The Prinz-Harbinger medium-scale (80 km-diameter) shield volcano: A transition in lunar volcanic eruption style

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

Abstract. 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. 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[2] reveal a complex volcanic feature spanning the Prinz-Harbinger region containing distinct surface textures that provide insight into the region's past. This feature is analyzed and a geologic history is summarized for the region.

The detrended topography data reveal a circular topographic rise in the central Prinz-Harbinger region ~80 km in diameter and over 500 m in height relative to the surrounding mare, with slopes generally between 0-2°. There is a well-defined boundary between the circular rise and the mare, and there is a textural contrast between the units, as the flanks of the circular rise contains linear grooves hundreds of meters wide extending for several kilometers. The smooth, topographically higher region of the Prinz-Harbinger region contains the highest density of sinuous rille source depressions in the region. The entire region has been mantled by pyroclastic material, as can be seen in Clementine VNIR spectral data.

We interpret this circular rise to have formed from cooling-limited extrusive volcanic flows. The circular rise is ~4600 km^2 in area, much larger than other lunar mare domes. These characteristics suggest that the cooling-limited flows necessary to form it were of higher effusion rates than was typical elsewhere on the Moon for smaller shields.

The grooved terrain appears morphologically similar to ejecta textures typical of crater formation, and was probably formed when a large crater, potentially Prinz crater, formed nearby and scoured the region.

Additional volcanic material was subsequently emplaced on the top portion of the circular rise, 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 which flow directly downhill off the circular rise, and contributed lava to the surrounding plains. The density of sinuous rilles (representing higher-effusion rate eruptions[3]) on the circular rise represent a shift in eruption conditions through time to higher effusion rates. Pyroclastic materials are expected to have been emplaced as a result of these high-effusion rate eruptions[4].

---

1. Zisk et al., *The Moon*, 17 (1977). 2. Kreslavsky et al., *Icarus*, 283 (2017). 3. Hurwitz et al., *JGR*, 117 (2012). 4. Head & Wilson, *Icarus*, 283 (2017).