

SUGGESTED REFERENCES

- *Meteorites and Impacts Advisory Committee to the Canadian Space Agency, Chicxulub Crater*
<http://miac.uqac.ca/MIAC/MIAC.html>
- *Chicxulub Crater and Impact Products at the KT Boundary in the Gulf of Mexico Region*
<http://earth.agu.org/revgeophys/claey00/node7.html>
- *More Evidence Points to Impact as Dinosaur Killer*
<http://www.jpl.nasa.gov/releases/98/yucatan.html>
- *Chicxulub Impact Crater Provides Clues to Earth's History*
http://www.agu.org/sci_soc/sharpton.html
- Alvarez, L. W., W. Alvarez, F. Asaro, and H. V. Michel
Extraterrestrial Cause for the Cretaceous/Tertiary Extinction
Science, 208, pages 1095-1008, 1980.
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Global Catastrophes in Earth History
Geological Society of America, Special Paper 247, 631 pp., 1990.
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Chicxulub Crater: A Possible Cretaceous/Tertiary Boundary Impact Crater on the Yucatan Peninsula, Mexico
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NATIONAL SCIENCE EDUCATION STANDARDS

5 - 8

History and Nature of Science
Nature of Science

Life Science
Diversity and Adaptations of Organisms

*Source: *National Science Education Standards, 1996, National Academy Press*

9 - 12

Life Science
Biological Evolution

Science as Inquiry
Understandings about Scientific Inquiry

CREDITS

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SCIENCE SCREEN REPORT

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SYNOPSIS

Dinosaurs were the dominant land vertebrates for 140 million years. They filled many niches and competed with other organisms, such as mammals, for space in ecosystems. For years, scientists have predicted that the dinosaurs became extinct in a short period of time, the result of an extraterrestrial impact from a comet. However they did not have the evidence to support this theory.

In this program, we show the trail of evidence that led scientists to an impact crater on the Yucatan Peninsula, suspected to be the result of a comet impacting the earth. This comet brought about the end of the age of dinosaurs and helped begin the age of mammals 65 million years ago.

CURRICULUM UNITS

- ASTRONOMY
- BIOLOGY
- ECOLOGY
- ENVIRONMENTAL SCIENCE
- EVOLUTION
- NATURE OF SCIENCE
- PALEONTOLOGY

RUNNING TIME

20:42

BACKGROUND

Dinosaurs have fascinated people since the first fossils were discovered. We know they were the dominant land vertebrates for over 140 million years. It seems incomprehensible that most of the dinosaurs could have died off rapidly, the result of a single event.

Although theories floated around for why the dinosaurs became extinct 65 million years ago, none of the theories contained enough evidence to convince most scientists. Walter and Luis Alvarez proposed that the dinosaurs were driven to extinction by a single impact. They proposed that this impact was from an extraterrestrial source, perhaps an asteroid, comet or meteor.

This hypothesis languished until it was discovered that a layer of sedimentary rock contained high amounts of the element iridium, which only comes from space. The Alvarez's suggested that high levels of iridium would be found in rock laid down at about the time of extinction. When scientists tested the rock in the layer known as the KT layer, they found massive amounts of iridium. More importantly, this was consistent all over the earth.

Although this was evidence of an extraterrestrial impact, it was not enough to convince scientists. Bruce Bohor discovered a type of quartz crystal that is formed only by the impact of objects from space on earth. Shock quartz is direct evidence of an impact event. He found shock quartz in rocks near the KT layer throughout southwestern North America, Central America and the Caribbean.

A third piece of evidence convinced scientists that the impact theory should be supported. Tektites are small glass balls that form from volcanic eruptions and extraterrestrial impacts. When rock melts and is thrown high into the atmosphere, it cools quickly as it comes down and forms into small glass balls.

With this evidence, most scientists accepted the impact theory. They still didn't know where the impact crater was located. Evidence suggested somewhere in the Gulf of Mexico. If the impact occurred there, then the layers of sediment would be thicker in the area closest to the impact site. Scientists in both Haiti and Texas found a very thick layer immediately preceding the KT layer in the sedimentary rock. It suggested that the area to explore was in Central America.

Mexican scientists were looking at the Yucatan Peninsula to find oil. But, when they drilled in the area they were surprised to discover igneous rock and crushed sedimentary rocks. Since they discovered no oil, their work was forgotten until scientists realized that it might be the impact crater. Gravity measurements were made of the area surrounding the failed oil wells and scientists discovered that the gravity was much lower in some areas than others. They mapped out these gravity lows and discovered the crater.

Alan Hildebrand is credited with discovering the impact crater that he named the Chicxulub Crater, after a nearby town. He predicted that the extraterrestrial impact must have been a comet. The comet impact and its effects on the planet are shown.

The rise of mammals is discussed. Prior to the extinction, mammals lived at the periphery, usually as nocturnal hunters and detritivores. After the impact, mammals were uniquely positioned to exploit food sources and to survive a broad range of temperatures. With the competition wiped out, mammals quickly diversified.

This program is an excellent example of the process and nature of science applied to a specific question.

ADVANCED ORGANIZERS

Prior to viewing this video, students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 1: The Nature of Science

Section B - Scientific Inquiry

Know by Grade 8

- Scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.

Know by Grade 12

- Hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available).
- In the short run, new ideas that do not mesh well with mainstream ideas in science often encounter vigorous criticism. In the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings.

Benchmark 5: The Living Environment

Section F - Evolution of Life

Know by Grade 5

- Fossils can be compared to one another and to living organisms according to their similarities and differences. Some organisms that lived long ago are similar to existing organisms, but some are quite different.

Know by Grade 9

- Individual organisms with certain traits are more likely than others to survive and have offspring. Changes in environmental conditions can affect the survival of individual organisms and entire species.
- Many thousands of layers of sedimentary rock provide evidence for the long history of the earth and for the long history of changing life forms whose remains are found in the rocks. More recently deposited rock layers are more likely to contain fossils resembling existing species.

Know by Grade 9

- The theory of natural selection provides a scientific explanation for the history of life on earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms.

**Benchmarks can be found at www.project2061.org/tools/benchmark/bolintro.htm*

CRITICAL THINKING EXERCISES

- Explain how scientist's hypotheses are tentative explanations for observed phenomena. Use the extinction of the dinosaurs as a specific example.
- In science, a theory helps to explain a broad range of phenomena and may generate many hypotheses. Describe why scientists are more willing to accept the impact theory for the extinction than other competing theories.
- Design an experiment using sand, baby powder and rocks of different sizes. The goal of the experiment should be to describe a relationship between size and speed of the rocks on the amount of sand and baby powder they can move when the rock strikes it.
- Using information from the video, describe how the single impact from a comet could affect the weather of the entire world.
- List three adaptive advantages of mammals that allowed them to thrive while the dinosaurs became extinct.
- Geologists spend a great deal of time "reading the rocks" to try to understand what life was like millions of years ago. Explain how scientists used this method to identify what happened 65 million years ago.

VOCABULARY

Acid rain

Andesites

Carbonic acid

Cenotes

Crater

Ejecta layer

Igneous rock

Iridium

KT Layer

Metamorphic

Niches

Paleontologists

Shock quartz

Tektites

CAREER POSSIBILITIES

- ASTRONOMER
- CIVIL ENGINEER
- BIOLOGIST
- ECOLOGIST
- PALEONTOLOGIST