

Name:

Lab Instructor:

Lab Section:

GEO104: Planetary Geology LAB 10: **MARS GEOLOGIC MAPPING**

OBJECTIVES:

- I. Apply our understanding of relative age dating and geologic processes to the Moon
- II. Develop an understanding of how to make regional geologic interpretations

MATERIALS: Computer-based lab.

INTRODUCTION

Throughout this semester, we've learned about a variety of geologic processes and what landforms they produce. In the last lab, we used that knowledge to interpret images from one area on the Moon. In this final lab, you get to put it all together in interpreting a variety of images of the surface of Mars. In the first part of the lab, you'll interpret some high-resolution images from multiple locations on Mars. In the second part of the lab, you'll focus in on a few particular areas and use multiple data sets to make regional geologic interpretations.

INTERPRETING INDIVIDUAL IMAGES

1. In Google Mars, first turn on a global background image (topography, perhaps – it's your choice, and the TA will show you how.) Then turn on the CTX and HiRISE image footprints. Navigate to each of these images one by one, by typing in the image coordinate into the "fly to" box. Load the image browser page by clicking on "observation information page" in the pop-up. Examine the geology in this scene by opening the "Full image (grayscale, map-projected)" JPEG product. An important first step for correctly interpreting each image is to determine the direction of illumination. The best way to determine the illumination direction is to find an impact crater, knowing that the bowl of the crater is a topographic low.

P22_009826_1865_XN_06N348W, CTX image located at 6.353°N 11.85°E

What kind of feature does this image cross? Use the context view to help you answer this question.

Do you think this feature is old or young? Cite at least 2 pieces of evidence for your assessment.

This CTX image has a resolution of 6 m/px. However, there are HiRISE images of Mars – the red rectangles – that have a resolution of 0.25 m/px. Do you think a higher resolution image would be helpful in determining age here?

Why or why not? (What would you look for in a higher resolution image?)

PSP_009394_2565, HiRISE image located at 76.1°N 270.6°E

What are the dark features scattered across this image? Include both the formation process and the feature type, and the specific feature name in your answer.

Based on the shape of the features, which way was the wind blowing at the time these features formed? [Be sure to look at the orientation of the HiRISE image in Google Mars to help determine the direction].

PSP_010100_2165, HiRISE image located at 36.267°N 87.644°E

Describe the ejecta material surrounding the crater in the upper NW portion of the HiRISE image. How could it have formed?

Try to determine the relative age of this material and the unit in the SE portion of the HiRISE image. If you're not sure, try viewing the MOC image that covers the same area. What are the relative ages, and which geologic law (Embayment, Superposition, Cross-cutting relations) did you use to deduce this?

What does this indicate about the relative ages of the smaller crater at $36^{\circ}17' \text{ N } 87^{\circ}33' \text{ E}$ and the larger crater centered at $36^{\circ}06' \text{ N } 87^{\circ}54' \text{ E}$?

ESP_011785_1875, HiRISE image located at $7.423^{\circ}\text{N } 168.94^{\circ}\text{E}$

Draw a hypothetical cross-section view of Cerberus Fossae below, indicating the graben block as a 'G'.

What fault type is the graben bound by? What type of motion is associated with this feature?

Now, go ~1 degree north of the HiRISE image and look at the crater with a dark spot in the center. What is the source material of the dark streak emanating from this crater? (View any appropriate imagery to help answer this question).

What do you think is the local dominant wind direction? Why?

INTERPRETING REGIONS

2. Now let's interpret multiple images over a single region. In the 'Fly to' box, enter Gusev Crater. Examine the Global Visible Imagery of the region. Look at the southern part of the Gusev crater rim (you may have to zoom out a bit) – what is unique about this crater? How would you interpret this area? First describe what you see, then provide an interpretation of the geologic history of this area.

3. Now 'fly to' Athabasca Valles. First examine the global imagery (including visible, colorized, day and nighttime thermal infrared) then click on some of the higher resolution images under 'Spacecraft Imagery.' What does this feature look like to you? Be specific in your description, listing as many landforms as you can to support your interpretation.

What is the source for Athabasca Valles?

4. Now 'fly to' Solis Dorsa. Zoom out to the global view with Solis Dorsa still centered. First examine and describe the global context for Solis Dorsa. What major landforms are located to the north and to the west?

What are the geologic implications of those landforms? That is, what do those landforms imply about the tectonic and volcanic geologic history of this region?

Now focus in on Solis Dorsa (zoom back in). First describe what you see.

Then, based on your description and the regional context, provide an interpretation for the formation of these features.