

# DISCOVERY OF AN UNLISTED DOME NEAR HORTENSIVS E, located at 25.17° W and 6.07° N

by Raffaello Lena, Zac Pujic, Christian Wöhler, Maria Teresa Bregante - GLR group

The GLR Group has an ongoing project to discover lunar domes. Our activity has shown both the elusive nature of these volcanic structures and the usefulness of ground-based CCD imaging and digital image analysis in the elucidation of their character [1-2].

In a previous paper [3], some of us described a highland dome located near the crater T. Mayer B. Moreover, we reported some images of the very well known Milichius region, where two lunar cones were detected [3]. A study about these two lunar cones located near the crater Milichius will be published in a forthcoming issue of *Selenology*, the Journal of the American Lunar Society [4]. In another recent paper, some of us described a study about the well known Milichius  $\pi$  dome: the average slope angle of Milichius  $\pi$  is 2.72° and the summit of the dome was measured to be (211 ± 10) m higher than the surrounding plain [5]. These results strongly suggest that previous estimates of Milichius  $\pi$  height were incorrect [6]. Furthermore, some of us recently described another dome located near the crater Vendelinus, investigating its slope and height [7].

The dome field near crater Hortensius has been extensively studied. The ALPO Lunar Dome list reports several low domes in this region, as visible also in our revised lunar dome maps [8]. North of Hortensius there is a group of six well known domes, 6 to 8 km wide, termed “Schlumberger Domes” by Jim Phillips [9]. Based on comparisons with terrestrial volcanism these domes were probably formed when mare basalts erupted at a lower rate from a central vent [10].

South of Hortensius a group of four domes is situated; they are not easy to image. These four domes require a very low solar altitude to display maximum detail [11]. Most mare domes have low relief and are often not readily visible on images with moderate to high Sun-elevation angles. The dome field near crater Hortensius shows that domes of different classes occur together, suggesting, as reported in [12], different stages in the development of dome structures.

Recently this region was monitored by the GLR group. A shallow dome has been observed in this area, near the crater Hortensius E, and is described here. For each of the observations, the local solar altitude (Alt) and the Sun's selenographic colongitude (Col) were calculated using the Lunar Observer's Toolkit by H. D. Jamieson.

The dome was detected by Zac Pujic on April 03, 2005, at 19:25 UT (Fig. 1) using a 310 mm Newtonian telescope, a Wratten 25A filter, and a Philips ToUCam (solar altitude = 1.48°, colongitude = 203.65°). The image is oriented with north at the top and west (IAU) to the left. Table 1 lists the 6 observers and their instruments.

The dome is located at 25.17° W and 6.07° N ( $X_i = -0.423$ ,  $Eta = +0.106$ ). It is, to our knowledge, previously unreported by any lunar dome survey.

This dome requires a specific solar altitude to be observed clearly. Information about the vertical cross-section was obtained using the Ashbrook method [14]. Using this method, we estimated in the raw image the fraction  $x$  of the dome's east-west diameter that is covered by black shadow. The corresponding scale of the image was determined to 0.326 km per pixel, allowing diameters and shadow lengths to be expressed in kilometres. According to Ashbrook [14], the average slope of the dome flank is equal to the solar altitude when  $x = 0.25$ , assuming a hemispherical shape of the dome. The height  $H$  of the dome was then calculated by equation (1):

$$H = r (\tan s)$$

Our preliminary estimation indicates a diameter of  $(7.82 \pm 0.33)$  km. Furthermore, a summit pit crater with an estimated size of about  $(3.10 \pm 0.33)$  km x  $(1.60 \pm 0.33)$  km is apparent.

**Table 1:** Contributing Observers.

Observer	Telescope	Type	Date and time (UT)	Solar altitude (Alt)
Fattinnanzi, C.	Newton 250 mm f/6	webcam	April 18, 2005 (19:25)	1.69°
Lena, R.	Refractor 100 mm f/15	visual	April 18, 2005 (19:40)	1.82°
Pujic, Z.	Newton 310 mm f/5.75	webcam	April 3, 2005 (19:25)	1.48°
Salimbeni, P.	SC 200 mm f/10	digicam	April 18, 2005 (21:40)	2.83°
Zannelli, C.	Mak-Newton 180 mm f/6	webcam	April 18, 2005 (21:45)	2.87°
Wirths, M.	Newton 450 mm f/4.3	webcam	February 19, 2005 (02:21)	6.19°

**Table 2:** Measurements on the raw image taken by Z. Pujic.

Alt	Dome diameter		Shadow length		Height (m)	Slope
	pixels	Km	pixels	km		
1.48°	48 ± 1	7.82 ± 0.33	12 ± 1	1.95 ± 0.33	101 ± 10	1.48°

From Table 2 and [14] it follows that the average slope angle of the dome is 1.48°. The height of the dome was then estimated using equation (1). It turns out that the summit of the dome is  $(101 \pm 10)$  m higher than the surrounding plain.

Fig. 2 shows another image. It was taken by Carmelo Zannelli on April 03, 2005, at 21:45 UT.

Further morphometric data was obtained by generating a digital elevation map of the dome from the image shown in Fig. 1, relying on a combined photoclinometry and shape from shading analysis (cf. [2] and references therein). The result is shown in Fig. 3, viewed from south-eastern direction. The effective height of the dome was obtained by determining elevation differences between the summit of the dome and its surrounding, leading to a height of  $(105 \pm 15)$  m. This value is in agreement with the dome height obtained by means of the Ashbrook method. The crater pit may be deeper than it appears in the 3D profile of Fig. 3 because it is not well resolved in Fig. 1.

Fig. 4 displays Lunar Orbiter frame IV-126-H1, where this dome is recognisable with an elongated depression. This depression represents the original vent, the place at which lava poured out over the lunar surface, successively building up a shield-like volcano around it. On the Earth, an elongation of this type would most likely represent an eruption along a rift zone, though other possible mechanisms also exist.

Clearly these preliminary data can be improved by new specific observations. Any observations that readers can make about the unlisted dome we are dealing with will be gratefully received for our GLR survey ([lana@glrgroup.org](mailto:lana@glrgroup.org)). The activities of the GLR group are described at <http://www.glrgroup.org>.

## References

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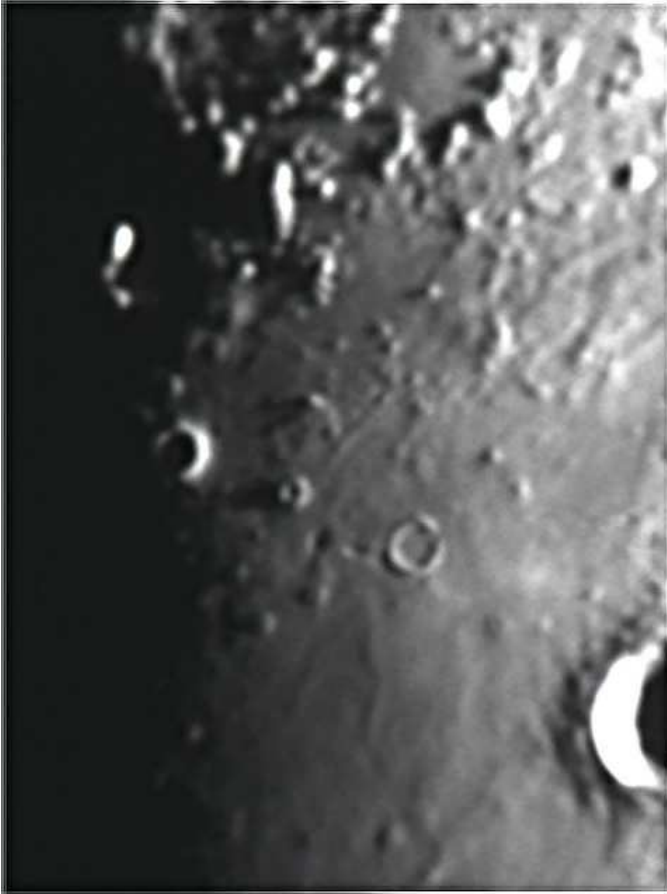
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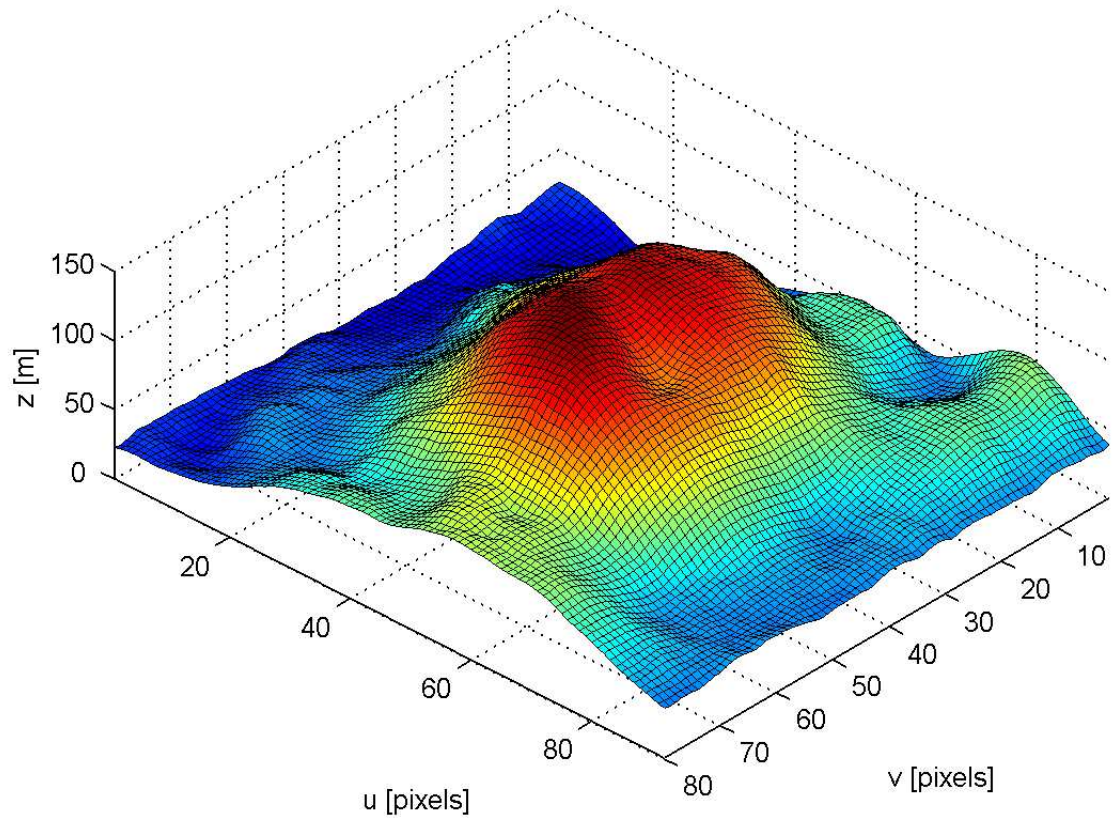
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**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**