Camp Classen YMCA
Trail Guide
Lick Creek Fossil Trail

Trail Cards

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

Trail Focus: Geology
Length: Approx. 1½ miles

12 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.

TRAIL MATERIALS LIST

***To be supplied by campus**

The other materials should be in the LISD trail bag.

*****School Supplied Snack

*1 apple/knife

*****Container per student to collect fossils (film canisters, small baggies, etc.)

*****Plastic hand lenses (to be shared by students)

*****Baggies for crinoid model

*****1 box of plain Cheerios and 1 box of Apple Jacks (for about 100 students)

*****1/2 piece of pipe cleaner per student

Tree Ring samples

3 Granite rock samples

Laminated sedimentary rock handouts

Laminated fossil identification sheets

1 used truck inner tube

Labeled rope

Rock socks/instruction sheets

1 liter used plastic water bottle with small 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 8 is a good location for a mid-trail snack.

The truck inner tube used at Station 3 could be left near the incinerator (Station 2) **AND RETRIEVED** by the trail leader after the trail is completed. It, therefore, would not have to be carried throughout the trail.

Emphasis on a "Clean trail" should be enforced-no littering!

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

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.

1

Dining Hall Patio

KEEP THIS VERY SHORT **Trail Introduction; Understanding the Past**

***Materials needed-tree rings**

The theme of the Lick Creek Fossil Trail is "Discovering Change Over Time" Or "History - The Study of the Past". Nature leaves behind clues to the past.

Look at this nearby tree; tell what changes it has undergone-high winds, lightning, people, automobiles, insects, and birds?

How do we know those factors caused the changes? We look for a pattern, and make inferences.

EX: *A saw leaves the same sort of mark on a tree every time. If you find that mark, it was probably from a saw. *Lightning leaves burn scars on the path that the electricity took as it traveled through the trunk of the tree. See the same lines anywhere? Probably caused by lightning strike. *A tree has annual rings. The dark part of the ring is fall and winter seasons' growth; the light part of the ring is spring and summer's growth. The light color comes from faster growth and the greater availability of water. See the pattern? Infer about the seasons. The oaks around the cabin area of Camp Classen are around 100 years old. Their tree rings would show this.

There are some patterns that are very well established in science called Scientific Laws. For example, "No material in nature is created or destroyed, but it can change in form".

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 change in the lithosphere over time.

STUDENT ACTIVITIES Make this brief

1. Trail Rules
2. Discuss a tree and its evidence of change over time
3. Pass around tree ring samples
4. Draw /discuss 'Three Spheres' in dirt by tree (See Lick Creek Fossil Trail Guide)

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 (animals)

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

2

Incinerator/Grill

***Materials needed: inner tube, granite samples**

Cycles in Nature

From the plaque on this structure, you will see that Camp Classen is over 50 years old. This stone structure was probably built for two purposes: a nice outdoor grill OR in 1941 when trash collection was not very regular at Camp, as an incinerator so cardboard and other paper products could be burned (or incinerated).

Just for starters, consider these ideas: NATURAL RESOURCES AND FOSSIL FUELS

- **limestone** used in the construction of this incinerator, and in the dining hall and cabins, 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.

-**stone structures** nearby are remnants of tables. Wood parts have either rotted away or been removed.

- **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 the electricity that lights the dining hall; traced to these ancient marine and marsh environments through petroleum-a fossil fuel

FOOD

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

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.

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.

All organisms **make waste**. Consider the nutshells squirrels leave behind, or a fallen tree lying on the forest floor. Material that is in an undesirable place is called waste and pollution. Many years ago some camp waste was burned here, but now as much as possible is recycled-metals, plastics, paper and leftover food (composted) **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. Discuss evidence of human activity: former picnic table, incinerator, pollution/waste

2. Inner tube Activity-landfill model

-Discussion of what to do with trash (trashcans, landfills, dumps)

-Inform students that inner tubes represent landfills. Discuss what a landfill is.

-Discuss pros and cons to living near/on a landfill, composting, capacity, prohibited items, etc…)

-Students name an item they've discarded before and become that item, placing themselves in the "landfill."-an inner tube. (You may wish to have parents stand around to keep students balanced.)

-Depending on group size, you may wish to have a couple of inner tubes. If inner tubes are not overflowing, you may suggest that one landfill has shut down, causing movement of trash to another landfill; therefore demonstrating an excessive amount of garbage/trash in a smaller land area

-Discuss how to make more room in the landfills. (Students should recognize that some materials could be recycled (glass, plastic, paper, etc…therefore sending less materials to the landfill.)

-Recyclable "students" could then remove themselves from landfill.

-Discuss ongoing efforts in science to discover new ways to deal with waste.

3. Show samples of granite. Examine rock and dirt samples to see how rock breaks down to smaller rocks, sand, and finally clay. These geological processes: weathering, erosion, compacting, and depositing, don't occur quickly. The Earth constantly changes rocks over a period of many years.

4. Students can also feel sedimentary stones in the incinerator.

VOCABULARY

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'**

Fossil fuels-a fuel formed from the decayed remains of ancient plants and animals

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

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

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

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

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

3

Straight Pathway before the Bridge

Materials needed: marked rope **The Geological Time Scale**

Scientists have come up with a **generalization**, a scientific theory, about the past history of the earth. It is based on **patterns** found in **evidence** gathered throughout the earth. Later in the hike we will learn about the patterns and evidence. **The Earth is constantly changing**. Geological changes can occur over a period of millions of years. Most current geological evidence places the Earth's age about 4.6 billion years.

STUDENT ACTIVITY Keep it brief

1. Have students line up in the pathway, standing shoulder to shoulder.
2. As you pass out the rope, have each student hold the rope where they're standing.
3. Tell them that the rope represents a timeline of the earth.
4. Have them predict how old the earth is and where dinosaurs might've been on the timeline. (Who is standing at that point?)
Cut any discussions about evolution vs. creation
Emphasize this is a scientific theory
5. There will be rings/knots on the rope to represent each of the marks indicated on the timeline below.
6. Begin at 46 feet, and explain briefly each of the points.
Major points: Emphasize how old the earth is, and that humans are only a minor part of the major timeline. The earth has been around a lot longer than we have.

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Geological Timeline

- **46 feet** = Estimated Age of Earth — 4600 Million years
- **39 fee**t = 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

VOCABULARY

Geological timeline-period of time covering the development and formation of the Earth

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Switchback Fence

Erosion Control

The fence on the sides of this trail was put up around 1990 to keep people on the trail.

1) It is easier to walk across a hill than straight up it.
2) Switchbacks encourage **low energy** waters-slow the water down- therefore discouraging erosion and preserving trail condition. Straight up and down trails encourage erosion because of **high energy** water.

You will also notice dead trees. They were cut down for the fence, and to provide a nice view. These are JUNIPERS, or RED CEDARS. They decompose slowly. Some have been burned. Burning speeds the recycling of nutrients, like carbon and nitrogen.

The fence and dead trees record history. Written and spoken records back this up. What record does nature leave regarding changes? What would dried mud or fossils indicate?

Start observing the plants and wildlife around us.

VOCABULARY

Decompose-to decay or rot

Erosion-period of time covering the development and formation of the Earth

Switchback trail-a looping path designed to slow down erosion & for easier hiking on a slope

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5

Wolfe Chapel, Top of Vesper Mountain

Materials: pipe cleaners, apple jacks or cheerios

Geological Contributions/Land Restoration

Vesper Mountain is the most famous landmark at Camp Classen. Vesper means, "quiet at the evening", that magic time between day and night. **Vespertine sounds** include **screech owls** (a mournful wavering trill), a **rabbit searching** for edible greens, a **coyote yelp**, and an **armadillo scavenging** for insects, **frog chirps**, crickets, and the calls of various evening birds. All of these animals take this particular time for activity and fill a unique niche. The cross on this mountain points north/south. A small stone shed to the south used to house a water pump. You can see several other Camp Classen buildings.

History: The early economy of Davis, OK was based on trade with the Native Americans. When the Santa Fe railroad came in 1887, trade between the region and the whole country was possible. Much of this trade was centered on cattle ranching, then the oil business. When profits from oil fell in the 1980s, Davis was forced to rely more on tourism for its main economy. Turner Falls Park,just south of Camp Classen, is owned by the city of Davis. People can get to this area easily on Interstate 35.

These old **Arbuckle Mountains** have benefited regional **agriculture** by holding and releasing soil building minerals locked in rock. It is important to remember that everything consumed, possessed or manufactured by man has a soil and/or geological origin.

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Dolese Stone Quarry: Rocks provide jobs! The Arbuckle Mountains have benefited industry by yielding rocks and minerals that are used for a wide variety of commercial purposes. Dolese is the major rock and cement producer throughout Oklahoma. You can see the face of a large gravel quarry in the distance, exposing Viola limestone which makes good cement and road gravel (the bedrock of Vesper Mountain is also Viola limestone). Remember, limestone is a sedimentary rock formed from ancient ocean bottom materials. Crushed limestone, dolomite, sandstone and granite are used for glass making. Clay and shale are used to manufacture pottery, brick, and cement. Sand and gravel are used to manufacture cement and for other construction purposes. Lime is used in agriculture. Granite and sandstone are used for construction purposes and for monuments. Asphalt, a petroleum impregnated sandstone or limestone, is used for road construction and patching. In 1989 the sale of crushed stone, cement, sand, gravel, and gypsum added $221 million to Oklahoma's economy and provided employment for thousands of workers.

Student Activity

1. Point out significant landmarks. Students can use compasses to determine degrees of certain landmarks(optional-if compasses are available)

2. Discuss Dolese Quarry. Discuss a quarry.

3. What rocks are probably mined? (limestone and sandstone) For what uses?

4. Have cabin groups choose a spot to put their "**mini quarry" WITHIN THE SEATING AREA**. Use rocks as **mining tools**, and have students excavate, discuss resources found, their everyday uses, and mining problems. Discuss restoration and the purpose of restoring the land. Have students attempt to restore their "quarry" to its original condition, discussing complications incurred while doing so.

5. Fossil Dig Preview Activity

- Tell the story-"**U.R. Rich story – The U.R. Rich Mining Co. had to shut down operations because an unusual fossil was uncovered while mining for limestone. Geologists and paleontologists came to investigate the fossils. They found fossil evidence of an ancient sea. The fossils were similar in shape to this model."**(hold up pre-made, sample model).

-Student model-pass out Cheerios, a pipe cleaner, Apple Jacks, and baggie to each student.

-Have them thread three Cheerios, then an Apple Jack, repeating this pattern once again.

"**This is a yummy model of a Camp Classen fossil."** **(DO NOT TELL THEM WHAT THEY HAVE BUILT YET. DON'T MENTION THE WORD CRINOID YET!)

-Have students store these in baggies for later snacking at fossil pit.

VOCABULARY WORDS

- **Mining-** the process of removing material from the earth
- **Model**-a representation of a natural object or event
- **Quarry**-a place where stone is excavated (dug out of the earth)
- **Restoration**-the process of putting back into the original condition

6

Northwest End of Vesper Mountain

Materials needed: rock socks/instructions **Human History/Striation and Folding of Rocks**

Human History:

Evidence indicates the earliest people were Caddoan Indians who settled before written records. Archeologists search for artifacts such as arrowheads. In 1837, southern Oklahoma was given by the US government to the **Chickasaw** tribe and **Choctaw** tribe (both originally located in Mississippi). In early America, people did not see Oklahoma as a valuable area, since it was remote and had poor soil (compared with the Midwestern/Eastern United States). Native Americans were relocated to this area for this reason. Later Americans established forts, like Ft. Arbuckle, to protect the tribes who were establishing a **farming and ranching industry.** The stream below, known as **Lick Creek**, begins as an artesian spring on private property miles to the west. It winds through Camp Classen, eroding valleys in nonresistant rock formations and widening weaknesses in rock caused by faults. Lick Creek is fed by other springs that flow from the ravines and hollows all along its course. It is the main artery of Camp Classen. In 1941, Lick Creek was dammed to make Lake Classen and in 1968, Lake Guy James (named after an Oklahoma City leader) was dammed. Lake Guy James acts as a reservoir for the water level at Lake Classen. Look for the Guy James dam from this hill.

Patterns in Geology

Sedimentary rock comes from **layers** of particles (sediment) pressed (compacted) into stone. The order of rock layers helps us tell **which is older.** The **layers** which lie underneath must be older. **Lime,** a mineral, found in ocean water, falls to the ocean floor and accumulates along with sediment and organic materials. This lime mud turns to **limestone.** Any organisms that do not fully decompose may be **preserved as fossils**. The **fossil record** creates a **pattern.** Layers of certain rock tend to contain only certain fossils. For example, we have never found a human fossil in the same rock layer as a dinosaur fossil. That is why we think humans never saw dinosaurs. **Older rock layers** contain the most extinct fossils, **younger rock layers** contain the most modern ones. Layers of rock must start out **flat (horizontal)**, but the rock layers here are tilted. The pattern of the **tilted rock layer**s resembles folding (or waves, or ripples) like pushing a carpet against a wall. This is was caused by forces in the earth pushing on the layers. **Rock layer orientation** tells us about the past. The layers of rock sometimes looked striped, or striated. In geology, striations mean the grooves and layers found in rock layers. **Different color rock layers** are due to different minerals found in the rock layers. For rocks to tilt, a force must be applied. **More tilt indicates more force.** It would require **huge forces in nature** to move bedrock, the bottom igneous layer of rock. Bedrock and other rock layers have cracks, or **faults**. As force is applied, **rock layers shift** in different ways along fault lines, or cracks.

(See complete Trail Guide for more information on faults)

Student Activity

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. See complete Lick Creek Fossil Trail Guide for more information)
2. Discuss Camp history from teacher background.

VOCABULARY WORDS

- **Fault-** a crack in the Earth's crust or rock layer
- **Folding**-a process of 'bending' rock by force
- **Fossil**- the remains or traces of an organism that lived long ago
- **Plates**-huge pieces of Earth's crust that move very slowly
- **Sedimentary rock-**rock particles deposited and compacted into layers, fossils are found in sedimentary rock
- **Striations**-grooves and layers found in rocks

7

West Slope of Vesper Mountain

Biotic/Abiotic Factors & Ecotones

(See complete Lick Creek 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.

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'.

- 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

8

White Rocks Near Lick Creek

Layers of the earth and their movement

Materials: apple/knife, plastic bottle w/ shell, Sedimentary Rock handout

You may take the group to sit on the rocks near the miniature water falls (“flume”) to talk with them while they have a snack. The rocks are a good example of the exposed tilted limestone. 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

1. This nearby stream, Lick Creek, flows over a flume here, carrying particles downstream.
2. You can see a layer of sediment filling up the gouge pool here. These sediments are particles of soil and debris from upstream. As the sediments fill the pool, 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 (radiolaria, diatoms, cocoliths, 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.

- **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 **"Cooooooool**"
- **Earth's layers activity: Apple**
  - 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)

4. Sedimentation Bottle

- Teacher- fill Sedimentation bottle (clear plastic) with H_2O from creek.
- A student-add one shell
- Students- add more stuff (i.e. sand, small pebbles, grass, dead leaves, dirt, etc.) make sure you add enough materials to result in layers
- Shake bottle up
- Put in trail bag, and view at station 11

VOCABULARY

Conglomerate- coarse grained sedimentary rock that consists of pebbles, gravel, or seashells cemented together by hardened silt, clay, calcium carbonate, or a similar material

9

Confusion Canyon-Waterfall

The Power of Water

Notice the present day environment. The stream has **worn away** the rock. You can tell that this is no ordinary straight canyon, but it has a zigzag pattern. The water turns when it meets hard rock, and easily erodes soft rock. The green shale on both sides of the wide part of the canyon just past the waterfall erodes quite easily. This shale can crumble in your hand. The waterfall is a result of the shale having eroded away. The harder sandstone forced the stream to make a quick turn. When the stream found a crack, it turned again, into the crack. What do you suppose made the crack in the sandstone? Major forces! Another crack in the rock allows the water to flow underground at another place in this canyon. **Some rock layers erode slowly, and slow the water's energy, and other rocks erode easily, leaving openings.** These unusual, crazy patterns of stream behavior are the reason we call it Confusion Canyon.

Here's the story:

The creek has been in this place since the dam was built in 1968. The original stream was a little further to the north (straight ahead as you stand on shore looking across the canyon). A big flood in 1987 eroded literally tons of this rock and made this canyon much bigger than it was. Imagine the power of flowing water, after several days of hard rain. The stream carried entire trees, and the noise must have been deafening.

Periodically, chunks of rock were loosened and carried away by the stream. When the powerful stream rolled over Classen Falls and hit Lake Classen, it lost much of its energy, and could no longer hold the sediments in suspension. So just beyond Classen Falls, it "dumped its load", leaving fresh (recycled) sand on the creek bed, and new islands in Lake Classen.

Student Activity

1. Tell story

2. Have students look over the edge down into the canyon. Make sure that every student is supervised while looking over. Please only let a few students look over the edge at a time.

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Confusion Canyon-Down the Ladder

Weathering

(See complete Lick Creek Trail Guide for information on Ordovician Sands)

Weathering processes: A sort of "vicious cycle" occurs when soft rock becomes habitat to plants. As one weather process occurs, it makes way for others to occur. Several kinds of weathering occur:

Mechanical Weathering:

1. **Grinding and crashing** -rocks breaking off as they collide with other materials or rocks
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 get established on a rock, the growth process of the roots helps widen existing cracks and breaks apart rocks. The roots trap soil, making a habitat for other plants.

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. Little pits in the rock are testimony to this process.

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

Erosion: Water/wind/ice moving across the rock carries away particles. The valleys and creek beds are the result of erosion.

Speed of water 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**.

STUDENT ACTIVITIES

1. Teacher takes small groups of students up the creek to the big rock to explain and point out Weathering, Erosion, and Deposition. W-E-D

2. ' Kodak moments'

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Before Bridge at Fossil Pit/Fossil Pit

Fossil Pit Preparation/Fossil collection

Materials needed: sedimentator bottle, fossil cereal model, fossil collecting materials

The rock here is called *fossilferous 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. Place Sedimentator bottle on the bridge to finish settling while talking

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

3. **Take out baggie** with 'yummy Camp Classen fossil model'. Discuss the shape of 'stacked cereal'. This is a VERY large sized version of a crinoid, one of the fossils in the fossil pit. Students can eat this here.
NO LITTERING!

4. Pass out fossil identification sheets to counselors

5. Analyze sedimentator bottle (short discussion)

- Layers? How could these form into rock?
- Where could the shell be?
- How could it be found?
- How would it become a fossil?

6. 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

7. 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)

8. Empty out/rinse out sedimentator bottle-TRY TO RETRIEVE THE SHELL!

Bridge Before the Activity Center
Conclusions and Review

Key concepts in this trail guide:

- All things come from the earth. We depend upon it for survival, and we can impact its care.
- We are members of a marvelous living community, interacting and depending upon one another.
- Change occurs continually.
- 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).
- Geologists determine the history of an area through evidence in the rocks. Evidence may include minerals present, or the orientation of the rock layers.
- An aquatic ecosystem includes micro- and macro- biotic parts, which interact in order to live.
- 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.