LRO TARGETING OF LUNAR TECTONIC FEATURES. J.F. Bell III[1], M.E. Pritchard[1], A.C. Schiff[1], J.O. Gustafson[1], N.R. Williams[1], and T.R. Watters[2], [1]Cornell University, Ithaca, NY; [2]NASM/Smithsonian Institution, Washington, DC; (jfb8@cornell.edu)

Introduction: The global-scale, high-resolution imaging survey to be conducted by the Lunar Reconnaissance Orbiter Camera (LROC) Narrow Angle Camera (NAC) subsystem will enable significant advances in our understanding of lunar tectonism, as well as possible testing of competing hypotheses for the early evolution of the Moon. This abstract describes the science rationale and status of LRO targets being entered as part of a global survey of lunar tectonic features.

Science Rationale: The ddds presence or absence of global-scale faults on the Moon has implications for the origin of the Moon and the early history of the Earth. If the Moon formed almost completely molten and cooled monotonically throughout history, the lunar radius would contract, building up stress in the lunar lithosphere and creating global-scale thrust faults [*e.g.,* 1,2]. Such global-scale faults on Mercury were long thought to indicate global contraction of that planet [*e.g.,* 3], although more recent work has questioned whether these faults were, in fact, global in extent [4]. Although thrust faults have been found in the lunar highlands [*e.g.,* 5,6], no global network of thrust faults have been found on the Moon. The lack of a global network of faults on the Moon has been used to place tight constraints on the lunar radius change since formation and on the initial thermal state of the Moon [*e.g.,* 2,7]. According to these models, the Moon must have started out so cold that the constrained initial thermal state might be inconsistent with current scenarios for the giant impact origin for the Moon that involve rapid accretion [*e.g.*, 8, 9].

However, there are several reasons to suspect that the absence of global-scale faults on the Moon does not rule out the giant impact theory of lunar origin [9, and references therein]. One reason is that lunar highland faults have not been completely characterized because only portions of the Moon have been imaged with the low solar illumination angle necessary to reveal low relief scarps [10]. Binder and Gunga [10] used Apollo high-resolution photographs to document some highland scarps, but they estimated that scarps could only be visible when the solar illumination angle was between 5 and 45 degrees. Only 4.4% of the lunar surface could be imaged with their available imagery within this range of illumination angles. Extrapolating the limited data to the rest of the Moon indicates that more than 2000 highland scarps could exist. Thus, it cannot be ruled out that there are numerous low-amplitude global-scale faults on the Moon. Such numerous small faults might, in fact, be expected to form in the highly comminuted lunar breccia and could accommodate significant radius change [*e.g.,* 11].

We are planning to use LROC to search for low-amplitude faulting, particularly in the lunar highlands. We are working with the LROC targeting team to select the camera viewing geometries that would be most favorable to detection of these scarps, focusing mostly on choosing low Sun illumination angles during dedicated "morphology" campaigns primarily during the Science Mission Phase (such as the 60°-80° incidence angle imaging campaign described by [12]), but also capitalizing on any Exploration Mission Phase inherently low Sun angle imaging in the polar regions (which are separately a major focus of LROC observations overall) and any opportunities during either mission phase that might be identified for off-nadir spacecraft slews to provide additional perspectives on possible candidate faults. To test for the global nature of these faults, a significant sampling of the Moon will need to be imaged under the most favorable geometries. If we are able to detect highland fault scarps, we will characterize their length, orientation and offset. The offset of the faults can be measured by properties of the shadows (photoclinometry) and by stereographic imaging [*e.g.*, 13], calibrated where data is available with topography measured by LOLA. The measurements of offset, length, location, and orientation will be essential for determining if the faults are of regional or global origin [*e.g.*, 4].

In addition to our search for highlands faults, we are also planning to use LROC to conduct a global-scale survey of catalogued and uncatalogued lunar tectonic features in general. High resolution stereo imaging of ridges, rilles, fractures, scarps, and transitional structural landforms will provide new, quantitative data on morphology and topography that will help us better understand the mechanical properties of and stresses in the lunar crust and lithosphere, with implications for their origin and evolution.

Targeting Strategy:

We have a two-part strategy for targeting regions of interest in our lunar tectonic survey. First, for our overall survey of lunar tectonic features, we are targeting all of the major named lunar tectonic features in the USGS Planetary Nomenclature Database [14], as well as structural features identified in the recent lunar tectonics review chapter by Watters and Johnson [15] and references therein. We are also targeting uncatalogued lunar tectonic features found during our examination of the newly-digitized Apollo Metric Image collection [16].

Second, our strategy for searching for evidence of highlands scarps involves targeting of a random subset of the lunar highlands. To begin to make this search as extensive as possible, we are starting with 500 randomly-distributed (lat,lon) coordinates in the highlands, using an albedo threshold to distinguish between highlands and mare. Our target list will be biased towards the lunar farside, because of the higher relative fraction of highlands material in that hemisphere. Because of the prior finding that highland scarps are most detectable in low solar illumination conditions [10], images of our random highlands scarp search images will be constrained to an incidence angle range of ~70 to 85 degrees. In addition, we will not initially request stereo imaging of these target regions. Rather, we will examine the images taken by LROC, and if potential evidence for interesting structural landforms or candidate highlands scarps is identified, we will resubmit a companion stereo target request for that region.

Images for our overall survey of lunar tectonic features will be targeted as Priority 3 (with 1 being highest and 5 being lowest), while images for our random highlands scarp search will be targeted as Priority 4.

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