

Mars for Earthlings

LESSON 1: Introduction

In-Class Activity 1

Mars Analogs

Purpose: Observe and rank potential Earth analogs for Mars planetary study.

Earth Analogs

1. What do you think scientists mean by an “earth analog” in the context of studying Mars?
2. As an example, why is the komodo dragon considered an “analog” for a dinosaur?

Analog Regions on Earth

For the following regions (may need to do a bit of internet searching) write in the most important similarities to Mars:

- Atacama Desert, South America
- Death Valley, CA
- John Day Formation, Oregon
- Southern Utah
- Antarctic Dry Valleys

NOW... Check off how important you think the following factors are in deciding whether this is a good analog to Mars (1-very important, 5-not important)

- _____ Environment conditions, setting for deposits
- _____ Geomorphic features (landscape expression)
- _____ Type of water and its presence or absence
- _____ Ambient temperature range
- _____ Mineralogy
- _____ Type of life, if present (extremophile or not)
- _____ Rainfall
- _____ Atmospheric composition

Note: it may be difficult for any Earth Analog to satisfy all the conditions of similarity to Mars



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Homework 1

Intro to Mars_MFE

Google Mars

Objective: Observe important features and “divisions” of the surface of Mars.

Introduction: This brief introduction will hone your observation skills to notice features on the surface of Mars and some of the major natural landscape features.

Getting Started

Use the web version of Google Mars <http://www.google.com/mars/>
Notice that the map wraps (repeats), so you’ll want to crop the window so it just shows 1.

Exploring Mars

This initial flat plane projection map has 3 viewing options (upper right). The standard default is _____. Here, the colors represent the scale in units of _____. The other 2 viewing options are _____ and _____.

Click on Stories. What is the name of the Martian rift zone? _____
In the left column window, click on “glossary” and review the terms. A mountain is called _____ and a low plain is called _____. A high plain is called _____.

Click on Spacecraft. Why do you think the spacecrafts were mainly in the “middle” of the planet? _____

Overall

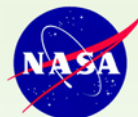
Just looking at the color patterns & textures, if you were dividing the planet into 2 parts, how would they be defined and what are their characteristics?

Location

Characteristics

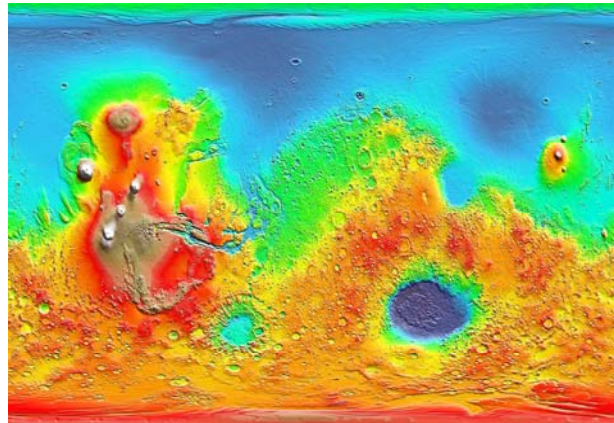
1.

2.



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Draw the boundary line between your two parts and discuss your answers with one of your classmates (as assigned) and compare thoughts.



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Homework 2

Intro to Mars_MFE

Exploring Gale Crater

Objective: To navigate, learn and utilize the tools offered within Google Mars.

Introduction: In order to accomplish this lab you will need to download Google Earth 6 (<http://www.google.com/earth/index.html>). This lab will completely utilize Mars; all answers to questions can found by using the layers provided in the program. Some questions will be straightforward; however others will require you to use your own judgment and intuition.

Intro to Google Mars

Open Google Earth. In the icon list across the top of the window, click on the planet with a single ring button with a small dropdown arrow. The dropdown menu will provide options for Sky, Mars, and Moon. Click on Mars.

Searching the Layers Bar on the left:

1. Click on the drop down arrow for Global Maps.
 - a. What map is used (checked/dotted) when Google Mars loaded (consult the Global Maps Layer)?

What do the colors refer to?
 - b. View the other Global Map types. Is there another you prefer? (Why or why not?)
2. Click on the drop down arrow for Spacecraft Imagery.
 - a. How many imaging devices are available?
 - b. What are the image devices' names and what spacecraft are they aboard (click on each)?
 - c. Which instrument/camera has the best resolution?
3. Make sure Rovers and Landers are checked before you proceed.



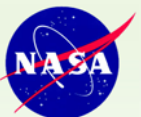
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Exploring Curiosity's Landing Site

4. Type Gale Crater into the Search Box (Curiosity's landing site on August 5th, 2012).
 - a. Is any imagery available right after it zooms in? Why or why not?
 - b. Who is the crater named for and what is his/her nationality?
 - c. What is the documented location of the crater?
 - i. Center latitude
 - ii. Center longitude
 - d. What is the diameter size of the crater?
5. Zoom out (exit street view if necessary) until the MOLA colorized elevation map comes into better resolution. You should see a swath of "I's" in the upper left corner of Gale Crater.
 - a. Find the landing site of the Curiosity Rover. It is marked with a flag icon. What was the location of its landing site (use the Google GPS coordinates)?
 - b. Click on the Flag icon. What other landing sites were considered for Curiosity?
 - c. Why do you think that the majority of landing sites are crater locations?
6. Activate the HiRISE imagery in the Spacecraft Imagery Layer (red outlined rectangles should appear).

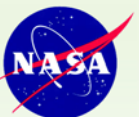
HiRISE stands for _____

 - a. Where are most of the HiRISE images taken?
 - b. Why might the majority of images be in this location?



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- c. View the HiRISE image with the small *pink square box* labeled “Grand Canyon of Gale Crater” ESP_012195_1750 (located S of the landing site, where red line box appears as you hover the mouse). Can you see the canyon? To download the image:
 - i. In the information pane click on *observation information page* in blue (link)
 - ii. This will bring up the HiRISE webpage. Scroll down to “Image Products” purple bar
 - iii. Choose JPEG → Grayscale → Map Projected
 - iv. Paste the image here as a .jpg or sketch the image. Use an arrow and point to the location of the canyon. Use the space below to explain why this might be of interest to scientists.
-
7. Go through other images and information provided by Google Mars for Gale Crater. Write a convincing argument in 3-5 sentences on why Gale Crater was chosen as the landing site for MSL Curiosity.



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Homework 3

Intro to Mars_MFE

JMARS- Mawrth Vallis "Potential landing site"

Objective: To navigate, learn and utilize the tools offered within the software JMARS.

Introduction: In order to complete this lab you need to register and download JMARS:

1. Go to webpage: <http://jmars.asu.edu/>
2. Click: Create New Account
3. Enter desired account information
4. Click: Request New Account (page should prompt you to check your email for password and further instructions)
5. Check email and click on link (or enter the link into your browser)
6. Click login and change password. The account should last 6 months.
7. Click on "Download JMARS" tab
8. Under section "JMARS Public Downloads" click "Cross-platform Java Webstart Installer"
9. Open installer: When JMARS opens you will need to enter username and password.

For information about the software and great tutorial videos, go to <https://jmars.mars.asu.edu/videotutorials>. Make sure to watch Tutorial 1 to gain a brief introduction to the layout and use of the JMARS software. Alternatively, go to the JMARS homepage and explore the options under the "Tour of the JMARS user interface" and "Tour of the JMARS Layers" panels. Have fun exploring Mars and other planetary bodies.

Intro to JMARS

Open JMARS using your email/password. JMARS functions very much like the layers in Photoshop or GIS in order to view different image sets.

8. In the Layer Window, choose and press the button "Add New Layer" in the Main tab (other tabs at this point are: MOLA Shaded Relief NE, Lat/Lon Grid).
 - a. Add the layer Nomenclature. With this layer open, you can navigate to any feature on Mars by name.
 - b. Activate/Open the Nomenclature tab. Keep all default boxes checked. Select Vallis in the *Selected Landmarks Types* menu.
 - c. In the *Navigation Menu* select Vallis for *Landmark Type* and Mawrth Vallis for *Landmark*.



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- d. Then press the *Go-To* button below. The software will automatically find and zoom to this location and label it.
 - e. What are the coordinates of Mawrth Vallis (place cursor/arrow over the red marker; the default color for the marker)?
 - f. Observe the terrain; explain why you think this area was considered as a landing site for MSL Curiosity (you may play around with the Zoom in the upper right of the viewing window, default is always 32).
9. Exploring Mawrth Vallis' relationship to other major Mars geologic/geographic features.

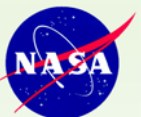
Add a new layer: Choose by Instrument → MOLA → MOLA Shaded relief/Colorized Elevation → View Graphic data. **note, if you are having trouble seeing the labels, move the Nomenclature label to the top of the layer window.

- a. How does the colorized data help you?
- b. Where is Mawrth Vallis in relationship to Vallis Marineris (you may need to using the Nomenclature tab to find Vallis Marineris)?

Do you think these features are the same? Why or why not?

- c. Where is Mawrth Vallis in relationship to the large expanse of “blue space” in the Martian Northern Hemisphere?

How could you potentially interpret the ‘blue space?’ What about Mawrth Vallis?



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10. Exploring the mineralogy of Mawrth Vallis.

There are several methods to explore the mineralogy of the Martian surface in JMARS. We will only explore one. *Note: Make sure you can see the Mawrth Vallis label. If not, drag your Nomenclature layer to the top of the Layer Window.

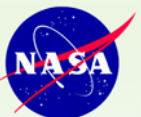
Using TES Mineral Maps: Add New Layer → Maps by Instrument → TES Mineral Map → Now select the following maps separately and explain their: spatial coverage, resolution and abundance of that mineral.

a. TES Hematite

b. TES Basalt Abundance

c. TES Carbonate Abundance (Bandfield 2002*)

* tes.asu.edu/mineral_map/bandfield_minmap.pdf



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Homework 4

Intro to Mars_MFE

Meet the Scientist-Who studies Mars?

Directions: Navigate to <http://serc.carleton.edu/marsforearthlings/index.html> and click on "Meet the Scientist". Answer the following questions:

Watch all the short clips (only 2 mins. each or less) and answer the following questions.

1. How is this group of profiled scientists DIVERSE?
2. Who are the scientists that study Mars? *Choose 5 scientists to profile.*
List the scientists' last name and the institution each scientist is associated with.
Describe the goals of their research.

	Name	Institution	Research
a.			
b.			
c.			
d.			
e.			

3. What is interesting and relevant? Choose two of your more favorite scientists from *Meet the Scientists*.

- What is the most interesting fact (or rumor) you can find when you Google their name?

	Name	Fact
a.		
b.		

- In your opinion, is their research relevant (use a scale from 1-10 with 10 being extremely relevant)? Give a brief statement to justify your answer.

	Name	Relevance
a.		
b.		

- Can their research be helpful in other fields? If so give example(s).



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Name

Helpful

a.

b.

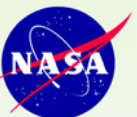
- If you were an investor/ philanthropist/ government official would you fund the scientist's research? What would you change or applaud in their research?

Name

Fact

a.

b.



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Homework 5

Intro to Mars_MFE

Having fun with Mars programs

1. Directions: Navigate to NASA's Eyes on the Solar System <http://eyes.nasa.gov/>

Explore Mars, and click on the Spacecraft icon.

Name the 3 types/categories of Mars Missions and cite the newest (most recent/current) example of each:

Mars Mission TYPE

Newest Example

- a. _____:
- b. _____:
- c. _____:

Click on the Landing Sites icon (top bar on right). Which landing site was closest to the N Pole of Mars? _____

Explore several other planets. Which of the other Non-Mars planets did you personally find most interesting? _____

Explain why, what was interesting to you?:

Note: You can look at the planet in all kinds of orientations.

2. Directions: Navigate to NASA Spacecraft 3D (may work best on mobile, available in app store free download). You may want to use the Augmented Reality target.

Take a picture of you and the Curiosity rover and email to your instructor

