COMPTON-BELKOVICH: NONMARE, SILICIC VOLCANISM ON THE MOON'S FAR SIDE. B. L. Jolliff[1], T. N. Tran[2], S. J. Lawrence[2], M. S. Robinson[2], F. Scholten[3], J. Oberst[3], B. R. Hawke[4], H. Hiesinger[5], C. H. van der Bogert[5] , B T. Greenhagen[6], S. A. Wiseman[7], T. D. Glotch[8], and D. A. Paige[9], [1]Dept. Earth & Planetary Sciences and McDonnell Center for the Space Sciences, Washington University, One Brookings Drive, St. Louis, MO 63130; [2]School of Earth & Space Exploration, Arizona State University, Tempe, AZ 85287; [3]German Aerospace Center (DLR), Institute of Planetary Research, Berlin; [4]SOEST, University Hawaii, Honolulu, HI 96822; [5]Institut für Planetologie, Westfälische Wilhelms-Universität Münster, Germany; [6]Jet Propulsion Laboratory, Pasadena, CA 91109; [7] Dept. Geological Sciences, Brown University, Providence, RI 02912; [8]Dept. Geosciences, Stony Brook University, Stony Brook, NY 11794; [9]Dept. Earth & Space Sciences, UCLA, Los Angeles, CA 90095. (blj@wustl.edu)

Introduction and Overview: At the center of the Compton-Belkovich Thorium Anomaly (CBTA) is a high-reflectance feature some 26×32 km in area (Fig. 1) [1], which we refer to as the Compton-Belkovich High-Reflectance Feature (CBHRF). Digital terrain models (DTM) derived from Wide-Angle (WAC) and Narrow-Angle (NAC) images show that this feature is elevated relative to its surroundings and contains positive relief features that we interpret to be of volcanic origin. The broad topographic feature also has irregular depressions that could be collapse features associated with volcanism. LRO Diviner thermal emission measurements covering the CBHRF are consistent with an enrichment in silica or alkali feldspar, corresponding closely to the area of high reflectance. These observations, coupled with very high thorium contents inferred for this feature from the Lunar Prospector Gamma-Ray Spectrometer (LPGRS) data [2], are consistent with felsic (rhyolitic) material. These observations taken together provide strong evidence for a unique occurrence of non-mare, silicic volcanism on the Moon's far side, in an area that is predominantly characterized as feldspathic, and located far from the Procellarum KREEP Terrane where silicic volcanism such as this might be anticipated.

Observations and Discussion: The CBTA is centered at 61.1°N, 99.5 °E and was first identified as a thorium 'hotspot' in data obtained by the LPGRS [2-4]. The site has a strong, focused concentration of thorium and is isolated in an area of Th-poor terrain on the Moon's far side. It occurs between two large impact craters, Compton (162 km) and Belkovich (214 km). Gillis and coworkers [4], using Clementine visible images, noted that the center of the CBTA corresponded to an area of unusually high reflectance, ~15×30 km in area; however, the Clementine image data were of insufficient resolution to reveal additional details about the feature. Lawrence et al. [2] considered the possibility that the highly reflective feature could be the cause of the thorium anomaly. Taking the broad spatial response function of the LPGRS into account, they calculated that the Th concentration could be as high as 40-55 ppm in the central feature. Few lunar igneous rock types have such high Th concentrations, among them granite, alkali-anorthosite, and monzogabbro [5].

The high-reflectance area is readily apparent in LRO WAC and NAC images (e.g., Fig. 1). An image

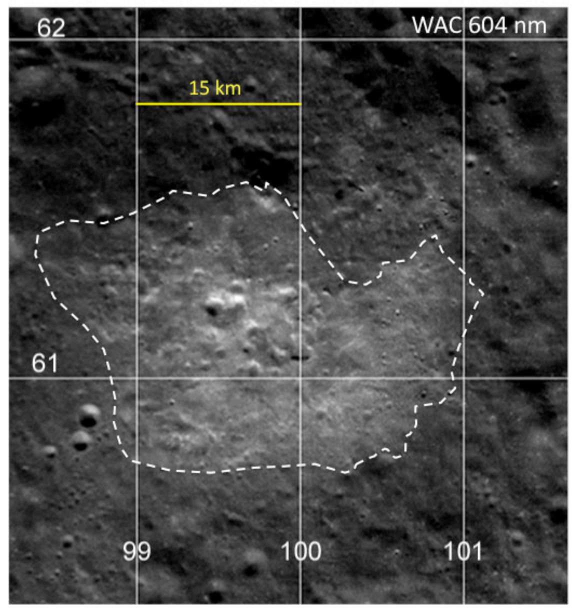

Figure 1. LRO Wide-Angle Camera image of central region of Compton-Belkovich Thorium Anomaly.

of the feature, draped over topography derived from a WAC DTM [6] shows that the high-reflectance area corresponds closely (but not precisely) to a topographically elevated terrain feature (Fig. 2). Notably, the bright material extends some 7-8 km to the east-southeast, beyond the topographically elevated terrain. This is significant because the Th anomaly is also "smeared out" to the east.

Within the CBHRF there are positive relief features ranging in size from small domes at an ~ 500 m scale, to an elongate (0.6×2.5 km) domical rock body, to an irregular massif about 6-7 km across at its base and up to a km high (Fig. 3) [see 7]. The two larger topographic features have steeper, inner dome areas (up to 20-26° slopes) and broader, shallower aprons. The big dome has a summit plateau with a broad central depres-

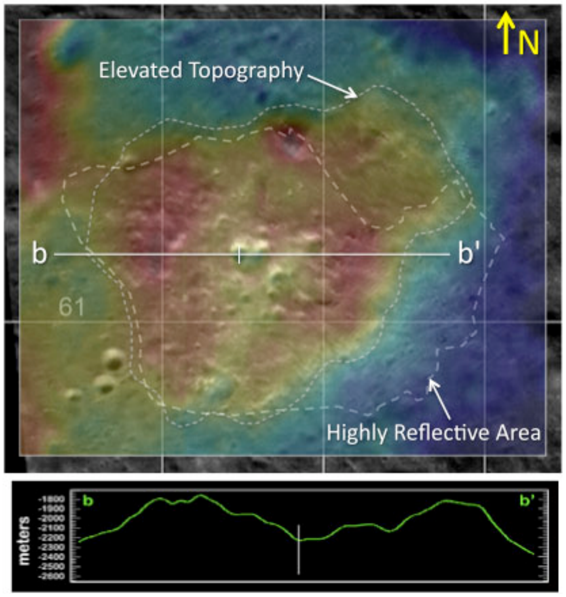

Figure 2. Topography of the Compton-Belkovich feature shown on a WAC DTM. Close-dashed outline is the elevated topographic feature; the long-dashed outline is the high-reflectance feature from Fig. 1.

sion. Boulders occur on the tops of these domes, especially “little dome” and “middle dome” (Fig. 3).

Shapes and slopes suggest that these positive-relief features formed by eruption of a relatively high- viscosity lava compared to typical, low-viscosity mare lava. The east-west profile across the entire CBHRF (b-b’ in Fig. 2) shows a broad central depression composed of several irregular, scarp-bounded depressions that could

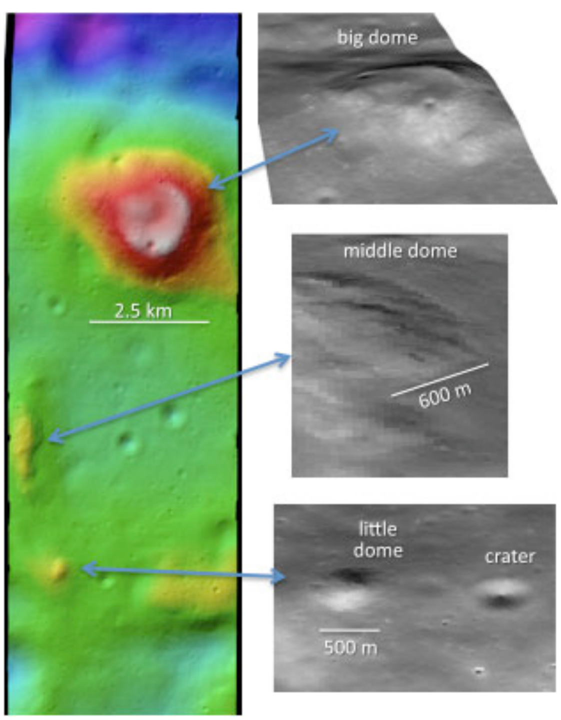

Figure 3. Positive relief features in the CBHRF inferred to be volcanic in origin.

be collapse features resulting from eruptive episodes.

An overlay of Diviner data, using a measure of Christiansen Feature (CF) band position, an emissivity maximum between 7-9 µm for silicates, shows that the high-reflectance material corresponds to the area indicated to have a short-wave shift in the CF (Fig. 4) [8]. This short-wavelength CF position indicates the presence of a polymerized silicate such as quartz or alkali feldspar [9]. Close correspondence to the outline of the highly reflective area indicates that the mineralogical signature extends beyond the topographic feature by ~7-8 km to the east-southeast. The extension of the highly reflective area to the E-SE could be explained by deposition of pyroclastics beyond the extent of the topographic feature.

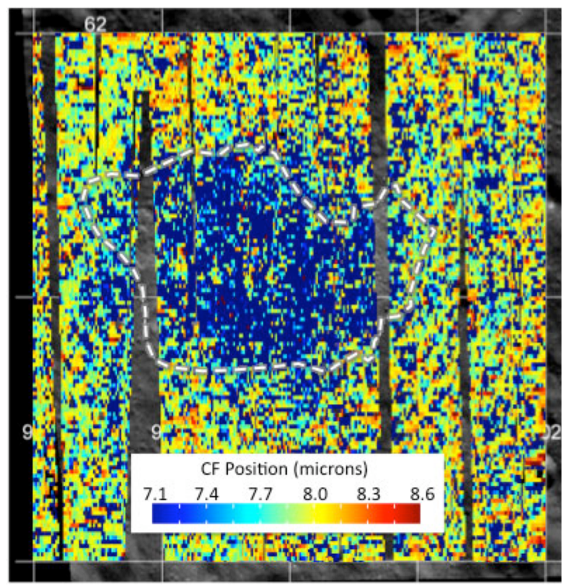

Figure 4. Christiansen Feature position. Dashed white line shows the outline of the high-reflectivity area. The short-wavelength CF position, corresponding to blue, is consistent with polymerized silicate material.

We note a low density of small impact craters on flat surfaces within the CBHRF that indicates a relatively young age. This observation is consistent with the fact that the compositional signature has not been laterally mixed or overprinted significantly by impacts.

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