Lesson 10 - E

Plant Pollen and Spores

Summary
In this interdisciplinary mystery, students will work with drawings of pollen and spores from the Hell Creek Formation and try to determine the diversity and abundance of plants in the environment.

Objectives
Students will be able to:

1. Describe the plants of the Hell Creek ecosystem
2. Describe how paleontologists use pollen to reconstruct a paleoecosystem
3. Explain the difference between wind and animal pollinated plants.

Estimated teaching time
NA

Groups
NA

Materials

- Worksheets and laminated drawings of pollen and spores

Teachers Background
One of the key ways that paleontologists put together the picture of an ancient environment is to study fossilized pollen and spores. They do so in part because pollen and spore fossils vastly outnumber most other groups of fossils, such as vertebrates, invertebrates, and plants. Consider that a typical gram of soil may contain tens or hundreds of thousands to millions of pollen grains. You may even experience this abundance yourself if you get hay fever, which results from allergic reactions to pollen.

So what is pollen? Pollen grains combine with the female part of flowers to produce seeds. In order to reach the female part of the flower, the pollen grain must either travel through the air, as pine pollen does, or get transported by an animal, such as bees in carrying the pollen of clover. Other animals that transport pollen include butterflies, beetles, and bats. In order to withstand travel, a strong outer wall protects the pollen. This wall is one of the most common fossils. Non-flowering plants such as ferns, horsetails, club mosses, and liverworts do not produce pollen. Instead they produce reproductive cells known as spores. Spores also fossilize commonly and abundantly.

Wind pollinated plants tend to produce much higher amounts of pollen. One study of wind and insect pollinated angiosperm weeds found that the wind-pollinated species produced 27,000 times more pollen. In the fossil record, this can lead to a bias as animal pollinated plants may be under-represented relative to wind pollinated plants.

For research, pollen and spores can provide several important pieces of information. Because they represent the parts of a plant's life cycle that evolves fairly quickly, pollen and spores occur

over discrete time periods, making them useful for age-dating rocks. Pollen and spores also aid in determining what types of plants lived and their relative abundance.

This activity will look at pollen and spores from the Hell Creek Formation to add another layer to the picture of that ecosystem.

Facilitating the activity
Pass out the worksheet and photographs to students. As noted in the introduction to this lesson, teachers should give a broad overview of activity to the students and tell them that each group is contributing to solving the overall issue of the paleoenvironment of the Hell Creek.

See Introduction to Lesson Ten for information on Assessment, Going Further, References, Teaching Standards, and Glossary.

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Questions

1. Have you ever seen pollen? If so, where and can you describe it?

2. In what sort of ecosystems do you think you would find pollen in? (Circle all the apply)

a. Lake and pond
b. Desert
c. Streams
d. Marsh
e. Swamp
f. Glacial
g. Ocean
h. Urban

3. Which do you think produces more pollen: wind- or animal-pollinated plants? _____

   Why?

4. How do you think that difference played out in the fossil record in regard to diversity (number of different types of taxa) and abundance (number of individuals within a taxa)?

   One of the key ways that paleopalynologists (those who study fossil pollen and spores) determine which and how many plants lived in the past is to collect pollen and spores and to count them. Using the sheets labeled "Counting Pollen and Spores of the Hell Creek Fm." and "Index to the Pollen and Spores of the Hell Creek Fm." determine the varieties and quantities of each type of pollen or spore.

5. Which group is more diverse: angiosperms or gymnosperms?

6. What are the three most diverse species?

7. What does this tell you about the environment of the Hell Creek Formation?

8. How does this description differ from the one provided by plant fossils?