

Cosmic Collision
Exercise: A Virtual Visit to Two Impact Craters
by Keith Milam, Ohio University

Name _____
Assignment Date _____
Due Date _____

Introduction: In this exercise, we will take a tour of two impact craters on Earth using Google Earth. We'll make some observations and measurements at each crater and then compare the two when finished.

Part I: Serpent Mound Impact Crater

Step 1: Some of the video *Cosmic Collision* was filmed in an impact crater in southern Ohio. Let's take a look at this crater from above using Google Earth. The free version of Google Earth can be downloaded to your computer by visiting: <http://earth.google.com/> .

Open Google Earth on your computer (an internet connection is required). Near the upper left hand corner of your screen under "Search", click on the "Fly To" tab. Enter "Serpent Mound, Ohio" in the address line and click <Enter>. Google Earth should take you to an aerial view of the Serpent Mound impact crater featured in the video. Adjust the zoom tool in the upper right hand corner of the window (it will appear when you scroll the cursor over to that area) until the scale bar in the lower left hand corner of the image reads approximately 3.5 km.

Now closely examine the image. Wooded areas are shown as darker green patches. These areas are often associated with hillsides or areas of high elevation. Lighter green and brown areas are farmland, typically in areas of lower elevation. Roads usually appear as white or gray colored lines.

Question #1: Are there any shapes, textures, or landforms that suggest that you may be looking at an impact crater? If so, what are they?

Step #2: Now we're going to visit the central peak of the Serpent Mound impact crater, or the location where the host had almost a 360° view of the crater. To do this, we're going to enter the latitude and longitude coordinates of the location where the video was filmed. You may recall that latitude is a measure of a location relative to the equator, while longitude is a measure of a location relative to the prime meridian. Latitude and longitude is measured in degrees, minutes, and seconds.

In the "Fly To" tab in the upper left hand corner of the Google Earth window, please enter the following text (if you're doing this exercise on your computer, just cut and paste the text):

39 01' 55.28"N, 83 24' 08.06W

Leaving out the degree symbol (°) is acceptable in Google Earth. Google Earth will zoom in on the site until the scale bar reads approximately 293 meters. You may want to zoom in a bit more. Now run your cursor over the spot. At the bottom of your screen, the latitude and longitude will be displayed along with the elevation. If the elevation is not displayed, click on the "Layers" menu on the left side of the window, select "More" and then enable "Terrain". Elevation data should now change as you move your cursor across the image. Please record the elevation of the central peak here _____ meters above sea level.

The rocks that the host views at this site are normally located at about 219 m above sea level.

Question #2: The landform in the center of your image, or central peak, is a common feature of which kind of impact crater? simple complex (circle one)

Question #3: Are there differences in elevation of the rocks in the central peak (inside the crater) versus outside the crater? _____ If so, how much of difference (in meters) and in what direction (up or down)? _____

Question #4: If there are differences in elevation between rocks outside of the crater versus those of the central peak, then develop a hypothesis explaining why this might be:

Meteor Crater, Arizona

Step #3: Now let us go on a virtual flight to the other side of the North American continent to visit another impact crater, this time in the Arizona desert. Type the following coordinates into the "Fly To" tab:

35 01'37.88" N, 111 01' 22.08"W

You should find yourself viewing a hole in the Arizona desert. Use the zoom controls on the right hand side of the window to zoom out until the scale bar in the lower left hand corner reads approximately 489 m. You should now have an overall view of the site known as "Meteor Crater". Observe the different parts of this 49,000 year old crater. Observe the crater rim, the area around outside the crater, the area inside. This crater is much smaller than the 8-11 km diameter Serpent Mound impact structure.

Let's measure the crater diameter and determine the depth using Google Earth. In the toolbar above the image, click on the "Ruler" icon. A window showing measurements that you will make will appear. Now click on one part of the crater rim and measure directly across the center of the crater to the other side of the rim. Repeat this process 10 times along different parts of the crater and record your measurements below:

Diameter Measurements (in km)									
#1	#2	#3	#4	#5	#6	#7	#8	#9	#10

Now divide the sum of all of your measurements by 10 to determine the average crater diameter for Meteor Crater: ____ km

Step #4: Now hold your cursor over the center point of the crater and record the elevation displayed in the bottom of your image window _____m.

Now using the “Ruler” tool again, measure a distance from the center of the impact crater to approximately 4 km away. Record the elevation displayed. Repeat this process 10 times in different directions from the center of the crater and record your elevations below:

Elevations (m)									
#1	#2	#3	#4	#5	#6	#7	#8	#9	#10

Now divide the sum of all of your measurements by 10 to determine the average elevation around Meteor Crater: _____.

Subtract the elevation measured at the bottom of Meteor Crater from the average elevation of the surrounding terrain. Show your work below. How deep of a hole did the impact excavate? _____ m

Now calculate the depth to diameter ratio of Meteor Crater by dividing the depth by the average diameter above. Show your work. The depth/diameter ratio is _____.

Step #5: Now zoom in on the center of the crater until the scale bar is approximately 57 m in length. Use the navigation controls in the upper right hand corner of the window to change your viewing angle such that you can pan around the crater for a 360° view. Panning around, you should notice an uplifted crater rim, disturbed sedimentary rocks, and boulders that have slid down the crater rim onto the floor of the crater. From this perspective, one obtains a better sense of the bowl-shaped depression that you’re in.

Question #5: Are the two impact craters of the same type or are they different? Please list observations that support your answer.

Question #6: The crater in the Arizona desert has more of a prominent bowl-shaped appearance, whereas in the southern Ohio crater, this shape is not as apparent. List two or three possible hypotheses as to why the two impact craters are so different in their general appearance.

Step #6: Go online and search for “Google Moon”, Google’s interactive map of the Moon. Take a virtual tour of the Moon examining several lunar impact craters and answer the following question.

Question #7: Which of the two impact craters (Meteor Crater or the Serpent Mound impact crater) most closely resembles impact craters on the Moon? _____ Why do you think that the crater you selected bears the most resemblance to craters on the Moon?

Don’t stop here! Use your newfound Google Earth skills to search for other impact craters on Earth such as the Upheaval Dome (Utah), Middlesboro (Kentucky), Charlevoix (Quebec), and Vredefort (South Africa) impact craters. Visit the Earth Impact Database online for more about these and the 176 confirmed impact craters on Earth.