Rampart Craters

Team Mu

Introduction

Science Question:

Can Rampart Crater ratios be used to determine differences in Rampart Crater sizes found at different Northern latitude bands? (90N – 80N, 80N – 70N, 70N – 60N, 60N – 50N)

Introduction

Question Importance:

Our question can help the people of earth determine the amount of ice located underneath Mar's surface around the north pole.

Introduction

Main Hypothesis:

Rampart Crater ratios can be used to determine differences in Rampart Crater sizes found at different Northern latitude bands. More ice will be found in the area located at 50N – 60N.

Alternate Hypothesis:

Rampart Crater ratios can't be used to determine differences in Rampart Crater sizes found at different Northern latitude bands. More ice will be found in the area located at 80N – 90N.

Definitions

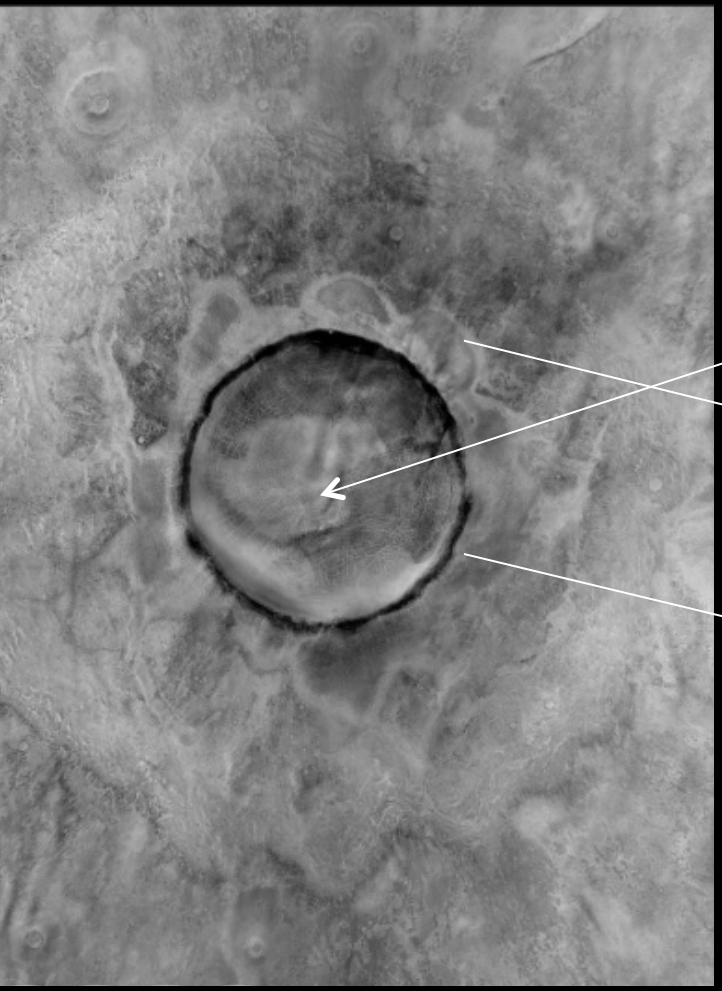
Terms:

Rampart Crater – A specific type of crater which accompanied by distinctive fluidized ejecta.

Lobate Ejecta - Formed when meteor makes impact with water/ice beneath the surface causing it to look like its flowing away from the crater, like dropping ball into a pile of mud.

Ratio – The diameter of the rampart crater divided by the length of the ejecta.

Background



Rampart Crater

Lobate
Ejecta

Raised Rim

Image ID:
P17_007543_2508_70N302W

Background

Ramparts Craters-are formed when the meteor strikes, it hits ice/water causing Lobate Ejecta. Lobate Ejecta looks as if its flowing away from the crater.

Mars Image of Rampart Crater

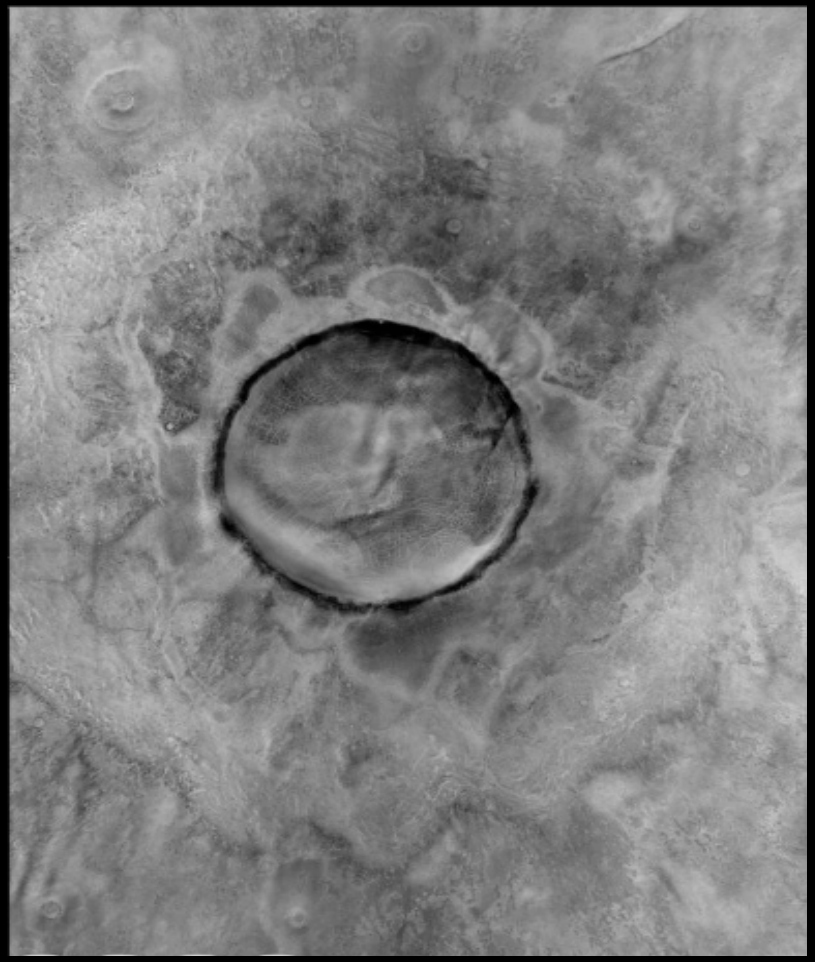


Image ID: P17_007543_2508_70N302W

Earth's Image of a "Rampart Crater"

http://ti.arc.nasa.gov

Background

"We find that only a few basic physical processes are necessary to form sharp distal ramparts. First, there must be sufficient material to form a continuum overland flow. Then, for simple choices of boundary conditions at the source of the flow, distal ramparts form naturally due to the cylindrical geometry, the inertia of the flow, and local frictional resistance."

- Baloga(2005)

Image Locations (90N – 80N)

Image ID #	Longitude	Latitude
B21_017647_2604_XN_80N051W	308.83	80.42
G16_024398_2621_XN_82N045W	314.22	82.13
B20_017588_2614_XN_81N242W	117.32	81.45
P01_001460_2625_XI_82N202W	157.64	82.34
P01_001427_2787_XI_81N170W	189.92	81.39
B21_017794_2613_XN_81N105W	254.57	81.31
P18_007929_2617_XN_81N054W	305.34	81.74
P18_007937_2624_XN_82N275W	84.75	82.44
P13_006142_2592_XN_79N216W	143.66	80.25
P21_009228_2620_XI_82N246W	113.61	82.01

Image Locations (80N – 70N)

Image ID #	Longitude	Latitude
B02_010449_2565_XN_76N094W	265.22	76.57
B21_017754_2563_XI_76N089W	270.54	76.3
B17_016448_2555_XN_75N071W	289.05	75.55
B19_017213_2529_XN_72N074W	285.36	72.94
B19_016852_2537_XN_73N298W	62.09	73.78
P20_008874_2521_XI_72N292W	67.99	72.16
P17_007594_2545_XI_74N257W	102.22	74.52
B01_010203_2601_XN_80N221W	138.31	79.2
P16_007157_2512_XN_71N202W	157.35	71.28
B22_018326_2529_XN_72N221W	138.37	72.99

Image Locations (70N – 60N)

Image ID #	Longitude	Latitude
P20_008925_2475_XN_67N239W	120.11	67.57
B20_017335_2407_XN_60N160W	199.24	60.81
P15_007037_2406_XN_60N162W	197.76	60.59
P16_007406_2481_XN_68N160W	199.35	68.18
B20_017622_2435_XN_63N076W	283.14	63.59
P17_007732_2434_XN_63N060W	299.17	63.48
G01_018701_2471_XN_67N016W	343.73	67.15
B18_016496_2473_XN_67N297W	63	67.32
B19_016865_2413_XN_61N288W	71.23	61.39
B21_017668_2460_XN_66N254W	105.16	66.09

Image Locations (60N – 50N)

Image ID #	Longitude	Latitude
B22_018346_2387_XN_58N042W	317.47	58.73
B18_016801_2372_XN_57N340W	19.44	57.29
B18_016721_2302_XI_50N314W	45.23	50.23
P19_008637_2299_XI_49N290W	69.43	49.93
B19_017142_2352_XN_55N290W	69.96	55.22
P17_007582_2342_XN_54N283W	76.67	54.26
P18_007885_2350_XN_55N276W	83.42	55.03
B20_017563_2372_XN_57N264W	95.7	57.3
G04_019645_2359_XN_55N226W	133.77	55.92
B18_016822_2378_XN_57N193W	166.24	57.82

Experimental Design

Procedures for Adding Layers

1. Go to Add New Layer, click maps by instrument, then MOLA and click MOLA Shaded Relief/ Colorized Elevation to get a colored view of mars. The limitation is that it isn't clear when its zoomed in.

2. Go to Add New Layer, click maps by instrument, then MOLA and click MOLA 128ppd Elevation, then click plot numeric data to measure the diameter of the Crater and the length of the rampart in Km. The limitation is that measurements aren't perfectly exact.

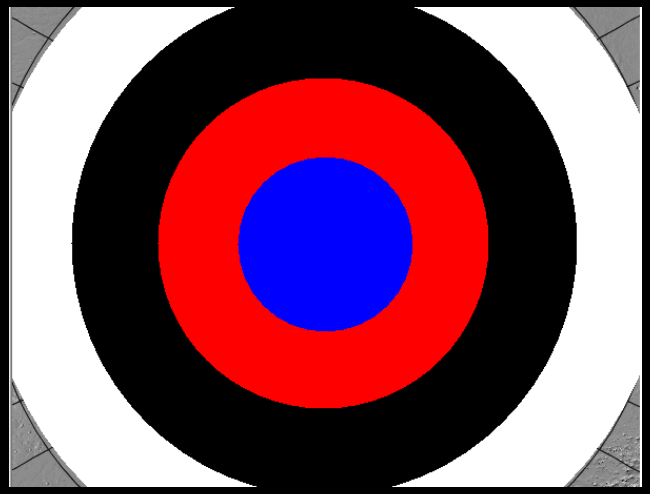
3. Go to Add New Layer, click stamps, and select Projected CTX stamps. The limitation is that one image doesn't show the whole feature.

4. Go to Add New Layer and click Crater Counting. This will help you mark all the craters and help you get an estimate on how big it is. The limitation is that it doesn't measure precise.

5. Use http://viewer.mars.asu.edu/#start to get more info on an image such as central lat. & long. By right clicking on an image, clicking on the THEMIS/CTX image you want and click web browse.

Experimental Design

Procedures for Finding Location



Color Coated Map:
Blue = 90N – 80N
Red = 80N – 70N
Black = 70N – 60N
White = 60N – 50N

1. Open up the CTX Stamp and locate CTX images within a specific area by typing in the latitude north box and putting 50 and 90.

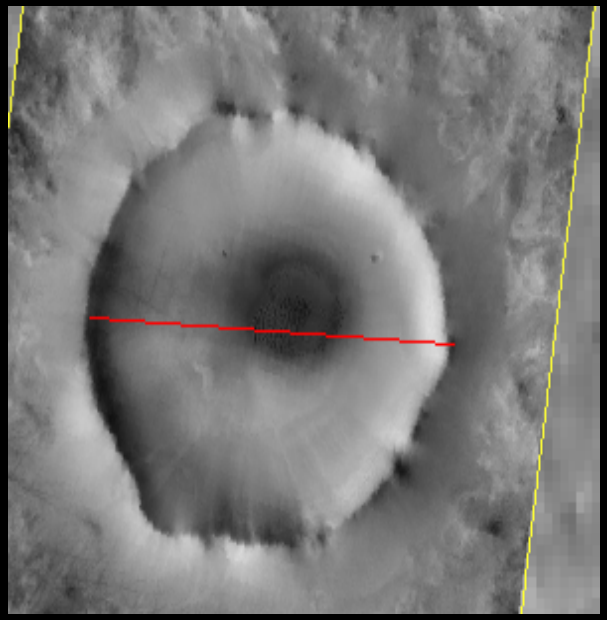
2. Find craters all around this marked area to be open minded to all of the area surrounding the North Pole of Mars and to not be biased.

3. After finding craters, use the CTX Stamp and render an image that will show your feature and record the ID #.

4. Record the central longitude and latitude for each image also.

Experimental Design

Procedures for Measuring

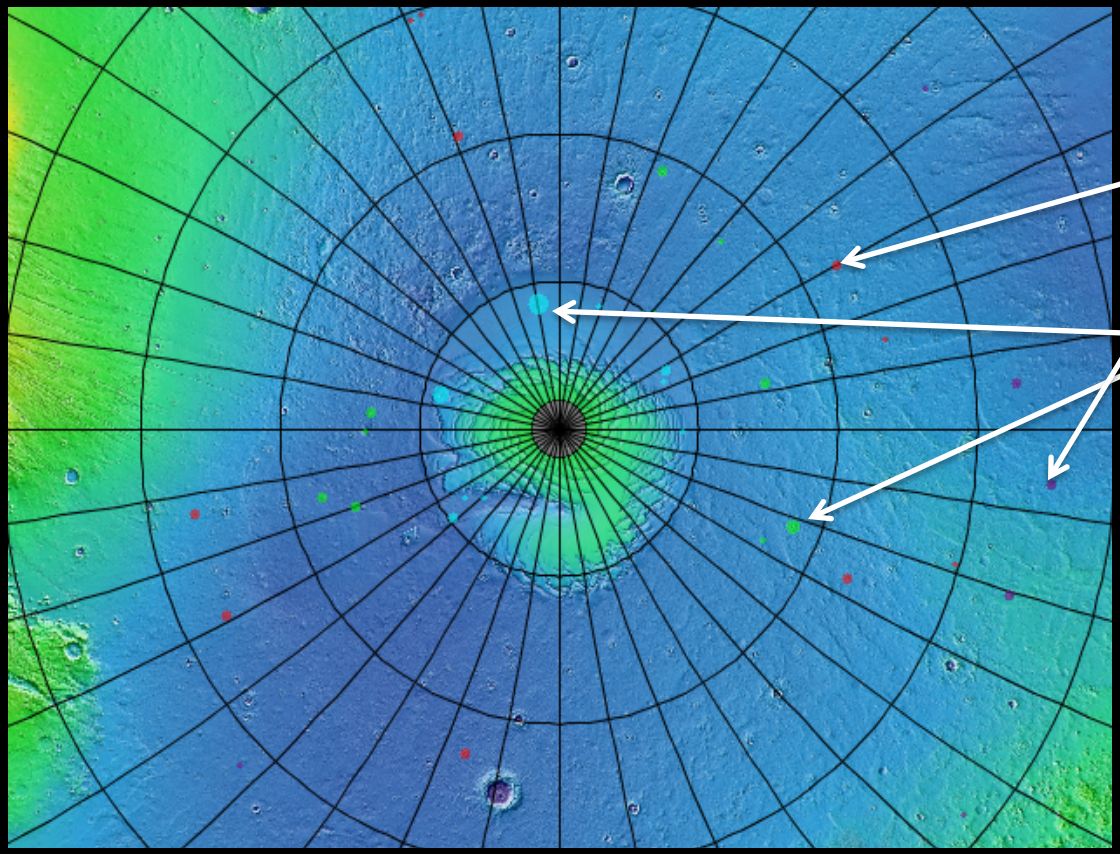


(What measuring looks like)

1. Find a rampart crater in the latitude of your area within 90N to 50N using the CTX stamps.
2. Open the crater counting tab and mark all rampart crater to its appropriate size.
3. Use the MOLA 128ppd Elevation to measure the diameter of the crater and the length of the rampart in Km.
4. Click at one end of the crater and double click at the other end to get your measurement in Km.
5. Repeat step 4 but measure the rampart in Km.
6. Record the two measurements in a data table and make sure to divide the two numbers and record a ratio also.
7. You will be looking for 10 different rampart crater images and measuring each in 4 different places from 90N-80N,80N-70N, 70N-60N, and 60N-50N with a total of 40 images.

- The name of the space craft is called Mars Reconnaissance Orbiter. The camera name is CTX which stands for Content Imager.

Analysis Plan



50N – 60N

60N – 70N

70N – 80N

80N – 90 N

Each Rampart Crater that was used to identify the hypothesis has been color-coted to its corresponding latitude band.

Data (90N – 80N)

Image ID #	Crater Diameter (Km)	Rampart Diameter (Km)	Ratio
B21_017647_2604_XN_80N051W	4.2	7.0	1.7
G16_024398_2621_XN_82N045W	5.9	8.9	1.5
B20_017588_2614_XN_81N242W	6.2	7.4	1.2
P01_001460_2625_XI_82N202W	8.3	10.0	1.2
P01_001427_2787_XI_81N170W	8.4	12.6	1.5
B21_017794_2613_XN_81N105W	9.1	9.7	1.1
P18_007929_2617_XN_81N054W	9.7	14.6	1.5
P18_007937_2624_XN_82N275W	10.5	15.6	1.5
P13_006142_2592_XN_79N216W	18	31.2	1.7
P21_009228_2620_XI_82N246W	18.3	22.4	1.2

Data (80N – 70N)

Image ID #	Crater Diameter (Km)	Rampart Diameter (Km)	Ratio
B02_010449_2565_XN_76N094W	6.5	9.8	1.5
B21_017754_2563_XI_76N089W	6.7	8.6	1.3
B17_016448_2555_XN_75N071W	6.9	9.3	1.3
B19_017213_2529_XN_72N074W	7.1	10.8	1.5
B19_016852_2537_XN_73N298W	8.7	13.1	1.5
P20_008874_2521_XI_72N292W	8.9	12.6	1.4
P17_007594_2545_XI_74N257W	10.5	18.4	1.8
B01_010203_2601_XN_80N221W	12.1	18.4	1.5
P16_007157_2512_XN_71N202W	12.7	18.3	1.4
B22_018326_2529_XN_72N221W	17.6	24.3	1.4

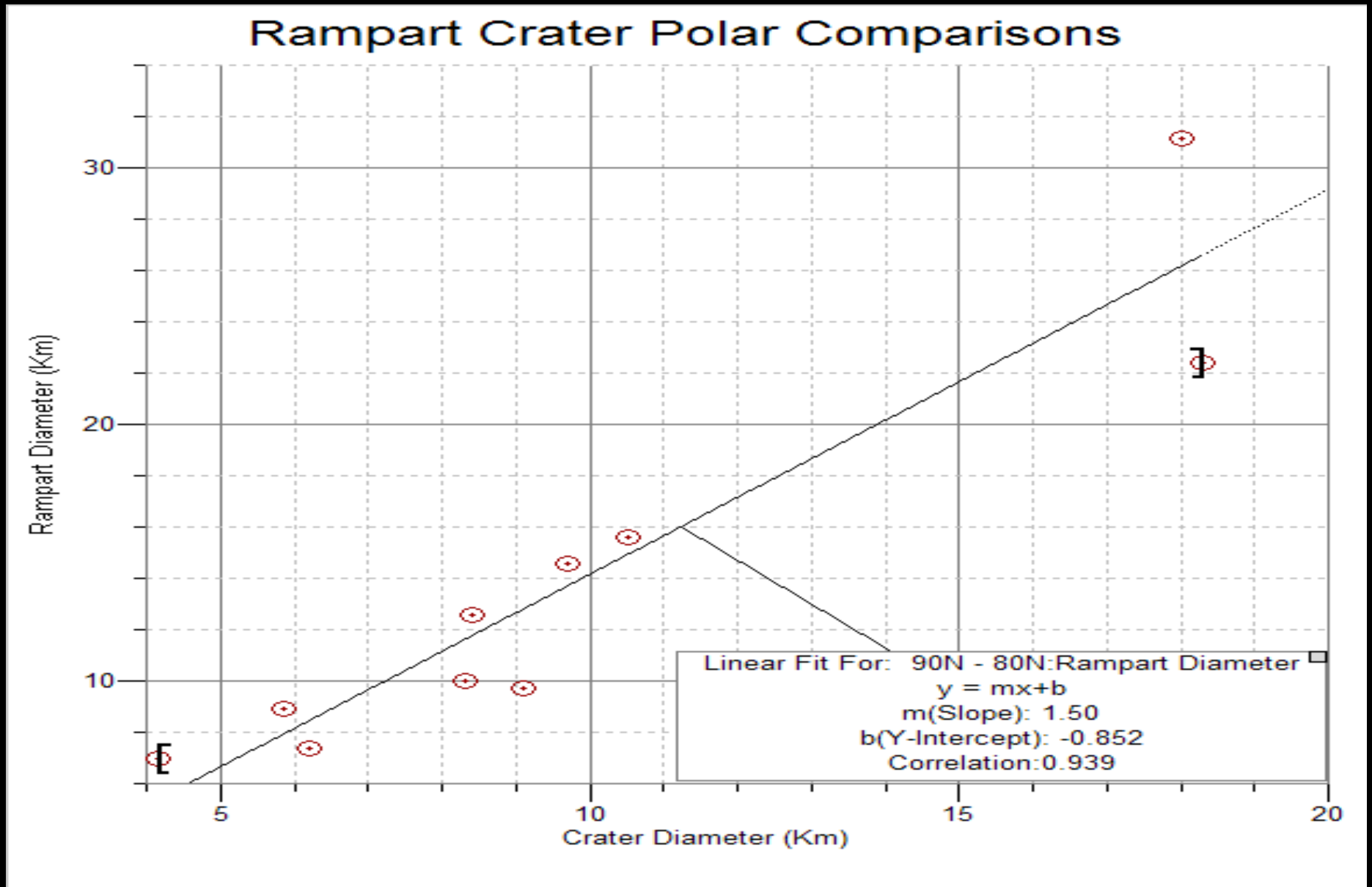
Data (70N – 60N)

Image ID #	Crater Diameter (Km)	Rampart Diameter (Km)	Ratio
P20_008925_2475_XN_67N239W	3.5	6	1.7
B20_017335_2407_XN_60N160W	5.6	8.9	1.6
P15_007037_2406_XN_60N162W	7.4	12.3	1.7
P16_007406_2481_XN_68N160W	7.9	9.1	1.2
B20_017622_2435_XN_63N076W	8.2	9.8	1.2
P17_007732_2434_XN_63N060W	8.8	10.4	1.2
G01_018701_2471_XN_67N016W	9.7	15.6	1.6
B18_016496_2473_XN_67N297W	9.7	14.9	1.5
B19_016865_2413_XN_61N288W	10.7	14.4	1.3
B21_017668_2460_XN_66N254W	11.7	16.3	1.4

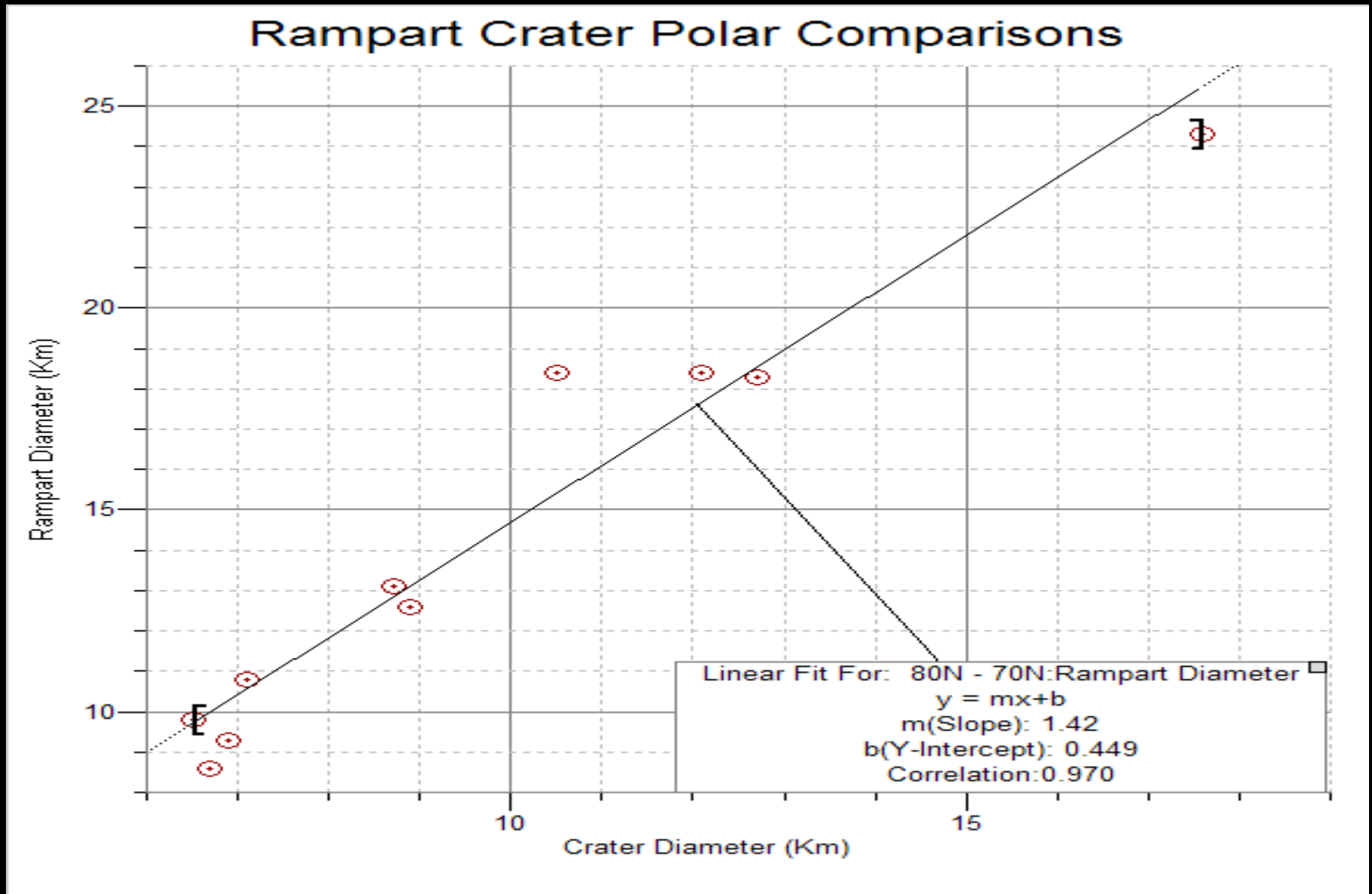
Data (60N – 50N)

Image ID #	Crater Diameter (Km)	Rampart Diameter (Km)	Ratio
B22_018346_2387_XN_58N042W	4.8	6.4	1.3
B18_016801_2372_XN_57N340W	5.1	9.4	1.8
B18_016721_2302_XI_50N314W	5.9	10.2	1.7
P19_008637_2299_XI_49N290W	7.6	13.4	1.8
B19_017142_2352_XN_55N290W	7.9	13.9	1.8
P17_007582_2342_XN_54N283W	8.4	14.3	1.7
P18_007885_2350_XN_55N276W	9.3	15.1	1.6
B20_017563_2372_XN_57N264W	9.7	15.6	1.6
G04_019645_2359_XN_55N226W	10.2	15.7	1.5
B18_016822_2378_XN_57N193W	11.6	16.2	1.4

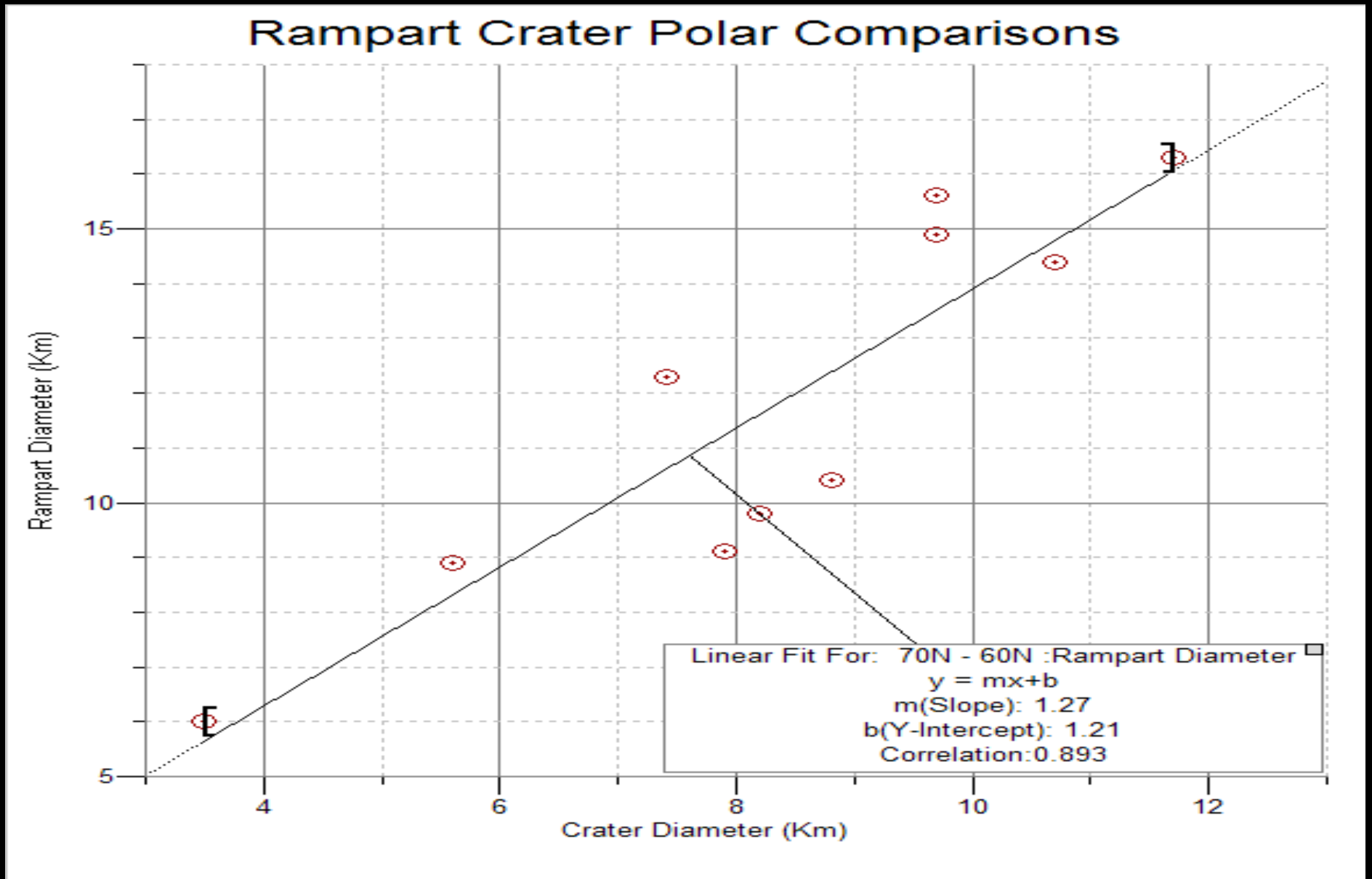
Analysis Plan



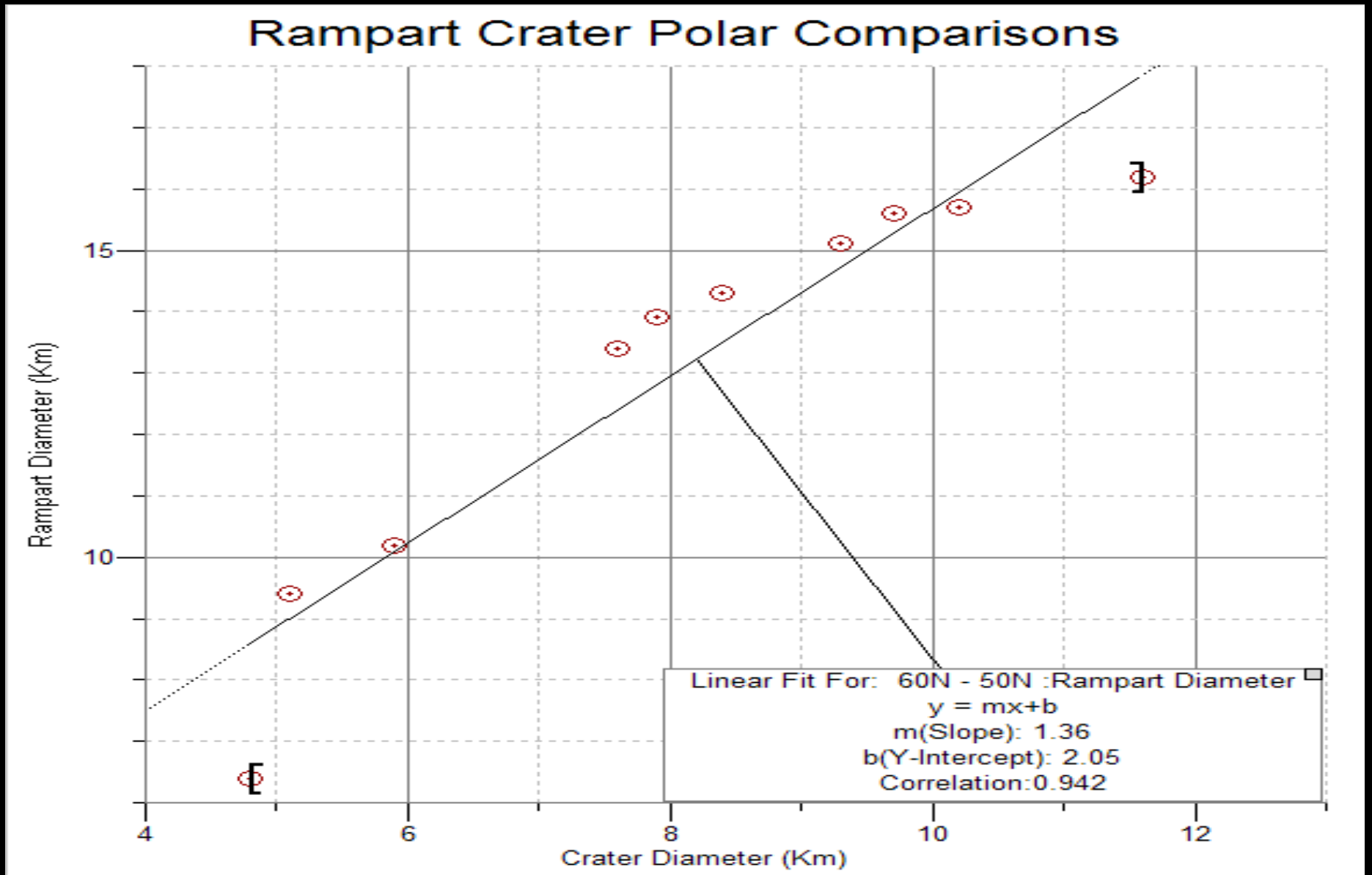
Analysis Plan



Analysis Plan



Analysis Plan



Analysis Plan

90N – 80N

Correlation = 0.939

Slope/ Ratio = 1.5

80N – 70N

Correlation = 0.97

Slope/Ratio = 1.42

70N – 60N

Correlation = 0.893

Slope/Ratio = 1.27

60N – 50N

Correlation = 0.942

Slope/Ratio = 1.36

Conclusion

Science Question:

Can Rampart craters ratings be used to determine differences in Rampart craters sizes found at different northern latitude lands

Conclusion

Hypothesis:

Rampart Crater ratios can be used to *determine* differences in Rampart Crater sizes found at different Northern latitude bands.

Supported or Not?

Our hypothesis was not supported.

- Slope numbers had an insignificant increase as we got closer to the north pole.
- One latitude band even had a slight decrease.

Analysis Plan

90N – 80N

Correlation = 0.939

Slope/ Ratio = 1.5

80N – 70N

Correlation = 0.97

Slope/Ratio = 1.42

70N – 60N

Correlation = 0.893

Slope/Ratio = 1.27

60N – 50N

Correlation = 0.942

Slope/Ratio = 1.36

Future Research

To go into further research, we would compare Rampart Crater Ratios in similar latitude bands between the North & South Poles of Mars to see a more significant area of Mars.

Another option would be to use the IR Camera to capture more Rampart Craters due to the fact that rampart craters stand out better through the camera.

References

- Christensen, P.R.; Engle, E.; Anwar, S.; Dickenshied, S.; Noss, D.; Gorelick, N.; Weiss-Malik, M.; JMARS – A Planetary GIS,

- NASA/JPL-Caltech/Arizona State University

- Baloga, S. M., S. A. Fagents, and P. J. Mouginis-Mark (2005), Emplacement of Martian rampart crater deposits, J. Geophys. Res., 110, E10001, doi:10.1029/2004JE002338.