



Finding Impact Craters

LESSON DESCRIPTION

Remote satellite images of the earth are used to distinguish impact craters from other landforms.

OBJECTIVES

Students will:

- Describe the effects of extraterrestrial objects upon the Earth's topography, atmosphere, and living organisms
- Describe the role of satellite technology in helping scientists to identify evidence of impact events
- Describe why and how science is an ongoing process of discovery

NASA SUMMER OF INNOVATION

UNIT

Earth and Space Science; remote sensing

GRADE LEVELS

Grade levels 7th -9th

CONNECTION TO CURRICULUM

Science, technology and mathematics

TEACHER PREPARATION TIME

1 hour, This time will vary dependent upon the familiarity of the instructor with landforms and the availability of student internet access.

LESSON TIME NEEDED

Estimated 1.5 hours Complexity: Basic

NATIONAL STANDARDS

National Science Education Standards (NSTA)

Physical Science

- Properties and changes of properties in matter
- Motion and forces
- Transfer of energy

Earth and Space Science

- Structure of the earth system
- Earth's history
- Earth in the solar system

National Geography Standards (NCGE)

- The World in Spatial Terms
- The Uses of Geography

MANAGEMENT

- Each activity within this unit has material which will need to be downloaded and printed in advance of the lessons.
- If students do not have access to the images online, the Landsat images of the land forms will need to be reproduced in color. For the identification and discussion portion of the activity, the teacher may need to rename Mount St Helens images since this feature is more well known in the U.S. as a volcano. Depending upon location, other features may need to also be renamed with their abbreviation.

Students should work in pairs in scrutinizing their images as we see and interpret images differently. This is also helpful with materials management.

CONTENT RESEARCH

Many people know that craters cover the surface of the moon. In fact, impact craters appear on all rocky (terrestrial) planets and many of their moons. The Earth has been shaped by these dramatic impact events no less than other planetary bodies have been, and one can see evidence on the Earth in terms of its geology, biology, and chemistry.

NASA scientists currently study satellite images for evidence of impact events. Finding the evidence requires careful interpretation of satellite images. Wind and water have eroded away most of the evidence; various other geologic processes have concealed it; oceans and vegetation now cover much of the rest. Satellite observation technology enables us to see landforms that we can't see with our eyes alone. When impact craters are found in satellite images, interdisciplinary teams of scientists can go to the sites on the ground to learn more about them and how they have changed their surroundings.

Vocabulary:

Impact Craters: Craters formed when objects or impactors smashed into the surface.

Ejecta is the material thrown out of the area that becomes the crater during impact. This does not account for all material since much is vaporized or melted.

Rays: The bright streaks starting from a crater and extending away for great distances.

Raised Rim: Rock thrown out of the crater and deposited in a ring-shaped pile at the crater's edge during an impact.

Crater Floor: The bowl shaped or flat area of a crater, usually below the surrounding ground level unless filled in with lava

Erosion: The movement or grinding away of surface materials by wind, water, ice or gravity.

LESSON ACTIVITIES

Finding Impact Craters

<http://craters.gsfc.nasa.gov/lesson.html>

This activity will guide students through discussions regarding known impacts that have occurred on the Earth and the possible outcomes that have resulted.

MATERIALS

Student worksheets

Student Worksheet for Step 1:

[When an Extraterrestrial Object Hits the Earth](#)

Student Worksheet for Step 2:

[Known Effects of Impact Events](#)

Student Worksheet for Step 4:

[Describing Satellite Images of Possible Impact Craters](#)

Student Worksheet for Step 6:

[Questions You Would Ask on a Field Expedition to a Possible Impact Crater](#)

Satellite images of landforms with pseudonyms for student use

(Students may recognize some names and know already whether or not they're impact craters.)

[Aorounga \(Aor\)](#)

[Elgygytgyn \(Elg\)](#)

[Haughton \(Hgh\)](#)

[Manicougan \(Man\)](#)

[Mount St. Helens \(Msh\)](#)

[Richat \(Rch\)](#)

[Schooner \(Sch\)](#)

Teacher Reference Sheet:

http://craters.gsfc.nasa.gov/teacher_ref.html

Working in teams of three to five, students will then evaluate satellite images of the earth to determine the traits associated with impact craters in different regions of the world.

The activity description contains six steps with the first three steps providing background which may or may not be required for every group in the upper grade levels.

ADDITIONAL RESOURCES

Graphics for Simple and Complex Impact Craters:

http://craters.gsfc.nasa.gov/crater_diagram.html

Aerial Image of Barringer Crater in the U.S.:

http://craters.gsfc.nasa.gov/assests/images/Barringer.best_aerial.gif

Video of Iturralde Impact Crater (also called Araona Crater) in Bolivia:

http://craters.gsfc.nasa.gov/assests/movies/Iturralde_movie.mpg

Solar System Exploration

http://solarsystem.nasa.gov/scitech/display.cfm?ST_ID=345

Geology.com utilizes many NASA Resources in discussing related topics. Near-Earth asteroids

<http://geology.com/articles/near-earth-asteroids.shtml>

DISCUSSION QUESTIONS

- How often do impacts occur? Does the rate of impacts vary over time? If so, does it vary regularly or randomly? *Impacts take place every day! The size and speed of the impactor is significant.*
- Are asteroids or comets the more frequent impacting bodies? *Both have been observed impacting on different planets in our solar system, but there appear to be more asteroids closer to the Earth.*
- Have impact events caused more than one major biological extinction event?
http://rst.gsfc.nasa.gov/Sect18/Sect18_4.html *approximately half way through this site you will see two graphics that help to support discussions in this area*
- When will the next impact event take place? How big will it be, and how will it affect life?
Answers will vary. 2012 discussion: <http://www.nasa.gov/topics/earth/features/2012-quest.html>

ASSESSMENT ACTIVITIES

Crater Rubrics

<http://craters.gsfc.nasa.gov/rubric.html>

<http://craters.gsfc.nasa.gov/assests/pdf/rubric.pdf> (Downloadable pdf)

Student assessment is divided into five levels with 0 = no understanding of how impact events have shaped the land, atmosphere, and living things. To Level 4 = There is evidence in this response that the student, using analysis, has a full and complete understanding of how impact events have shaped the land, atmosphere, and living things.

On the web site, each Level has further details for the characteristics associated with the level.

ENRICHMENT

NASA Earth Observatory provides current and archived articles and images on a variety of topics related to remote sensing of the Earth:

<http://earthobservatory.nasa.gov/>

Geology.com and Google Maps identify many of the larger known "asteroid impacts":

<http://geology.com/meteor-impact-craters.shtml>

USGS Study of the Chesapeake Bay Impact Crater:

http://meteor.pwnet.org/impact_event/impact_crater.htm

GSFC BASIC SCIENCE STUDIES II: IMPACT CRATERING This is an instructive article by scientists at NASA's Goddard Space Flight Center with deep background in the study of impact craters:

http://rst.gsfc.nasa.gov/Sect18/Sect18_1.html