Mars for Earthlings

LESSON 12: Surface Water

In-Class Activity 1

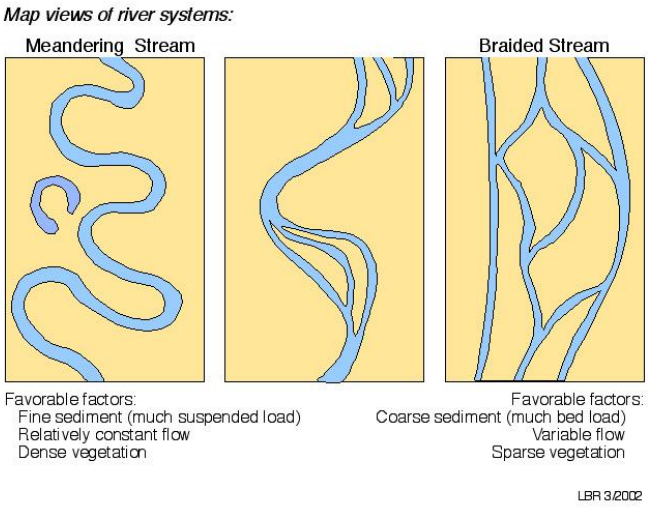
Carving Mars: Rivers

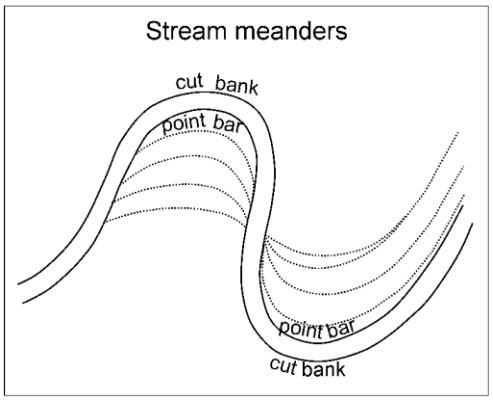
Purpose: Observe the formation of fluvial channels, the effects associated with varying water velocity and changing base-level/gradient, and the evidence for fluvial/alluvial environments on Mars.

Materials Needed: Internet connection and 3D glasses

Terms to understand:

- Cut bank
- Point Bar
- Meandering vs. braided (channel gradient, sediment input)





Source: http://www.gly.uga.edu/railsback/1121Lxr28.html, http://commons.wvc.edu/rdawes/G101OCL/Basics/streams.html

Why do waters "rage"?

Watch the following video: https://www.youtube.com/watch?v=E6sWiPAu708

As you watch the video, answer the following:

a. Where is the river fastest?

b. Where do sandbars form?

c. Why does the river form sinuous bends?

Watching a stream form:
Observe the Davidson Geology department's stream table experiment:
http://www.youtube.com/watch?v=YsQ7hW2fAEs&feature=related

1. Sketch each of the following as you observe it and list a time stamp for each. You may need to watch the video several times (use a separate sheet if necessary).
   a. Formation of a cut bank

   b. Formation of a point bar

   c. Stream avulsion

   d. Formation of multiple channels

2. For each of the sketches, describe why you think it occurred:
   a. Cut bank

   b. Point bar

   c. Stream avulsion

   d. Multiple channels

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Seeing Mars stream in Red-Blue?

Explore the HiRISE anaglyph image of the Eberswalde region of Mars using red-blue glasses (blue filter over right eye):
http://hirise.lpl.arizona.edu/images/2007/details/cut/Eberswalde-delta-3x.jpg

1. Are any of your stream table sketches similar to what you observe on Mars? Which one(s), if any?

2. Explain how this surface geomorphology on Mars might have formed.

Mars Rivers?

Access the following Mars Global map produced by MOLA via Google:
http://www.google.com/mars/

1. Consider the landscape of Mars. In what regions could water have flowed as braided channels?

2. Would meandering or braided fluvial styles be more common on Mars? Does this differ from Earth? If so, how?

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Just checking….

In reference to Figure 1, answer the following:

a. Where would it be safe to build a house (draw at least 2 arrows to areas in the photo where you would feel comfortable building a house)?
b. Where is deposition occurring? What about erosion?

With reference to the "scars":

c. What does this tell you about the meanders?

d. Can you discern which meanders are older and which are younger?

e. Do you observe similar geomorphology on Mars?

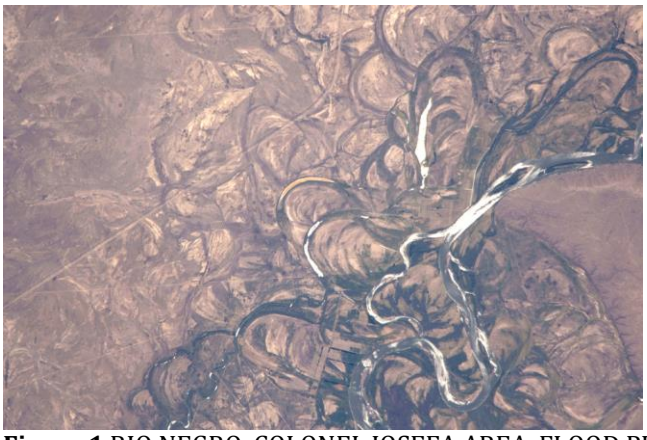

Figure 1 RIO NEGRO, COLONEL JOSEFA AREA, FLOOD PLAIN
Center Point Latitude: -39.8 Center Point Longitude: -65.4
(Image Source: ftp://eol.jsc.nasa.gov/EFS_highres_ISS022_ISS022-E-19513.JPG. ISS/NASA)

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In-Class Activity 2
Surface Water_MFE
Eberswalde Delta Mars

Purpose: Become acquainted with deltas on Earth and apply the principles of delta-formation to Mars images.

Do you know what a delta is?
Compare and contrast the images provided by your instructor (or see the *Image File* for the Surface Water module online). Which image is of a delta? Why?

Delta Search on Earth

1. Explore other deltas on Earth via Google Image search or a similar method (Hint: search major coastal river systems). Which delta on Earth is most similar to Eberswalde Delta on Mars? Are any a good match? Why or why not?

Deltas on Mars?
View the following video from NASA.gov- click on the "+ View Video" link in blue:
http://www.nasa.gov/multimedia/imagegallery/image_feature_98.html

1. List the evidence cited by scientists that this is a delta on Mars.

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2. Using the below grid, compare and contrast the Martian delta and Earth's Mississippi River delta.

Delta	**Overall Geometry**	**Into what body of water/fluid does/did it empty? Evidence?**
Eberswalde Delta, Mars		
Mississippi River, Earth		

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Homework 1
Surface Water_MFE
Mars Fluvial Channels: Contour Maps

Purpose: Become familiar with contour maps and learn how to read them. Observe fluvial incised-channels on a contour map of Earth and compare to a contour map of Mars, and make predictions of potential fluvial activity on Mars.

Preparation:

1. If not uploaded to your Google Earth application, load the USGS topographic maps layer to Google Earth using the following website and link: http://www.gelib.com/ng-topo.htm
2. Open the Mars contour map found here: http://pubs.usgs.gov/imap/i2782/i2782_sh2.pdf

Directions/Questions:
Earth Fluvial Channels

1. Open Google Earth:
    a. To get your bearings on Earth, center your map/viewer on the following coordinates:38°27'N, 109°41'W, near Pyramid Butte, UT.

    b. What is the major river in the area?

    c. Find Dripping Spring (southeast of Pyramid Butte). What is the flow direction from Dripping Spring to the nearby major river?

    How do the contour lines indicate the flow direction? Sketch an example below of what the contour lines look like in relationship to the stream:

    d. If you were to hike from Pyramid Butte to the nearby campground in the northeast, would you be hiking uphill or downhill? Explain your reasoning.

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e. Follow the meanders of the major river channel. How are the contours drawn near the river? Do they follow the river? Cross the river? Explain the reason why the contours are drawn that way.

f. Using the ruler tool, estimate the distance in miles from Pyramid Butte to Musselman Arch to the southwest.

g. Zoom in on the Goosenecks of the major river. Zoom in enough to see the annotated hand-drawn sand bars of the river. Explain the origin of the sand bars and whether or not you could hike out of the Goosenecks easily.

h. Is the white area where the words "Goosenecks" are written an area of relief or a depression? Explain your reasoning.

Mars Fluvial Channels

2. Using the Mars contour map, find Valles Marineris. Look northeast of Valles Marineris, around the 330E/30W longitude line and the Martian equator.
   a. What features stand out/are enhanced by the contour data (mountains, rivers, craters etc.)?

   b. Are there any areas that are similar to a fluvial channel? If so, screen capture an image and paste here or sketch what you see as evidence of a fluvial channel.