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LithoSpace: A Digital Framework for Extraterrestrial Geochemical Data Integration

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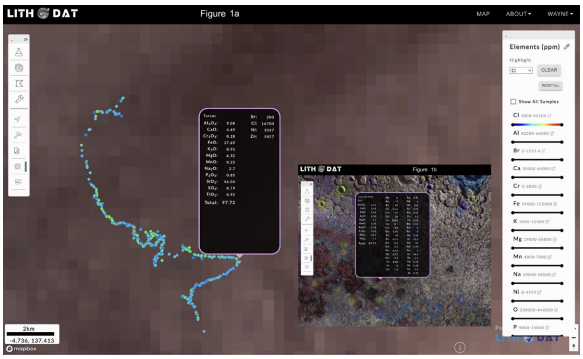

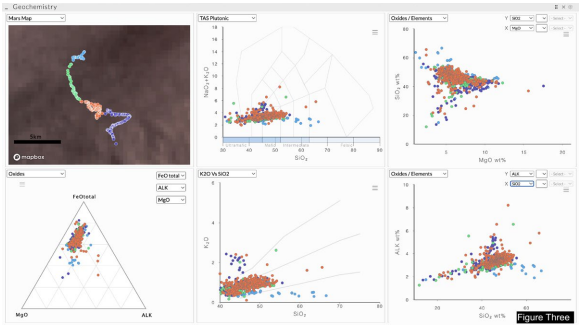

As space exploration accelerates and the search for extraterrestrial resources gains momentum, the ability to analyze and interpret geochemical and isotopic data from planetary surfaces is becoming increasingly critical. Understanding the chemical evolution of celestial bodies such as the Moon, Mars, and asteroids relies on advanced data visualization and analysis tools. LithoSpace provides a freely accessible digital infrastructure designed to integrate and interpret spatial geochemical data from extraterrestrial environments, facilitating the exploration of planetary formation, surface processes, and potential resource deposits.

Building upon the established LithoSurfer technology for terrestrial geochemistry, LithoSpace enables researchers to collate, analyze, and visualize isotopic and elemental datasets from space missions. Its relational data models integrate rover and probe data, satellite imagery, and topographic features, facilitating in-depth planetary comparisons and supporting isotope geochemistry's expanding role in planetary science.

Figure 1a highlights chlorine (Cl) concentrations in Curiosity rover data from Mars. Figure 1b presents one lunar geochemical data set from the Luna mission. Figure Three showcases multiple geochemical plots of Curiosity's data, allowing detailed classification and comparative analysis of Martian surface materials. Together, these figures illustrate how LithoSpace enhances the visualization and interpretation of extraterrestrial geochemistry.

LithoSpace's geochemical tools reveal subtle isotopic variations, validating known findings such as the basaltic composition of Apollo 11 samples while enabling on-the-fly interpretation, rock classification, and isotopic trend identification. As a new era of planetary exploration unfolds, the platform will facilitate seamless integration and analysis of incoming extraterrestrial geochemical datasets, allowing researchers to uncover fresh insights from future missions.

With its cloud-based architecture, LithoSpace enhances isotopic data synthesis, predictive modeling, and comparative geochemical analysis across planetary bodies. By providing a freely accessible, standardized framework for high-resolution isotopic datasets (https://app.lithospace.com/), the platform strengthens the role of isotope geochemistry in planetary science, driving new discoveries in planetary formation and resource exploration.