

From Mount Etna to the Moon: Remote Sensing and Geochemical Assessment of Volcanic Deposits as Lunar Construction Simulant

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The development of new lunar simulants remains essential for advancing lunar construction technologies and habitat development. We present a systematic investigation to identify potential lunar simulant sources within Italy through integrated hyperspectral and geochemical screening approaches. Our methodology combines VNIR-SWIR (0.35-2.5 μm) remote sensing analysis with targeted geochemical characterization to identify regions exhibiting spectral and compositional signatures analogous to Apollo 14 basaltic samples.

Preliminary hyperspectral surveys have identified promising geological formations for detailed investigation. The screening protocol incorporates X-ray diffraction, X-ray fluorescence, and mineralogical analysis to evaluate compositional compatibility with NASA simulant requirements [1]. Concurrent research explores the feasibility of alkali-activated geopolymeric materials for lunar construction, focusing on activation parameters and mechanical performance under simulated lunar conditions.

This work establishes a framework for simulant identification and validation while advancing the understanding of geopolymer formulation for extraterrestrial applications. Ongoing validation studies will evaluate the suitability of identified materials as lunar simulants and their potential for space construction applications.

[1] Slabic, A., Gruener, J. E., Kovtun, R. N., Rickman, D. L., Sibille, L., Oravec, H. A., ... & Keprta, S. (2024). *Lunar Regolith Simulant User's Guide: Revision A* (No. NASA/TM-20240011783). National Aeronautics and Space Administration.