Searching domes in Mare Spumans
By Raffaello Lena

In this contribution I examine Mare Spumans. The search for lunar domes in the easternmost regions of the Moon can be a goal for amateur astrophotographers and astronomers. The domes in Mare Undarum are an example of the volcanic activity that also occurred in these regions. The domes in Mare Undarum have been studied some years ago and reported in the article published in Planetary and Space Science (Lena et al., 2008; Lena et al., 2013).

All five domes near Condorcet (see also the image reported in our lunar domes atlas: https://undarumdomes.blogspot.com/) have moderate diameters between 10 and 12kms. Condorcet 1–3 are similar to effusive domes of intermediate flank slope between 1° and 2° like those situated in the Hortensius/Milichius/T. Mayer region, while Condorcet 4 has steeper flank slope of 2.8° and a large volume. Dubiago 3 displays an average slope of 0.9° (Lena et al., 2008).
Mare Undarum is situated in a major trough concentric to the Crisium basin. The domes Condorcet 1–3 are aligned radially with respect to the Crisium basin. Similar dome configurations aligned radial to major impact basins are known from other lunar mare dome fields (Lena et al., 2013).

Thus it is interesting to monitor neighboring regions such as Mare Spumans, searching lunar domes. During a survey, I have identified a dome, circular in shape, located at 66.2°E and 0.08° S, with a base diameter of 8.5km (Fig.1).

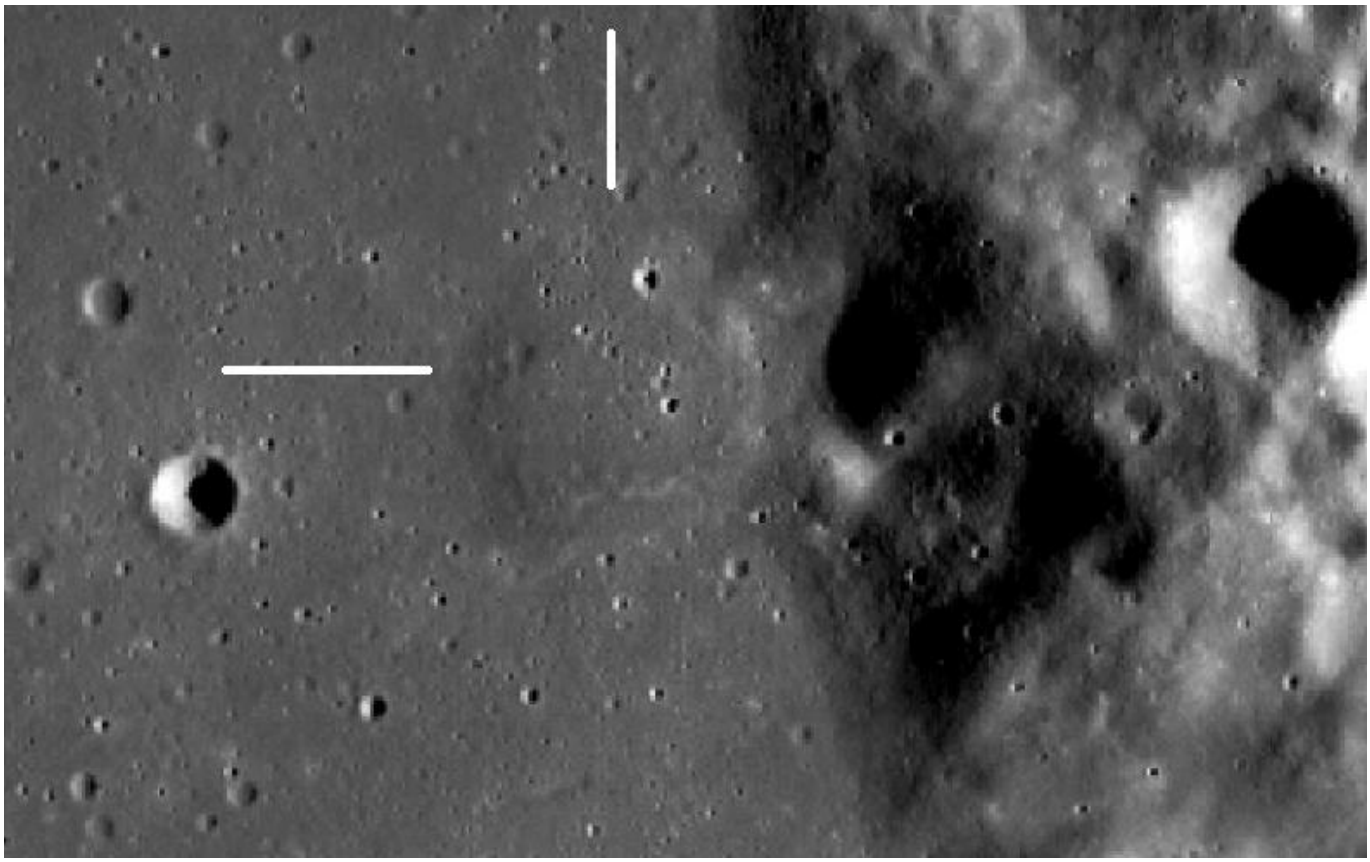

Figure 1: The dome described in the current study, termed as Spumans 1.

It lies at about 26km south west of the crater Pomortsev. ACT-REACT Quick Map tool was used to access to the LOLA DEM dataset, obtaining the cross-sectional profile (Fig. 2).

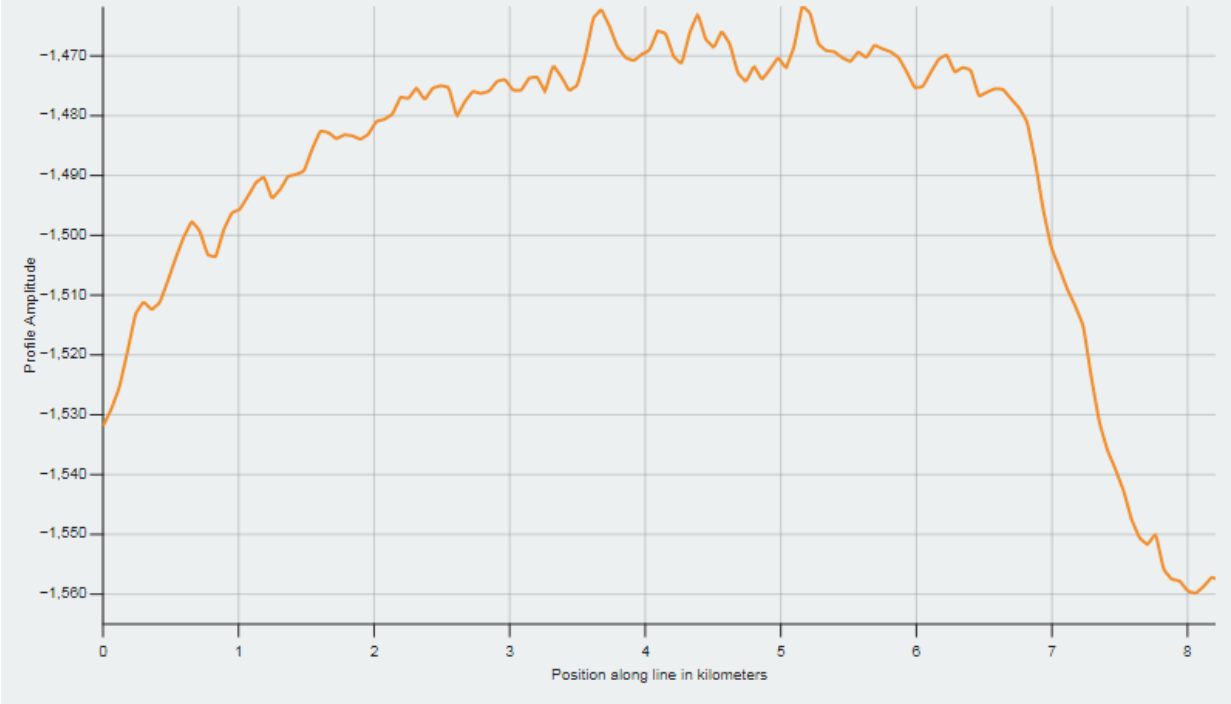

Figure 2: LRO WAC-derived surface elevation plot of Spumans 1 in East-West direction based on LOLA DEM.

The height amounts to 80 ± 10m, yielding an average flank slope of 1.1° ± 0.1°. The dome edifice volume is determined to about 3km³ assuming a parabolic shape. A 3D reconstruction is shown in Fig. 3.

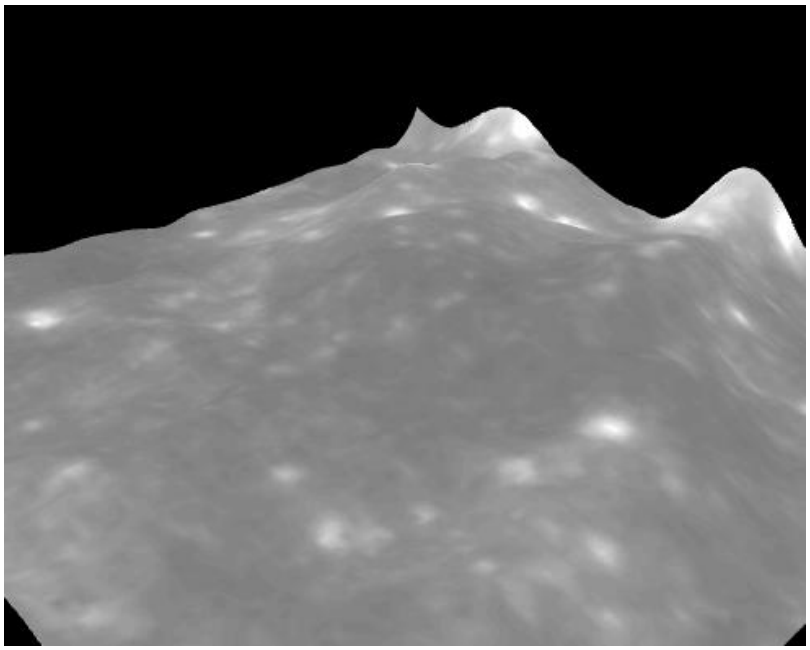

Figure 3: Spumans 1, 3D reconstruction based on GLD100 dataset derived using ACT-REACT Quick Map tool.

The rheologic model (Lena et al., 2013; Wilson & Head, 2003) applied to the examined dome yields an effusion rate of 220 $m^3 s^{-1}$ and a lava viscosity of 6.5 x 10^4 Pa s. It formed over a period of time of 0.4 years. According to the classification scheme for lunar domes (Lena et al., 2013) the examined dome identified in Mare Spumans belongs to class C_2.

Some possible vents are under investigation. Furthermore a wrinkle ridge is detectable in its summit in south eastern direction.
The spectral signature of the dome, derived from Clementine UVVIS imagery, reveals that it consists of basaltic lava with a low TiO_2 content below 2wt% and with FeO content about 15wt%.

According to the FeO and TiO_2 content we can infer that the main rock type is low-Ti basalt, with some signatures of olivine in some regions on the summit (Fig. 4 and 5).

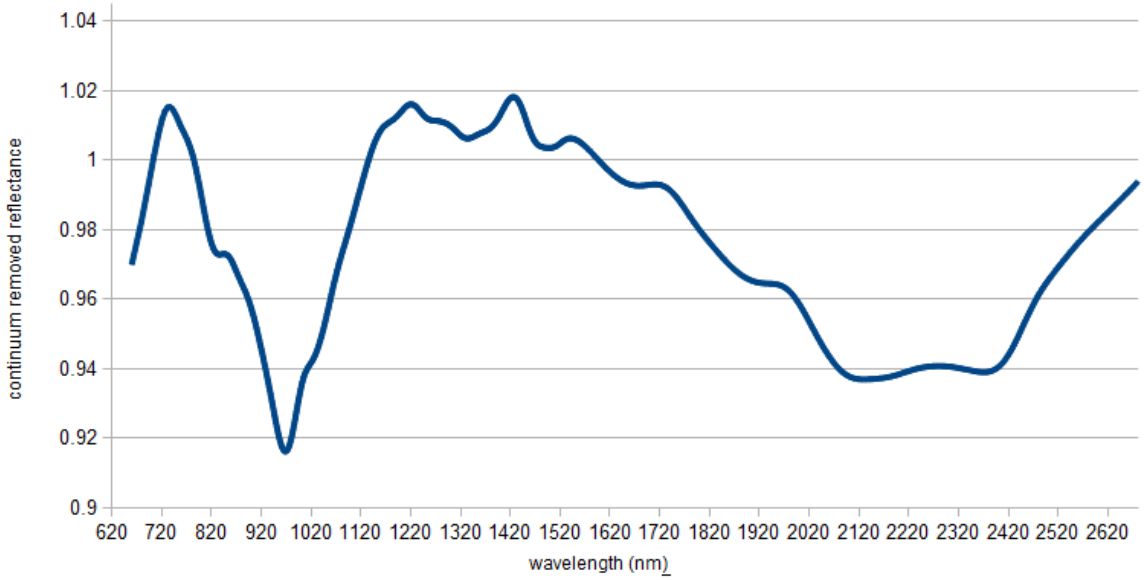

Figure 4: Chandrayaan-1 Moon Mineralogy Mapper, spectral analysis.

The distribution of olivine is shown in Fig. 5 derived by Mineral Mapper reflectance data acquired by the JAXA SELENE/Kaguya mission (Kodama, S., et al., 2010) ranging from -50° to 50° latitude, and indicating a different composition across the dome summit.

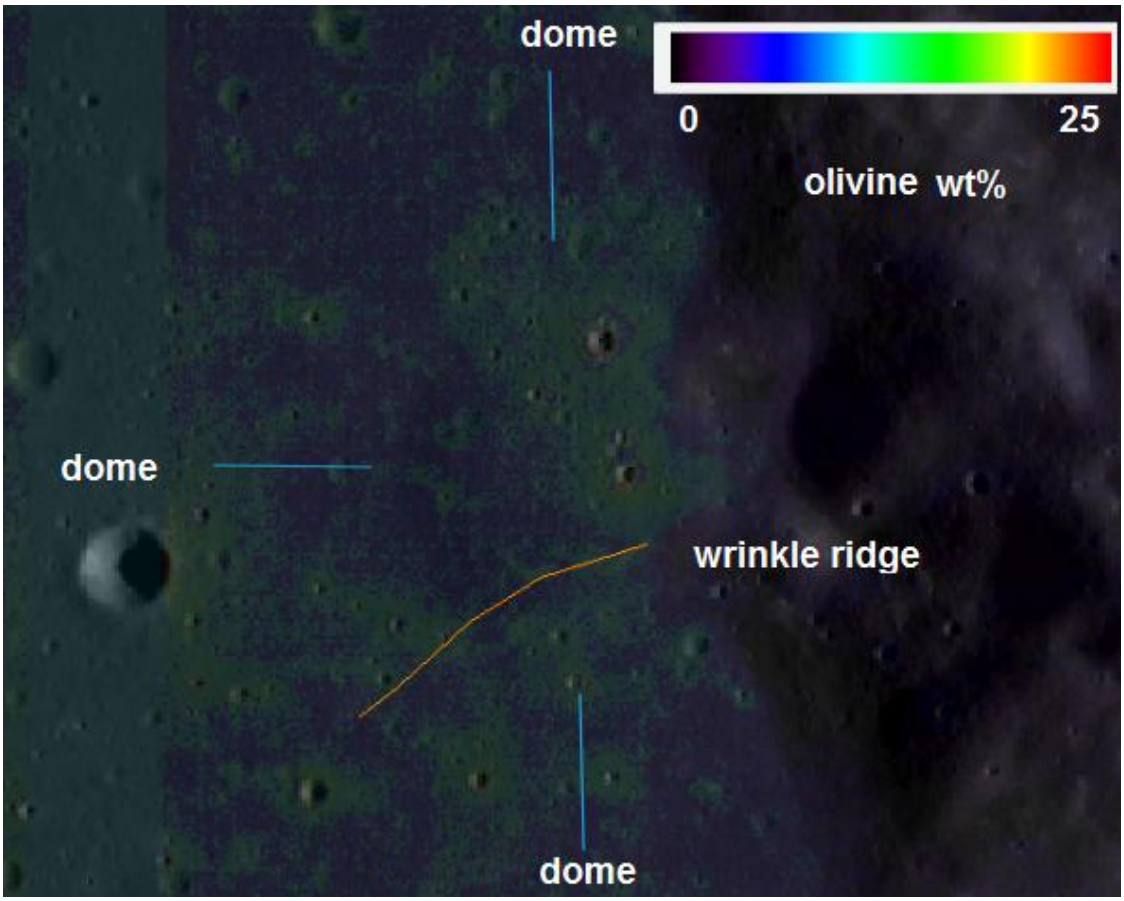

Figure 5: Mineral Mapper reflectance data acquired by the JAXA SELENE/Kaguya mission. Olivine distribution (wt %).

This dome lies in a region mapped as *Im2* unit in the rasterized version of the 2013 renovation of the I-0703 Wilhelms Geologic Map of the near side, mapped at a scale of 1:5,000,000 and ranging from -64 to 64 degrees latitude and -70 to 70 degrees longitude (Fortezzo and Hare, 2013), which denotes *Upper Imbrian* mare material (3.2-3.75 billion years ago). Thus it is of *Imbrian* age.

I encourage high-resolution imagery of this area using telescopic images, which I will correct for the inevitable foreshortening effect, so we can have more data of this dome, under study.
Further investigation is currently ongoing. Please check also your past imagery and send them to me for the ongoing study (lunar-domes@alpo-astronomy.org).

References

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