



Using Boulder Diameter-Crater Diameter Ratios to Differentiate Primary from Secondary Craters on the Lunar Surface



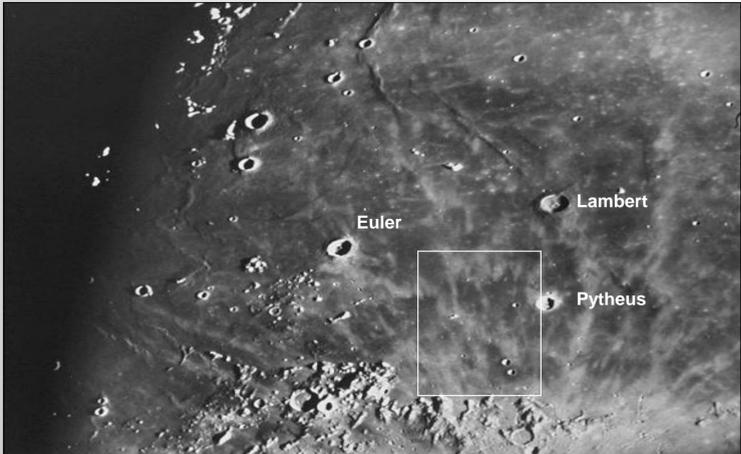
ADAMS, Hannah, FESS, Ally, HEARN, Richie, CARROLL, Cody, SNYDER, Richard D.
 Kickapoo High School, 3710 S. Jefferson Ave, Springfield, MO 65807

Introduction

Relative dating of the lunar surface enables scientists to have a better understanding of our solar system and the evolution of the moon. However, the process of relative dating is often skewed by the presence of secondary craters. When using the dating method of crater counting, a surface may appear older than it truly is because of the presence of these secondary craters. The purpose of our research was to provide a means to differentiate primary from secondary craters on the lunar surface in an effort to improve this dating method.

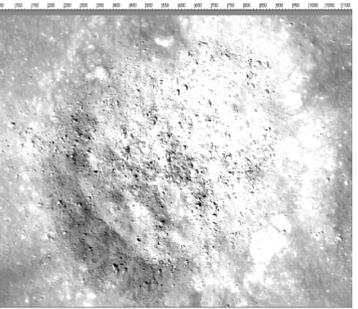
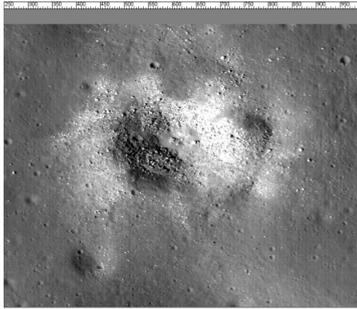
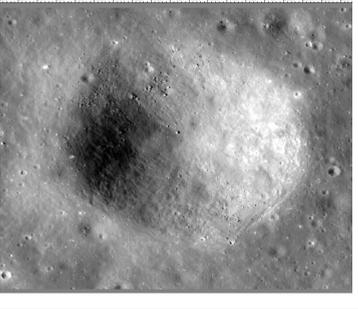
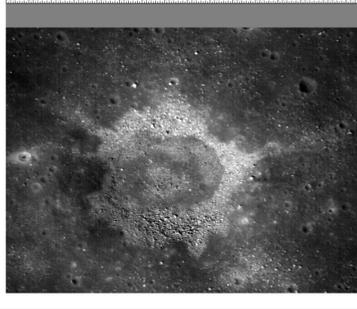
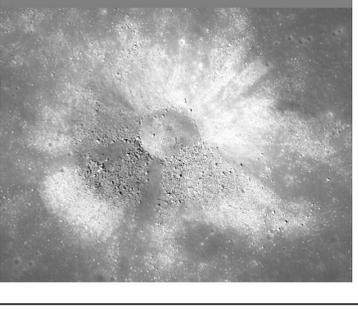
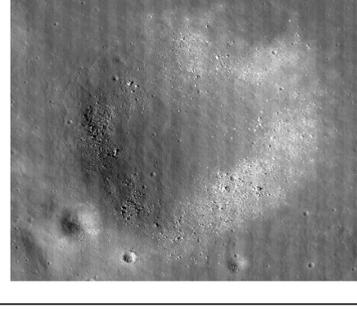
High-resolution images of sixteen craters of varying size located in the southeast Mare Imbrium region were obtained using the Lunar Reconnaissance Orbiter Camera (LROC) Narrow Angle camera (NAC). We used accepted methods of differentiation to preliminarily distinguish primary from secondary craters, including crater eccentricity and orientation of ejecta rays. We then used a method of measuring the diameters of craters and the diameters of their subsequent boulders. A ratio was used to compare crater diameter to boulder diameter. A pattern developed and a distinction could be made using this ratio to differentiate primary from secondary craters. This analysis was consistent with the accepted methods of distinction we had preliminarily used.

Study Area: Southeastern Mare Imbrium



Between latitudes: 10°N-30°N and longitudes: 20°W-40°W

Research and Data

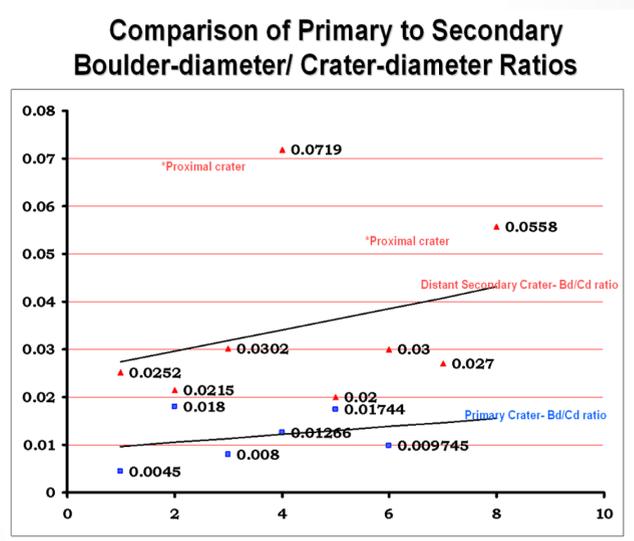
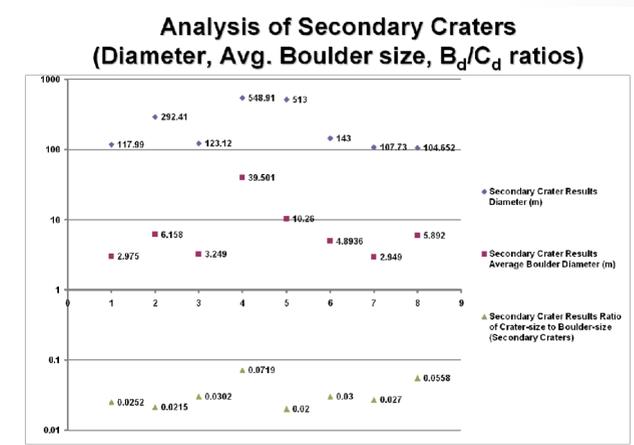
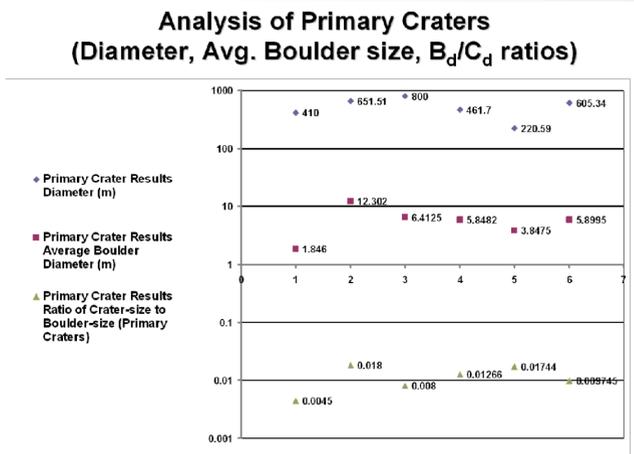
Primary Craters	Secondary Craters
 M142394256LE	 M144870473LE
 M144857093RE	 M142421418LE
 M142421418LE	 M144856909LE

Primary Crater Statistics

Primary Crater Results			
Image Number	Diameter (m)	Average Boulder Diameter (m)	Ratio of B_d/C_d
M142394256LE	410	1.846	0.0045
M142421418LE (1)	651.51	12.302	0.018
M144856909LE (2)	800	6.4125	0.008
M144870473LE (1)	461.7	5.8482	0.01266
M144870473LE (3)	220.59	3.8475	0.01744
M144857093RE	605.34	5.8995	0.009745

Secondary Crater Statistics

Secondary Crater Results			
Image Number	Diameter (m)	Average Boulder Diameter (m)	Ratio of B_d/C_d
M137699035LE (1)	117.99	2.975	0.0252
M137699035LE (2)	292.41	6.158	0.0215
M142421418LE (2)	123.12	3.249	0.0302
M144856909LE (1)	548.91	39.501	0.0719
M144856909LE (2)	513	10.26	0.02
M144870473LE (2)	143	4.8936	0.03
M144857093LE (1)	107.73	2.949	0.027
M144857093RE	104.652	5.892	0.0558



Conclusions

Secondary craters, due to the trajectory angles from the primary impact site, demonstrate a more eccentric shape than primary craters.

No correlation was observed between secondary craters and the length of their asymmetrical ejecta rays distributed unevenly around the crater rim.

Boulders of secondary craters are unevenly distributed and oriented downrange of the impact trajectory (although all boulders used for this study were within the crater rim or within 60m outside of downrange rim).

Secondary craters demonstrate a larger boulder-diameter: crater-diameter ratio (>0.02) than primary craters.

References

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