SCIENTIFIC RETURN FROM SYSTEMATIC IMAGING OF THE CONSTELLATION EXPLORATION SITES: COMPTON-BELKOVICH EXAMPLE. B. L. Jolliff[1], S. A. Wiseman[1], S. J. Lawrence[2], T. N. Tran[2], and the LROC Science Team. [1]Department of Earth and Planetary Sciences, Washington University, One Brookings Drive, St. Louis, MO 63130; [2]School of Earth and Space Exploration, Box 871404, Arizona State University, Tempe, AZ 85287; (blj@wustl.edu

Introduction: Fifty sites on the Moon were identified by NASA's Constellation Program (Cx) to represent a broad range of terrain types and geologic features of interest for human and scientific exploration on the Moon [1-3]. The sites are broadly distributed and include near and far side as well as north and south polar locations. Data collected by LRO and specifically the LROC Narrow Angle Cameras will provide Cx with information that will form a basis for planning scientific exploration, resource development, and mission operations, including traverse and habitation-zone planning.

Scientific Context: The Cx sites include volcanic terrains (surfaces with young and old basalt flows, pyroclastic deposits, vents, fissures, domes, low shields, rilles, wrinkle ridges, and lava tubes), impact craters and basins (crater floors, central peaks, terraces and rims; impact melt and ejecta deposits, basin ring structures; and basin antipodal terrain), and contacts of geologic features in areas of complex geology. Polar sites include craters with areas of permanent shadow as well as extended illumination. Six sites are located in or near the South Pole-Aitken Basin on the far side. Sites were also chosen that represent feldspathic highlands terrain, areas in the highlands with anomalous compositions, and unusual features such as magnetic anomalies.

Data Products: Regions of interest (ROI) for each of the Cx targets consist of nested 10, 20, and 40 km squares with prioritized (levels 1 to 4) coverage. Priority 1 is assigned to the 10 km ROI, and targeting is designed to obtain images at 50 cm/pixel at high Sun and low Sun, and repeat coverage at similar incidence but different emission angles for geometric stereo derivations and at different incidence and azimuth angles but similar emission for photometric stereo. The 20 km ROIs are targeted similarly, but with priority 3. Targeting of the 40 km ROIs is at priority 4 and is intended to fill in high-Sun and low-Sun mosaics. Many of the Cx sites are surrounded by scientifically interesting features beyond the 40 km ROI; these features are targeted separately. The LROC Team is generating DEMs for some sites; others will be completed under the Lunar Mapping and Modeling Project (LMMP) [4]. The LMMP is also responsible for derived products such as boulder distributions, slope maps, and resource maps.

Compton-Belkovich: The Compton-Belkovich site, centered at ~61.1°N and 99.5°E (Fig. 1), serves as an example of coverage and data products, and the science associated with a Cx site. This site has a strong, focused concentration of thorium (Th) and other KREEP elements, and is isolated in an area of Th-poor, feldspathic highlands [5, 6]. The concentration of Th determined from the Lunar Prospector gamma-ray spectrometer low-altitude data and binned at 0.5° reaches ~5 ppm [6, 7] in an area where FeO is ~5-6 wt% (Fig. 2). Gillis et al. [8] noted that the Th anomaly corresponds to an area of unusually bright albedo, about 20x30 km, which is readily apparent in LRO Wide Angle Camera (WAC) images (Fig. 3). The compositional anomaly is asymmetric and "smeared" to the east, beyond the extent of the bright terrain, possibly related to topography [8].

Potential origins of the Compton-Belkovich anomaly include deposition of secondary ejecta, either from nearby or from far to the west, i.e., Imbrium, or exposure of a near-surface, isolated, alkali-intrusive complex that has the characteristics of high Th, but low Fe, such as granite or alkali anorthosite [6, 8]. The feature bears no relationship to ejecta deposits and compositions of nearby large craters, so a local secondary origin is ruled out. Origin as an Imbrium ejecta deposit is unlikely because the composition of the anomaly differs from other Imbrium ejecta and is not plausible as a mixture. Lawrence et al. [6] modeled the GRS spatial response function and calculated that the anomaly itself could have as much as 40-55 ppm Th, which indicates granite or felsite, or a very Th-rich alkali anorthosite or anorthositic norite (Fig. 2). We agree with Lawrence et al. and Gillis et al. [6, 8] that the most plausible explanation is exposure of a near-surface alkali intrusive.

The 50 cm/pix NAC images show irregular topography and craters, and exposures of outcrop and boulders within the albedo anomaly that can be coupled with high-resolution topography [9] to determine the nature of the albedo anomaly substrate (Fig. 4) and to provide context for high-resolution multispectral data.

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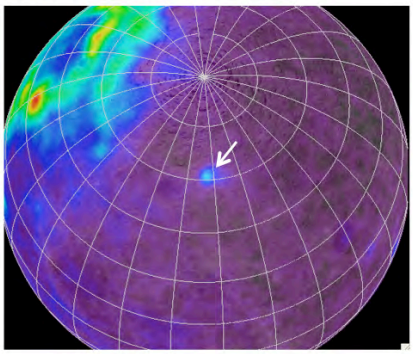
References: [1] Jolliff B. L. et al. (2009) *Lunar Planet. Sci.* **40**, #2343; [2] Gruener J. E. and B. K. Joosten (2009) LRO Sc. Targeting Mtg, Tempe, AZ, #6036; [3] Lucey et al. (2009) LRO Sci. Targeting Mtg, Tempe, AZ, #6022; [4] Cohen B. A. et al. (2008) *Lunar Planet. Sci.* **39**, #1640; [5] Lawrence D. J. et al. (1999) *Geophys. Res. Lett.* **26**, 2681-2684. [6] Lawrence D. J. et al. (2003) *J. Geophys. Res* **108**, 5102. [7] Lawrence D. J. et al. (2002) *New Views of the Moon, Europe*; [8] Gillis J. J. et al. (2002) *Lunar Planet. Sci.* **33**, #1934. [9] Tran T. (2010) this Conf.

Figure 1. Compton-Belkovich thorium anomaly (LP-GRS 0.5-degree (~15 km) resolution Th data overlain on shaded relief). The highest Th concentration at this resolution is ~5 ppm, at the center of the hotspot. In this Figure the purple background represents ~1-1.5 ppm.



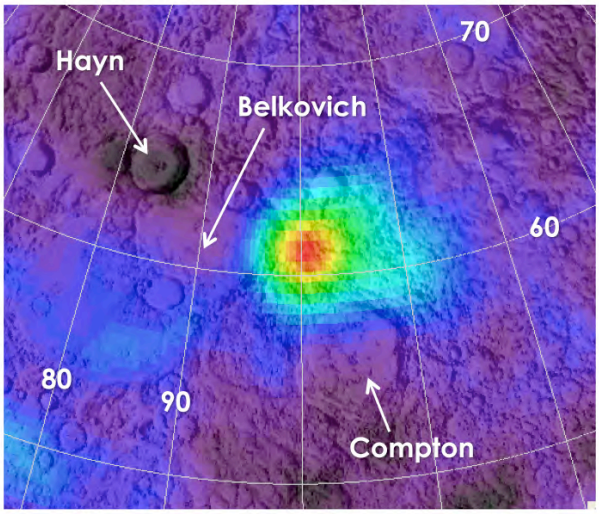


Figure 2. LP-GRS Th vs. FeO for area of 92-128°E Lon and 55-70° N Lat. Low altitude, 0.5° binned data (Lawrence et al., 2002).

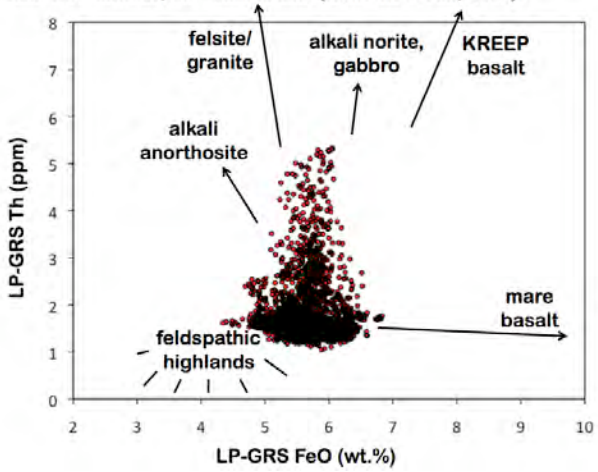


Figure 3. Portion of LROC WAC image M108555211CE, 604 nm. Area of Fig. 4 shown with white rectangle. Yellow: 10×10 km, Red: 20×20 km, Blue: 40×40 km.

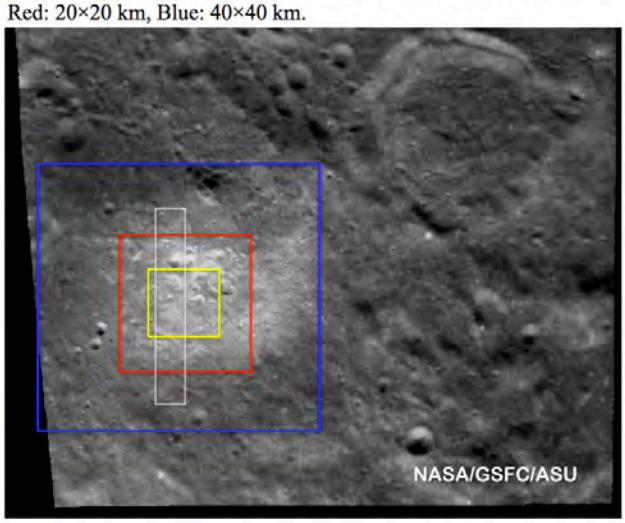


Figure 4. Portion of NAC "pair" M113296065 on left and topographic shaded relief from DEM on right, derived from two NAC pairs, same area.