STEALTH DOME IN CENTRAL OCEANUS PROCELLARUM: USING DETRENDED TOPOGRAPHY DATA TO REVEAL THE HIDDEN PAST OF THE PRINZ-HARBINGER REGION. Erica R. Jawin[1], James W. Head[1], Mikhail A. Kreslavsky[2], Lionel Wilson[3], [1]Dept. Earth, Environ. & Planet. Sci., Brown University, Providence, RI USA, [2]Earth and Planet. Sci., UC Santa Cruz, CA USA, [3]Lancaster Environ. Centre, Lancaster University, Lancaster UK (Erica_Jawin@brown.edu).

Introduction: The Aristarchus Plateau and the surrounding region contain some of the highest density of volcanic features on the lunar surface [*1*]. The Prinz-Harbinger region, ~100 km east of the Aristarchus Plateau, contains multiple sinuous rilles and is bound by Prinz crater to the southwest and Montes Harbinger to the northeast (Fig 1). This region is of interest due to the proximity to the Aristarchus Plateau and similarly high density of volcanic features in the region, including pyroclastic material, suggesting a related geologic history for the two locations [*1*] (Fig 1B). In the Prinz-Harbinger region, quantitative analyses suggested the lavas that carved Rima Prinz (Fig 1B) were similar to lunar low-Ti basalt [*2*]. This lava composition may have also dominated the other sinuous rilles in the region.

In this work, we used a combination of visible images and topography data to observe the detailed stratigraphy and morphology of the Prinz-Harbinger region. Detrended topography data [*3*] reveal a complex dome feature spanning the Prinz-Harbinger region (Fig 1C) containing distinct surface textures that provide insight into the region's past. This 80 km-diameter dome is analyzed and a geologic history is summarized for the region.

Methods: The analyses were performed using visible images from Lunar Reconnaissance Orbiter Camera (LROC) Wide-Angle Camera (WAC) [*4*] and Kaguya Terrain Camera (TC) [*5*], and topography data from the Lunar Orbiter Laser Altimeter (LOLA) [*6*].

The detrended LOLA data were generated by calculating the difference between the actual elevation at a given point and the median elevation of every pixel within a 10 km circular window [*3*]. This method of topographic filtering perfectly filters out features larger than the window, preserves features smaller than the window, and distorts features of comparable size to the window [*3*]. Previous analyses have proven detrended LOLA data useful for identifying otherwise invisible features such as compound flow fields [*7*], lava channels, and low shields, as well as subtle tectonic features referred to as "stealth graben" [*3*].

Observations: Eight sinuous rilles are visible within the Prinz-Harbinger region (Fig 1B). Other major features include Prinz crater and Montes Harbinger, highlands exposures probably shaped during the formation of Imbrium basin [*1*]. The detrended topography data (Fig 1C) reveal a circular topographic rise in the central Prinz-Harbinger region ~80 km wide and over 500 m in height relative to the surrounding mare, and slopes <4° (Fig 1). There is a well-defined boundary between the domed area and the mare (white arrows, Fig 1C), and there is a textural contrast between the units, as the flanks of the dome have a linear, sculpted texture. This sculpted texture contains grooves hundreds of meters wide (up to ~1 km) extending for several kilometers (Fig 2). The texture of the sculpted unit is apparent in the detrended data, but the grooves are much less defined in

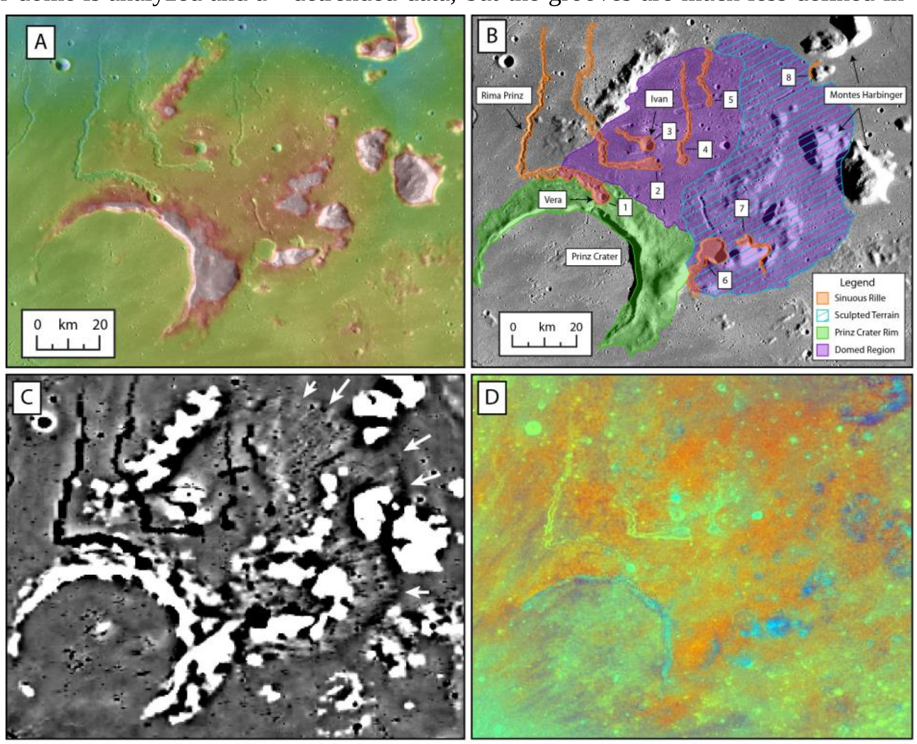

Fig 1. Prinz-Harbinger Region. (A) LOLA over WAC global mosaic. (B) Sketch map of Kaguya TC morning mosaic. (C) Detrended topography showing domed area (white arrows). (D) Clementine color map showing distribution of pyroclastics (red-orange), R:750/415nm, G:750/950nm, B:414/750nm. Some sinuous rilles are mantled (rilles 5-8) while others are not (rilles 1, 2, part of 3).

visible imagery (Fig 2). In addition, this sculpted texture is only present on the flanks of the dome – the top of the dome is smooth in the detrended data, similar to the surrounding mare. The smooth, topographically higher region of the Prinz-Harbinger region contains most of the sinuous rille source depressions (Fig 1B). There are several smaller sinuous rilles in the sculpted terrain as well.

Discussion: The Prinz-Harbinger region was previously proposed to be a shield volcano representing an undeveloped volcanic complex due to the density of volcanic features in the region [*8*]. Utilizing the data shown here, we identify a specific dome with distinct boundaries and variable surface textures that suggest a more complex geologic history than has been previously discussed.

The detrended topography data show the smooth top of the dome and the sculpted northern and eastern flanks. With these observations, it is possible to recreate the geologic history of the region. The edge of the dome has a sharp contact with the surrounding mare, suggesting it has been embayed by younger lava flows. The smooth top of the dome is also stratigraphically younger than the sculpted portion. Therefore the history of the region includes (1) formation of the dome by extrusive volcanism; (2) creation of the sculpted unit; (3) eruptions to produce pyroclastics and form sinuous rilles, mantling the upper dome surface, and finally, (4) embayment of the dome.

The domed region must have been created first because it contains both sculpted and smooth units, and all the sinuous rilles in the region. We interpret this large dome to have formed from cooling-limited flows erupted at low effusion rates [*9*].

This sculpted terrain appears similar to ejecta textures typical of crater formation, and was probably formed when a large crater formed nearby and scoured the region. Prinz is the expected source: it is the closest large crater, the grooves are oriented radial to Prinz crater, and the crater has been breached and embayed by mare (Fig 1B), indicating it is a similar age to the sculpted unit. Furthermore, its tilt to the SSW suggests that it formed on the flanks of the previously-formed dome.

Additional volcanic material was subsequently emplaced on the top portion of the dome, embaying the NE rim of Prinz crater and parts of the sculpted terrain. This volcanic material was either erupted from, or contributed to by, the formation of the sinuous rilles (rilles 1-5, Fig 1B) which flow directly downhill off the dome, and contributed lava to the surrounding plains.

The Prinz-Harbinger dome is ~4600 km^2 in area, much larger than other lunar mare domes, and similar to terrestrial Galapagos-type domes [*10*]. These characteristics suggest that the cooling-limited flows necessary to form it were of much longer duration than was typical elsewhere on the Moon. The density of sinuous rilles (representing high-effusion rate eruptions [*2*]) on the dome may represent a shift in eruption conditions through time to higher effusion rates. There may have been several stages of sinuous rille activity, as evidenced by the mantle of pyroclastic material – several sinuous rilles appear mantled by pyroclastic material (rilles 5-7), while others (rilles 1-3, half of 4) appear to have eroded through the mantle (Fig 1B,D). The latter half of rille 4 (further north) is mantled, while the region closer to the source vent is not, suggesting a multi-stage eruption or a variable effusion rate.

There is some ambiguity as to the source of the pyroclastic material; the proximity to the Aristarchus plateau and the large areal extent of the Aristarchus pyroclastic deposit could suggest that the pyroclastic material in the Prinz-Harbinger region was sourced from Aristarchus. If the Aristarchus pyroclasts were all erupted at Cobra Head [*11*], the range of erupted clasts (~200 km) could overlap with the Prinz-Harbinger region (200-250 km from Cobra Head). However, the density of sinuous rilles on the domed area in the Prinz-Harbinger region provides ample local sources of pyroclastic material anticipated at the beginning of these eruptions [*9*].

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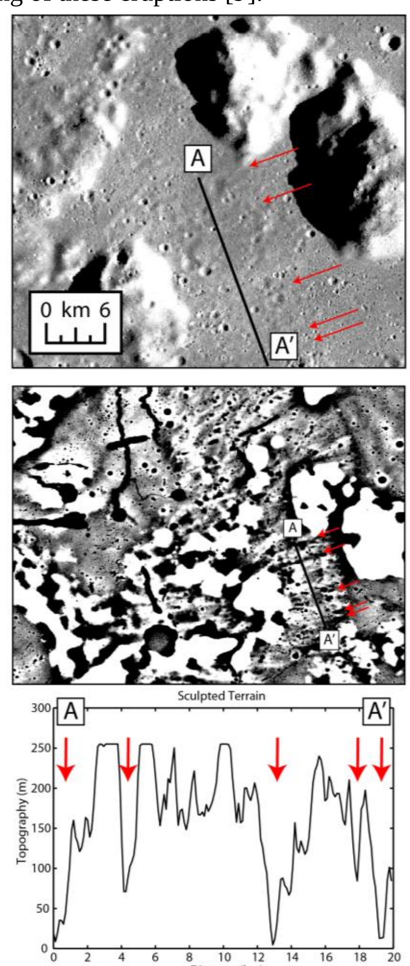

Figure 2. Sculpted Terrain. (Top) Kaguya TC morning. (Middle) Detrended topography. (Bottom) LOLA profile showing texture of sculpted terrain. Red arrows indicate troughs in this unit on all images.