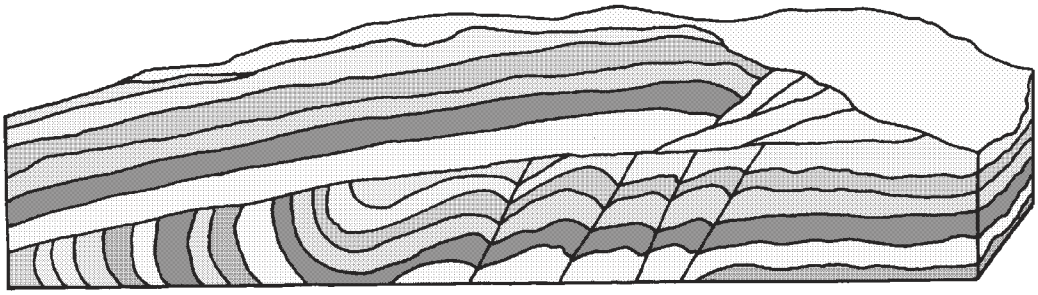
3. Take a stack of felt squares and begin to lay them in successive layers on the table. If the presenter is familiar with the rock formations of Glacier Park, she or he may wish to lay down a succession of colors that correspond to the colors of formations in the park. Any series of earth tones will do just fine. You may want to cap your felt Dagwood sandwich with a layer of blue or green to represent water or vegetation. Facilitate student discussion of the sediments that make up the materials for mountain building.



Folding due to horizontal pressure



Fold has developed into a thrust fault



Thrust has over-riden younger rocks

4. Slip an orange ball under the stack of felt squares to leave a bulge in the middle. Fold back the layers to reveal the ball. The ball represents a batholith. This is an illustration of dome mountains like those in Yosemite, the Black Hills, and closer to home, the Boulder Batholith at Homestake Pass near Butte. The activity illustrates the erosion of overlying sediments to reveal intruded granite. Magma that finds its way to the surface may produce a volcano. Underwater lava flows occurred during the formation of Glacier's mountains, but volcanos were not part of the region's geologic history. Some limited magma intrusions filled in space between rock layers and moved up through faults to form sills and dikes. Invite students to make suggestions about how they can demonstrate the intrusion of sills and dikes into your layered model. Have a student draw a green ink square on an orange balloon. Have her blow up the balloon. Observe the distortion of the surface area square when the balloon is inflated. Invite discussion of what might happen to the surface of the earth when there is a batholith intrusion below.
5. While looking at your sedimentary sandwich of felt squares, briefly discuss how mountains like the Catskills of eastern North America were formed (high flatlands eroded by streams). People live in the valleys that have been carved out by water. What was once a flat plateau is now a mountainous area. This is almost a reversal of mountain building. Push the edges of the felt layered sandwich together as far as you can. This is an example of mountain formation by folding. Even materials as soft as felt can only be folded so far before they are compacted as tightly as they can be. Certainly a great deal of folding was involved in the making of our mountains. The younger, softer, sediments underlying the overthrust were much more subject to folding than the overriding, older and harder, partially metamorphosed Pre-Cambrian rocks.
6. Make a short stack of balsa wood squares. Have a student make an oblique cut through the materials. Have him push these layers together to demonstrate folding. The layers will pile up, shuffle, or even overturn. This is what happens in fault blocking dynamics when harder materials are compressed by plate tectonics.
7. Pile several layers of various length building blocks together as if you were building a brick wall. Make sure that the bottom run is composed of your two longest blocks. Pull the two bottom blocks apart slowly until the upper layers collapse into the gap. This is known as rifting. Rifting occurs when subsurface intrusions spread the surface materials to the point of collapse, when tectonic plates pull apart, or in rare cases when surface materials happen to slough or slide across subsurface materials. The North Fork and Flathead Valleys are actually a kind of rift valley that has been partially refilled with sedimentary materials.
8. Set aside time for the students to do the activities and discuss the dynamics that they demonstrate. Encourage them to experiment as long as they show interest and do appropriate activities. Don't be too concerned about proper technical language. The students should feel free to apply their own vocabulary to facilitate communication skills. When appropriate, supply technical vocabulary and nomenclature but not to the point where students become hesitant to discuss the dynamics.

Follow Up:

As a review and a treat have the students bake a layer cake using mixtures of food color to represent the various sedimentary layers comprising the Glacier National Park rock formations. Instead of putting frosting on top, spray a large layer of whipped cream on a clean piece of stiff paper. Place the cake on top of the whipped cream. Place the edge of the stiff paper on the edge of a baking sheet. Lift the back edge of the paper slowly until the cake slides over onto the baking sheet. Cut and serve the cake and top it with the whipped cream conveyor surface. This little procedure gives a rough impression of how the Lewis Thrust Fault may have operated. It may be healthier, though not as much fun, to make a large hero sandwich with the class, using ingredients that suggest the appropriate and corresponding sedimentary layers in the park. Either activity will make a lasting impressions on the students.

Park Visit Activities

Park Visit Activity 1

The Lakes Within

Mountains in the St. Mary Area

Objective:
Students will identify the processes that created the mountains of Glacier National Park. Students will define the Belt Sea, Larimide Revolution, and the Lewis Overthrust Fault. Students will also recognize the effects of stream erosion in the St. Mary area.

Background:
The naturalist will discuss mountain building processes and the effect of erosion in shaping the landscape.

Divide Creek, as it runs through St. Mary, is an amazing laboratory for the study of what can happen when nature and man are at odds. For hundreds of years Indians from both sides of the mountains came here to camp, hunt, and take part in gatherings and ceremonials. Today you would have to be an astute archaeologist to find any trace of them having been here.

Divide Creek marks the boundary between the Blackfeet Reservation and Glacier National Park. Over the years the park has gained and lost land depending on the latest flood. Private facilities on the east side of the creek and park buildings on the west side are subject to the whims of nature and Divide Creek. The policy has been to let the creek find its natural course as much as possible. Before 1964, Divide Creek was a silty little creek with a healthy population of aquatic life. The last three floods have filled the bed of the creek with large boulders and gravel. The creek is currently seeking a more efficient path for carrying its load into the St. Mary River and eventually to Hudson Bay. In an effort to preserve manmade structures on both sides of the creek, humans have desperately tried to control this quiet little creek that becomes a raging torrent during times of high water.

Divide Creek has flooded several times. The bed of the creek is now higher than the surrounding land in several locations. Artificial levees have kept it within its banks during normal runoff, but the creek will break out and try to form a new bed every spring. It has already altered its course just below St. Mary. Above St. Mary an ancestral distributary shortcut to the upper lake has already reestablished itself. The National Park Service has installed and repaired culverts and discontinued maintenance of the old road bed into Red Eagle Lake. The creek is moving toward the road bed again. In the past, the Blackfeet would never have thought about dealing with Divide Creek. They would have noticed that it was changing and simply moved their lodges to a safer place if flooding seemed imminent. Until the creek has settled into a fairly predictable pattern, all involved will have to continue making adjustments.

Park Visit Activity 2
Sacred Dancing Waters
Mountains in the Apgar Area

Objective:
Students will identify the processes that created the mountains of Glacier National Park. They will define the Belt Sea, Larimide Revolution, and the Lewis Overthrust Fault. Students will also recognize the effects of stream erosion in the Apgar area.

Background:
The park naturalist will discuss mountain building processes and the role of erosion in shaping the landscape. Lower McDonald Creek flows high and strong in the spring on its way to the Middle Fork of the Flathead River. It carries a sedimentary load, cuts into its banks, and with the help of the beavers, establishes and abandons little backwaters in its short run from lake to the river. Lower McDonald Creek cuts down through glacial tills and glacial outwash materials and flows through a well-established forest terrain with a relatively well-established soil horizon visible high on the banks of the creek. The grasses and trees along the course of the creek hold the ground water table up and keep the moist soils together so that erosion is not radical in this area.

Human impact in the Apgar area is very apparent. American Indians walked so lightly in the Apgar area that many historians question whether they really ever used the area. Native sources assert that they used it but left no impact. At any rate, the Apgar area was fairly heavily settled even before Glacier National Park was established. Today, each summer thousands of people explore the area. The Park Service asks people to stay on the established paths and avoid damaging the vegetation. People naturally wander over to the edge of the creek causing some erosion and vegetation damage. Campers sometimes damage live trees in search of firewood and each tree killed lets the water table drop a bit. Few notice individual contributions to erosion, but the total impact is obvious at the end of each summer. In order to combat artificially accelerated erosion, the Park Service maintains a nursery where native plants are nurtured and used to restore heavily impacted areas.

In the long run nature will have a far greater impact upon the Apgar area than humans will, but our short run acceleration of impact is extremely apparent to those who use and appreciate the natural beauty of Glacier National Park.

Back in the Classroom

Take the time to reinforce the Park Visit experience. Discuss the field trip with the students and decide what worked and what didn't. Be sure to fill out and return the trip evaluation form. Some follow-up activities for the Mountains and Mountain Building Track include:

1. Have the students write a report about the trip and share it with the class.

2. The Activity Kit contains slides and some narrative on Plate Tectonics. Have cooperative learning groups research the topic and use the slides to present a program to the rest of the class.

3. Making pudding is a good activity that can be used to illustrate the role of Plate Tectonics in mountain building. Have the class make a pot of chocolate pudding. After the pudding is done, pour it in a shallow glass cake pan (like the one in the Activity Kit) to cool. When almost cool, carefully use a sharp knife to cut the film that formed on top of the pudding into two equal portions. Carefully tilt the pan so that half of the pudding film slides up and over the other half of the pudding. The film represents the lighter continental crusts colliding and forming folded mountains. Even if the mountains collapse into a heap, the pudding can still be eaten by a hungry class.

4. Have students write a letter to the park naturalist that conducted the Park Visit activity. Ask each student to tell the naturalist at least one fact learned during the visit. Illustrate the letters if so inclined.

5. Ask a local geologist to come and speak to the class about the geology of your area.