DIRECT HIT AT THE K-T BOUNDARY

ACTIVITY E-8

GRADE LEVEL: 7-12

Source: This activity comes from an excellent NASA book called *Exploring Meteorite Mysteries* (NASA EG-1997-08-104-HQ), developed by scientists at the Planetary Materials Office at NASA's Johnson Space Flight Center and teachers from school districts around Houston. You can obtain the full teachers' guide and many other activities in this collection from NASA Resource Centers or download them from the Web at: www-curator.jsc.nasa.gov/sn/outreach/astromaterials/astromaterials.htm

What's This Activity About?

In a piece of exemplary scientific detective work, an interdisciplinary team of scientists in 1980 found an intriguing explanation for a puzzling feature in the history of life on Earth. About 65 million years ago, the fossil records show that large numbers of species died out rather suddenly, among them the dinosaurs. What the team discovered is that the cause of this "great dying" may have been an asteroid (perhaps 10 km across) that hit the Earth with devastating consequences. (Among these would be that the explosive impact raised huge clouds of dust which – together with the soot of many forest fires – would circulate around our planet and cause a serious drop in the average temperature – a kind of "nuclear winter" scenario.) One piece of evidence that could help substantiate this hypothesis would be the discovery of the large crater left by this impact. In this activity, students go through a number of suggested crater candidates to see if they can select the best one. (K-T, by the way, is the geological short-hand for the Cretacious-Tertiary Boundary, the epoch of the "great dying.")

What Will Students Do?

After learning more about the events of 65 million years ago, students brainstorm about what kind of crater such an impact might leave. They then receive a list of "suspects" (four craters) which they are asked to assess. In the second part they do some simple simulations of impacts in the ocean and on land using everyday materials, and see what effect smoke or soot will have on atmospheric temperature. Finally, they write a story describing the impact event from the point of view of the dinosaurs.

Tips and Suggestions

- Note that the background information section in Activity A mixes up the names of the father and son who led the team. Luis Alvarez was the Nobel-medalist physicist (and the father) and Walter Alvarez was the geologist (and the son).

- For other activities involving impacts and impact craters, see Activity E-1, "Experimenting with Craters" in *The Universe at Your Fingertips*.

What Will Students Learn?

Concepts
- Impact craters
- Extinction of species
- Astronomical influences on life on Earth

Inquiry Skills
- Comparing
- Observing
- Inferring
- Experimenting
- Measuring
- Reasoning

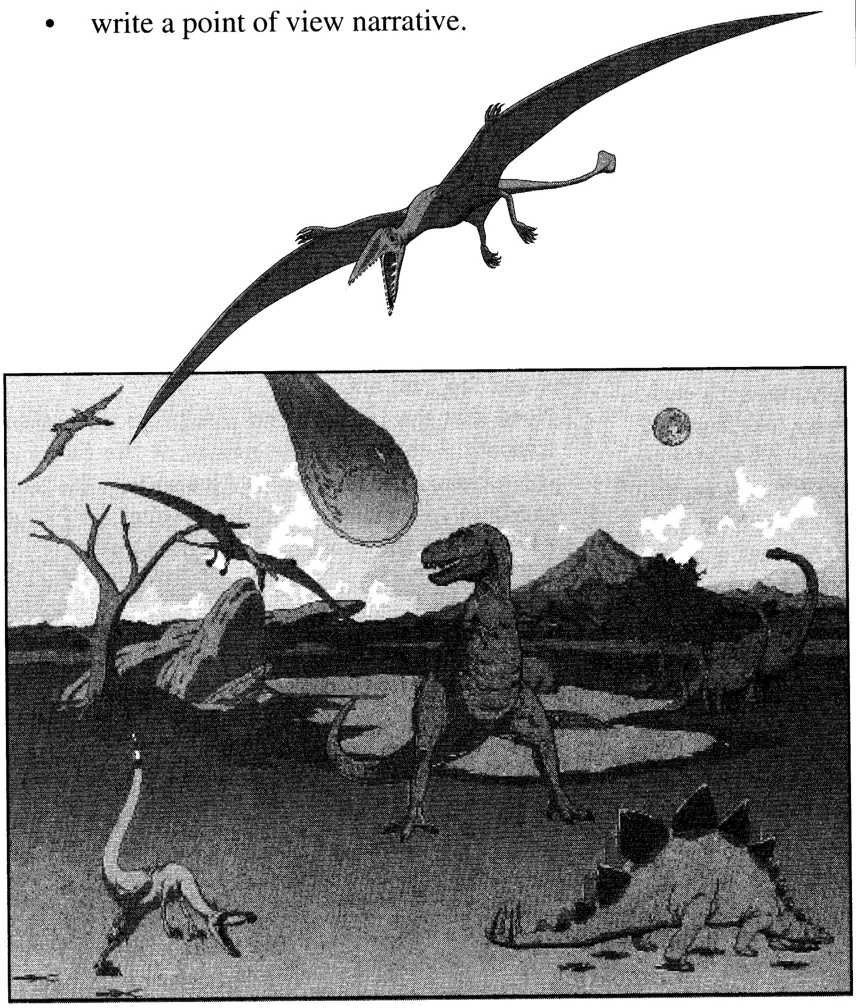
Big Ideas
- Patterns of change
- Simulations
- Interactions
- Scale

Exploring Meteorite Mysteries
Lesson 14 — Direct Hit at the K-T Boundary

“What effect do they have?”

Objectives
Students will:

- evaluate and apply data from a narrative to a scientific selection process.
- demonstrate or visualize simulations of some of the effects of a huge impact.
- write a point of view narrative.



About This Lesson
In this lesson, students explore information about the effects of large impacts. A critical thinking activity helps students select the likely impact site associated with the extinction of the dinosaurs.

Using simple simulations students will find it easier to relate to the massive destruction caused by large impacts. Creative writing skills are developed by writing a first person narrative to illustrate the destruction.

Lesson 14 — Direct Hit at the K-T Boundary

Activity A: Find the K-T Crater

About This Activity

This activity starts with a short informative narrative about the extinction of many species, including the dinosaurs. An asteroid impact was identified as the major reason for the long lasting global changes that killed so many living things. But the location of the large crater, caused by the impact, was not immediately obvious. Like the scientists, the students will be asked, "Where is the crater?" Students will develop the criteria for evaluating crater candidates from the background narrative information. In teams they will evaluate selected craters to see which one(s) might have caused the extinction of the dinosaurs.

Materials for Activity A

- ❑ Student Background *(pgs. 14.7-14.8)*
- ❑ Geographic Features Suspect List *(four sets are provided, pgs. 14.9-14.12)*
- ❑ Geographic Features Teacher Key *(pg. 14.6)*
- ❑ physical maps(s) of the world
- ❑ overhead projector *(optional)*

Objective

From a narrative, students will:

- select criteria and then apply them to a scientific problem by using critical thinking skills.

Background

Sixty-five million years ago three quarters of the life forms on Earth became extinct. The most well-known group to die out were the dinosaurs. However, birds may be lineal descendants of one group of dinosaurs. Other species that became extinct were the ammonites (marine molluscs like the chambered nautilus), rudistid clams (so abundant that they formed huge reefs), and whole groups of small marine organisms. The only groups of animals that were not affected lived deep in the oceans. Some land animals like the early mammals survived also. This extinction marks the end of the Cretaceous period of geological history and the beginning of the Tertiary period. Rocks that formed during these distinct periods are recognized by their fossils, which are enormously different because of the great extinction. As a shorthand (or jargon), geologists call this geological instant the K-T boundary (K for the German word for Cretaceous; T for Tertiary).

The extinction of the dinosaurs has been a source of scientific speculation. Hypotheses about the cause of the extinction have included:

—it wasn't a single event, but a series of unrelated local extinctions;

—the extinction was a slow decline in numbers and diversity, not a catastrophe;

—the extinction was caused by a rapid change in climate from warm and wet to cool and dry;

—the dinosaurs became an evolutionary dead end and could no longer adapt to minor changes in their environment;

—living things were killed by the effects of massive volcanic eruptions (specifically those in the Deccan region of India);

—the effects of a meteorite impact caused the extinctions.