



History of the Earth Lesson 2 Extension:

The Make Student Handout

Directions

Do you think it's possible to use rocks to reveal Earth's history? Earth is more than 4.5 billion years old! Over this time, new species have evolved and others have become extinct. How can we use rocks to unlock the unique history and timeline for planet Earth?

Your *Make* task today is to:

1. Discover a rule about relative dating by observing a rock layer demonstration.
2. Uncover the clues and patterns in the Mystery Words in order to properly sequence the cards.
3. Uncover fossil patterns throughout Earth's history and use these clues to build a rock column. Use your evidence to create a scientific explanation for how rock layers can show the progression of life on Earth.



Planning Organizer

Part 1: Rock Column Demonstration

Demonstration

In the container below, sketch each item as it's added. Label each layer with its contents and the time it was poured. *For example: "Pasta Layer, 1:43pm"*

Geologic Column Layers



Analysis Questions:

1. Is the pasta layer older or younger than the rice layer in this activity? Use evidence from your recorded times to support your answer.



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2. Which bean layer (pinto beans or black beans) is the oldest according to this demonstration? Explain.

3. What rule can you come up with that describes the relationship between the age of the rock and its location in the layers?

4. You just explained the _____ of _____!

This law states that in an undisturbed column of rock, rock on the bottom layer is the oldest while rock on the top layer is the youngest.



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Part 2: Mystery Word Practice

Appendix A contains a series of Mystery Word cards. Your challenge is to use clues in those cards to determine their correct sequence.

Getting Started: The oldest card is marked with picture of Mosa. Study the patterns on that card. Do you see any of the same words on another card in the packet? That will be the next card. Place that card above the oldest card. Record the letter shown on the bottom left of each card in your chart. Make sure you start at the bottom of the chart and work your way up to the top!

Card Sequencing Results	
Youngest Card	
	Oldest Card



Analysis Questions:

1. How did your team determine the order of cards?
2. Is TAG or ZEN an older word? Explain based on the Law of Superposition.
3. How might this activity apply to the way that scientists use fossils to sequence the history of life on Earth?



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Part 3: Fossil Sequencing

1. Study the Fossil Cards in Appendix B. Just like in Part 2, the oldest rock layer has been marked with a Mosa symbol. The letters on the bottom left of each card represent the periods within the Paleozoic era
2. As with part 2, to find the sequence, look for the most similarities between the cards. But be careful: some fossils appear in more than two cards!
3. Record the letter shown on the bottom left of each card in your chart. Make sure you start at the bottom of the chart and work your way up to the top!

Fossil Sequencing Results

Youngest Fossils Card	
Oldest Fossils Card	



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Analysis Questions:

1. How did your team determine the order of fossil cards?
2. Explain your observations of the progression of life on Earth during this time period according to the fossils found in rock layers.
3.
 - a. What species existed in multiple rock layers?
 - b. What does this tell you about when the species existed?
4. Find the fossils that only appear in one layer.

Index fossils are from species that existed on the planet during a known period of time. When you find an index fossil and know the specific period of time it existed, you can then date surrounding fossils and rock layers.



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5. Based on this information, which of these fossils could be considered index fossils? Explain.

Use the chart below to answer the following question:

6. If you found a layer of rock that contained a *Syringopora* coral from the Carboniferous period, how old would this rock layer be? Tip: Give an age range.

Era	Period	mya*
Paleozoic	Permian	240
	Carboniferous	290
	Devonian	360
	Silurian	410
	Ordovician	435
	Cambrian	500

*mya = million years ago



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Rock Column Construction

Construct a full-color rock column on a separate sheet of paper by gluing your fossil cards into the correct column order (oldest at bottom, youngest at top of column).

Label the oldest and youngest layer of rock on the diagram.

Next to the rock column, provide a written explanation that explains:

- Approximate age of rock column (refer to Paleozoic era dates posted above Fossil Cards in Part 3: Fossil Sequencing).

- Progression of life on Earth during era as shown by fossil evidence, including details such as:

 - Physical structures of species existing in each time period (shells, fins and tail, legs, etc.).

 - Type of environment you believe the species existed in based on fossilized traits (aquatic environment, land environment, etc.).

- Identify at least one fossil that could be used as an index fossil and explain how it helps scientists understand the age of the rocks in which it is preserved.

- How the Law of Superposition was used to determine proper sequence of rock layers and fossil evidence.



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Name: _____

Date: _____

Exit Ticket

1. What is an index fossil?
2. If a scientist found a rock layer that contained an index fossil that we know dates to 25 million years ago, what does this tell us about the age of the rock layer?
3. Locate and circle the *Pecten gibbus* and *Scaphites hippocrepis* on the chart below. Which fossil is older? Explain your answer.

CENOZOIC ERA (Age of Recent Life)	Quaternary Period	<i>Pecten gibbus</i> 	<i>Neptunea tabulata</i> 
	Tertiary Period	<i>Calyptrophours velatus</i> 	<i>Venericardia pianicosta</i> 
MESOZOIC ERA (Age of Medieval Life)	Creaceous Period	<i>Scaphites hippocrepis</i> 	<i>Inoceramus labiatus</i> 
	Jurassic Period	<i>Perisphinctes tiziani</i> 	<i>Nerinea trinodosa</i> 
	Triassic Period	<i>Trophites subbullatus</i> 	<i>Monotis subcircularis</i> 

4. If you found another fossil in the rock layer containing a *Nerinea trinodosa* fossil, what period is this fossil from? In which era is this period?
5. Bonus: In the rock strata, we can see that the history of life on Earth is marked by mass extinctions and the appearance of new organisms. What factors do you think could have led to the mass extinctions that have occurred on our planet?



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The Make Assessment

Use the Checklist and Science & Engineering Practices Rubric to ensure you have addressed all aspects of *The Make* with quality work.

History of the Earth *The Make* Checklist: Content Concepts and Practices

Part 1

- Demonstration diagram illustrates layers and time of each established layer
- Demonstration diagram is well organized, neat, and complete
- Questions are answered completely

Part 2

- Mystery word data chart completed
- Mystery word analysis questions completed
- Data charts reflect accuracy of sequencing
- Analysis responses consist of complete sentences.

Part 3

- Fossil data chart completed
- Fossil analysis questions completed
- Data charts reflect accuracy of sequencing
- Analysis responses consist of complete sentences.

Rock Column Diagram:

- All six fossil rock cards properly sequenced
- Label are included for oldest and youngest rock layers
- Written explanation included to explain:
 - Approximate age of rock column
 - Progression of life on Earth during era as shown by fossil evidence including details such as:
 - Physical structures of species existing in each time period (shells, fins and tail, legs, etc.)
 - Type of environment you believe the species existed in based on fossilized traits (aquatic environment, land environment, etc.)
 - Identification of at least one index fossil and explanation of how it helps scientists understand the age of the rocks
 - How the Law of Superposition was used to determine proper sequence of rock layers and fossil evidence
- Diagram design is well-organized, neat, and in color



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Science & Engineering Practices Assessed

	Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Developing and Using Models	Drawings, diagrams, or visual models include major misconceptions or have missing parts. Explanation of the model is minimal or not present.	Drawings, diagrams, or visual models include minor misconceptions or have missing parts. Explanation of the model is minimal.	Drawings, diagrams, or visual models are complete, but contain a minor misconception. Explanation of the model is complete but lacking complexity.	Drawings, diagrams, or visual models have no misconceptions and contain all details. Explanation of the model is complete and complex.
Constructing Explanations or Arguments From Evidence	Constructs an explanation with no clear sources of evidence.	Uses scientific principles and/or data from at least one source to construct or evaluate an explanation, but explanation contains minor misconceptions.	Uses accurate but incomplete scientific principles and/or data from multiple sources to construct or evaluate an explanation.	Uses accurate and complete scientific principles and/or data from multiple sources to construct or evaluate an explanation.



Appendix A (Mystery Word Cards)

 <p>ZAM ZEN</p> <p>K</p>	<p>MED ZIP</p> <p>M</p>
<p>KAT KED</p> <p>S</p>	<p>KED SED</p> <p>MED</p> <p>O</p>
<p>ZET WAG</p> <p>A*</p>	<p>TAG KAT</p> <p>A</p>
<p>WAG TAG</p> <p>KAT</p> <p>M*</p>	<p>ZEN BIG</p> <p>ZET</p> <p>C</p>

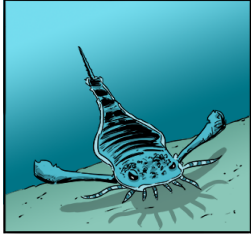

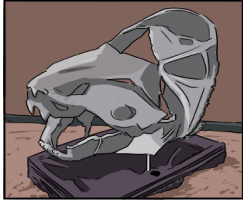


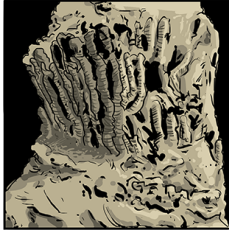

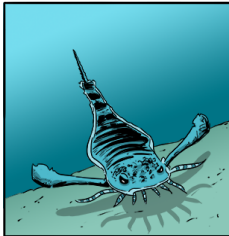



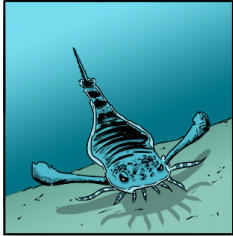
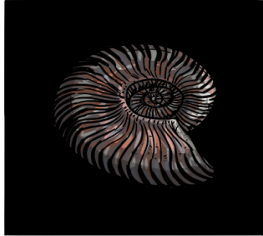





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Appendix B (Fossil Rock Evidence)


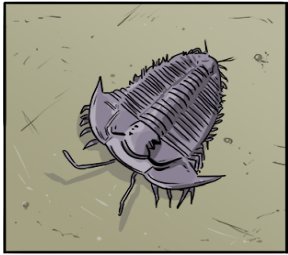
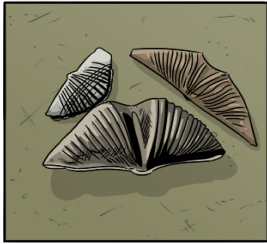
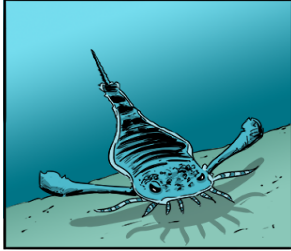

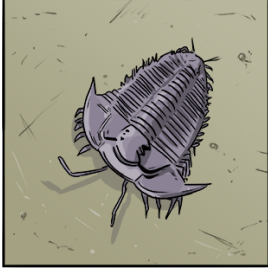
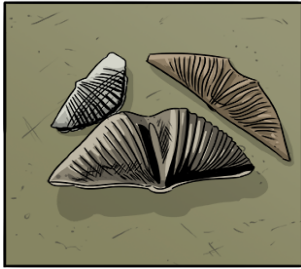
Paleozoic era dated about 540-248 million years ago)

<p>Eurypterid</p>  <p>Antiarch</p>  <p>Placoderm</p>  <p>Gastropods</p>  <p>Graptolite</p>  <p>S</p>	<p>Syringopora coral</p>  <p>Ammonite</p>  <p>Eurypterid</p>  <p>Blastoid</p>  <p>Ca</p>
<p>Antiarch</p>  <p>Placoderm</p>  <p>Eurypterid</p>  <p>Ammonite</p>  <p>D</p>	<p>Eryops</p>  <p>Dimetrodon</p>  <p>Blastoid</p>  <p>P</p>



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<p>Gastropods</p>  <p>Trilobite</p>  <p>Brachiopods</p>  <p>Eurypterid</p>  <p>O</p>	 <p>Trilobite</p>  <p>Brachiopods</p>  <p>C</p>
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