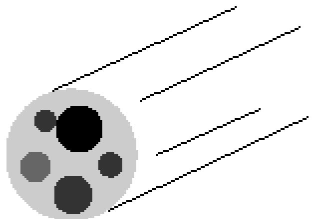
Skyler Grable-Gibson 4/22/2014

Craters



Overview

- Evaluate parameters affecting crater formation.
- Find the size of the asteroid/comet that killed the dinosaurs.
- Make your own series of craters, to observe the "geological" results.
- Look at and evaluate images of craters on other planets/celestial bodies.

Prelab

Answer these questions:

- What factors could affect an impact crater's shape and size?
  - The size and shape as well as the velocity.
- What effect do you expect varying these factors will have on the craters?
  - The amount of damage craters could cause.
- Explain how you could test these hypotheses.
  - Equipment used large bowl, colored sand, marble, and a rock.

Activity 1: History of Cratering

Craters can be used to find out information about conditions on the planet or moon. An active planet will have few craters because tectonics and volcanism recycle the planet's surface. On a planet with an atmosphere or craters can be worn away due to wind or water erosion. A geologically dead planet with no atmosphere has no way to remove craters, except through more cratering.

To demonstrate cratering, you'll need a box of sand or similar material. There should be a thick base of white sand which you'll add a thin **regolith** of colored sand to.(note if the sand in the box isn't white, you should get colored sand with a good contrast). Be sure to make the layer of colored sand very thin, since you want to see the pattern of **ejecta** when you make the crater.

Smooth the surface of the sand and apply a thin layer of colored sand. Drop a marble into the sand. Observe the shape and size of the crater. Try different sizes of marbles, and different heights. Try throwing the marble sideways into the sand and see what shape it makes. Get some other objects and throw them in. Make a bunch of craters without wiping the sand clean, to see how they pile up on top of each other (be careful not to mess up your craters pulling the objects back out!) Look carefully at the patterns in the sand and in the colored sand on top of the white sand -- around the crater you should see a crater rim and a little further away, rays of ejecta thrown out by the objects.

Activity #1 Questions:

1. As you dropped the marbles from different heights, how did the ejecta (material tossed out of the crater) change?

    - ✓ Experiment used marble and rock.
    - ✓ When the marble was dropped at multiple heights by looking at the crater it made a perfect sphere with the ejecta equally balanced.
    - ✓ The rock also was dropped at multiple heights but did not make an equally balanced ejecta. The rock does not have an equally distributed weight like the marble does. So with multiple testing with the rock the ejecta would have greater distance depending on what side of the rock is heavier and what side hit the ground first. The lighter side if the rock would cause some ejecta just not as far. Pieces may have fallen off after hitting the sand, which would cause other smaller craters.

2. When you dropped non-spherical objects, or threw the marble at an angle, how did the shape and ejecta change? How does this relate to craters seen on other planets/moons?

    - ✓ The non-spherical object/ rock was thrown at an angle multiple times as well as marble.
    - ✓ The shape of the crater changed from having a deep crater with ejecta all around the rock to having the rock land sideways rolling to a stop. The ejecta was not even close to looking circular as did falling straight down, but did cause a larger ejecta when the rock first hit the sand at the angular position.
    - ✓ The marble also was tested multiple times. Had almost the same effect as the rock but the marble dug into the sand more than did the rock possibly because the marble was smooth and the rock was rough. Had a larger ejecta at the beginning of friction.

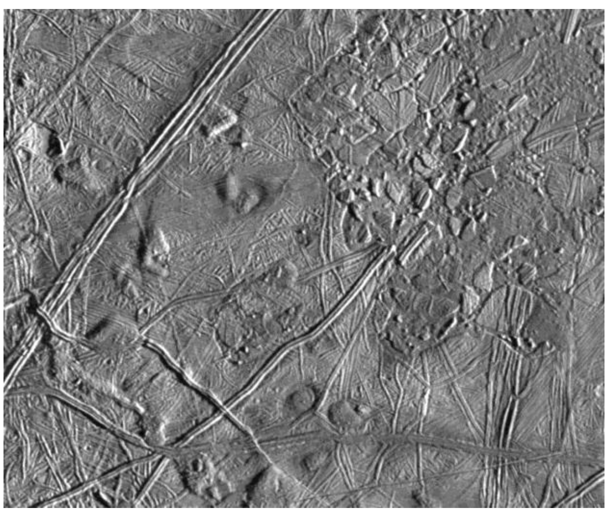
- ✓ Not all asteroids hit a planet/ moon head on depending on the atmosphere and rotation of the planet.

3. If you were to look at another person's sandbox, could you tell which craters were made first ('older')? How?

   - ✓ I believe you could tell which crater's are older by observing what the crater looks like when first hitting land then letting the crater age would cause some of the land to erode and settle back into the crater making the crater not as smooth as it was when first hit.

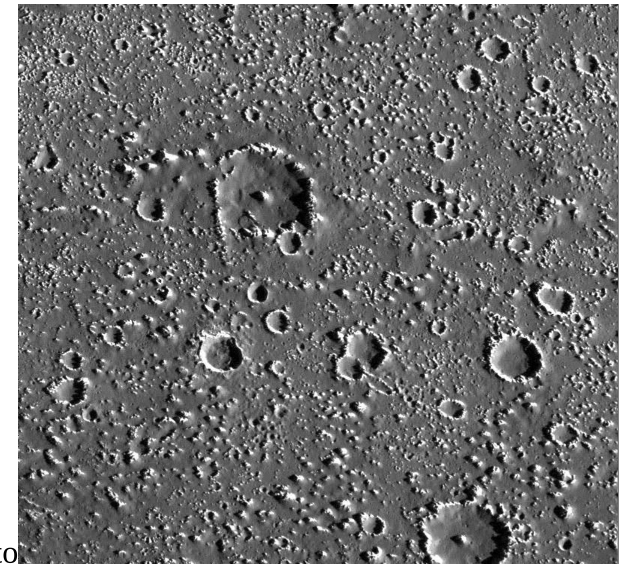
4. By looking at craters astronomers can get an idea of conditions on another planet/moon without even going there. Below are images of the four Galilean moons of Jupiter. Place them in order from oldest to youngest surface terrain. Explain how you figured out what order to put them in.

   - ✓ Information was found in book on Chapter 9 and on http://lasp.colorado.edu/education/outerplanets/moons_galilean.php

Europa 

3

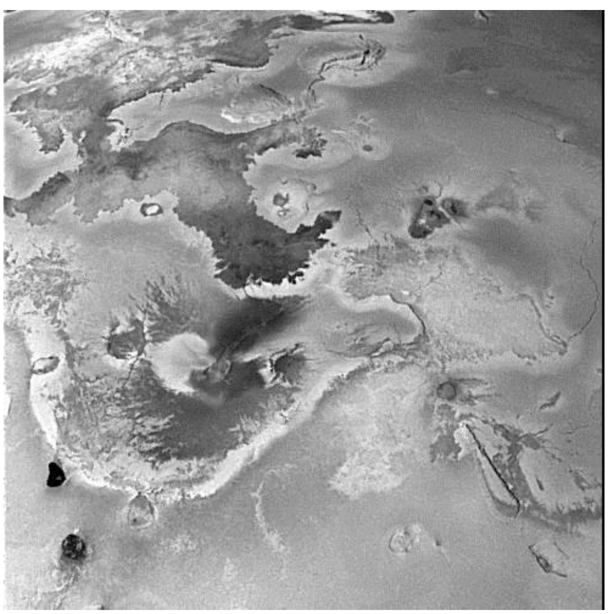
- ✓ Million years old
- ✓ Made entirly of was and ice



Callisto

2

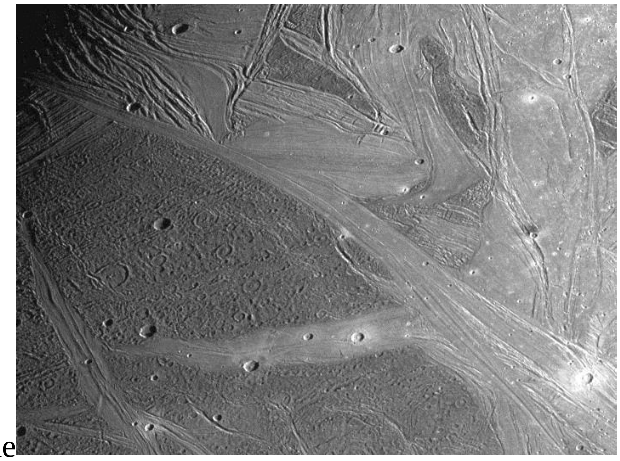
- ✓ 4 billion years old craters
- ✓ saltyocean supported by deeper rocky interior



Io

4

- ✓ Youngest looking surface
- ✓ Constantly changing
- ✓ Covered with volcanoes that constantly erupts

Ganymede 

1

- ✓ Billions of years old
- ✓ Might be the oldest craters
- ✓ Darker areas are covered with craters

5. Based only on the pictures, which one(s) are most likely to be geologically active? Why (note none of them have a substantial atmosphere)?

- ✓ Io is covered with large volcanoes the erupt everyday which does fill in the craters
- ✓ The other moons ages longer than Io does
- ✓ The others are mostly covered with ice and water