

Comparative Planetology

I. Objectives

1. Identify geologic similarities and differences among the terrestrial planets and describe the processes that formed them.
2. Define geologic terms relevant to the study of comparative planetology.
3. Make effective use of internet resources to complete research tasks.

II. Resources and Readings

1. Volcanic and Geologic Terms <http://volcano.und.nodak.edu/vwdocs/glossary.html>
2. Terrestrial Impact Craters <http://www.solarviews.com/eng/tercrate.htm>
3. Physics Classroom <http://www.glenbrook.k12.il.us/gbssci/phys/class/energy/u511c.html>
4. Computing Crater Size from Projectile Diameter
http://www.lpl.arizona.edu/tekton/crater_c.html
5. Barringer Meteorite Crater <http://www.barringercrater.com/>
6. Principal Types of Volcanoes <http://pubs.usgs.gov/gip/volc/types.html>
7. Plate Tectonics <http://zebu.uoregon.edu/~imamura/121/nov13/tectonic.html>
8. Continental Drift <http://www.ucmp.berkeley.edu/geology/anim4.html>
9. Erosion <http://www.irim.com/ssm/ssm00050.htm>

III. Introduction

Comparative planetology enables us to study planets through comparison and contrast, using Earth as the basis of comparison. Studying the geologic processes on Earth helps us reconstruct Earth's history and provides insight into geologic processes occurring on the surfaces and interiors of Mercury, Venus, the Moon, and Mars, as well as some Jovian planet moons. The stages in the development of the terrestrial planets include impact cratering, volcanism, plate tectonics, and erosion. We also need to understand geologic time and terminology and become familiar with natural geologic processes. The effects that we, as humans, have on those processes and on our environment can be both beneficial and harmful depending on the situation.

There are many processes that have shaped the interiors and exteriors of the terrestrial planets. These processes include differentiation, desertification, glaciation, plate tectonics, cratering, weathering, global warming, volcanism and erosion. Some of these processes have occurred on all of the terrestrial planets, while other processes are evident on only some of them due to physical characteristics, such as size, gravity, temperature, composition, atmosphere and distance from the Sun.

VI. Lab

1. Define the following terms:

cratering

desertification

differentiation

glaciation

volcanism

weathering

2. Access the website Computing Crater Size from Projectile Diameter (http://www.lpl.arizona.edu/tekton/crater_c.html), and run 7 different scenarios. Complete the following table:

Crater Size and Impactor Energy

Projectile diameter in (m)	Projectile density in (kg/m ³)	Impact velocity in (km/s)	Impact angle in degrees	Target density in (kg/m ³)	Acceleration of gravity in (m/s ²)	Target type	Final Crater diameter in (m)	Energy in Joules	Energy in Megatons

3. Explain how projectile diameter, projectile density, impactor velocity, impact angle, target density, acceleration of gravity, and target type affect the size of the crater formed as a result of the impact?

4. Describe the history and characteristics of Barringer Crater.

5. Explain why the number of craters remaining on the surface of the Earth is so much lower than the number of visible craters on the Moon, Mercury and Mars.

6. Complete the following table:

Volcano Types, Descriptions, and Locations

Volcano Type	Description	Location
cinder cone		
composite volcano		
shield volcano		
lava dome		

7. What evidence exists to support the theory of plate tectonics?

8. Complete the following table:

Geologic Eras

Era	Time Span	Summary
Cenozoic		
Mesozoic		
Paleozoic		
Precambrian		

9. Complete the following table:

Erosion Types

Erosion type	Description
Landslip	
Water	
Wind	

10. Complete the *Geologic Processes* table below using the images provided on the class website. Identify the terrestrial object as Earth, the Moon, Mercury, Venus or Mars and the geologic processes that may have occurred. These processes include differentiation, desertification, glaciation, plate tectonics, cratering, weathering, global warming, volcanism, erosion or others that may apply.

Geologic Processes

Image	Terrestrial Object	Processes
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		
K		
L		
M		
N		
O		
P		
Q		
R		
S		
T		

11. Summarize the evidence of the geologic processes that you think have taken place on each terrestrial object in the *Terrestrial Planet Geologic Processes* table below.

Terrestrial Planet Geologic Processes

Terrestrial Object	Evidence of geologic processes
Earth	
Moon	
Mercury	
Venus	
Mars	

11. Which terrestrial planets have undergone similar geologic processes? Why? What are those processes?