# Analysis of Crater Lara and Immediate Neighborhood as Potential Science Landing Target

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**Introduction:**

The proposed Landing site of the mission of the Google Lunar X PRIZE team Synergy Moon is the Taurus Littrow Region, investigated during the Apollo 17 mission.
In this study, we investigate the potential of the region as a possible landing target. The Taurus Littrow region is a valley located in the Taurus Mountain range, and is ornamented by a number of craters and rilles. The mountain range is formed on Mare Serenitatis , near the connection to Mare Tranquilitatis. The Taurus system is a ring of mountains, in a southern direction from the Littrow Crater, which is a heavily worn impact crater. The whole system is located in Lunar nearside.

**Geology:**

The Apollo 17 mission returned sampled from that area, improving our understanding about the region, in addition to telescope based observation. *Formation.* Radioactive dating of the samples indicate the edge of the mountains, as well as Serenitatis to be 3.8 to 3.9 Billion years. The impact Breccia found in the surface indicate a impact origin of the system. [1]

*Surface Properties.* Apollo 17 EVA discovered the presence of orange glass beads, which indicates the presence of Extrusive Volcanic activities. However, the albedo of the material is relatively low, despite the age. [1] In the southern uplands, the surface is composed of lighter colored magma.

*Formations.* Besides the mountain ring system consisting of Northern Massif, Bowen Apollo, and Southern Massif, the region contains, among other things, the crater Lara, and the rille Scarpe.

**Potential Science Objectives:**

The fact that the location was chosen as the Apollo 17 landing site already suggests the potential of it as a science landing site. Besides, since we already have a wealth of data from apollo, the prospect of revisiting the site is worth investigating. The mission of Team Synergy Moon involves traversing the lunar surface using robotic rover and possibly micro-rovers. The Mission profile will probably not extend 10 kilometers in range from landing point. We assume the location of the Apollo 17 Lunar Descent Module (A17 LDM) as the point of reference (PR)

*The regional map.* The Taurus Littrow valley is not circular, elongated along an axis pointing towards Serenitatis. [1] The southern exits are partially blocked by subsequent crater formations, the principle exit

being the one to the west, also partially blocked by low mountains. The Orbital Gravity Data suggests the presense of multiple underlaying basins. [1]

*General slope.* The immediate idea at this point is finding the large scale structure and anomalies of the system, which however, does not fall in the scope of TSM mission. Other more specialized missions (e.g. Grail) are intended for this purpose already.

*Dynamics.* The crater Lara appears to be a young crater, as the A17 EVA station 3 sample indicates (around 100 million years) [1], The lava drapes over a scrape, possibly a fault. Since tectonic activity in moon does not occur, the driving force behind such fault formation may well be thermal deformation of crust. The thermal activity on the surface can be observed using static sensors inserted into ground. The Mare basin deposit consists of particles with mean radius 40μm, consisting volcanic glass [1]. On lunar surface, transport of microparticles is well known [2] [3]. The target valley is a almost closed system with a exit to a vast low laying basin. It is possible to monitor the dust transport in the closed system relatively well by monitoring the exits. The exits lie within the reachable range of a rover. Static sensors / microrobots dropped from a rover can perform the task of monitoring the exits.

The final topic of interest is erosion. There exists very young Tracks left by A17 EVA, and photographed by Lunar Reconnaissance Orbiter Camera, from the camera (and from theoretical models) considerable erosion is not to expect. The massif foothills consists of mass wasteing deposits [1], which are rather young as well. However, since these targets lie within rovers reach, investigation of erosion may be undertaken.

**Conclusion:**

There exists possibilities of science return with limited resource and instruments as assumed by the mission profile of Team Synergy Moon. As the team continues to investigate, further possibilities and possible targets continue to appear.

**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