

From Space to Earth: Meteor Crater

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Teacher Lesson 4: The Battle for Impact Theory

Overview

The origin of the crater in Arizona was the basis for heated debate. Working through this activity, students will learn how evidence from the Barringer Meteorite Crater site fueled differing scientific arguments.

PURPOSE

Learning about the evidence discovered by Grove Karl Gilbert, Daniel Moreau Barringer, and others, students will apply all their gained knowledge of impact craters from the previous lessons and learn how the impact theory that formed Barringer Meteorite Crater won scientific acceptance.

COMPLETION TIME

2 class periods/2 hours with additional homework assignments

LEARNING OUTCOMES

Students will gain knowledge about how scientists use evidence to answer questions.

Students will compare and analyze differing views and evidence.

Students will learn how impacts alter the Earth.

Students will learn about the process of a scientific theory gaining acceptance

Students will learn how science and history intersect

TOOLS/MATERIALS

Computer access

Student Handout “The Battle for the Impact Theory”

Provide link to Chapter 1: Introduction in *Guidebook To The Geology of Barringer Meteor Crater, Arizona*(Kring,2007)

http://www.lpi.usra.edu/publications/books/barringer_crater_guidebook/

Procedure

BEFORE THE ACTIVITY

Share link to student slideshow handout

Share link to Introductory Chapter in *Guidebook To The Geology of Barringer Meteor Crater, Arizona*(Kring,2007)

http://www.lpi.usra.edu/publications/books/barringer_crater_guidebook/

ON THE DAY OF THE ACTIVITY

1. Ignite Curiosity and Activate Prior Knowledge of Craters (10 minutes)

- Reflect back on the previous lessons on the times students' assumptions/predictions were wrong. (briefly discuss a few examples)
- Show an image of the Barringer Meteor Crater

https://en.wikipedia.org/wiki/Meteor_Crater#/media/File:Barringer_Crater_aerial_photo_by_USGS.jpg

- Have students imagine they were crossing Northern Arizona on a horse (before cars!!) in 1903. What would they have thought when they first saw the crater? What do you think the first scientists to analyze the crater thought? (accept all ideas)

2. New Information: Slideshow “Weighing the Evidence” (45 minutes)

- Share Student Handouts and review all questions. Assign teams of 2-4 students to share information and answers.
- In breakout groups, students will watch slideshow (9 minutes)
Slideshow “Weighing the Evidence”: <https://youtu.be/Xx-dwxKPGDc>
- Give students time to work in groups and answer questions. (20 minutes)

You can assign certain groups responsible for reporting answers back to class.

3. Discuss answers. Reflect on the scientific process, on the strengths and weaknesses of the scientists' thinking about the crater. (10 minutes)

Strengths - observation, data collecting, experimenting/modeling

Weaknesses - assumptions about the Earth's surface, biased toward conclusion

What is revealed about scientific thinking? When we do experiments or make assumptions, what should we be mindful of?

The great challenge is to be objective toward the subject and open to new ideas that may contradict our assumptions.

4. Scientific Reading and Analysis (50 minutes in class or for homework)

- Share David Krings' introductory chapter in his *Guidebook to the Geology of Barringer Meteorite Crater, Arizona*.

(Warning! This is difficult reading for your average middle schooler, so give it a quick glance before and decide how much of it your students could tackle in the time allotted.)

- Tell students it is a scientific text written by a top impact crater scientist David Kring for other scientists.
- Challenge: Confirm information from "Weighing the Evidence" slideshow.
- In-Class Group activity: Assign each group 1-3 paragraphs, expect them to read them closely, highlight and look up words they didn't know, and report to the class 1) words they learned 2) any facts confirmed from "Weighing the Evidence" slideshow 3) any new information they learned
- Require quotes from the reading to support their points about the facts and new information

5. Discuss Scientific Reading (20 minutes)

- What facts were confirmed about Gilbert, Barringer, and new scientific discoveries?
- What new facts did they learn?
- What did they observe about the writing style?

6. Journal of Historical Figure: (30 minutes in class or for homework)

- Barringer’s fight to prove his impact theory subjected him to controversy, personal economic loss, and the emotions of a forceful personality. Students put themselves in Barringer’s place and write an original journal entry or letter home to his family from his perspective that describes his ideas or feelings during the impact debate.
- Writing must include Barringer’s thoughts on his mining venture, his scientific opinions, and his opinions about the scientific community.
- Students will use information about Barringer’s story from “Weighing the Evidence” slideshow and David Kring’s book on Barringer Meteor Crater.

ASSESSMENT CRITERIA

Did the students accurately record the evidence from the slideshow?

Did their answers reflect understanding of the scientific process?

Did the students complete the assignment on time?

Did the students work collaboratively with team members to prepare their answers?

Did the students find and comprehend information in the scientific text?

In their narrative writing, did the students show an understanding of both the facts and the struggle of historical figure Daniel Moreau Barringer?

Links

Weighing the Evidence slideshow narrated by Dr. Carolyn Ernst:

<https://youtu.be/Xx-dwxKPGDc>

Images of Barringer Meteorite Crater:

https://en.wikipedia.org/wiki/Meteor_Crater#/media/File:Barringer_Crater_aerial_photo_by_USGS.jpg

Guidebook To The Geology of Barringer Meteor Crater, Arizona(Kring,2007)

http://www.lpi.usra.edu/publications/books/barringer_crater_guidebook/

Link to download Chapter 1: (Introduction)

http://www.lpi.usra.edu/publications/books/barringer_crater_guidebook/chapter_1.pdf

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