Analysis of Crater Lara and Immediate Neighborhood as Potential Science Landing Targets

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Crater Lara

Location : 20.04°N 30.05°E

Geological Properties:

- Crater in an almost Closed valley (specific Exits)
- Young Mantle Material (Orange Glass Globeule)
- Light Mantle Nearby (older)
- (Lincoln Lee) Scrape
- Fault Zones Covered in Lava Flow

Mission Profile:

Extension of Zone of interest: 13000 meter

Estimated mission time for entire route: 50 days (~ 350 meter a day, 35 days of work, 15 dormant days)

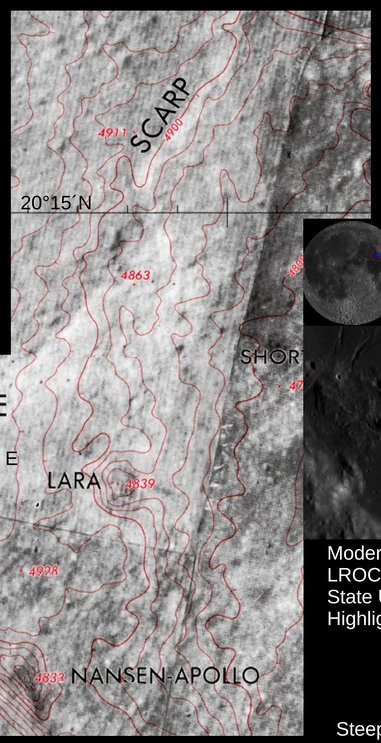
Expected Mission time: 20 Days

Two rovers, Six microrovers

Lander as Relay and Static sensor hub

Crater Lara : Geological Interests

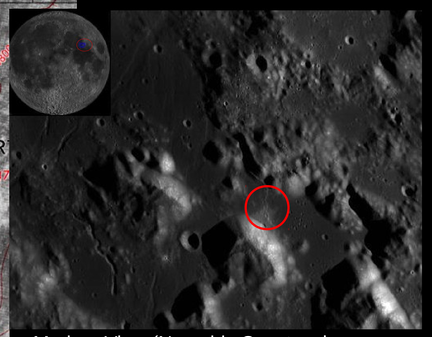
1. pIr material in flatland. Rectilinear outline suggests Thermal Fracture
2. Presence of Scrap and Eroded Rim (Rayless). Lara, Shorty, and Victory shares common origin
3. Location in a Ring System valley, Exit nearby
4. Tectonic rejuvenation, and lava cover on Fault zone (Scrape)
5. Light and Dark Mantle, differential origin of regolith.
6. Long distance transport: pyroclasts from Procellarium, Impact ejecta from Tycho
7. Synthetically inserted Feature: Apollo 17 tracks



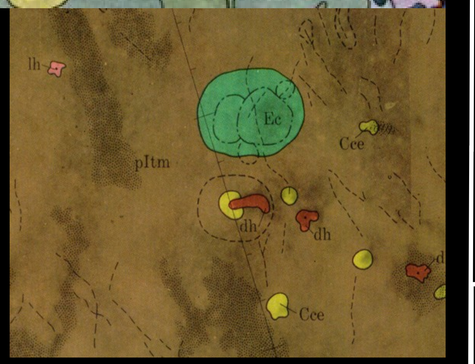
Crater Lara in Lunar Atlas (LPRI/NASA Publication, Lunar Topophoto Map, Sheet 43D1S1(50))

Crater Lara and Regional Geological Map (USGS)

pIr: Rugged Material, rectilinear outline (10 km), IpIt: Terrain Material, age not exactly known Cld: Dark Mantle Material, Troughs at mare margins, possibly pyroclastic. Cc: Crater material in general. pIe: Further crater material

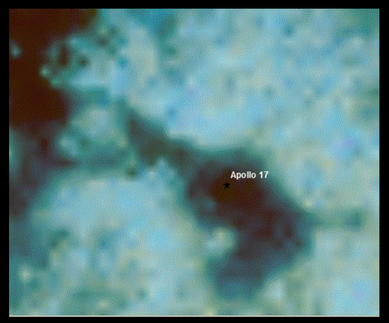


Modern View (Nearside Spectacular, LROC WAC, NASA/GSFC/Arizona State University) Inset: location Highlighted in Moon Map



Crater Lara and Regional Geological Map PreMission Map (GAM)

Ec: Eratosthenian Crater, > 300m diam. Steep, Shallow. Morphographics of Impact crater, PItm: Ejecta, uplifted via faulting. Cce: Subdued, eroded rim dH: Dark Halo Possibly Locally Volcanic, lH: light Halo

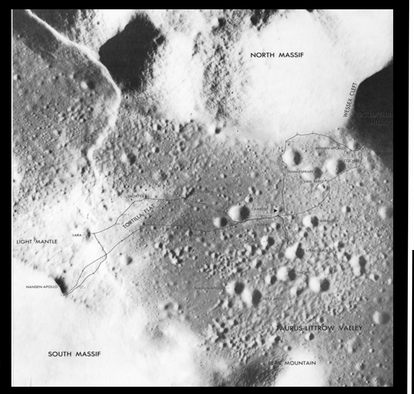


Clementine Mineral Concentration map:

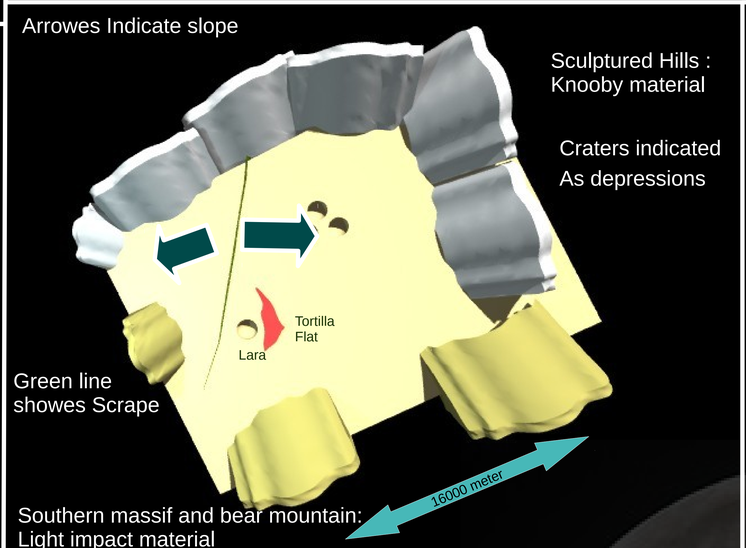
Bluer: higher concentration of TiO_2

Redder : higher concentration of FeO.

(up to 25 wt.% maximum)



Apollo 17 Traverse Map (USGS/LPRI)



Geological Situation : Simplified Cartoon

Questions to answer:

1. Thermal Dynamics of Lunar Regolith, and Possible relation to thermal crustal dynamics (Tortilla Flat)
2. Lara as a rayless crater: Morphology of older eroded craters. Deposition, and erotion dynamics
3. Scrape : Rilly along fault zone: Role in Dust transport, lava covered morphology, and possible historical fluid trnsport.
4. Stability of sharp regolith boundaries reported by E. Carman
5. Long range transport of material (Craters, Sculptured Hills)
6. Tectonic rejuvination, and it's effects on crater morphology (Lara, Shorty, Victory)
7. Dynamics of regolith erotion and deposition, and estimation of Crater morphology change. (East of tortilla flat)
8. Later lunar magma (Eu deplation), Secondary impacts (Breccia in Breccia)

Mission Concept Review : Summary

1. Monitoring Thermal Fractures using static accoustic sensors inside Regolith (projected profile : 20 Earth days, of which 15 correspond to a lunar night)
2. Dust transport monitoring using static / mobile sensors, Static sensors near rim edges (to estimate dust driven erosion)
3. Impact counter to monitor / estimate particle budget
4. Mobile Sensor to monitor regolith properties, over a large area.
5. Solar wind / cosmic ray – surface interaction : local surface and subsurface probing
6. Optical system to identify geological structures

References:

1. Wolfe E. W. et al. (1981, digital version 2004) The Geologic Investigation of the Taurus-Littrow Valley: Apollo 17 Landing Site, Apollo 17 Lunar Surface Journal, GSPP 1080.
2. Garrick-Bethell I. et al. (2011) Icarus 212 480–492
3. Sternovsky Z and Robertson, S. (2002) JGR, 107, NO. E11, 5105, doi: 10.1029/2002JE001897
4. Spudis, Paul D.; Wilhelms, Don. E. And Robinson Mark S. (2011) 42nd Lunar and Planetary Science Conference

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