VOLCANIC GLASS DISTRIBUTION AND POTENTIAL SOURCE VENTS FOR THE TAURUS-LITTROW PYROCLASTIC DEPOSIT AT THE APOLLO 17 LANDING SITE REGION.

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Introduction: Apollo 17 landed in Taurus-Littrow valley, characterized by the prominent Taurus-Littrow regional pyroclastic deposit. The valuable *in situ* geologic context and returned samples from this and other regional lunar pyroclastic deposits have contributed significantly to our understanding of explosive volcanism on the Moon. Samples were obtained during the Apollo 17 mission from the Taurus-Littrow valley that contained orange, glassy and black, crystalline volcanic beads (i.e., [1]). Remote sensing analyses suggest that the Taurus-Littrow regional pyroclastic deposit contains a high percentage of the black crystalline beads in addition to the glass-rich material [2, 3].

The bulk of the Taurus-Littrow pyroclastic deposit is located west of the Apollo 17 landing site (Figure 1), bounded by highlands massifs and mare basalts from Mare Serenitatis. There are several rilles located in the region, including Rima Littrow, Rima Carmen, and Rima Rudolph as well as several unnamed sinuous rilles. As a prominent sinuous rille to the west of the Apollo 17 landing site, Rima Carmen has been hypothesized to be volcanic in origin, and it has an oval depression located at the southern end of the rille that may be a volcanic vent [3,4]. Although at ~22 km in length and 1.5 km across in places Rima Carmen is the largest possible source vent for the Taurus-Littrow pyroclastics, earlier studies have suggested that it is too far away from the darkest units, the vent was most likely located to the west, and it was buried by later basalt flows in Mare Serenititatis [3].

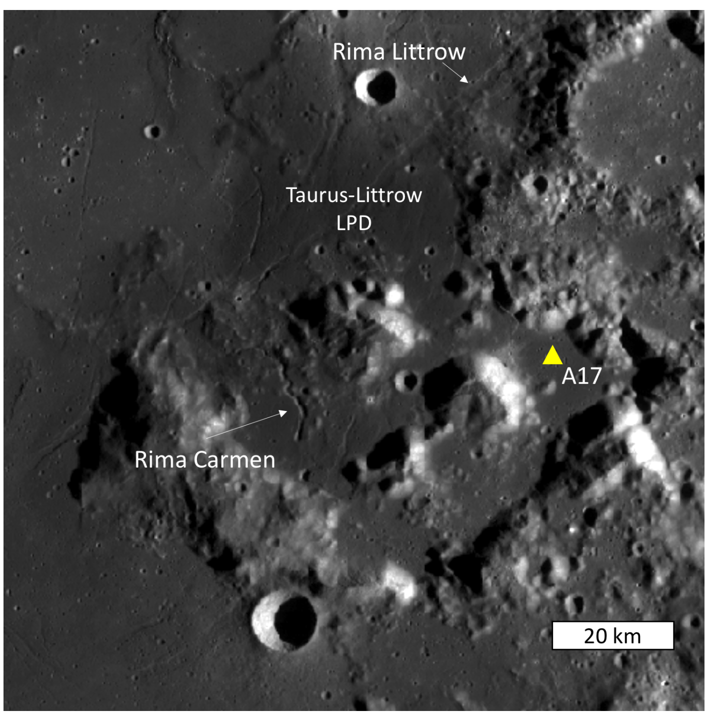

Figure 1: Apollo 17 landing region. Basemap: LROC WAC.

Glass and crystalline pyroclastic beads from Taurus-Littrow are enriched in iron and titanium oxides [5]. In addition to being a potential source for iron, titanium, and oxygen [6], the glass and crystalline beads also have surficial vapor-deposited coatings of volatile-element compounds that may be valuable resources. Because the thickest pyroclastic units are likely to be closest the vents, it is important that we identify source vents where possible. In this study we use Moon Mineralogy Mapper (M^3) [7] data to investigate possible vent locations for the Taurus-Littrow regional pyroclastic deposit and to characterize the regional geology. In particular, we produce a glass map of the region to constrain the distribution of volcanic glass in the area. We will test the hypothesis that the Taurus-Littrow pyroclastic deposit was sourced from one of the local rilles, with emphasis on Rima Carmen, a possible source vent of this deposit [3]. If the deposit was sourced from one of these rilles, we predict that glass will be more abundant or concentrated near those potential vents.

Methods: M^3 data are used to map the presence and distribution of volcanic glasses and mafic mineralogy of surface units. Such maps are used to identify potential vents and characterize local and regional variations in composition. Data processing (including continuum removal, spectral smoothing, and band parameter derivation) is completed using the methods from Horgan et al. [8]. The glass band parameter used here was created by taking the average of the depth below the continuum at three wavelengths: 1.15, 1.18, and 1.20 µm [8]. This band parameter will also detect olivine if it is present, so analysis of individual spectra is necessary to confirm the presence of glass. We investigate multiple M^3 images over the Apollo 17 region (Figure 2).

Results and Interpretations: Glass is present throughout the region, corresponding to the spatial extent of the darkest pyroclastic deposit (Figure 2). This is consistent with previous findings that the Taurus-Littrow deposit contains glass, but the glass map by itself does not provide an estimate of the ratio of glass-rich material to crystalline black beads. The highest concentration of glass shown in Figure 2 is located in the northern part of the deposit. While there is glass present near Rima Carmen, there is not an increased concentration as compared to the rest of the deposit. We interpret these results as evidence that Rima Carmen is likely not the source of the Taurus-Littrow pyroclastic material, supporting earlier results [3].

Figure 2 also shows a general lack of glass near the Apollo 17 landing site. This is likely a result of the images used. We selected these two images based on their similar acquisition times within one optical period. However, the image that covers the right half of the scene does not show much glass, while other M^3 images that cover this area show glass present around the Apollo 17 area. Future work will include comparing the multiple M^3 images and identifying the coverage with the least noise and best viewing geometry to most accurately represent the surface materials.

Rima Littrow runs through the northern portion of the Taurus-Littrow pyroclastic deposit, which corresponds to the location of the highest concentrations of glass-rich material. This is a linear rille, not a sinuous rille, and there is no identified potential vent at the end of this rille such as at Rima Carmen. However, based on the proximity of this feature and other nearby small sinuous rilles to the glass-rich pyroclastic materials, we will further investigate the possibility that one of these was the source of the Taurus-Littrow pyroclastic deposit.

Conclusions and Future Work: We find that the majority of the Taurus-Littrow deposit is glass-rich, which suggests that the samples that contained glass-rich material obtained at the Apollo 17 site are likely representative of the entire deposit.

We conclude with previous work that Rima Carmen is not the source of the Taurus-Littrow pyroclastic deposit because there is not an increased glass concentration surrounding the sinuous rille or its potential vent.

In future work, we will investigate the hypothesis that Rima Littrow and nearby smaller sinuous rilles could have sourced the pyroclastic material by analyzing the mafic mineralogy of the region from M^3 and by using high resolution visible images to investigate the spatial and compositional relationships between the rille and the pyroclastic materials.

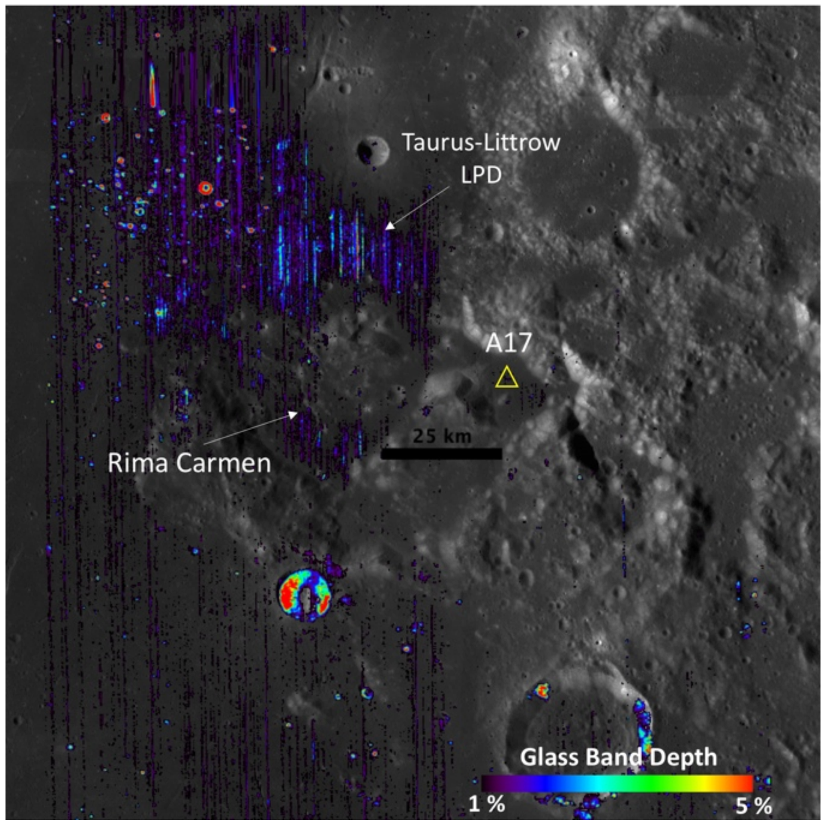

Figure 2: M^3 derived parameter mapping results. Glass parameter map overlain on LROC WAC basemap. M3 images used: M3G20090730T205153 and M3G20090731T005012.

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