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europlanet 2024
Research Infrastructure

Geology & Planetary Mapping
Winter School

Geomorphological mapping of the Valentine Domes on the Moon

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EUROPLANET 2024 Research Infrastructure

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GMAP
Geological Mapping

Introduction

The end goals of the current space exploration programs would require extensive logistics and **plenty of resources**. Important sources have been already identified, but other geological settings have not been studied in detail, including the **intrusive igneous processes and their derivative features**.

Geological characterization of the Valentine Domes in the Moon, and assessment of their potential as resource reservoirs.

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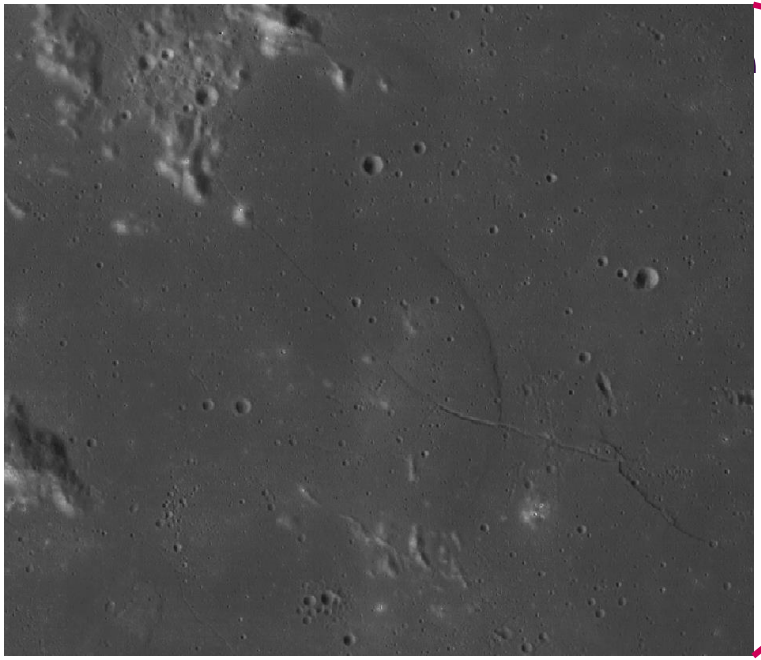
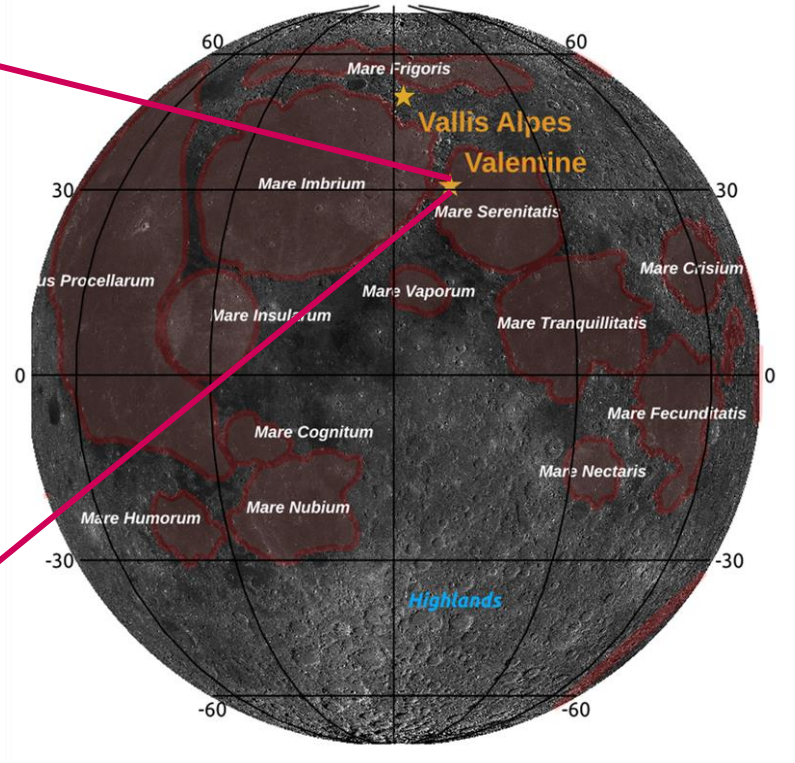
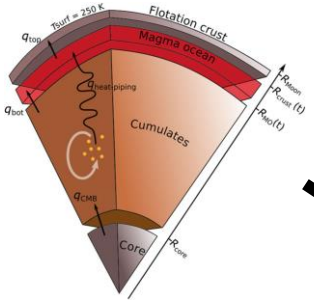
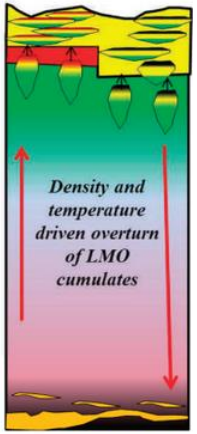




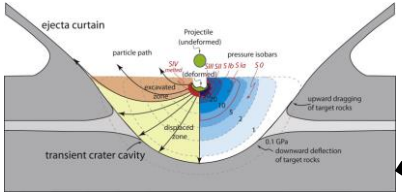
The Moon



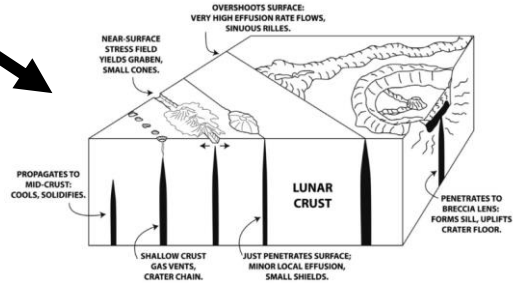
Maurice et al. (2020).



Shearer et al. (2015).

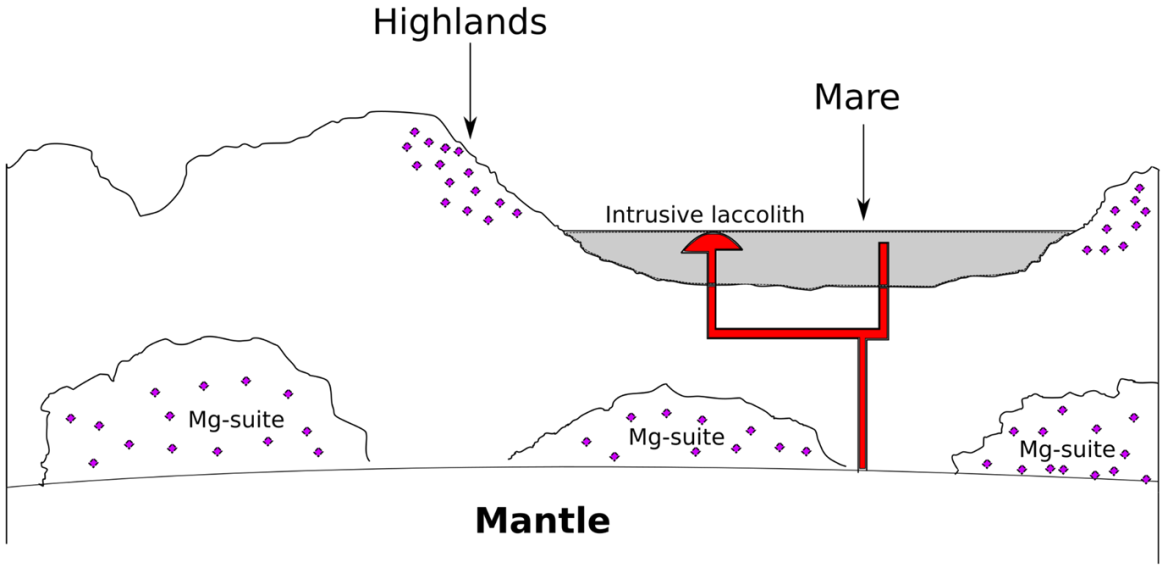


Kenkmann et al. (2017).



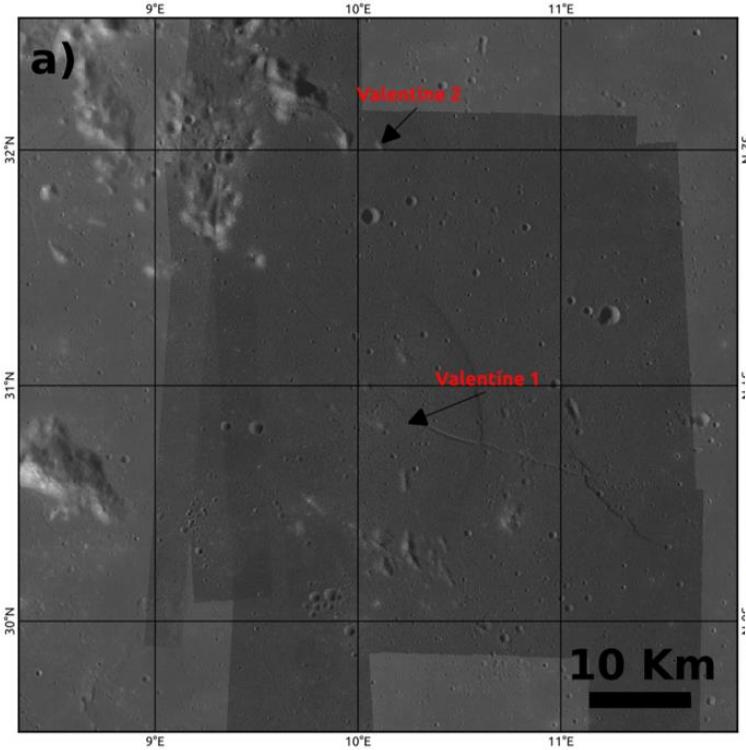
Wilson and Head (2017).

The Moon

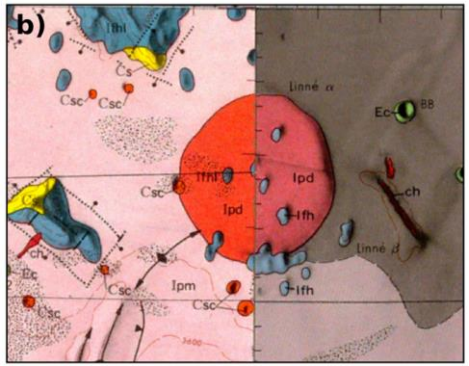


The two possible scenarios where plutonic rocks can reach the surface: as ejecta of massive asteroid impacts, or as intrusive bodies originated from magma ascending on a thinner crust.

Valentine domes

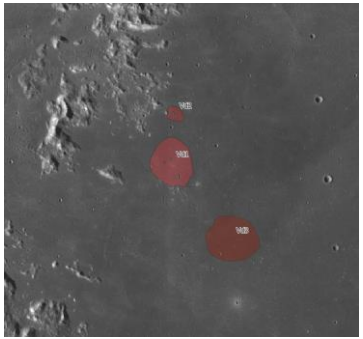


- West margin of the Serenitatis Basin (30.69° N, 10.20° E).
- Two edifices, a small one to the north and a big asymmetrical dome 70 km wide.
- Large fault to the east side of the bigger edifice.

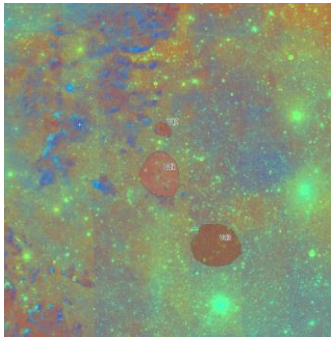


a) Valentine domes. b) Geologic map (Taken from Hackman 1996, Carr 1966).

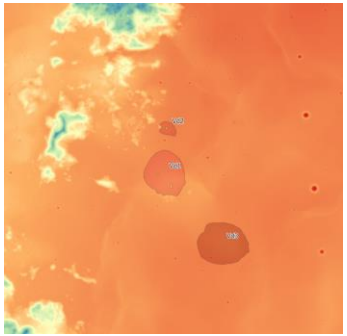
Data



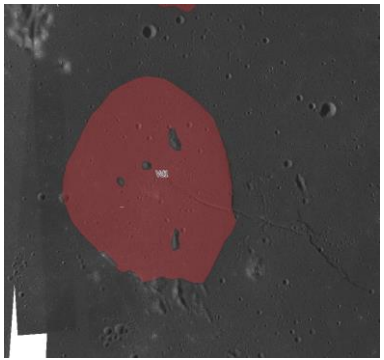
Wide Angle Camera (WAC)



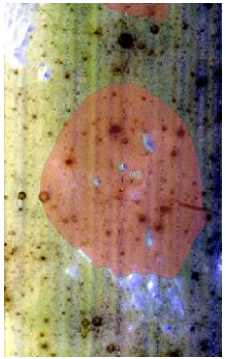
Ultraviolet/Visible Camera (UV-VIS)



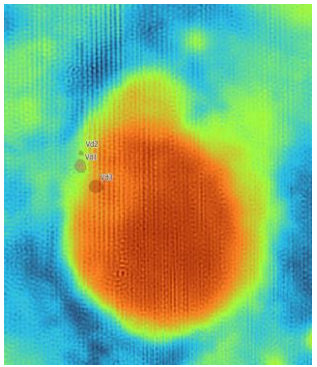
Laser Altimeter (LALT)



Narrow Angle Camera (NAC)



Moon Mineralogy Mapper (M^3)

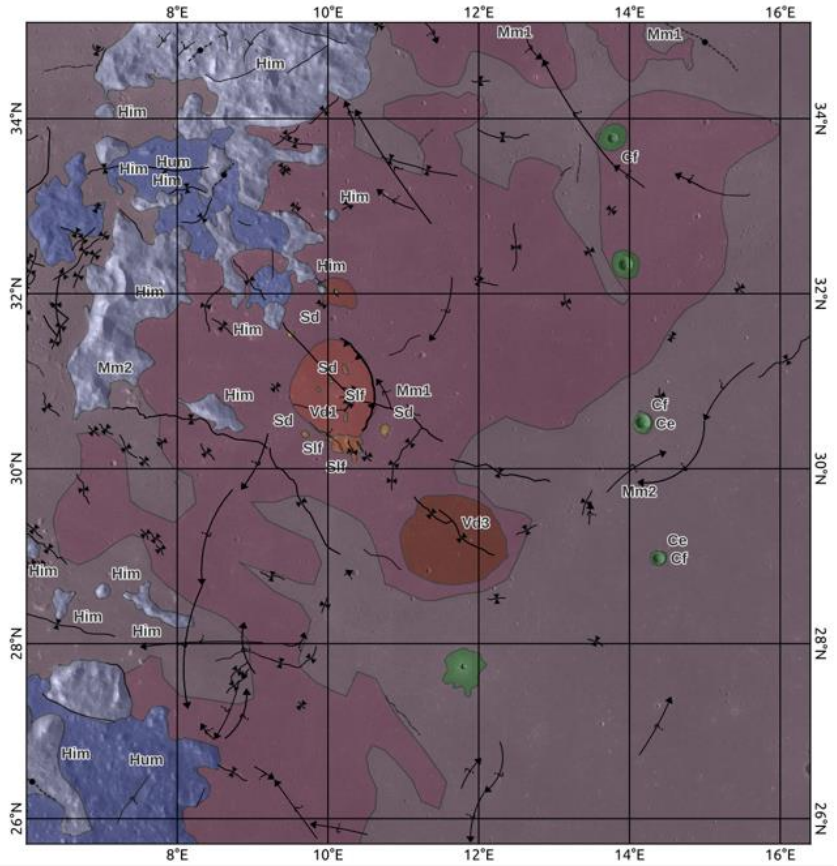


GRAIL

Results

Geomorphology

- Identification of a third dome.
- Several mounds are located inside the main domes.

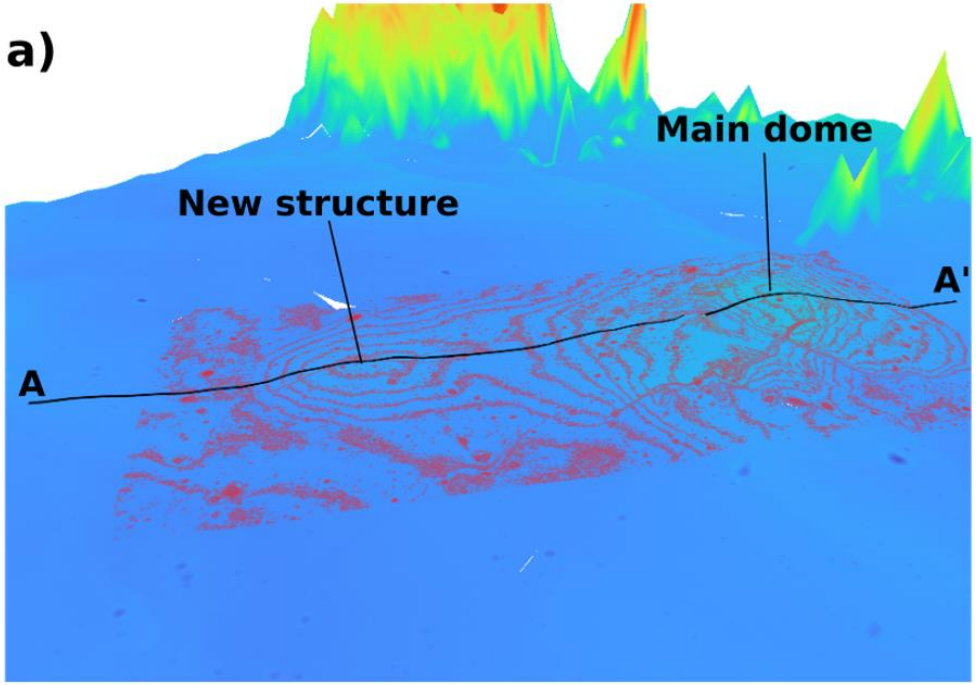


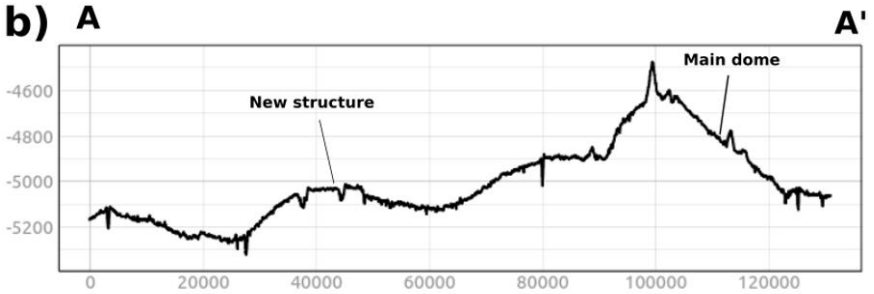
Legend

Contact Type
- Certain
- Uncertain

Linear_Faeatures
- Crater chain
- Inverse fault
- Rille
- Wrinkle ridge
- Ridge
- Valley

Regional_Geomorphological_map
- Ce: Ejecta from a crater.
- Cf: Floor of crater inside the Serenitatis Basins.
- Him: Tophographically high area in the rim of the Serenitatis Basin.
- Hum: Tophographically less high area, hummocky texture.
- Mm1: Lava flood plain. It is darker than the other mare unit.
- Mm2: Lava flood plain, it is lighter than the other mare unit.
- Sd: Secondary domes associated with Valentine domes.
- Slf: This features are located inside the area of the main domic structure.
- Vd1: Main structure of the dome complex.
- Vd2: Second domic structure in the complex.
- Vd3: Third domic structure in the complex.

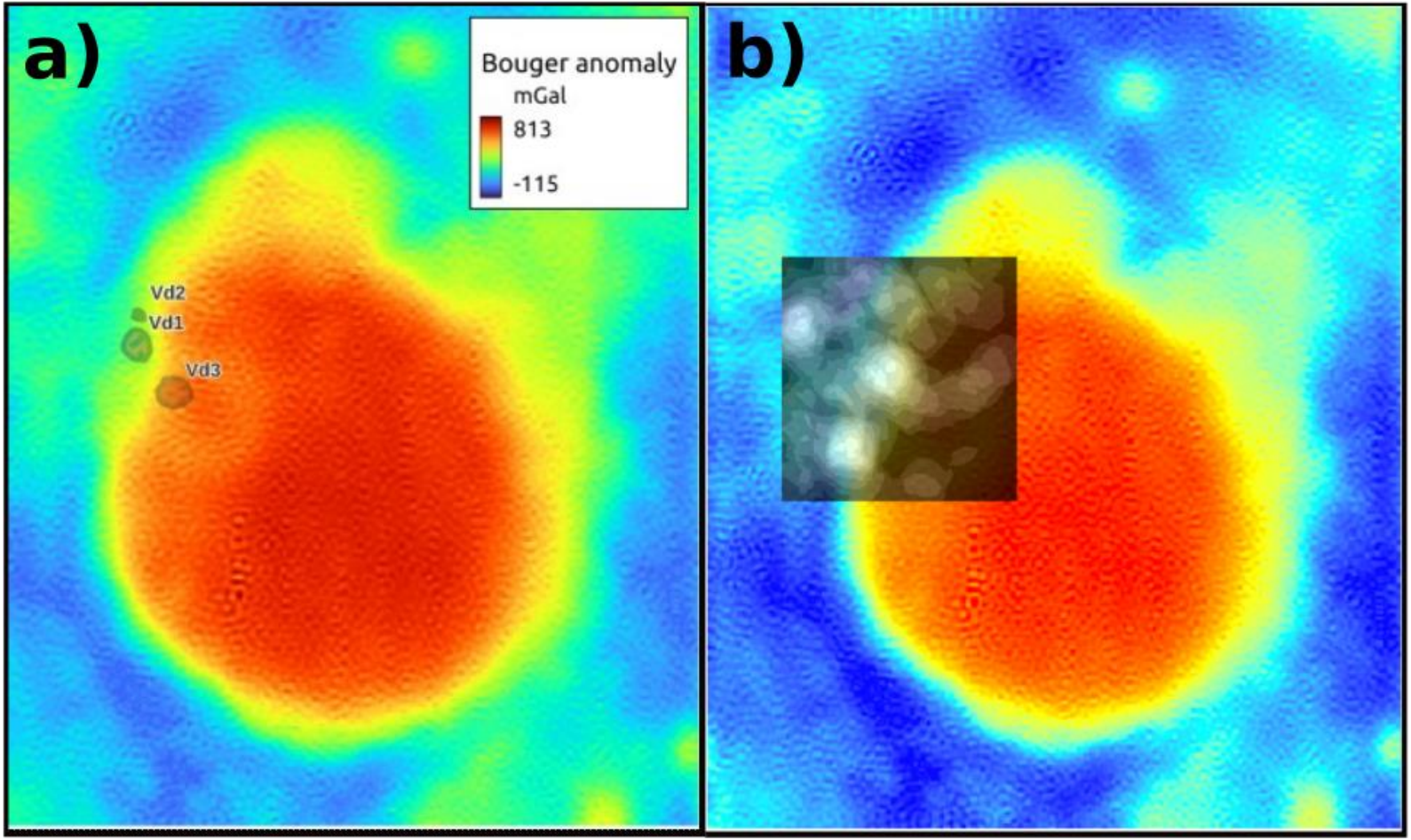




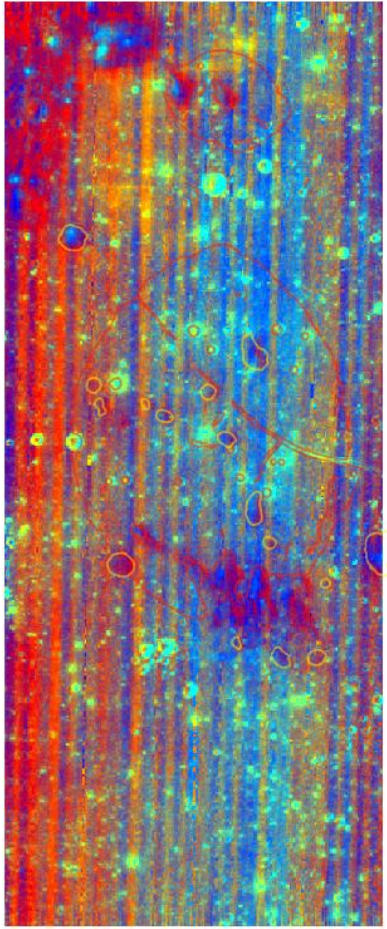
- The main dome is topographically connected with the new dome.

Geomorphology

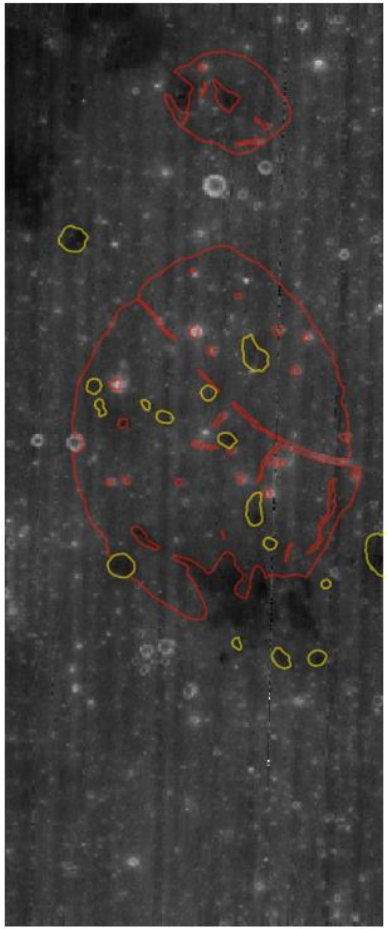
- Multiple secondary domes outcrop inside and around the main dome.
- Dykes and kipukas are also present in the area.


a)
Bouger anomaly
mGal
813
-115
Vd2
Vd1
Vd3
b)

Spectral indexes



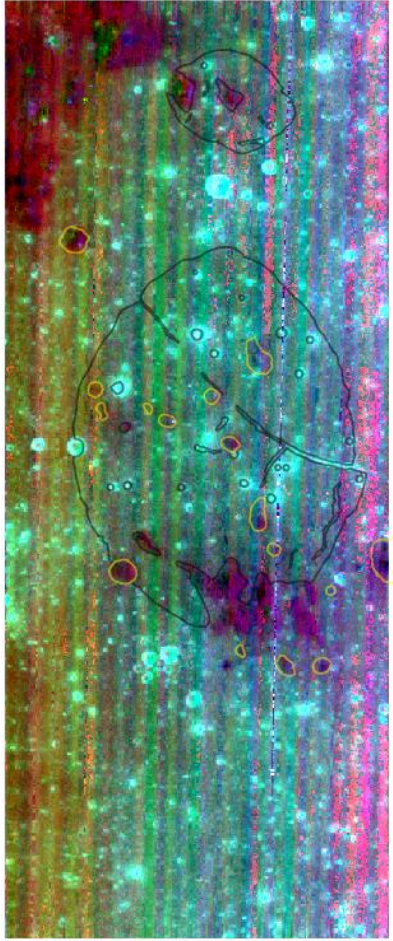
CLEM



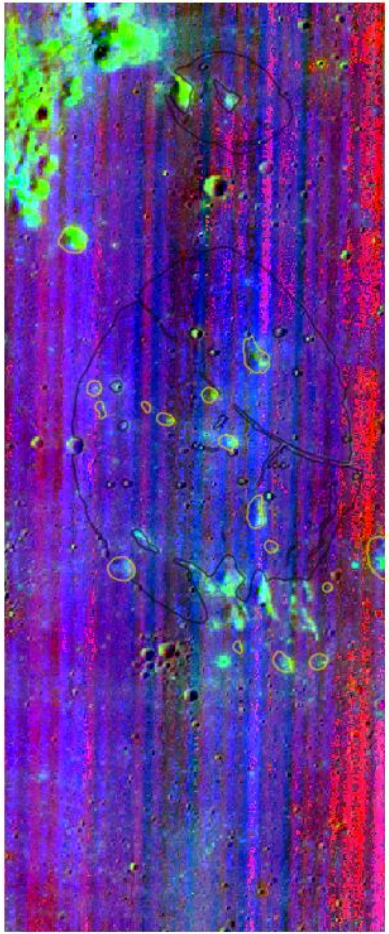
BD1

- Clem: Red: R750 nm/R540 nm, Green: R750 nm/R1000 nm, Blue: R540nm/R750 nm.
- BD1: Band Depth at 1000 nm.

Spectral indexes



RGB1



RGB2

- RGB1: Red: SpectralSlope1000 nm, Green: Band Depth 1000 nm, Blue: Band Depth 2000 nm.
- RGB2: Red: SpectralSlope1000 nm, Green: Reflectance 540 nm, Blue: Band Depth 2000 nm.

Conclusions

- The Valentine Dome system seems to be more complex than previously though.

- Several secondary domes and faults indicate that the intrusive body could have had a connection to the surface, creating a suitable environment for mineral accumulation.

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