

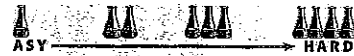


How DO You Stack Up?

Teacher's Notes

Time Required
Two 45-minute class periods

Lab Ratings



TEACHER PREP ▲

STUDENT SET-UP ▲▲

CONCEPT LEVEL ▲▲▲

CLEAN UP ▲

MATERIALS

The materials listed on the student page are enough for each group. The activity works best if the class is divided into five groups.

Safety Caution

Remind students to review all safety cautions and icons before beginning this lab activity.

How DO You Stack Up?

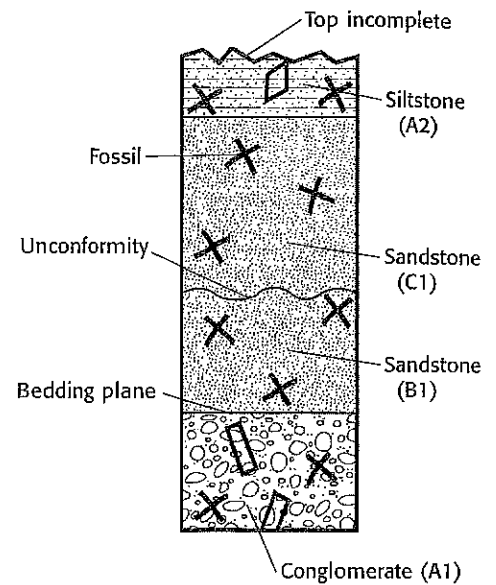
According to the *law of superposition*, in undisturbed sequences of sedimentary rock, the oldest layers are on the bottom. Geologists use this principle to determine the relative age of the rocks in a small area. Geologists can also use fossils in the rocks to date the rocks. When geologists find similar rock sequences and fossils in different areas, they can match parts of the sequences. Each new area they examine helps improve and expand our picture of the rock record. When enough areas around the world are examined, geologists then build a geologic column that shows a general history of the Earth and a relative age for each rock.

In this activity, you will model what geologists do by drawing stratigraphic sections for different rock outcrops. Then, along with your classmates, you will create a part of the geologic column, showing the geologic history of the area that contains all of the outcrops.

Procedure

- After your teacher assigns you to one of five groups, look at the illustration of the section for Outcrop 1 at right. Copy this section onto a blank piece of paper. Follow the specific instructions in steps 2–6 concerning rock color and texture and the contact between layers—bedding planes or unconformities. Use the Rock and Fossil Key on the next page to determine the color and texture of each layer.
- Use a metric ruler and a pencil to draw a box 3 cm wide and 9 cm tall. With colored pencils, sketch a layer of conglomerate (A1) on the bottom of the box. It should reach from side to side and be 2 cm tall.
- Use a black crayon or pencil to add B3 and C3 fossils to the conglomerate layer. The top of this layer is a bedding plane, so it should be a straight line.
- Draw a 2 cm layer of sandstone (B1) with B3 fossils above the conglomerate layer. The top of the layer is an unconformity, so use a wavy line to represent the break in rock-layer sequence.

Section for Outcrop 1



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- Add a 3 cm layer of another sandstone (C1) with B3 fossils. The top of this layer is another bedding plane.
- Add a 1 cm layer of siltstone (A2) containing B3 and C4 fossils. The top of this layer is incomplete, so draw a jagged edge at the top. Write the outcrop number (1) at the top of the section.

Outcrop 1				
Layer	Rock type	Fossils	Thickness	Upper contact
top	siltstone (A2)	B3, C4	1 cm	incomplete
	sandstone (C1)	B3	3 cm	bedding plane
	sandstone (B1)	B3	2 cm	unconformity
bottom	conglomerate (A1)	B3, C3	2 cm	bedding plane

- Compare the section you drew with the chart above. You will need to follow a similar chart to draw your own stratigraphic section. Be sure you understand how the section and chart for Outcrop 1 are related before you continue.
- After your teacher assigns an outcrop to your group, find the chart on the following page that corresponds to your outcrop's section. As a group, use the chart to draw the section.
- Sketch your section in a column that is 3 cm wide. The height of each rock layer is given in the chart for your section. Include the rock color, the rock type, and the types of fossils, as indicated in the chart and the Rock and Fossil Key at right. Pay close attention to the type of contact between the layers. (Assume that the bottom of the lowest layer is a bedding plane.)
- When you finish your section, check to make sure it represents the information in the chart and key correctly. Write the outcrop number at the top of your section.
- Make four more copies of your section, and pass them out to the other groups in your class. Ultimately, each group should have six sections, including the section for Outcrop 1.

Rock and Fossil Key			
	A	B	C
1			
2			
3			
4			
5			

Preparation Notes

You may need to review correlation and the law of superposition before performing this activity. Also be certain that you students understand what an index fossil is.

Thicknesses of layers given in the lab are the thicknesses on the stratigraphic sections only. The rock layers represented by the sections would probably be much thicker. However, the relative thicknesses of the layers are represented in the measurement given (i.e., a layer that is 4 cm thick is twice as thick as a layer that is 2 cm thick).

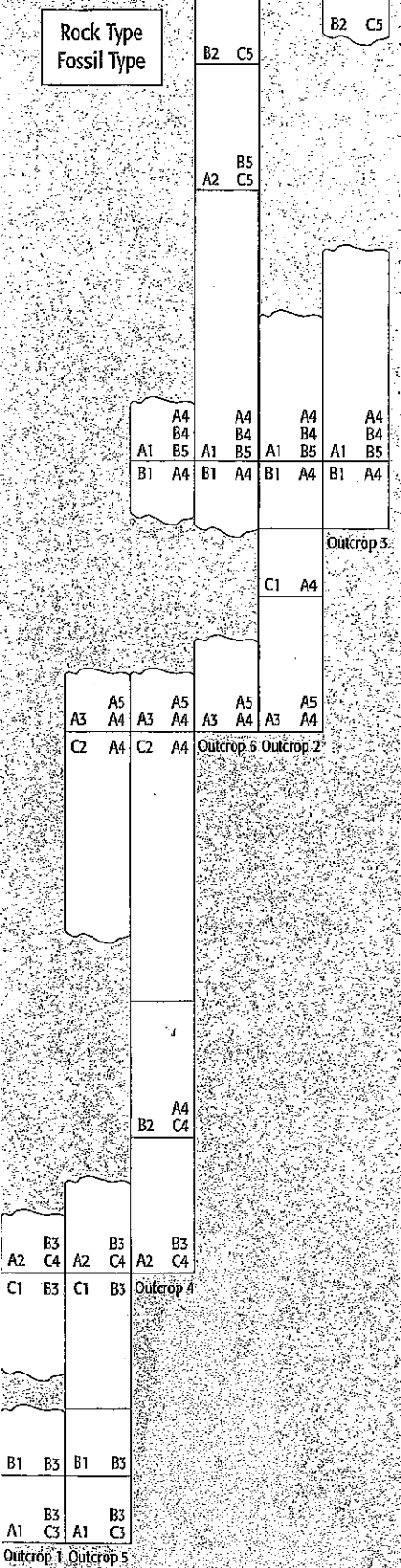
Lab Notes

Explain that the geologic column for the entire Earth is constructed from smaller columns similar to the hypothetical column in this lab. Stratigraphic sections are pieced together to form short columns, and short columns are pieced together to form longer columns. All columns put together make up the geologic column for the entire Earth.



Datasheets for LabBook
 Datasheet 12

A Sample Geologic Column



Layer	Rock type	Fossils	Thickness	Upper contact
top	conglomerate (A1)	A4, B4, B5	4 cm	incomplete
↑	sandstone (B1)	A4	2 cm	bedding plane
	sandstone (C1)	A4	2 cm	bedding plane
bottom	limestone (A3)	A4, A5	3 cm	bedding plane

Layer	Rock type	Fossils	Thickness	Upper contact
top	shale (B2)	C5	4 cm	incomplete
↑	conglomerate (A1)	A4, B4, B5	6 cm	unconformity
	sandstone (B1)	A4	2 cm	bedding plane

Layer	Rock type	Fossils	Thickness	Upper contact
top	conglomerate (A1)	A4, B4, B5	1 cm	incomplete
↑	sandstone (B1)	A4	1 cm	bedding plane
	limestone (A3)	A4, A5	1 cm	unconformity
↑	shale (C2)	A4	6 cm	bedding plane
	shale (B2)	A4, C4	4 cm	bedding plane
bottom	siltstone (A2)	B3, C4	4 cm	bedding plane

Layer	Rock type	Fossils	Thickness	Upper contact
top	limestone (A5)	A4, A5	1 cm	incomplete
↑	shale (C2)	A4	4 cm	bedding plane
	siltstone (A2)	B3, C4	3 cm	unconformity
↑	sandstone (C1)	B3	4 cm	bedding plane
	sandstone (B1)	B5	2 cm	bedding plane
bottom	conglomerate (A1)	B3, C3	2 cm	bedding plane

Layer	Rock type	Fossils	Thickness	Upper contact
top	shale (B2)	C5	3 cm	incomplete
↑	siltstone (A2)	B5, C5	4 cm	bedding plane
	conglomerate (A1)	A4, B4, B5	8 cm	bedding plane
↑	sandstone (B1)	A4	2 cm	bedding plane
	limestone (A3)	A4, A5	2 cm	unconformity

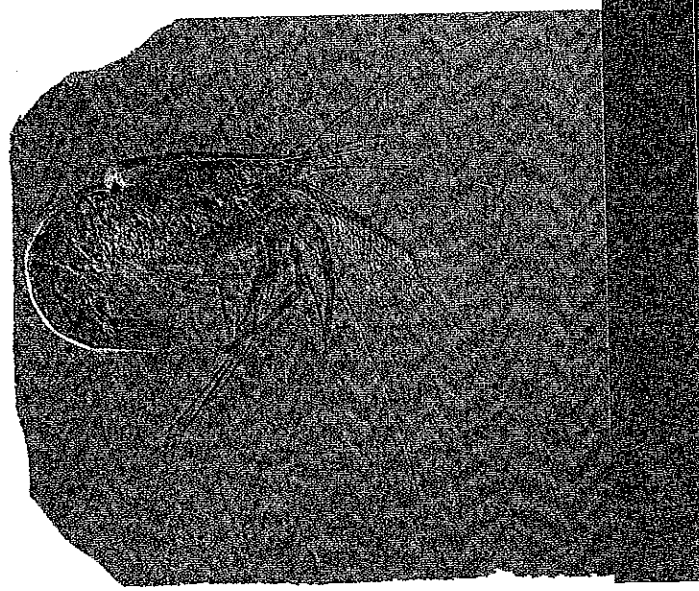
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Answers

- There are 12 layers in the completed geologic column.
- The oldest layer in this column is conglomerate A1. This rock layer contains B3 and C3 fossils and is 2 cm thick. The youngest rock layer is shale B2. This layer contains C5 fossils, and its thickness is at least 4 cm.
- C3, A5, and B4 fossils can be used as index fossils for single layers. The bottom layer (A1) contains C3 fossils. The layer of

limestone (A3) contains A5 fossils, and the younger layer of conglomerate (A1) contains B4 fossils. These fossils are considered index fossils because they occur in a narrow range of geologic time.

Note for Question 18: Index fossils are not always restricted to a single rock layer, but the shorter the column occupied by an index fossil, the more useful the index fossil is.



LabBook

2. Cut the sections out of the paper. Don't cut off the outcrop numbers! In different sections, find layers that have the same rocks and contain the same fossils. Line the sections up next to each other by matching similar layers. Don't be surprised if layers don't look exactly the same. This happens in the real world, too.

3. If unconformities appear in any of the sections, there may be some rock layers missing. You may need to examine other sections to find out what fits between the layers above and below the unconformities. To leave space for these layers, cut the sections along the unconformities.

14. When you find layers that match, you should be able to do one of three things with the other sections—add rock layers to the bottom of your matched sections, add rock layers to the top of your matched sections, or slip missing rock layers between unconformities. Remember to determine whether any of the fossils are index fossils for certain layers.

15. After several tries, you should be able to create the part of the geologic column that corresponds to the area containing the six outcrops. The part of the column will show rock types and fossils for all the known layers in the area.

Analysis

16. How many layers are found in this part of the geologic column?

17. Which is the oldest layer in your column? Which rock layer is the youngest? Describe these layers in terms of rock type and the fossils they contain.

18. Which (if any) fossils can be used as index fossils for a single layer? Which layer or layers contain each of these fossils? Why are these fossils considered index fossils?

19. Fossils may also be used to distinguish similar layers from one another. Name two layers in your column that are distinguished only by the fossils they contain. Which fossil(s) identifies each layer?

20. List the fossils in your column from oldest to youngest. Label the oldest and youngest fossils.

21. Look at the unconformities in the sections for Outcrops 3 and 4. Which rock layers are partially or completely missing from each section? Explain how you know this.

19. There are two layers of sandstone (B1). These can be distinguished by their fossils. The older layer contains B3 fossils, and the younger layer contains A4 fossils. There are two other layers of sandstone (C1) that can be distinguished by their fossils. The older layer contains B3 fossils, and the younger layer contains A4 fossils. Students may also compare the two layers of conglomerate (A1), the two layers of siltstone (A2), or the two layers of shale (B2).

20. The relative age of the fossils in this column, from oldest to youngest, is: C3, B3, C4, A4, A5, B4, B5, and C5.

21. The following layers are partially or completely missing from the section for Outcrop 3:

- Shale B2 (containing fossil C5)
- Siltstone A2 (containing fossils B5 and C5)
- Conglomerate A1 (containing fossils A4, B4, and B5)

The following layers are partial or completely missing from the section for Outcrop 4:

- Sandstone B1 (containing fossil A4)
- Sandstone C1 (containing fossil A4)
- Limestone A3 (containing fossils A4 and A5)

The missing layers from the sections for outcrops 3 and 4 are identified by comparing the layers in the outcrops with the complete geologic column.

LAYER	ROCK TYPE	FOSSILS	THICKNESS	CONTACT	
top	shale (B2)	C5	≥ 4 cm	incomplete	
↑	siltstone (A2)	B5, C5	4 cm	bedding plane	
	conglomerate (A1)	A4, B4, B5	8 cm	bedding plane	
	sandstone (B1)	A4	2 cm	bedding plane	
	sandstone (C1)	A4	2 cm	bedding plane	
	limestone (A3)	A4, A5	3 cm	bedding plane	
	shale (C2)	A4	6 cm	bedding plane	
	shale (B2)	A4, C4	4 cm	bedding plane	
	siltstone (A2)	B3, C4	4 cm	bedding plane	
	sandstone (C1)	B3	4 cm	bedding plane	
	sandstone (B1)	B3	2 cm	bedding plane	
	bottom	conglomerate (A1)	B3, C3	2 cm	bedding plane

Students should create a geologic column that contains the information shown in the table at left.