# FOSSILS

*Massachusetts State Science Olympiad • B Division • March 5, 2016*

# PART 2: DOCUMENT BASED QUESTION

For competitors to complete:

Full School Name: _____

Team Number: _____ Team Type (circle): *Alternate* *Competing*

For event supervisor to complete:

**Part 2 Score**

out of 15 possible points

*In the event of a tie, ties are broken first by the highest score on Part 2 and then the highest score on Part 1.*

## EXAM FORMAT

- Part 2: Document Based Question. You will have ten minutes to answer one document-based question with designated subsections. This question is worth 15 points.

## EXAM INSTRUCTIONS

- You are allowed only to use the information contained within one three-ringed binder during the course of the exam. All electronic devices are prohibited. Use a pencil or a dark-colored pen to complete the exam.
- Mark your answers on the appropriate blanks in this packet. Any illegible response will be counted as an incorrect response. In Part 2, please use complete sentences and write succinctly.
- The exam supervisor will *not* answer any questions regarding the content of the exam, and you will *not* be able to view any images a second time. The event supervisor can deduct points for poor behavior.

**Exam by Phoebe Cohen, Abigail Kelly, Spencer Irvine, and Jeffrey Rubel (Williams College Geosciences Department)**

## Do not begin this section of the exam until you are told to do so.

# PART 2: DOCUMENT BASED QUESTION

**DIRECTIONS:** *You have ten minutes to complete this section of the exam. Answer each section of the question completely and concisely with reference to the information provided.* ***(15 points total)***

You are a paleontologist working in outcrops in the middle of the United States. You just discovered a new outcrop in the Wabaunsee Group. In your outcrop, you have not only discovered a number of known fossil species but also one new species of fossil.

All of the information you have gathered from the outcrop is presented in the sources below. Answer the questions to prepare for your conference presentation at the Geological Society of America.

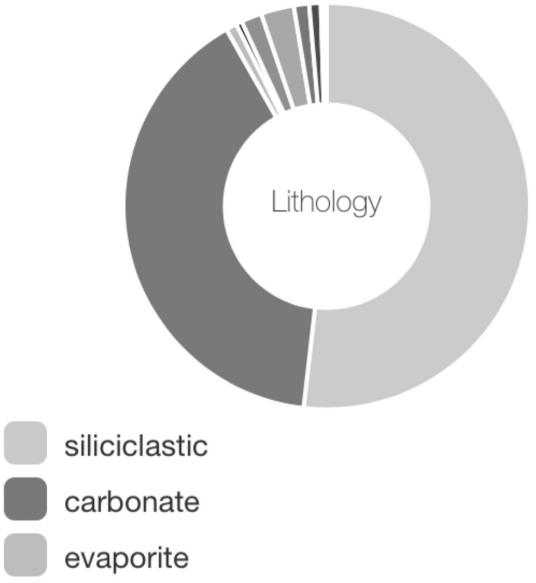
## SOURCE 1: Wabaunsee Group

| | |
|---|---|
| Primary rock type | Shale |
| Secondary rock type | Sandstone |
| Other rock types | Limestone; Siltstone; Coal |

Data from the USGS

## SOURCE 2: Midcontinent Geologic Overview

The major lithologies in the Midwest are shown below with the three main classes of lithology highlighted.



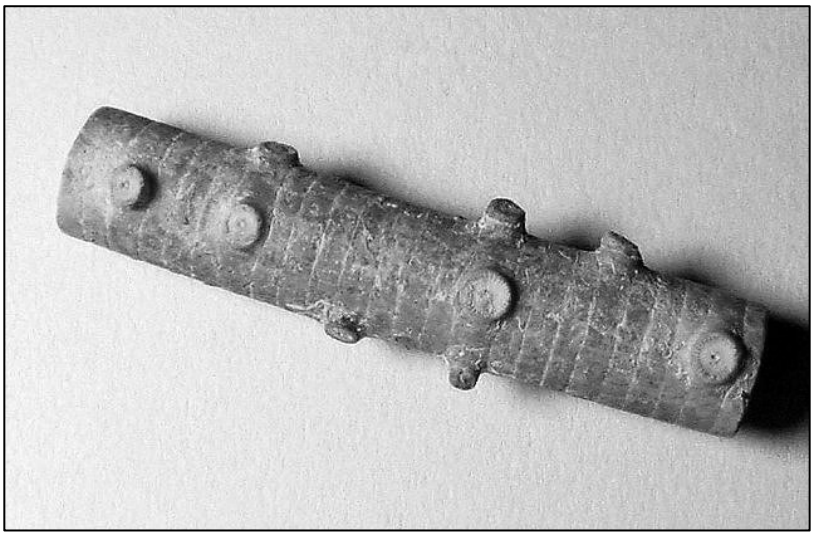

Data from Macrostrat

## SOURCE 3: Fossils

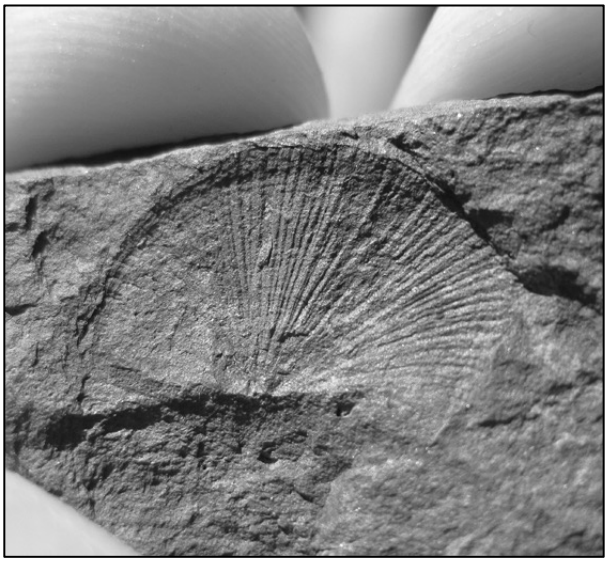
Below are the fossils found at your outcrop.

**Fossil A**

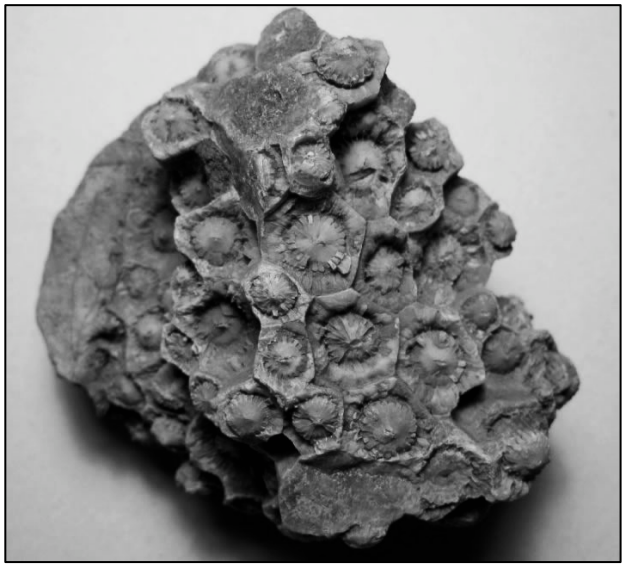
**Fossil B**



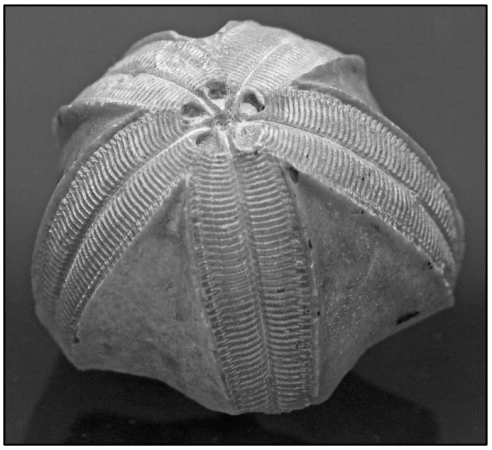
**Fossil C**



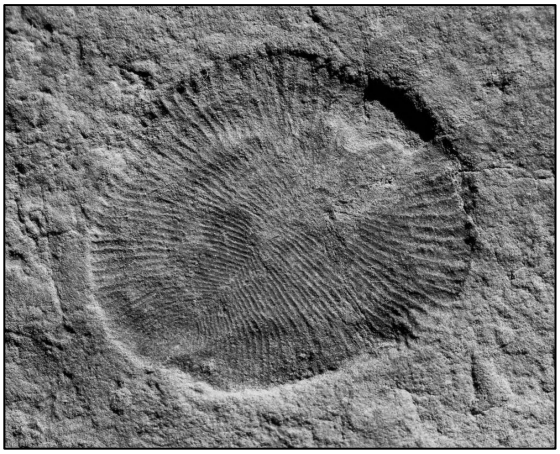
**Fossil D**



**Fossil E**



**Fossil F (new discovery)**



## QUESTIONS.

1. What geologic era (from the Phanerozoic) do you think this outcrop dates back to? *(1 point)*

2. You want to determine a more precise date for this outcrop. Assuming you have access to surrounding outcrops (with volcanic ash layers in them along with numerous fossil-filled layers!) and a radiometric-dating lab, propose a method to date your outcrop. *(2 points)*

3. Paleontologists study motility, or the ability of fossils to move through their environment (freely, floating, not at all, etc.), as a way to assess ecosystem diversity. Looking at the six fossils found at this location, is there diversity in movement methods? Explain. *(2 points)*

4. Which of the fossils found are colonial? List all that apply. For one of these fossils, explain why being colonial is more advantageous than being solitary. *(2 points)*

5. What mode of preservation is seen with Fossil A? What about with Fossil C? *(1 point)*

6. Initially, Fossil E confused you. Then, you realized it was most closely related to which of the other fossils you found? (Hint: Think about taxonomy.) *(1 point)*

7. Your friend SueAnn (who has not studied fossils like you have!) takes a look at Fossil D and says, "It looks like that thing photosynthesized like a plant!" Is SueAnn right or wrong? *(1 point)* Explain why you agree or disagree with her. *(1 point*)

8. You decide you need to assess the overall environment in which the fossils were found by taking a look at the rocks. Given the information in Sources 1 and 2, describe what you predict (a) the depth, (b) the light levels, and (c) ocean/wave energy levels would be at this outcrop when it was under the sea. You do not need to quantify your answers (i.e., no need for numbers, etc.). *(2 points)*

9. You finally get a chance to look at the new discovery, Fossil F. Looking at the morphology of the fossil, determine if the organism shown could move and if it could, how it moved. Cite specific evidence from the fossil shown (reprinted to the right for easy reference). (Note: You will not be scored on what answer is "right." You will be scored on how well your idea is supported.) *(2 points)*