☒ **Talk** ☐ **Poster**

Exploring phosphorus and sulfur speciation in Martian and lunar regolith simulants via synchrotron-based microspectroscopy

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The specific conditions required to sustain life on Earth are highly complex and difficult to replicate on other planets. Planetary exploration will require in-situ resource utilization (IRU) to meet human needs. Therefore, it is essential that the available resources in extraterrestrial systems are well understood. Due to limited insitu samples from these systems, scientists have simulated Martian and lunar regolith to aide in IRU investigation. Researchers are currently using simulated regolith in agricultural studies to better understand how we might grow food on Martian and lunar surfaces. Therefore, it is important to analyze key macronutrients such as phosphorus (P) and sulfur (S) in both real and simulated regolith to assess their similarity and ensure the accuracy of these man-made substrates.

The X-ray fluorescence microprobe (XFM) beamline 4-BM at the National Synchrotron Light Source II (NSLS II) was used in this research to determine the elemental distribution and speciation of P and S in three regolith simulants: MGS-1, JSC-M-1, and LSP-2. µ-XRF mapping of each sample was followed by µ-XANES at various P and S hot spots. Spectral feature analysis (SFA) was used for data analysis and elemental species identification[1].

Each of the three simulants both aligned and deviated from extraterrestrial composition data seen in the literature. In the lunar simulant LSP-2, iron and calcium phosphates were identified, consistent with findings at Apollo sites[2]. JSC-M-1 and MGS-1, the Martian simulants, were found to contain different phosphate species. JSC-M-1 contained primarily iron and aluminum phosphates, while MGS-1 contained calcium phosphates. The presence of the species in MGS-1 indicates a closer resemblance to the composition documented in Martian meteorites[3]. However, none of the regolith samples contain sulfide species typically found in low oxygen atmospheres[4,5]. As researchers continue to investigate space agriculture, these differences need to be addressed for the future of space exploration.

References

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