

# Camp Classen YMCA Trail Guide Rose Ridge Fossil Trail

Trail Cards



Revised Summer, 2004  
Implemented **Fall, 2005**  
Trail Cards

**Trail Focus: Geology**  
**Length: Approx. 1½ miles**

***11 Numbered Teaching Stations***

**Color Code: Yellow**  
**Revised Summer 2004**

## **Geology and Natural History**

- ♣ **The interrelationships between environmental factors impact the course of the earth over geological time.**
  - ♣ **We can recognize the relationship between the environment and mankind's use of its natural resources.**
  - ♣ **Geological factors influence the development of distinct plant and animal ecosystems.**
  - ♣ **The fossil record is a means to understand past relationships of once living organisms and the quality of their environment.**
  - ♣ **Abiotic(non-living) factors help shape the physical landscape through the processes of weathering, erosion, and deposition.**
  - ♣ **Man has an impact on the environment and can bring about changes in both the physical landscape and biological communities.**
  - ♣ **We should gain an awareness of man's responsibility to preserve natural resources.**
- Please refer to the complete Trail Guide for additional information.**

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## TRAIL MATERIALS LIST

### **\*To be supplied by campus**

The other materials should be in the LISD trail bag.

**\*School Supplied Snack**

**\*Apple/knife**

**\*Hand lenses for fossil viewing**

**\*Film canister/baggie for each student**

Fossil identification sheets

3 samples of granite

Marked rope

Rock socks/instructions

Sedimentary Rocks handouts

1 liter plastic water bottle/seashell

## NOTE ABOUT THE FOSSIL TRAIL

There are many hands-on activities embedded in this trail. Each of these activities has been included to make the geological processes more concrete for students. Due to the enormity of time spans and slow pace of most geologic events, it can be difficult for students to firmly grasp the concepts of geologic changes, weathering, erosion, deposition, plate movement, and faulting. Active student participation is important on this trail.

Station 7 is a good location for a mid-trail snack.

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### Teaching and Hiking Suggestions

- Before beginning the trail, explain trail rules and what is expected of each student and counselor
- Backpacks should only contain necessary trail items
- Everyone should check for tied shoelaces
- Position counselors at the end of their cabin group
- Be observant of the surroundings and take advantage of “teachable moments”
- At teaching stations, gather students close so that they can hear, attend, and be involved
- Rotate cabin groups during the hike to give everyone a chance to be at the front

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## Trail Rules

- Stay on trails and walk single file. This reduces erosion and helps maintain habitat for animals. Don't shortcut the "switchbacks."
- Don't litter! Leave no record that you were here, except for footprints. Paper, water bottles, orange peels, piles of rocks, even broken limbs are sad signs of human impact.
- Be prepared. Dress for the weather. Bring water in hot weather. Don't carry so much that you may tire yourself.
- Stay with your group. This keeps people safe, and allows everyone to share in the learning. Keep one person at the end to "bring up the rear."
- Use study materials. There are other trail guides, field guides, and other materials available to tell you more.
- Be patient and quiet. Getting there is half the fun. Slow down: noise scares away wildlife, and you will miss the things you came to see. Take time to learn and appreciate beauty.

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## **Fenced-off Area With Sandstone Boulder Trail Introduction; Understanding the Past**

### **\*Materials needed-rope**

We will experience the natural world around us in order to better understand and appreciate the world in which we live. Natural science, including ecology (the study of interdependent relationships in nature), and geology (the study of processes that build and recycle the earth's crust), and biology (the study of living things) will become even more meaningful to us during this week at Camp Classen.

The theme of the **Rose Ridge Fossil Trail** is "**discovering change over time**". Think of three circles-lithosphere, biosphere, and atmosphere. **Lithosphere** refers to all of the geological features of earth such as rocks, minerals, geographical features, water and all other abiotic (non-living) structures that support the biosphere. The **biosphere** includes flora (flowers/plants), fauna (animals), and all other biotic (living) features of earth. **Atmosphere** refers to the outer layer of gases, oxygen, and water vapor surrounding the lithosphere and biosphere. Our focus on this trail is the lithosphere and its changes over time.

We study what changes have occurred in the past. To do this we look for **evidence** of change. Nature and people leave behind many **clues** to tell us something about what happened in the past.

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## STUDENT ACTIVITIES

1. Trail Rules
2. Draw /discuss 'Three Spheres' in dirt by tree (See Rose Ridge Fossil Trail Guide)
3. Rope timeline activity-From sandstone boulder to trading post. Model geological changes over time by using the rope timeline.

### Geological Time Scale Activity

- 46 feet = Estimated Age of Earth 4600 Million years
  - 39 feet = Earliest form of single celled life 3900 Million years
  - 38 feet = Oldest dated rocks 3800 Million years
  - 23 feet = N. America/Europe covered in Ice Age 2300 Million years
  - 15 feet = Oxygen builds up in the atmosphere 1500 Million years
  - 4 feet = Continents take shape 400 Million years
  - 2.25 ft = Age of Dinosaurs 225 Million years
  - 6.5 inches = End of Age of Dinosaurs 65 Million years
  - 0-2 inches = Human Life 200,000 years
4. Go to the sandstone boulder. Scratch it hard with your fingernail. The particles that rub off are sandstone. These little sand particles were weathered, eroded and deposited originally came from what kind of rock? (Granite) Then they were cemented together to form sandstone, a sedimentary rock.
  5. Find clues
    1. Human Clues: Look for some **litter**.-This is a clue telling us what has happened in the past. What does this evidence tell us?

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2. Natural clues: Look for a **gnarled tree** around the patio area.
  - **Annual Rings**- nature's evidence telling us the age of a tree, the weather patterns of the past, how rainy past spring and winter seasons were, when periods of severe drought occurred.
  - **Burn scars**- these blackened spirals around the trunk of a tree indicate previous lightening strikes. The thickened scar tissue on the outside edges of these burn marks can indicate how recently the scar was made.
  - **Trees with strange looking tops**- are the result of ice damage and wind damage. These trees remain alive because the cambium layer of cells produce new shoots that have become new limbs for the tree.
  - **Sand and clay**-evidence of weathering, erosion, and deposition

### VOCABULARY

**Lithosphere**-geological features of the earth, such as rocks, minerals, water, geographical features, and other biotic features

**Biosphere**-includes all biotic (living) features of the earth, such as flora(trees, plants, flowers) and fauna

**Atmosphere**-outer layer of gases surrounding the biosphere and lithosphere; includes nitrogen, oxygen, carbon dioxide, water vapor, and other gases.

**Deposition**-the process in which weathered material that has been carried by an agent of erosion is dropped in a new place **D** in 'W-E-D'

**Erosion**-movement of weathered materials by wind, water and ice(the agents of erosion) **E** in 'W-E-D'

**Weathering**-breaking rock into smaller pieces; **W** in 'W-E-D'

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## Rose Homestead-Old Shed Remnants of a Community; Resources from Earth

These are a few remnants of the **Rose Family Homestead** that used to be a working farm from the early 20<sup>th</sup> century until the early 1960's. The materials left behind are evidence of all the activities of their daily life of cooking, chores, and repairs. Most of the trees in the area are the same size, indicating that the land had been cleared and farmed until more recent times. Most of the products the Rose family used on their farm came from somewhere in the Arbuckle Mountains.

### NATURAL RESOURCES AND FOSSIL FUELS

- **limestone** used in the construction of the chimney in the dining hall and bell tower, was quarried less than 15 miles away. It started as marine sediments composed of microscopic plant and animal skeletons from beneath Paleozoic seas between 250-500 million years ago.

- **asphalt paving** consists of compacted oil and sand that formed in Arbuckle Mountain rock as a result of these same marine ecosystems

-**gasoline** that powered your transportation to Camp, fuels the ovens in the kitchen and Mr. Rose's farm machinery; traced to these ancient marine and marsh environments through petroleum-a fossil fuel

### WATER

-Camp Classen **water supply**, obtained from the Arbuckle Mountain Reservoir, contains water that has been cycled over again through the water cycle; this water returns in the water (hydrologic) cycle to also erode rocks, deposit soil particles, and nourish the landscape for plants.

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### FOOD

-**foods** prepared in the Rose kitchen including fruits, vegetables, grains, dairy products and meats, only one or two links away from the soils that obtained their minerals from prehistoric rock formations

### AIR

-clean Arbuckle Mountain **air** is being purified and recharged with oxygen by trees that are drawing their nutrition from rocks and soil deep beneath us that originated in marine environments

### WOOD AND PLANTS

-**wood** and graphite in your pencil, the paper you are writing on, the calcium in your bones and the iron in your blood are linked to "mother earth". How? Your clothing? **Cotton** comes from the flowers of a cotton plant, which grew in the soil. Wool comes from sheep, which ate **grass** that grew in the soil.

### ALL THESE THINGS ARE PART OF THE EARTH SYSTEM.

**Rose family trash** was recycled by:

1. Burning
2. Feeding the "slop" or food waste to the pigs
3. Composting plant materials to make fertile soil
4. Reusing materials for different purposes

One of the best "recyclers" the Rose family had was the domestic pig. Most of the food that the Rose family ate was raised on their land. Pigs are particularly fond of food leftovers. As the pigs grew and became hogs, they in turn became a food source for the Rose family. Many years ago some camp waste was burned here, but now as much as possible is recycled-metals, plastics, paper and leftover food (composted)

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### **Earth has always been recycling materials naturally by . . .**

-breaking down rocks into smaller particles to form soil; compacting the soil into sedimentary rock layers; breaking the rocks again to form soil; melting and cooling to form igneous rock; pressing and heating rock layers to form metamorphic rocks, animal/plant waste deposited on soil to add minerals and organic matter

### **STUDENT ACTIVITIES**

1. Clues- You can find evidence indicating how people used this area in the past. Have the students look for evidence while remaining on the trail.
2. Pick out several nearby objects and try to determine how they came from nature and how they will later be recycled  
Evidence to be found:  
Lumber (fashioned from the wood of a tree and is now decaying)  
Wire (from a fence)  
Corrugated tin (from a roof)

### **VOCABULARY**

**Recycle**-to use materials again in the same or another way

**Resource**- materials needed in daily living

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### **Rose Creek Cliff and Spring Geological Notes, Finding Faults**

**Materials needed: rock socks/instructions**

(see Rose Ridge Trail Guide for more information on faults)

By looking for patterns in nature, and interpreting them, we can learn how nature has shaped the land. The large steep cliff near us is a big clue; the springs are another clue. All of these clues indicate faults, associated with tectonic activity.

Look at the way the **layers** of the rocks are tilted. Here is another clue about the geologic history of this area. The entire mountain is made of tilted bedrock. Strong forces must have moved the rock layers to the angle we see.

Let's look at the rocks sticking up on edge, sitting in and near the creek bed. Within the bedrock, there are some whitish, long, rectangular-shaped rocks called **boudans**. These are actually stretched rocks, changed by the same strong forces, which produced the faults (cracks)

Now that we have seen evidence, what are these forces? Geologists tell us that there are large pieces of the earth(plates), which make up the **crust**, actually slide and shift around on a layer of magma under the crust. When these plates slide past or push on each other, the forces of pushing/sliding are very strong. This strong force causes things to happen:

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- more cracks or faults in other rock layers
- rock layers pushing up
- vibrations in the rock layers (earthquakes)
- rock layers bending or folding

Look around for signs of a **natural spring**. The rock holding the water must be porous (limestone) and it acts as a natural water filter. (DESCRIBE AN AQUIFER USING THE EXAMPLE OF MARBLES IN A GLASS(like limestone); WATER FILL THE SPACES IN THE LIMESTONE LIKE IT WOULD FILL THE SPACES BETWEEN THE MARBLES IN A GLASS)

The springs you see in nature are clues that there is a crack in the rock layers. Tremendous forces in the earth have pushed the rock hard enough to make them crack, and the broken parts slip past each other. Water stored in the porous rock runs out these faults as a spring. Faults are very common here. Seismometers measure the forces of rock movement.

A **fault** is a fracture in the Earth's crust along which motion may occur. It marks the boundary between two plates. Rock layers do not all look the same. **Striation** refers to the grooves and layers found in rocks; often appearing as different colors due to the different minerals found in the various layers.

### STUDENT ACTIVITIES

1. Rock Socks — Use 4 socks to demonstrate the moving/colliding/folding/breaking of layers at the fault lines. (Mention 3 types of faults and the results of each while modeling each of them with the socks.)

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### 2. Faulting Hand signs

-Rest one hand on top of the other with both palms facing down. These are layers of rock.

-Slowly move your hands to form an arch as if they are being forced upward by a strong force pushing from below. The rock layers have been folded and are no longer laid out horizontally. If your hands have been forced apart, a crack or fault has appeared in the rock layers.

3. Explain an aquifer (see Rose Ridge Trail Guide for information)

### VOCABULARY

**Fault**-a crack in rock layers

**Folding**-a process of 'bending' rock by force

**Aquifer**-underground layer of sand, gravel, or porous rock that collects water and holds it

**Spring**- a natural source of groundwater; groundwater is released from an underground aquifer through a crack (fault) in a rock layer

**Seismometer**-an instrument that records tectonic plate movements

**Tectonic plate**-rock layers of the Earth's rocky crust that rests and moves on magma in the mantle

**Crust**-outside rock layer of the Earth

**Striations**-grooves and layers found in rocks

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## Rose Ridge Rock Biotic and Abiotic Factors

(See complete Rose Ridge Trail Guide for Major Prairie and Forest Plants information)

### Notice a pattern: *Abiotic* factors determine the *biotic* factors present in an area.

Look down into the valley. How do the plants change as one goes down in elevation? What else changes with elevation? (Water, shade, soil, animal habitat) As the **abiotic** things (bedrock, water, soil, exposure to the sun) change, the plants change, and thus animals change.

Two major **biomes** are represented at Camp Classen-grasslands and deciduous forest. A biome is a major ecologic community. The **eastern deciduous forest** biome is the largest remaining deciduous hardwood forest in the world. The **Great Plains** biome is the most diverse temperate grassland remaining on earth. Oak and hickory trees mark the forest. Several grasses, prickly pear cactus, yucca, and a variety of wildflowers mark the prairie. Take a look to find where both of these biomes are present. This blending of communities is called an **ecotone**.

Eastern Red Cedar, or Juniper, grow in the rocky, sandy soils here. Notice how cedars are taking over. Look for evidence of how people control the cedars. Fire and grazing controlled their growth in the past. Now Classen controls the cedars with saws and controlled burns. This area was burned in January 1995 and March 1997. Burning yields fertilizer for pasture grasses. The trail on the west side of Vesper Mountain goes through a grassland habitat that has been partially restored by the removal of invading juniper trees. Since the tree cutting began in 1987, there has been a noticeable increase in the populations of prairie grasses and flowers. We see that the **mountains are folded**.

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### Student Activities

1. Teach acronym of **G.R.E.W.** These abiotic factors are necessary for biotic survival or growing!

**G—gases & oxygen**

**R – rocks, soils & minerals**

**E – energy from the sun**

**W —water**

2. Discuss ecotone. Lead students to notice difference in plant life. Mention the root depth of these plants required for survival and how soil depth determines type of plant life; leading to specific type of animal life.

3. OH DEER ACTIVITY (This activity should be done at a flat place on the trail. The ‘Y’ is a good spot)

- Make two lines of students on the path facing each other.
- Explain that one line of students will be ‘resource’ and the other line will be the ‘deer’.
- Explain that the three ‘resources’ are **shelter(shown by placing hands on top of head like a roof)**, **water(shown by placing both hands over mouth)** and **food(shown by placing both hands on stomach)**.
- **Round 1**
- Each student (‘resources’ and ‘deer’) will face in opposite directions; ‘resources’ will decide what to be/act out and ‘deer’ will decide/act out which resource they will need.
- Once all students are acting, have them turn and face each other.
- The ‘deer’ step across and take a ‘resource’ (student) that is the resource they need to survive.
- The ‘deer’ that get their resources (shelter, food, water) stay alive and their ‘resources’ now become ‘deer’.

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- The deer that do not get their needs met become 'resources'. The unclaimed 'resources' stay 'resources'.
- Discuss how the number of each group has changed
- **Round 2:**
- Students keep their current status ('deer' or 'resource')
- Face away from each other, decide what to act out, begin acting
- Turn and face each other
- 'Deer' collect a 'resource' and these 'resources' become 'deer'
- Unclaimed 'resources' remain 'resources'; 'deer' without a 'resource' become 'resources'.
- Discuss how the numbers of each group have changed and what has happened to resources and deer population

Continue for about 3-4 Rounds to see the pattern.

### VOCABULARY WORDS

- **Abiotic**-nonliving factors
- **Biome (land)**-a large region of land with a distinct climate and certain types of plant and animal life
- **Biotic**- living factors
- **Deciduous forest**- a forest of trees and plants which drop their leaves seasonally
- **Ecotone**-a zone where two biomes meet and overlap
- **Grassland**-a land biome characterized by many varieties of grasses

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## Rose Ridge Rock Outcrop

### Rock cycle

**Materials needed: apple/knife, sedimentary rock handout**

These rocks are a good place to examine evidence, to form the basis for knowledge of geologic past. Another important cycle in nature is the **rock cycle**. Geologists believe that all rock material on earth was originally hot magma. **Sedimentary** rock is made of particles (examples are sandstone, limestone, shale). Almost all the rock at Camp Classen is sedimentary. **Igneous** rock is any rock which came from molten rock, or magma, and cooled and solidified (examples are granite, rhyolite, basalt). **Metamorphic** rock is any rock that has been altered by heat and pressure (examples are gneiss, shist, slate, marble). The process of **weathering** can break down any kind of rock. The hardest minerals in the rocks take the longest to break down.

- a. Igneous rock resulted from the cooling of magma
- b. Sedimentary rock results from the weathering of preexisting rock
- c. Metamorphic rock results from the transformation of preexisting rock under heat and pressure; For example
  1. limestone changes to marble
  2. shale changes to slate
  3. sandstone changes to quartzite

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1. This nearby stream, Rose Creek, carries particles downstream.
2. You can see a layer of sediment. These sediments are particles of soil and debris from upstream. We would expect the top of the sediment layer to be flat.
3. The white rocks are made of particles. If you examine the particles under a microscope, they look like microscopic ocean life ( radiolarian, diatoms, coccoliths, etc.).
4. Chemicals in the stone are the same as those of ocean mud: calcium carbonate.
5. A few fossils have been found in this rock; relatives of squid (cephalopods), jellyfish and shellfish. *What do you suppose the environment was like when this rock formed?*
6. The layers in this rock are angled.
7. Several miles to the west, rock layers are angled, but they face the opposite direction.
8. Other places at Camp Classen have outcrops of a rock which contain smaller rocks (**conglomerate**) made of the same rock (Viola limestone) we are sitting on. Limestone is present across most of the edge of the continent of North America.

### Student Activity

1. Scratch a rock with your fingernail, another rock, or a metal key. Notice how sediments come off. Different rocks have different hardness. Compare the hardness of several rocks.

2. Pass around 'SEDIMENTARY ROCKS' handout

### 3. Rock hand signs

- **Sedimentary** – (layers)

Place one hand on top of the other; move bottom hand to the top (repeat again and again) saying the words “**Sedimentary rock layer**” every time you move a hand.

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- **Metamorphic** – (Heat and pressure)
  - Fan yourself-saying “**Heat**”
  - Squish and twist cheeks with hands saying “**Pressure**”
- **Igneous** – (Melting and Cooling)
  - Act like the Wicked Witch of the East from *Wizard of Oz* saying “**I’m Melting**” in a high-pitched voice
  - Act like “The Fonz” (Happy Days) Thumbs up saying “**Coooooool**”
- **Earth’s layers activity:** Apple and knife
  - Cut the apple in half horizontally (across the widest part of the apple)
  - Discuss layers of the earth using the half apple (skin-earth’s crust, bottom rock layer of the crust is bedrock (granite); fruit-mantle; core-Earth’s outer core; seeds-inner core)

### VOCABULARY

**Fossil**-a the remains or traces of an organism that lived long ago

**Core**-central or innermost layer of the Earth; divided into inner core and outer core

**Igneous rock**-rock formed by melting and cooling; cooled lava or magma

**Mantle**-the layer of the Earth between the crust and the core; the layer on which the crust moves; source of magma and lava

**Metamorphic rock**-rock formed by high heat and pressure deep within the Earth

**Sedimentary rock**-rock particles deposited and compacted into layers, fossils are found in sedimentary rock

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## First Fossil Area Paleo-Ecology

The rock here is called *fossiliferous limestone*. It is fairly soft, and we will find a valley here. The fossilized animals we find here were all “filter feeders”, which means they ate microscopic plants (phytoplankton) and animals (zooplankton) which floated in the shallow ocean. Each species occupied its own niche in the reef ecosystem. The basis of the food web in this reef was algae. Algae require sunlight for photosynthesis, so the water must have been shallow enough for sunlight to penetrate and keep the algae alive.

Three main kinds of fossils: **Bryozoans, brachiopods, and crinoids.**

**Bryozoans:** The most common fossil here. Name means, “tree animals”, from their branchlike shape. **Crinoids:** These animals are related to starfish, are echinoderms, and you might see the five-sided pattern on a connecting piece. They break easily after they die, so most often we find parts of them. **Brachiopods:** Name means “salt foot” or “arm foot”. You can identify these by the heart-shaped shell.

**For a fossil to form, it must:**

1. Have hard parts, like what?
2. Be buried quickly by sediment (such as in a storm)
3. Minerals must replace the living tissue over a long period of time

### STUDENT ACTIVITIES

1. Characteristics of the three common fossils found in the Lick Creek fossil pit:  
very small, white/tan, covered with sand.
2. Pass out fossil identification sheets to counselors
3. **Fossil Pit Rules:**
  1. Each student may collect **NO MORE** than 5 fossils. Students may use a sandwich size bag/film canister for their fossils
  2. No digging tools are necessary, but a stick may be helpful
  3. Usually the best fossils have been washed to the bottom of the pit, but students may climb in a safe manner to find another digging location
  4. If you climb up, be careful not to kick rocks on anyone below you
  5. Stay in sight of adult supervision at all times
4. **Hunt for fossils —become a paleontologist**
  1. Pass out fossil finding equipment (hand lenses, collecting bags/canisters)
  2. Five fossils per person maximum, each fossil should be smaller than your thumb nail!!!  
(Note: if outstanding specimen is found please turn it into the Outdoor School Director)

## Second Fossil Area Ordovician Reef/Paleo-ecology

**Habitat Tree and Creek Bed-** We can stop near this large, unusual chinkapin oak. The vernal stream has eroded the ground, which used to surround this tree. What forces of nature have occurred here to cause the tree to wrap its roots around itself? When the ground becomes saturated from rainfall, what happens to all the extra water?

We may find larger fossils here. In order for the bryozoans to grow larger, there must have been deeper water. The geologic age of this rock is the same as the rock at the last stop. This is the deeper water of the same ocean where the other, shallower ecosystem existed (at the previous stop).

Three main kinds of fossils: **Bryozoans, brachiopods, and crinoids.**

**Bryozoans:** The most common fossil here. Name means, “tree animals”, from their branchlike shape. **Crinoids:** These animals are related to starfish, are echinoderms, and you might see the five-sided pattern on a connecting piece. They break easily after they die, so most often we find parts of them. **Brachiopods:** Name means “salt foot” or “arm foot”. You can identify these by the heart-shaped shell.

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### For a fossil to form, it must:

1. Have hard parts, like what?
2. Be buried quickly by sediment (such as in a storm)
3. Minerals must replace the living tissue over a long period of time

### STUDENT ACTIVITIES

1. Characteristics of the three common fossils found in the Lick Creek fossil pit:  
very small, white/tan, covered with sand.

#### Sedimentation Bottle

- Teacher- fill Sedimentation bottle (clear plastic) with H<sub>2</sub>O from creek.
- A student-add one shell
- Students- add more stuff (i.e. sand, small pebbles, grass, dead leaves, dirt, etc.)
- Shake bottle up and put in trail bag, view at station 10

2. Pass out fossil identification sheets to counselors

#### 3. Fossil Pit Rules:

1. Each student may collect **NO MORE** than 5 fossils. Students may use a sandwich size bag/film canister for their fossils
2. No digging tools are necessary, but a stick may be helpful
3. Usually the best fossils have been washed to the bottom of the pit, but students may climb in a safe manner to find another digging location
4. If you climb up, be careful not to kick rocks on anyone below you
5. Stay in sight of adult supervision at all times

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#### 4. **Hunt for fossils —become a paleontologist**

1. Pass out fossil finding equipment (hand lenses, collecting bags/canisters)
2. Five fossils per person maximum, each fossil should be smaller than your thumb nail!!!  
(Note: if outstanding specimen is found please turn it into the Outdoor School Director)

#### Fossil Pit discussion: after collecting fossils

- What was the most common type of fossil found? Why do you think there were more of these types of fossils?
- What was the most common type of crinoid part found? What factors would cause this part to be preserved more frequently than other parts of the crinoid?

#### **VOCABULARY**

**Fossil**-the hardened remains or imprint of a plant or animal that lived long ago; found in sedimentary rock

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#### **Horse Bone Clearing How are fossils formed?**

#### **Watch for scorpions under rocks on warm days!**

This clearing was made flat by bulldozers and backhoes for oil drilling equipment around 1978. There are approximately 12 oil-drilling sites on Camp Classen property. None have struck oil, though there are working oil wells on neighboring property in all four directions. Find the place where some dry large mammal bones are lying on the ground. Do not disturb them; rather leave them for others to see later!

Cephalopod fossils are present here. These relatives of squid were fierce predators, eating trilobites and any other animal they could. They swam in deep water. Paleo-ecology tells us we have found a still deeper ancient ocean ecosystem!

**How does oil form?** Oil is incompletely decomposed organic material. We call it a **fossil fuel** because it is made of the “sludge” left from the decomposing parts of plants and animals. Abundant life and rapid burial are good conditions for the formation of oil. A shallow ocean reef, or a swamp are excellent oil depositional environments. We often find identifiable fossils in oil-rich rocks. There is even an oil company (Sinclair) that uses a dinosaur that lived in an ancient swamp for its mascot! We know that these limestones are the record of ancient shallow ocean reefs that were here in Ordovician time.

#### **Student Activity**

1. Hunt for fossils

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## Ecotone Ecology Hard Rock and Soft Rock

Students should be able to tell what ecological factors make this area a hardwood forest, as opposed to a cedar and prairie community. The transition area from one ecosystem to another is called an ecotone. What kind of soil is in a forest? Soil that is rich in minerals from the weathered rock pieces and high in organic (biotic) material. The good soil layer is fairly deep here. When rich soils accumulate and lithify, they turn to shale.

Look for an organism called a **lichen**. It is an alga and a fungus growing together.-a beneficial relationship for both of them. Look for lichens on tree bark and rocks. Lichens break down rocks into smaller pieces in two ways. Let's look at the process of weathering and see where lichens fit in.

**Weathering processes:** Several kinds of weathering occur:

### Mechanical Weathering:

1. **Grinding and crashing** —rocks breaking off as they collide with other materials or other rocks; when you walk on rocks, especially soft rock you are doing this kind of weathering
2. **Freeze – Thaw:** Frozen water is about 10 % larger in volume than liquid water. If liquid water should get trapped in a crack, and later refreeze, it will certainly expand, widening and breaking up the rock.
3. **Root Pry:** As plant and tree roots attach to a rock, the growth process of the roots helps widen existing cracks and breaks rocks apart. Soil is trapped making a habitat for other plants.

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**Chemical Weathering:** Rainwater is slightly acidic. It always has been, even before the issue of acid rain. Lime is an alkali, which is the opposite of an acid. When the two meet, a chemical reaction occurs in which the rainwater dissolves the lime.

**Lichens:** These pioneer plants are usually the first things to grow on exposed rock and dead tree bark. Lichen is a symbiotic relationship of *fungus* and an *algae*. All three major lichen groups, the crustose (crusty), foliose (leafy), and fruticose (looks like fruit-bearing) are found at Camp Classen. Lichens growing on rocks have roots that break rock surface and also secrete weak acids that erode limestone, leaving a pitted surface. Lichens weather rocks both mechanically and chemically

**Erosion:** Water running across the rock physically carries away particles. The valleys and creek beds are the result of erosion. Wind blows loose soil. Sliding ice moves dirt.

**Speed of water/wind/ice greatly effects erosion rate.** High energy (fast moving) water/wind/ice causes greater amounts of particle movement (carries bigger particles and/or particles a longer distance) Low energy (slower moving) water/wind/ice causes less particle movement.

**Deposition:** As various forms of weathering occur, sediments accumulate in the area. They will “pile up”, layer by layer, and one day become compacted. This lowland is truly a modern day **depositional environment**.

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## STUDENT ACTIVITIES

1. Look for lichens on rocks or tree materials
2. Discuss W-E-D and its place in the rock cycle
  - What kind of rock could be formed?
  - What kinds of rock can be weathered?
  - How do different energy levels of the agents of erosion (wind, water, ice) affect erosion?

## VOCABULARY

**Alluvium**-sand, silt, mud, or other fine-grained abiotic matter deposited by flowing water

**Erosion**-the process of carrying rock particles by wind, water, or ice (agents of erosion)

**Deposition**- the process of dropping rock pieces, sediment, alluvium into a new location

**Weathering**—the process of breaking rocks into smaller pieces mechanically or chemically

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## Down Cedar Hill Life on Limestone

**Materials needed: sedimentator bottle**

These cedars grow easily on very shallow limy soil, which comes from the Ordovician limestone with which we are now familiar. The limestone is relatively hard, so it breaks down slowly. There are several ways the limestone breaks down, eventually forming soil.

Age of Limestone: This limestone is middle Ordovician in age, approximately 470 million years old.

Fossil age: The age can be determined. Of course, this method is costly, and can't be done on every rock (and you couldn't do it right here, since the rock sample must be sent to the lab!) But the results would fit well with the patterns we find in rock layer positions and fossils that we have seen today.

## STUDENT ACTIVITY

1. Analyze sedimentator bottle
  - Layers? How could these form into rock?
  - Where could the shell be?
  - How could it be found?
  - How would it become a fossil
2. Empty the bottle; TRY TO RETRIVE THE SHELL FOR NEXT TIME!
3. Review Rock Cycle Hand signs (from #5)
4. W-E-D-one more time!!  
Describe each of the processes

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**Key concepts in this trail guide:**

- All things come from the earth. We depend upon it for survival, and we can impact its care.
- Springs are clues that there are faults in the bedrock.
- Evidence of tectonic activity includes sharp turns in the creek, boudans, and tilted rock layers..
- Natural resources have affected human living throughout history. Soil, minerals, plants, and animals in an area affect our economic activities.
- Abiotic (nonliving) factors (climate, soil, water, etc.) determine plant life, and plant life determines animal life (biotic factors - living).
- A fossil is evidence of past life.
- Bedrock controls soil formation which controls plant growth which in turn controls wildlife.
- Many cycles are present in nature. One is the recycling of minerals as sediments, as they are eroded, deposited, and lithified (turned to stone).
- A fossil reef is an ancient ecosystem, made of lime, turned to limestone. Sand becomes sandstone, swamp mud becomes shale.



