

## Lesson 10 - C

# Plants of the Hell Creek Formation

### Summary

In addition to its wealth of animal fossils, the Hell Creek Formation contains abundant plant fossils, although few were collected until the late 20<sup>th</sup> century. The total now runs into the tens of thousands, the majority of which come from Hell Creek rocks in North Dakota. Of these fossils, the majority is of angiosperms, the flowering plants. They make up 90 percent of the flora both in number of taxa and specimens collected. Ferns, cycads, ginkgos, and conifers make up the remaining 10 percent. Paleobotanist Kirk Johnson has written that the “abundance of large dinosaurian herbivores argues that they should have had some role in the shape and density of the vegetation.”

### Objectives

Students will be able to:

1. Distinguish between broad-leaved trees, conifers, and other
2. Describe the plants of the Hell Creek ecosystem
3. Describe the relationship between plants and animals in this ecosystem

### Estimated teaching time

NA

### Groups

NA

### Materials

- Worksheets and laminated plant photographs

### Teachers Background

Three conditions are required for the preservation of plant fossils:

1. Removing the material from oxygen-rich environment of aerobic decay;
2. "Fixing" the organic material to retard anaerobic decay;
3. Introducing the fossil to the sedimentary rock record (a.k.a., burial).

Consequently, plant fossils are generally preserved in environments very low in oxygen (e.g., anaerobic sediment) because most decomposers (e.g., fungi, most decomposing bacteria and invertebrates) require oxygen for metabolism. Such sediments are commonly gray, green or black rather than red, a sedimentary signal of oxygen-rich conditions. The "fixing" requirements means that plant material must fall into an environment rich in humic acids or clay minerals, which can retard decay by blocking the chemical sites onto which decomposers fasten their degrading enzymes. Plant material can also be "fixed" by removing degradable organic compounds during the process of charring by wildfire. This is a common and spectacular mode of preservation for flowers. Plant material can then be incorporated into the rock record in areas where sediment is being deposited, which usually, but not always, requires the presence of water. Consequently, streams, flood plains, lakes, swamps, and the ocean are good candidates for fossil-

forming systems. Plant fossils are commonly preserved in fine-grained sediment such as sand, silt, or clay, or in association with organic deposits such as peat (coal).

Plants are divided into two broad categories. Angiosperms are the flowering plants and include such common plants as elms, daffodils, roses, and corn. Angiosperm trees are often called broad-leaved. Within the angiosperms there are two groups, the dicotyledons (dicots) and monocotyledons (monocots). Dicots have two seed leaves and usually have leaves with branching veins. Monocots have one seed leaf and leaves with parallel veins. Angiosperms are deciduous, meaning the plants drop their leaves. Gymnosperms, which refers to a naked seed, are what most people think of as conifers. Most conifers have modified leaves known as needles, which remain on the tree year round. One exception to this is the ginkgo, which has broad leaves and is deciduous

### **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.

## Lesson 10 - C

# Plants of the Hell Creek Formation

In this activity, you will work with photographs of plant fossils from the Hell Creek Formation. You will try to distinguish what types of plants were growing, why they grew where they grew, and the relationship between plants and animals.

1. Look at the nine photos, which illustrate seven different plants (Images 4, 7, and 9 are from the same plant, though two different specimens). Which do you think are broad-leaved trees, such as oak, elm, or maple? Which do you think are conifers, such as pine, fir, or spruce? Which ones are something else? Explain your choices.
2. Judging by the size of the leaves do you think that most of the fossils came from large or small plants? Why?
3. What do you think would account for the variety of plants?
4. The types of plants illustrated in this lesson give a relatively close approximation of the ratio of types of plants (angiosperm to gymnosperm) found in the Hell Creek. How would you describe this ecosystem (meaning what types of plants dominated)?
5. How did the animals use this ecosystem? (circle all that apply)
  - a. Plants provided a good food source for the many large, herbivorous dinosaurs.
  - b. Animals might have taken advantage of the dense foliage to escape predators.
  - c. Mammals and birds lived in the trees.
  - d. Dinosaurs ate the wood for fiber as part of a healthful diet.
  - e. Animals moved away during colder times when the plants dropped their leaves.
6. On the other side of this piece of paper draw your favorite fossil plant specimen. Include measurements and a scale bar, and list five characteristics that help distinguish this specimen from the fossil plant material of other species.