



# Analysis Of Highland Material In Apollo 17 Sample 73263: Implications For Future Discoveries

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LPSC 51

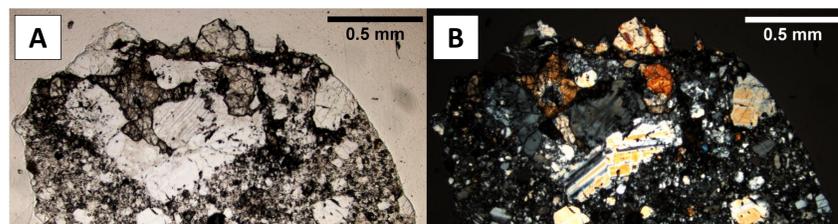
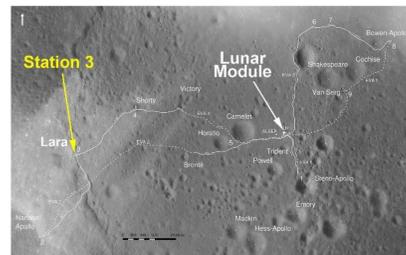
## Background & Introduction

The Taurus-Littrow valley, the landing site for Apollo 17, is located on the south-eastern border of the Mare Serenitatis. Station 3 was in the light mantle landslide deposit approximately 50m east of Lara Crater (Fig. 1). The samples collected from this station include a double-drive tube, which is comprised of samples 73002 above 73001.

The focus of the **Apollo Next Generation Sample Analysis** (ANGSA) project is to investigate drive tubes 73001 and 73002, which have stayed preserved under unique conditions and have not yet been opened or studied. In preparation for this study, we are examining samples from Apollo 17 Station 3.

While more samples will be studied, the initial work is on a breccia fragment (73263,6 – Fig. 2) containing a highlands clast taken from highlands soil 73263,1.

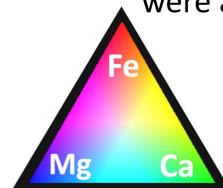
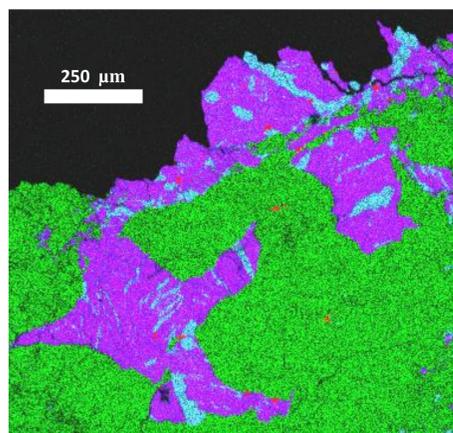
**Figure 1:** Map showing locations of the Lunar Module and Station 3 in the Taurus-Littrow valley (modified from [1])



**Figure 2:** Photomicrographs of 73263,6,11 taken in (A) plane-polarized and (B) crossed-polarized light

## Methodology

- Element map of clast produced using CAMECA SX 100 electron microprobe (Fig. 3)
- Data collected were used to identify points of interest for LA-ICP-MS
- Nu Plasma Attom High Resolution ICP-MS was utilized for laser ablation using a 55µm spot size
- 2 spots were examined for both high and low Ca pyroxene
- 6 spots on 4 different plagioclase were analyzed

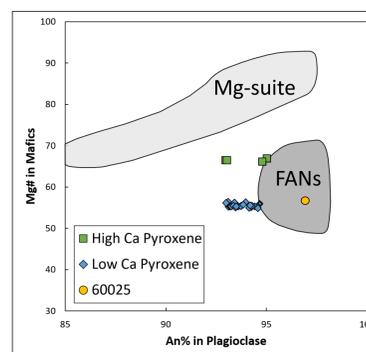
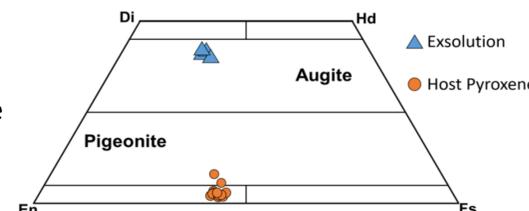


**Figure 3:** An element map showing a close-up of augite exsolution in the pyroxenes

## Results

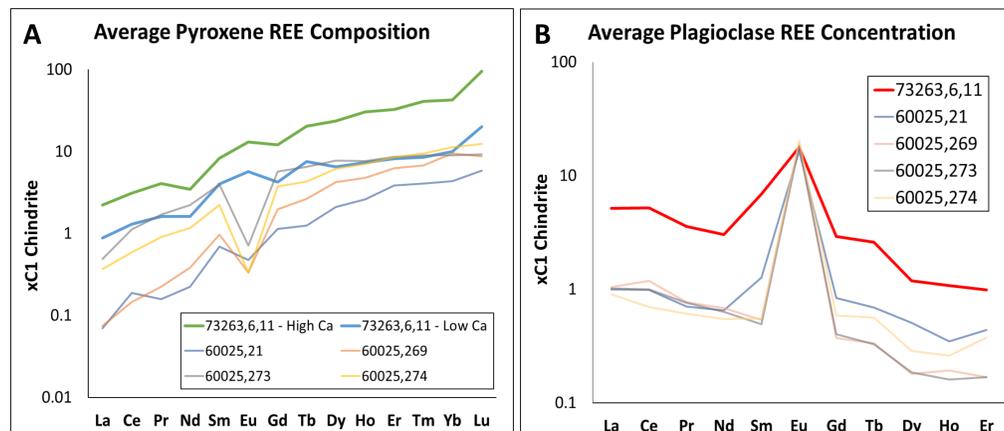
- There is a mixture of high- and low-Ca pyroxene (Fig. 4), with the host orthopyroxene exhibiting both wide and fine lamellae as well as blebby exsolution of augite (Fig. 3)
- Through comparison of the Mg number of the mafics and the anorthite content, 73263,6,11 may be from the ferroan anorthosite (FAN) suite (Fig. 5)

**Figure 4:** Pyroxene quadrilateral for 73263,6,11 showing the 2 pyroxene populations present in the clast



**Figure 5:** The highland clast found in 73263,6,11 plotted on a graph of Plagioclase An content vs. Mg# of the mafics (pyroxenes) in the sample. The pyroxene in 73263,6,11 are represented by green squares for high Ca and blue diamonds for low Ca. The yellow circle is sample 60025. Adapted from [2]

- Pyroxene and plagioclase from 73263,6,11, when compared to different samples taken from an Apollo 16 FAN (60025), have higher concentrations of rare earth elements (REE) (Fig. 6)
- Both high and low Ca pyroxene spots show an uncharacteristic enrichment in Eu



**Figure 6:** The average REE concentrations in (A) both the high Ca and low Ca pyroxene analyzed by LA-ICP-MS plotted with pyroxene from an Apollo 16 FAN [3] and (B) plagioclase taken from the same samples

## Discussion & Conclusions

- 73263,6,11 is a unique sample with lower anorthosite content when compared with other FANs defined by Apollo samples
- Both pyroxene and plagioclase appear to be relatively more enriched in REE than FANs from Apollo 16 and are possibly more evolved
- This sample may be representative of a new FAN composition that has not previously been seen
- FANs are relatively rare from the Serenitatis region sampled by Apollo 17 sample collection
- We hypothesize there could be more FANs of this type to be found in the unopened Apollo 17 cores, as well as possibly other types of samples from this site that were previously unknown

## Future Work

- Studying pyroxene exsolution features and crystallographic orientation to determine cooling rates and possibly infer burial depth
- Re-examination of other Station 3 samples to potentially identify similar patterns
- Samples identified for potential further study: 73155,28 (gabbro clast), 73215, 73216, 73217, 73218, 73235, 73255, and 73275 (breccias/impact melts containing various highlands clasts)

## References

- [1] Hasse, I. et. al. (2018) *ESS* 6, 59-95. [2] Gross. et. al. (2014) *EPSL* 388, 318-328. [3] Torcivia, M. & Neal, C. (2018) *LPSC* 49, #1331