

Who's on First?

<http://www.ucmp.berkeley.edu/fosec/BarBar.html>

Focus on Inquiry

The students will focus on inquiry by identifying patterns in fossils and explaining their understanding of how rock layers are deposited. They will use the evidence from the activity to make inferences and predict trends.

Overview

By completing this activity, students develop an understanding of how geologists use the Law of Superposition, which states that in an undisturbed horizontal sequence of rocks, the oldest rock layers will be on the bottom, with successively younger rocks on top of these, to correlate rock layers around the world. The students will show how fossils can be used to give relative dates to rock layers.

Duration One class period 50-65 minutes	Setting Classroom or lab	Grouping Individual or small groups of 2-3	PTI Inquiry Subskills 3.3, 3.6, 4.3, 5.2, 5.3, 7.2
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	10 min	5.2	Computer with Internet Access (optional)	2	Students brainstorm ideas on how rock layers are deposited.
Explore	30 min	3.3, 3.6, 4.3		3	Students sequence nonsense syllable cards and cards with sketches of fossils to develop and understanding of how rock layers are deposited.
Explain	10 min	5.2, 5.3, 7.2		3	Students explain why they chose the sequence of cards in the Explore section.
Expand	20 min		Computer with Internet Access	1	View a video and discuss the use of fossils as a dating tool for sediments.
Evaluate	varies				Teacher developed rubric for lab sheet.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry Develop description, explanations, predictions, and models using evidence.	
National Science Education Standards – Earth Science Structure of Earth. Water which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle."	
Louisiana Grade Level Expectations – Inquiry Gr. 8, Inquiry GLE#12 – Use data and information gathered to develop an explanation of experimental results (SI-M-A4) Gr. 8, Inquiry GLE#13 – Identify patterns in data to explain natural events (SI-M-A4) Gr. 8, Inquiry GLE#16 - Use evidence to make inferences and predict trends (SI-M-A5) Gr. 8, Inquiry GLE#22 – Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)	
Louisiana Grade Level Expectations Earth Science Gr. 8, GLE#24 – Investigate and explain how given factors affect the rate of water movement in the water cycle (e.g., climate, type of rock, ground cover) (ESS-M-A10)	

Materials List (per group)

- Copies of Blackline Master 1 – one per student
- Copies of Blackline Masters 2-4 – one per group

Advance Preparation

1. Make copies of Blackline Masters 1-4 (see Materials list). Optional: You may want to laminate card sets of Blackline Masters 2-4 for future use.
2. Make sure that each of the card sets (Blackline Masters 2-4) has been cut and mixed up.
3. Go to the Earth Revealed website [<http://www.learner.org/resources/series78.html>] and pre-register with the site (FREE) so that you will be able to have students view Episode #10 – Geologic Time. This is a 30 minute video, so you might want to prescreen the video and select the portion you wish to show students.

Other Information

Learning Objectives

The learner will

- analyze and interpret data and think critically and logically to make the relationships between evidence and explanations
- communicate results
- discover the Law of Superposition

Prior Knowledge

- students should understand the concept and function of an index fossil.

Procedure

Engage

1. Have students view pictures of the Grand Canyon. As a class, visit this website: <http://www.nps.gov/archive/grca/photos/> or print out a couple of these pictures to pass around or show to the class.
2. Ask the students to brainstorm ideas about which layers they think are the oldest and why? Accept all answers.
3. Tell students that they will be completing an activity to determine how sedimentary rock layers are laid down.
4. Review activity worksheet (Blackline Master #1) with students. Have students form groups (if applicable) and pass out all materials for Part 1.

Explore

1. Allow students time to complete Part 1 of the investigation (Blackline Master #1). Students will use Blackline Master #3 for Part 1.
2. Pass out materials for Part 2.
3. Allow students time to complete Part 2 of the investigation (Blackline Master #1). Students will use Blackline Master #2 and #4 for Part 2.

Explain

1. When the majority of students finish parts 1 and 2 of the investigation, have them explain their answers to the *Interpretation questions* (Blackline Master 1). Answers to questions can be found on the website.

Expand

1. Go to the Earth Revealed website [<http://www.learner.org/resources/series78.html>] and view segment #10: Geologic Time (total time: 30 minutes). The summary of this segment is as follows: “To illustrate the immensity of geologic time, the entire span of Earth’s existence is compressed down to a year. The timeline of major geologic events is superimposed onto the year for a condensed view of Earth’s evolution. A relationship between this timeline and that of life on Earth is established, with fossils and radiocarbon dating playing a major role in the discovery.” *NOTE: you will need to have pre-registered to access this FREE video. YOU MIGHT WISH TO PRE-SELECT A PORTION OF THE VIDEO THAT MOST RELATES TO THIS LESSON.*
2. Discuss the use of fossils as a dating tool for sediments.

Evaluate

1. Use student answers to interpretative questions.
2. Note: Use Blackline Master #5 (Figure 2-B) as an answer key.

Blackline Master

1. Activity Worksheet
2. Figure 2-A. Sketches of Marine Fossil Organisms



3. Copies of Set A—nonsense syllable cards
4. Copies of Set B—fossil index cards
5. Figure 2-B. Stratigraphic Section for Set B (use as answer key)

Supplementary Resources

Rocks and Time

<http://pubs.usgs.gov/gip/fossils/contents.html>

Contains information about rock layers, fossils, geological time and other information related to the formation of rock layers.

Name: _____ Date: _____ Class Hour: _____

Who's on First?

PART 1

Procedure:

1. Spread the cards with the nonsense syllables on the table and determine the correct sequence of the eight cards by comparing letters that are common to individual cards and, therefore, overlap. The first card in the sequence has "Card 1, Set A" in the lower left-hand corner and represents the bottom of the sequence. If the letters "T" and "C" represent fossils in the oldest rock layer, they are the oldest fossils, or the first fossils formed in the past for this sequence of rock layers.
2. Look for a card that has either a "T" or "C" written on it. Since this card has a common letter with the first card, it must go on top of the "TC" card. The fossils represented by the letters on this card are "younger" than the "T" or "C" fossils on the "TC" card which represents fossils in the oldest rock layer. Sequence the remaining cards by using the same process. When you finish, you should have a vertical stack of cards with the top card representing the youngest fossils of this rock sequence and the "TC" card at the bottom of the stack representing the oldest fossils



Interpretation Questions: When you have finished answer the following questions.

1. After you have arranged the cards in order, write your sequence of letters (using each letter only once) on a separate piece of paper. Starting with the top card, the letters should be in order from youngest to oldest.

2. How do you know that "X" is older than "M"? _____

3. Explain why "D" in the rock layer represented by DM is the same age as "M." _____

4. Explain why "D" in the rock layer represented by OXD is older than "D" in the rock layer represented by DM.

PART 2

Procedure:

1. Carefully examine the second set of cards which have sketches of fossils on them. Each card represents a particular rock layer with a collection of fossils that are found in that particular rock stratum. All of the fossils represented would be found in sedimentary rocks of marine origin. Figure 2-A on the handout gives some background information on the individual fossils.
2. The oldest rock layer is marked with the letter "M" in the lower left-hand corner. The letters on the other cards have no significance to the sequencing procedure and should be ignored at this time. Find a rock layer that has at least one of the fossils you found in the oldest rock layer. This rock layer would be younger as indicated by the appearance of new fossils in the rock stratum. Keep in mind that extinction is forever. Once an organism disappears from the sequence it cannot reappear later. Use this information to sequence the cards in a vertical stack of fossils in rock strata. Arrange them from oldest to youngest with the oldest layer on the bottom and the youngest on top.



Interpretation Questions: When you have finished answer the following questions.

1. Using the letters printed in the lower left-hand corner of each card, write the sequence of letters from the youngest layer to the oldest layer (i.e., from the top of the vertical stack to the bottom). This will enable your teacher to quickly check whether you have the correct sequence.

2. Which fossil organisms could possibly be used as index fossils? _____

- 3) Name three organisms represented that probably could not be used as index fossils and explain why.

- 4) In what kinds of rocks might you find the fossils from this activity?

- 5) Based on your investigations, write a scientific law to explain how layers of rock are deposited and explain how this activity illustrates this law.

Figure 2-A. Sketches of Marine Fossil Organisms (Not to Scale)



NAME: Brachiopod
 PHYLUM: Brachiopoda
 DESCRIPTION:
 "Lamp shells"; many living species; exclusively marine; have soft bodies and bivalve shells.



NAME: Ichthyosaur
 PHYLUM: Vertebrata
 DESCRIPTION:
 Carnivore; air-breathing aquatic animal; extinct



NAME: Trilobite
 PHYLUM: Arthropoda
 DESCRIPTION:
 Three-lobed body; burrowing, crawling, and swimming forms; extinct



NAME: Eurypterid
 PHYLUM: Arthropoda
 DESCRIPTION: Many were large (a few rare species were 5 feet in length); crawling and swimming forms; extinct



NAME: Graptolite
 PHYLUM: Chordata
 DESCRIPTION:
 Primitive form of chordate; floating form with branched stalks; extinct



NAME: Ammonite
 PHYLUM: Mollusca
 DESCRIPTION:
 Squid-like animal with coiled, chambered shell; related to modern-day Nautilus



NAME: Horn coral
 PHYLUM: Coelenterata (Cnidaria)
 DESCRIPTION:
 Jellyfish relative; stony calcareous exoskeleton found in reef environments; extinct



NAME: Crinoid
 PHYLUM: Echinodermata
 DESCRIPTION:
 Multibranched relative of starfish; lives attached to the ocean bottom; some living species ("sea lilies")



NAME: Placoderm
 PHYLUM: Vertebrata
 DESCRIPTION:
 Primitive armored fish; extinct



NAME: Shark's tooth
 PHYLUM: Vertebrata
 DESCRIPTION:
 Cartilage fish; many living species



NAME: Foraminifera
 PHYLUM: Protozoa (Sarcodina)
 DESCRIPTION:
 Shelled, amoeba-like organism



NAME: Gastropod
 PHYLUM: Mollusca
 DESCRIPTION:
 Snails and relatives; many living species



NAME: Pelecypod
 PHYLUM: Mollusca
 DESCRIPTION:
 Clams and oysters; many living species

Set A

TC	CGA
AU	UBN
BN	NO
OXD	DM

Card 1, Set W

Set A

TC	CGA
AU	UBN
BN	NO
OXD	DM

Card 1, Set W

Set A

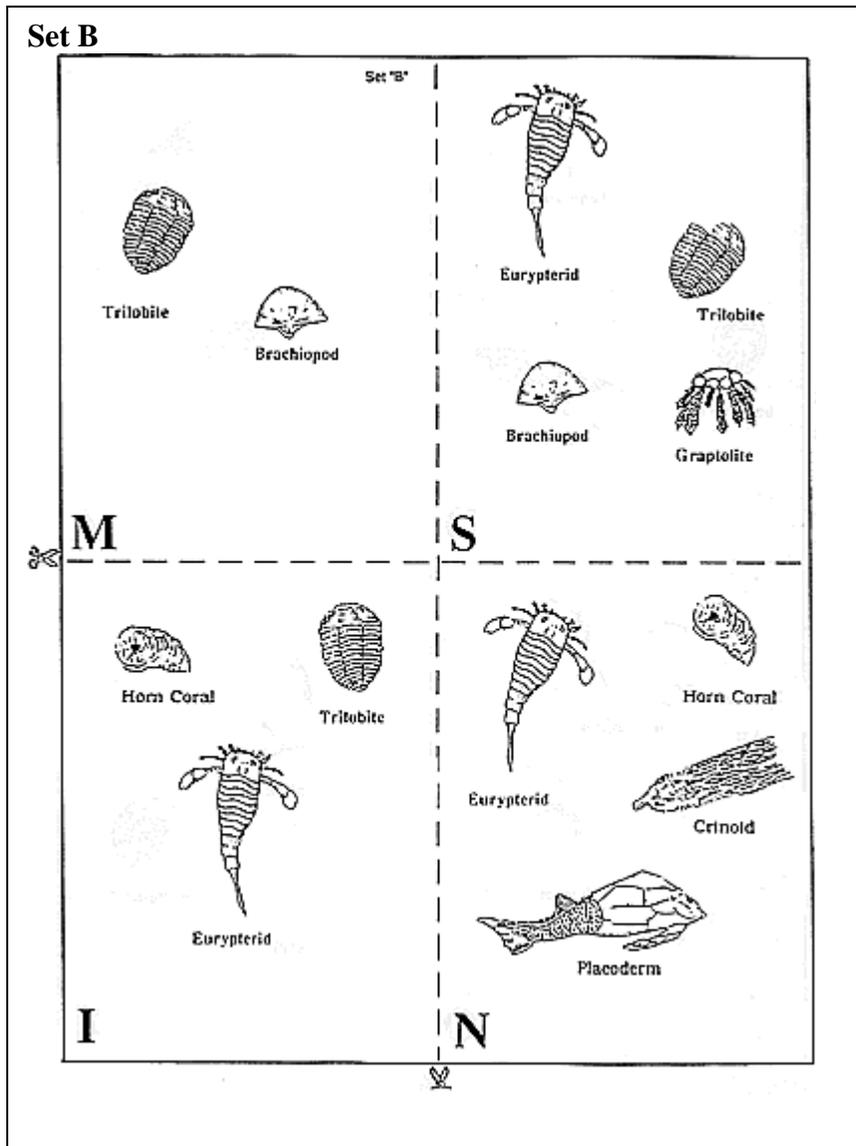
TC	CGA
AU	UBN
BN	NO
OXD	DM

Card 1, Set W

Set A

TC	CGA
AU	UBN
BN	NO
OXD	DM

Card 1, Set W



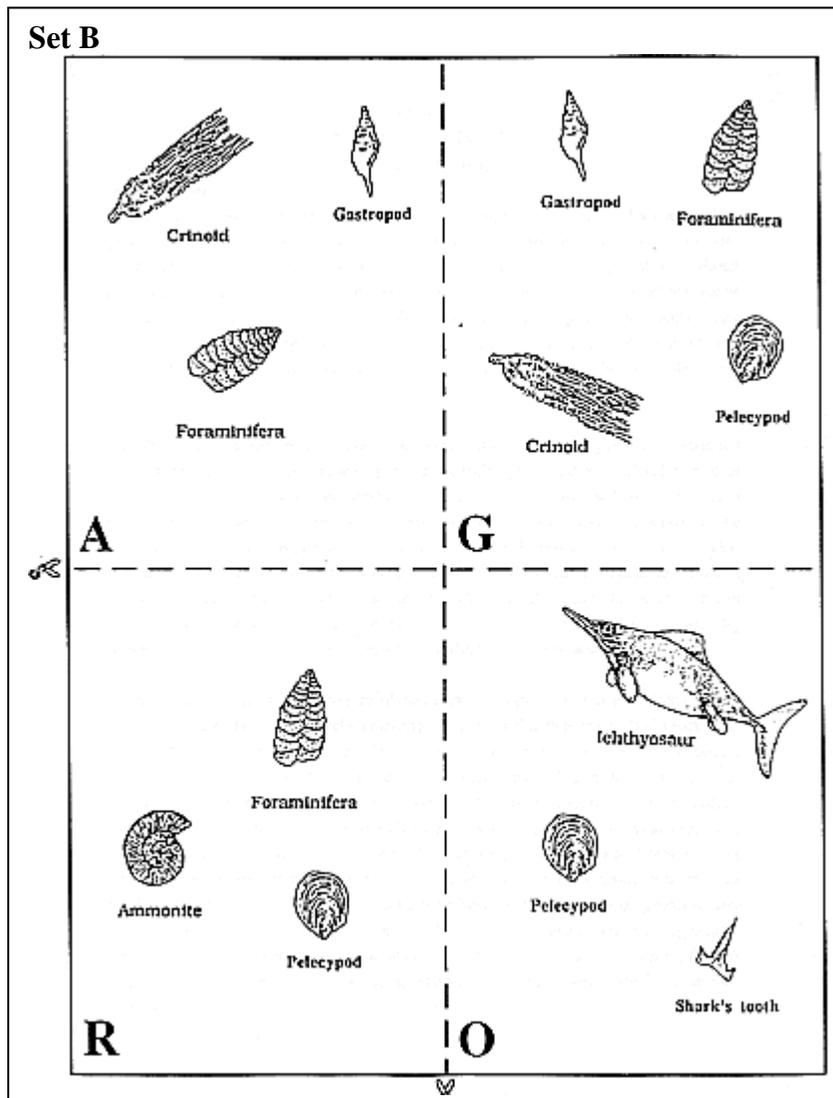


Figure 2-B. Stratigraphic Section for Set B (use as answer key)

