

Lesson 2: Relative Dating and Stratigraphy

This lesson introduces students to the Law of Superposition and the concept of index fossils. Students will also learn that geologists use a stratigraphic column to describe the order and type of rock units in a given area.

Student objectives:

- ▶ Create a simple stratigraphic column based on fossil evidence
- ▶ Describe what an index fossil is and how it is used by geologists
- ▶ Reconstruct the geologic history of the Grand Valley based on information given in a stratigraphic column

NGSS: MS-ESS1-4, MS-LS4-1

Materials: Stratigraphy Scramble worksheet, Colored pencils, Grand Valley Stratigraphic Column, Who Dunnit?! picture

Time: 1 class period

Information relevant to stratigraphy and relative dating for teachers:

Stratigraphy is a branch of geology that is concerned with the order of and relative position of rock units and the relation of rock units to geologic time. The Law of Superposition is used by geologists when they want to determine the order in which rock units were deposited. This law states that for any undisturbed sequence of rocks deposited in layers, the youngest layer is on top and the oldest on bottom, each layer being younger than the one beneath it and older than the one above it. Index fossils are also useful for determining the order rock units were deposited. An index fossil is a widely distributed fossil that appears narrow range in time. If we know how old a certain index fossil is, we can have a general idea of how old a rock unit containing that index fossil is.

Both the Law of Superposition and index fossils are used when determining the relative age of rock units. Relative dating does not give a numerical or absolute age for a rock unit. Rather, it informs scientists of the order in which rock units occurred.

Suggested procedure:

Engage

- ▶ Tell the class that they are going to have the opportunity to solve a crime
- ▶ Show the Who Dunnit?! picture developed by Steve Dutch, Univ. of Wisconsin, Green Bay, on a large screen so the entire class can see it or use a color printer to print the image for each student.
- ▶ Ask the class if they can figure out who stole the last cookie based on the clues in the picture. Students should back up their claim with evidence (Answer: the nephew)
- ▶ If students are unable to figure out the answer, come back to this after the explain section

Elaborate

- ▶ Once we know the order of different rock layers, we can use them and the fossils within them to learn about the history of the area and how the local ecosystem has changed over time.
- ▶ Hand out the Grand Valley Stratigraphic Column
- ▶ Explain to the class that a stratigraphic column (also known as a strat column for short) is a way to visualize the relative age of rock layers with one another. Just like in the previous activity, the oldest layers are on the bottom and the youngest are at the top.
- ▶ This particular stratigraphic column also explains the fossils and the ecosystems represented by the different rock layers.
- ▶ Have students choose a rock unit with an associated description. Students should do quick research on the types of plants and animals alive at that time and draw a picture or write a story based on life at the time their rock units were deposited. They can then share their pictures and stories with the rest of the class to piece together the geologic history of the Grand Valley.

Evaluate

Students can be assessed during class discussions and performance on the group activity. Students can also be evaluated on the quality of their story or drawing from the elaborate section.

Extension

Take a virtual field trip through the geologic history of the Grand Valley using the museum's online exhibit Geology and Paleontology of the Grand Valley:

<https://museumofwesternco.com/learn/grand-valley-geo-and-paleo/>

Explore

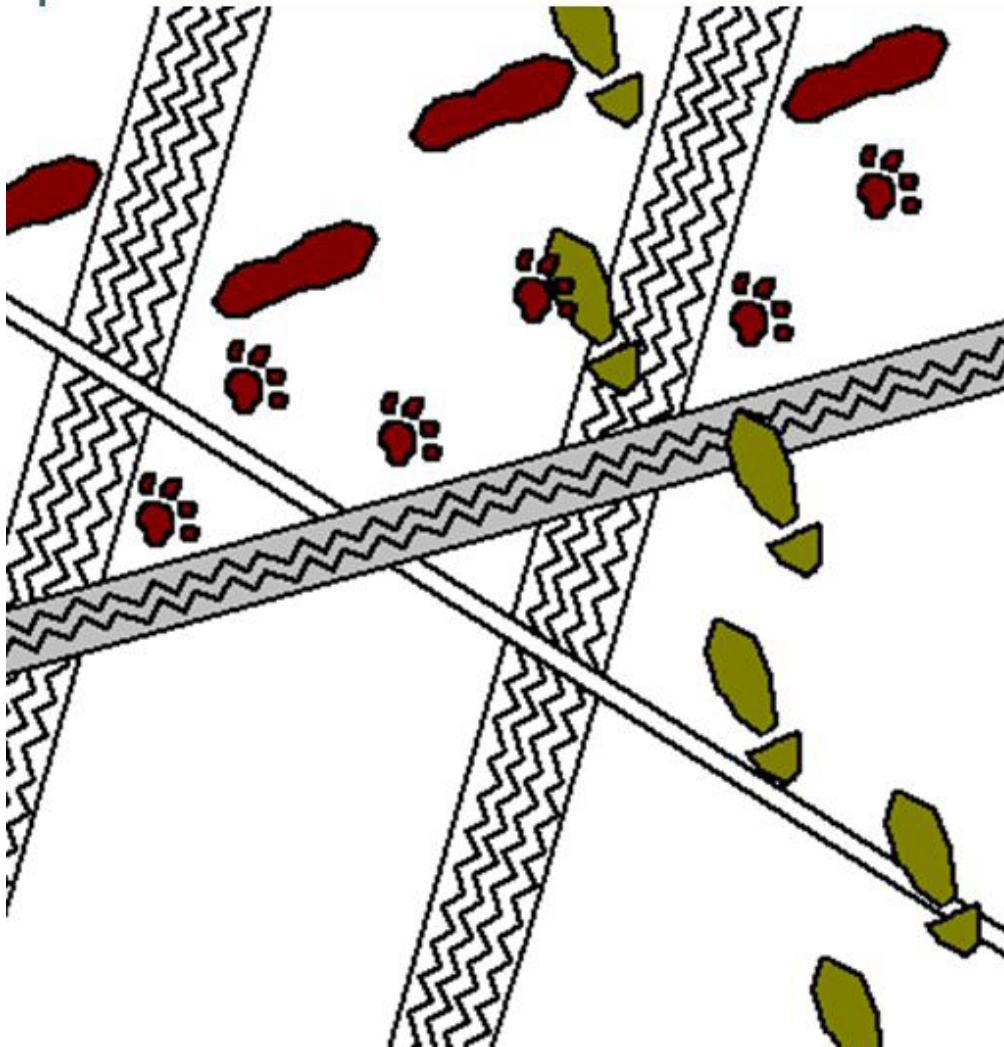
- ▶ Just like the class used clues to determine who stole the last cookie, geologists use a variety of clues to determine the order in which rocks were deposited.
- ▶ One of these clues are the fossils contained in the fossils
- ▶ Divide the class into small groups
- ▶ Give each group the Stratigraphy Scramble worksheet
- ▶ Students will be asked to cut out the different “layers” on the worksheet and place them in order based on the fossil clues
- ▶ Optional: have students color the different layers and fossils using colored pencils

Explain

- ▶ As a class, discuss the order of the layers (Correct answer, from oldest to youngest: A, G, C, E, B, H, D, F)
- ▶ Some questions to consider:
 - o How do you know what layer goes on top of layer A? Which layer is the youngest?
 - o Which Eubrontes track is older, the one in layer C or G? How do you know? (G is older)
 - o An index fossil is a widely distributed fossil that appears narrow range in time. It can help geologists figure out how old the rock layers are relative to other layers. What fossils from your worksheet do you think would be good index fossils? Why? (Rhynchosaur, Cynodont, Gingko. They all appear in only one layer. Note: Brachiosaurus also appears in only one layer; however, we do not know if it continues beyond that layer because we do not have younger rock units in our sample)
 - o How can knowing the order of rock layers help us figure out how old the layers are?
- ▶ Teacher may want to explain that the **Law of Superposition** states that for any undisturbed sequence of rocks deposited in layers, the youngest layer is on top and the oldest on bottom, each layer being younger than the one beneath it and older than the one above it. This is very similar to a stack of pancakes, where the first pancake to be made is on the bottom and the most recent pancake is on the top.

Who Dunnit?!

Someone took the last cookie in the cookie jar last night. The last person to leave is the culprit!

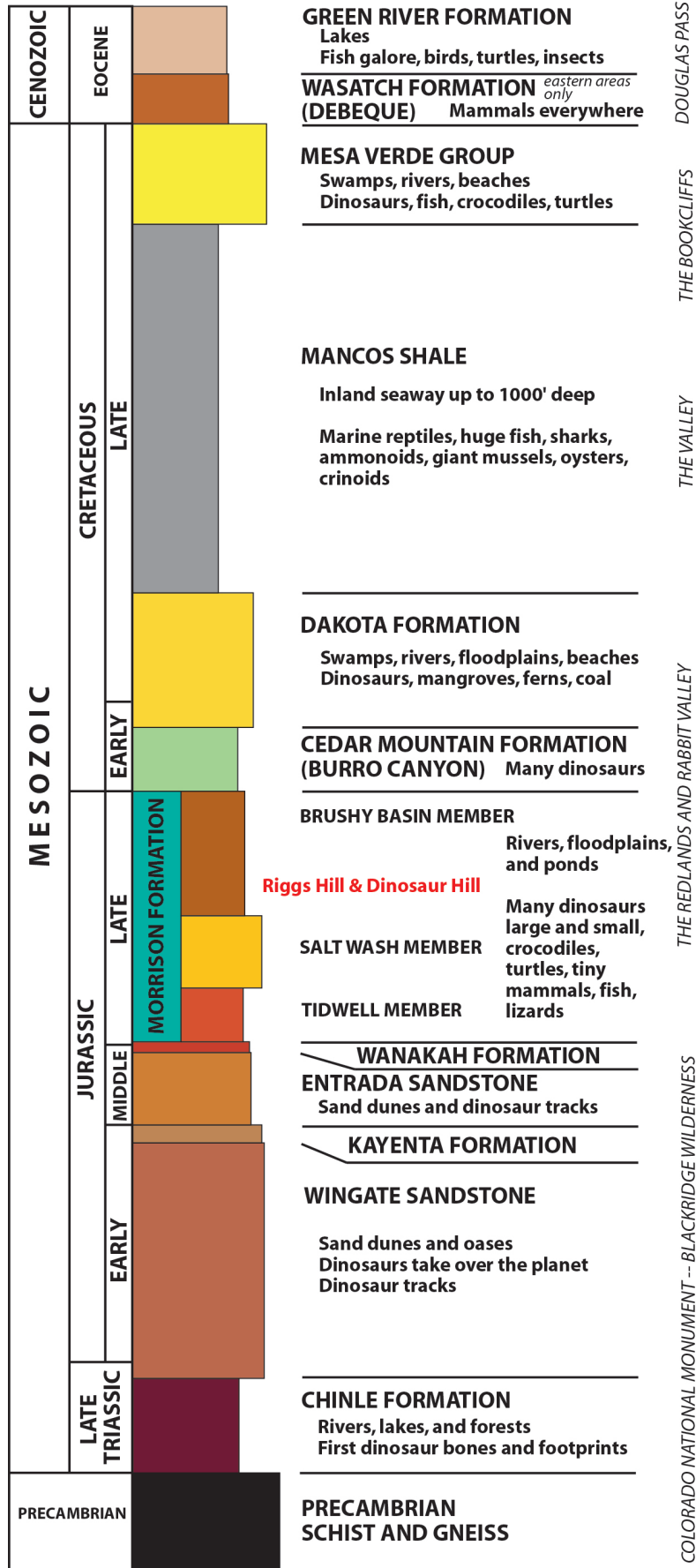


Clues:

- The Butler walks to work
- The Handyman rides a bike
- The Cook rides a motorcycle
- The Maid drives a car
- The Nephew has a seeing-eye dog

THE GRAND VALLEY LONG AGO

THE ROCK FORMATIONS THAT MAKE UP THE AREA AND THE ANIMALS AND ENVIRONMENTS FOUND IN THEM



Stratigraphy Scramble

Stratigraphy is the branch of geology that is concerned with the order of rock layers.

On the next pages you have eight different rock layers with fossils in them. Your job is to figure out what order these rock layers were formed.

Directions:

Cut out each of the layers into individual strips and place them in order.

Hints:

1. Layer A is the oldest. It should go on the bottom.
2. Once an animal goes extinct (disappears) it cannot come back

Fossil Identification Guide:



Camptosaurus
KAMP-tuh-SAWR-us



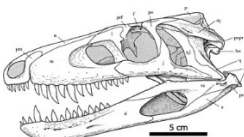
Eubrontes
you-BRONT-tees



Ceratosaurus
sih-RAT-uh-SAWR-us



Cynodont
SY-noh-dont



Ancestor Crocodile



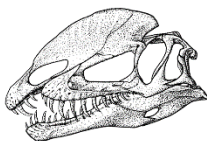
Brachiosaurus
BRACK-ee-uh-SAWR-us



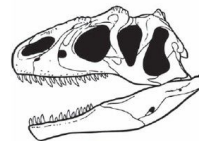
Rhynchosaur
RINE-chow-sawr



Gingko



Dilophosaurus
dye-LO-fuh-SAWR-us

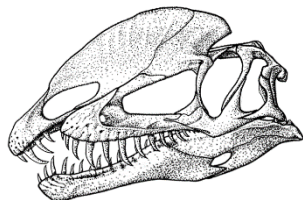


Allosaurus
AL-uh-SAWR-us

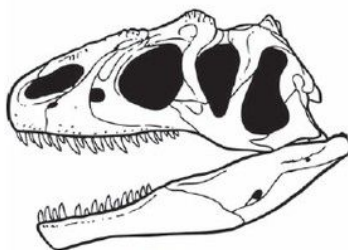
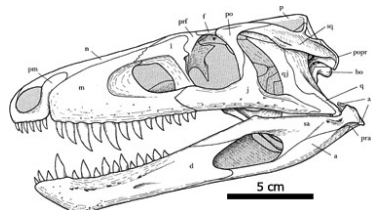


Aetosaur
a-EAT-uh-SAWR

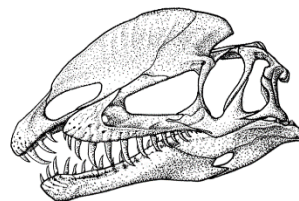
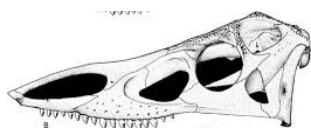
A



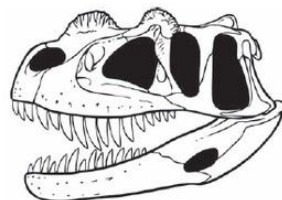
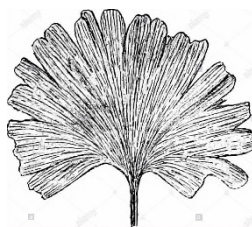
B



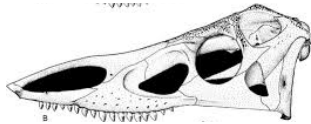
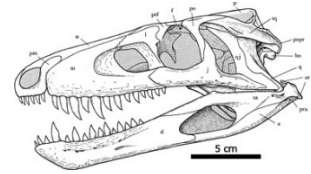
C



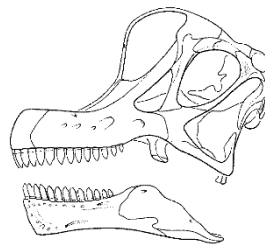
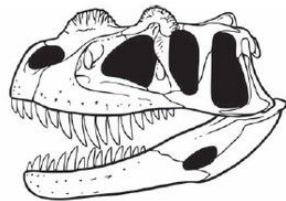
D



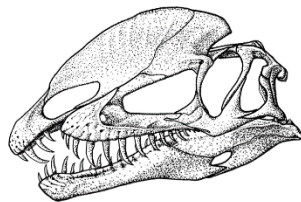
E



F



G



H

