VOLUMES OF VOLCANIC CONSTRUCTS AT THE COMPTON-BELKOVICH VOLCANIC COMPLEX ON THE MOON. H. R. Walcek[1], B. L. Jolliff[1], and M. Zanetti[2], [1]Department of Earth & Planetary Sciences and the McDonnell Center for the Space Sciences, Washington University in St. Louis, 1 Brookings Dr., St. Louis, MO 63130, walcekhannah@wustl.edu, [2]University of Western Ontario, London, Ontario, CAN.

Introduction: The Compton-Belkovich Volcanic Complex (CBVC) was first identified as an isolated thorium anomaly located between the Belkovich and Compton craters on the Moon [1]. The Th concentration has been estimated to be as high as 40-55 ppm at the center of the hotspot [2]. Upon further investigation using LRO data, it was determined that this area is unique not only for its thorium anomaly, but for the occurrence of silicic volcanism at a volcanic complex near the center of the Th anomaly [3,4]. At the complex, volcanic features include extrusive domes as well as irregular depressions interpreted to be collapse features. Volcanic construction ranges from a large cumulodome with a small summit depression in the northern part of the complex, a broad cone with a central depression along a complex area of volcanic construction on the western ridge of the complex, to other domical features and small domes or bulges scattered throughout the interior of the complex. A key aspect of the record of volcanic history at the site is reflected in the volumes of the volcanic constructive features in this area.

Methods: We analyzed the volumes of a representative suite of five domes in the CBVC, which we refer to herein as the Alpha dome, Beta dome, Gamma dome, and small domes 1 and 2 (Fig. 1). These domes were first identified using the digital elevation models acquired from images from the Lunar Reconnaissance Orbiter Cameras (LROC). Wide Angle Camera (WAC) and Narrow Angle Camera (NAC) images and DTMs were used. All of the domes, except for a small portion of the Alpha Dome are captured in the NAC DTMs. We also measured the volume of the large central depression.

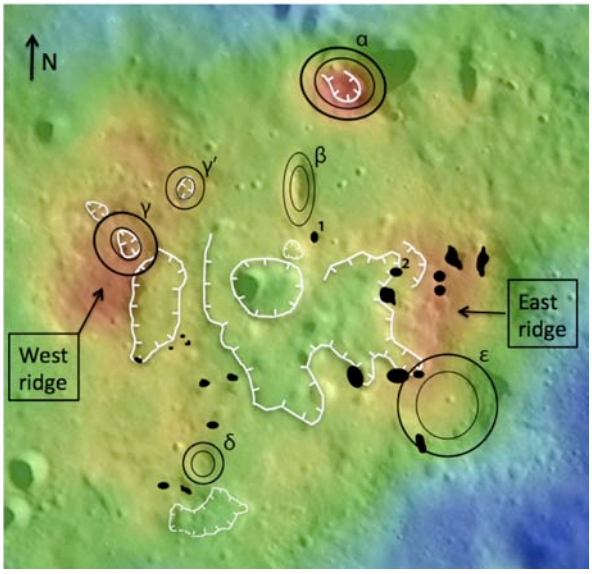

Fig. 1: Portion of the area of the CBVC on WAC GLD100 DTM [5] showing features referred to in this abstract.

Elevation profiles were constructed using REACT and ArcGIS, and dome and caldera volumes were measured using ArcGIS. For each feature elevation profile lines were constructed for different directions across the feature and used to define baselines and heights. The DEM was clipped to the perimeter of the feature thus defined and the Surface Volume tool in ArcGIS was used to determine volumes.

Results: The overall CBVC broad dome as defined using the WAC GLD100 DTM [5] and a mosaic of NAC DTMs covering various parts of the CBVC has a volume of ~360 km^3 (Fig. 2). We used elevation profiles to establish a base elevation of -2600 m and computed the volume above this elevation. We take this volume to be an approximation of the total magmatic inflation of the CBVC. This estimate includes construction along the east and west ridges and the Alpha dome in the north.

Five representative positive relief features were analyzed to determine baseline dimensions, height, and volumes; values are summarized in Table 1. The Alpha Dome is interpreted to be a cumulodome and is the largest individual constructive feature. It has an elliptical base of 4.5 × 6.5 km, a height of just over 450 m, and a summit plateau of 1.5 × 1.8 km, with a well-formed summit depression (Fig. 1, 3a). The Beta Dome is an elongate feature, with a domical summit and no depression. Its flanks exhibit a break in slope at -2100 m elevation, reflecting a debris apron from downslope mass wasting (Fig. 3b). It is situated between the Alpha dome and small dome 1 and appears to be continuous with small dome 1. Its position relative to Alpha dome suggests it may be the surface expression of an arcuate radial feeder dike that extends toward Alpha dome. The Gamma dome (Fig. 1, 3c) has a complex structure; it is superposed on the west ridge of the CBVC. It has an elliptical summit pit ~ 1.3 × 2 km and 50-75 m deep. It appears that lava flowed from this cone to the northwest.

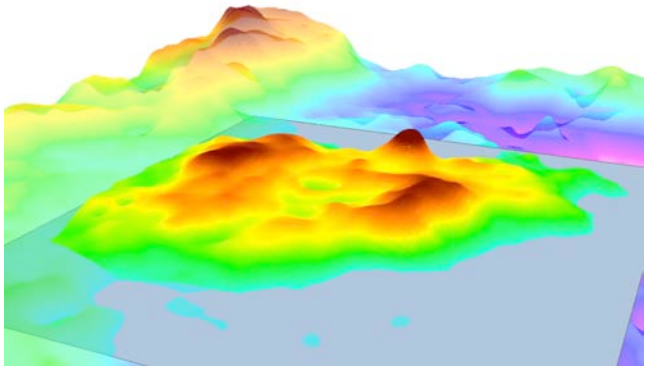

Figure 2. CBVC topography above -2600 m elevation based on WAC DTM (GLD100 [Scholten et al].

In plan view, small dome 1 appears ~ 400-500 m across, but the DTM profile shows that it sits atop a broad base 1.5 km across (Fig. 3d). Similar to the Beta Dome, the slopes exhibit an inflection at -2020 m where a debris slope has formed. Small done 2 occurs as a low (~ 55 m high) "bulge" with an ~ 1.5 km base on the sloping escarpment of the CBVC's large central depression (Fig. 1, 3e). Small domes 1 and 2 are both boulder-rich, which we interpret as breakdown of coherent silicic blocks.

The large, centrally located irregular depression in the CBVC has been interpreted as a complex collapse caldera [4, 6]. We estimate its volume (the volume lost from the original CBVC inflation) to be at most 38 and possibly as little as 10 km^3. depending on the amount of construction along the east and west ridges that accompanied drawdown of the magma chamber. The volume of material comprising the east and west ridges above elevation -2100 m is ~15 km^3. Collapse may have occurred during inflation of the east and west ridges and of the larger domes, including the δ and ε dome, so the true caldera volume probably is close to 20 km^3. We think it likely that at a late stage, associated with caldera collapse, evolved silicic pyroclastics were ejected, forming a blanketing deposit some tens of meters deep.

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References: [1] Lawrence, D. et al. (1999) *Geophys. Res. Lett.* **26**, 2681-2683. [2] Lawrence, D. et al. (2000) *Geophys. Res.* **105**, 20,307-20,331. [3] Glotch, T. et al. (2010) *Science,* **329**, 1510-1513. [4] Jolliff, B. et al. (2011) *Nature Geoscience* **4**, 566-571. [5] Scholten, F., et al. (2012) *J. Geophys. Res.*, **117**, E00H17. [6] Chauhan, M., et al. (2015) *Icarus* **253**, 115-129.

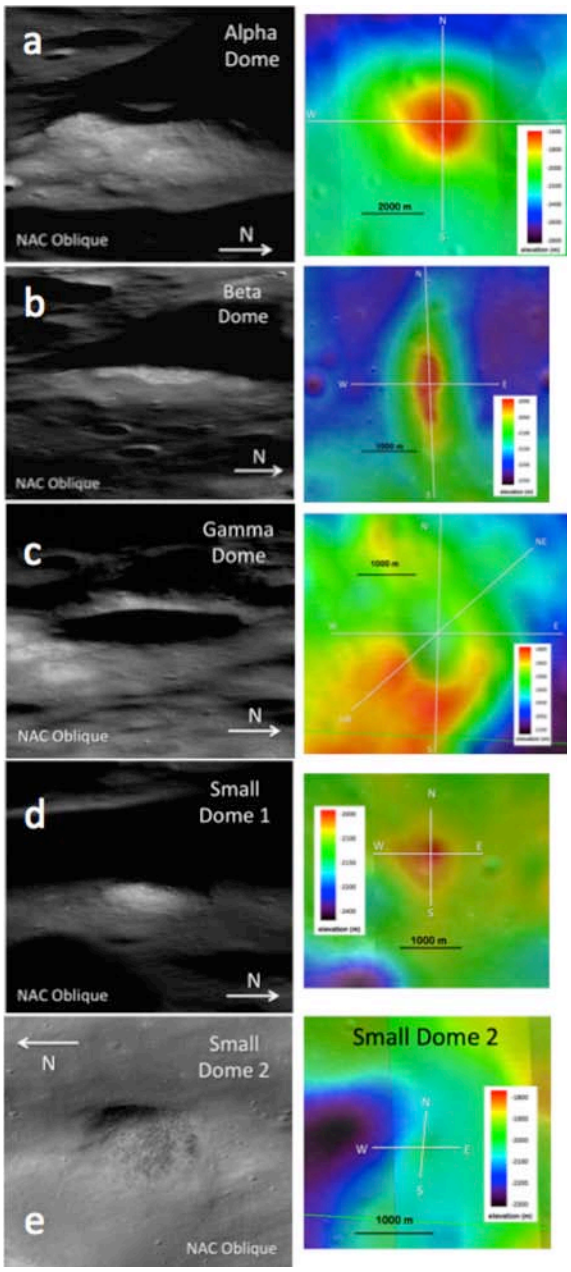

Figure 3. Examples of volcanic constructs within the CBVC. NAC Obliques: M183004454, M192154128

Table 1. Dimensions of volcanic constructs

			Dome			Summit Feature	
Feature	Base Elevation	Base Length	Height (m)	Volume (km^3)	Summit Feature*	Depth (m)	Volume (km^3)
CBVC	-2600	26 x 34 km	400	360	~ 10 x 12 km	~ 100 - 200	38
Alpha Dome	-2200	4.0 x 6.5 km	450	3.2	1.65 km (Plat)		
Beta Dome	-2200	0.9 x 1.2 km	205	0.56			
Gamma Dome	~ -2000	3.5 x 4.1 km	~ 140	~0.6	~ 1.3 x 2 km	~ 50 - 75	0.13
Small Dome 1	-2090	1.5 km	100	0.036			
Small Dome 2	-2090	0.5 km	55	0.004			

*summit feature: plateau or depression