

Lab – Surface Age Dating Using Impact Crater Statistics

Mars Reconnaissance Orbiter CTX Image P03_002050_1813_XN_01N079W
Echus Chasma, 280.4E, 0.3S (5.34 m/pixel)

http://earthweb.ess.washington.edu/ess-306/labs/lab3/Echus_Chasma_Crater_Image.gif

Opening JMARS, Navigating to Echus Chasma and Loading the CTX image

- a. Double-click the JMARS icon on your desktop to open JMARS.
- b. Enter your JMARS user name and password. If you do not have a user name and password, follow the instruction under the appropriate "Getting Started" link on the [Main Page](#).
 - At this point, the Layer Manager should only have the MOLA Shaded Relief Layer and the Lat/Lon Layer loaded.
- c. In the Lon/Lat box in the upper-left corner of the Viewing Window, enter the coordinates corresponding to the Echus Chasma CTX image "280.4E, -0.3"
 - The Main View should now be centered over Echus Chasma.
- d. Set Zoom level to 64 if it isn't already (units here are pixels per degree latitude)
- e. In the Layer Manager, click "Add New Layer" -> select category "Imagery", then under the "Image Sets" list select CTX
- f. In the window that pops up type in the image ID# ("P03_...", see above), then click "Okay"
- g. A blue rectangular outline should appear – this indicates the boundaries of this particular CTX image, and is called a "stamp". The image itself is not visible – to see the image data we have to "render" it.
- h. To render an image, right click in the stamp, select "View Projected CTX Stamps", select the particular stamp (here there's only one), then click "Render PROJECTED_CTX"
- i. While it's rendering (downloading data from the ASU JMars server) the colored square in the Layer Manager corresponding to this layer will turn red or yellow to indicate it's working on it, then turns green when it's done.
- j. To see the image detail, change the Zoom level to 2048. At this resolution, you can clearly see that CTX images have much higher resolution than the background MOLA Shaded Relief Map.
- k. **QUESTIONS:**
 - What is the resolution of the MOLA Shaded Relief Map, in meters/pixel? To find out, you can double-click the MOLA layer in the layer manager and it will tell you what it is in units of degrees per pixel. The distance corresponding to one degree of latitude on Mars is about 60km, so you can do the math.
 - What is the distance corresponding to a degree of latitude on Earth?
 - What is the distance corresponding to a degree of longitude at 45 degrees North latitude on Earth? (approx. Seattle's latitude)
 - What is the resolution of the CTX image, in meters/pixel? Hint: Right click on the image and follow the same sequence you did above to render it, but select "Web browse..." instead.
 - What Zoom level would you have to use in order to start seeing the individual pixels of the CTX image?

Opening the Shape Layer and Loading a Shape File

- a. Go to the ESS 306 web page, click on the Labs link, and Lab2. Download the file called "Lab3CCA.gml" and save it on your computer (maybe in D:/Temp?)
- b. In the Layer Manager, click "Add New Layer" -> Select Category "Home" => "Custom Shape"

Layer", then double-click on the "Custom Shape" layer in the layer manager to access the focus panel, then click on Dock Me at the bottom.

- a. At the top of the Shape Layer focus panel, click on "File" -> "Load File", select the shape file you just downloaded, select the corresponding File Type ("GML Files") and click "Load".
- b. In the "Files" section of the focus panel, click on the name of the shape file you just loaded. This will display the features in the shape file in the "Features" section of the focus panel.
- c. If it looks like a solid red square, select "Feature" in the Shape layer panel, then "Edit Styles", then by the "Fill Color" setting click on the "Color" box and adjust the transparency slider at the top to make it 0% Opaque (i.e. transparent). Then click Save.
- d. If you can't see the whole shape outline, then Zoom out one step, then right-click in the center of the shape and select "Recenter Window". Now zoom in as far as you can and still see the entire shape. (I recommend making this JMars frame as big as possible on your monitor.

----Steve will have to guide you from here....

To properly date the surface, it is necessary to count craters within specific size ranges. Use the following crater diameter size bins (you'll have to translate each size into number of pixels):

16-23 m
23-31
31-45
45-63
63-90
90-125
125-180
180-250

Count all of the craters in each size range by marking them with colored circles, using a different color for each size. Plot the crater density in each size bin on the graph on the next page..

Procedure:

- Start with the **largest** crater size (180-250 m).
- In the Layering menu, select "New Layer", then change its name (e.g. "180-250")
- Click on Pencil tool, then in Brush Editor window, right click on any black circle "brush" and select "New Brush"
- Change Hardness to 1
- Change brush name ("180m")
- Set radius to number of pixels corresponding to half the diameter of the minimum crater size in the range of interest
- To create other brushes for each crater size range, right click on the brush you created then select "Duplicate Brush", then change the name and radius values accordingly
- Select the corresponding layer in the Layer window, and the corresponding brush circle
- Click on the Foreground color box (black rectangle partly covering white rectangle in Toolbox window) then select a color
- Move the brush outline over each crater. If the crater is larger than the brush outline, click on the spot and fill it in with color so that you know that it has been counted..

As you move to smaller crater sizes, you can pick subsets of the image – just remember to calculate the area coverage properly! Remember that you have to divide by the total area of the image (in km^2 – not m^2 !). The image size is 2000 x 2000 pixels

How old is this surface? Do the crater frequency bins fall close to a single isochron?

What are some possible complicating factors in your analysis of this particular image?

Locate this area on a regional or global map of Mars. What geologic event do you think this surface age represents?

