

LCROSS: IMPLICATIONS FOR A LUNAR CATAclysm. G. D. Bart¹, A. Colaprete², ¹Dept. of Physics, Univ. of Idaho, Moscow, ID (USA), (gwen@barnesos.net), ²NASA Ames Research Center, M/S 245-3, Moffett Field, CA 94035.

Introduction: The evolution of the early solar system was dominated by impacts. The rate at which these impacts occurred over the first billion years of solar system history is not yet entirely understood. One possibility is that the number of impacts simply tapered off slowly with time. However, evidence from both returned Apollo samples [1], and from found lunar meteorite samples [2] indicate that there was also a brief but intense period of bombardment about 3.9 billion years ago. Several unknowns remain regarding this lunar cataclysm. For instance, what was the source of the impactors? Were they asteroids or comets? What perturbed their orbits to produce this cataclysm? In this abstract we first introduce the LCROSS mission, and then discuss some ways that the LCROSS data may be able to help answer some questions about the lunar cataclysm.

LCROSS:

Lunar CRater Observation and Sensing Satellite (LCROSS), will be launched on the same rocket as the Lunar Reconnaissance Orbiter (LRO) later this year (<http://lcross.arc.nasa.gov>). The primary LCROSS objective is to confirm the presence or absence of water ice in a permanently shadowed region on the Moon. Other related objectives include identifying the form and state of hydrogen observed at the lunar poles; quantifying (if present) the amount of water in the lunar regolith, with respect to hydrogen concentrations; and characterizing the lunar regolith within a permanently shadowed crater on the Moon. The presence of the water ice is hypothesized [3, 4] and supported by data from the Lunar Prospector neutron spectrometer showing hydrogen in permanently shadowed regions at the poles [5].

The LCROSS spacecraft will set the rocket's Centaur Earth departure upper stage (EDUS) on an impact trajectory with the Moon. Once the trajectory is set, the spacecraft will release the EDUS, which will then impact the Moon in a permanently shadowed region characterized by high concentrations of hydrogen according to the Lunar Prospector neutron spectrometers. Following four minutes behind the EDUS, LCROSS will fly through the impact plume, using its 9 instruments to examine the impact ejecta. The LCROSS payload includes 5 cameras (1 visible, 2 Near IR, 2 Mid IR), three spectrometers (1 visible, 2 NIR) and one photometer.

Although the primary LCROSS objective is to look for water, its instruments will be taking data about the entire impact plume. It will be excavating to a depth of about 10 m, identifying subsurface composition at the pole.

Impact Site Candidates: Four regions are currently candidates for the LCROSS impact: Shoemaker crater (88.1°S, 44.9°E, 50.9 km diameter), Shackleton crater (89.9°S, 0.0°E, 19 km diameter), Faustini crater (87.3°S, 77.0°E, 39 km diameter), and Cabaesus (85°S, 35°E). These regions are labeled in Fig. 1.

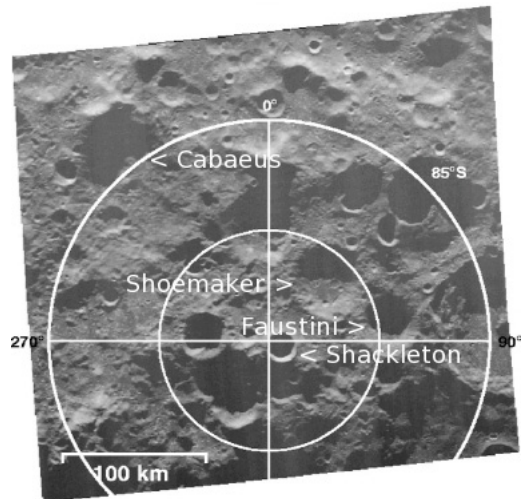


Figure 1: Illustration of the location of possible candidate impact locations for LCROSS, superimposed on a radar backscatter map of the lunar south pole from [6].

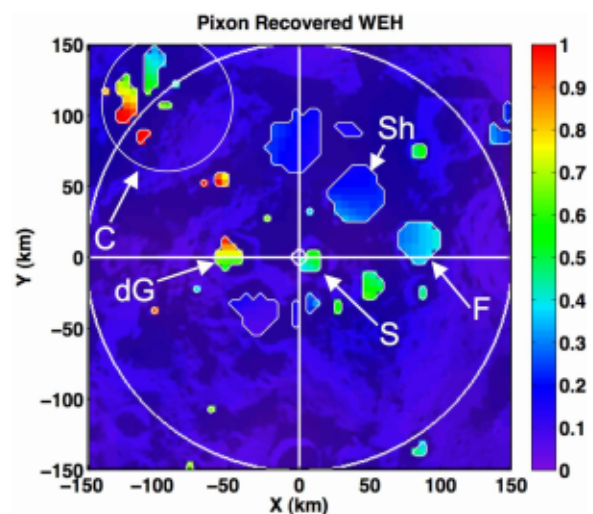


Figure 2: Water-equivalent hydrogen (WEH) in wt% corresponding to the epithermal count rates. Large circle denotes 85S. C = Cabaesus, Sh = Shoemaker, dG = de Gerlache, S = Shackleton, F = Faustini. From [7].

