Geophysical Research Abstracts
Vol. 14, EGU2012-210, 2012
EGU General Assembly 2012

Landing on the Moon's farside: What are the geochemistry, astrobiology and instrumental issues?

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A high research priority in astrobiology is the search and eventual identification of biomarkers in the Solar System with feasible instrumentation. In spite of numerous steps forward lunar science remains largely disjoint from the main stream of astrobiology. In recent years the Moon has begun to emerge as a novel target for astrobiologists (Crawford et al., 2010). We discuss an overlap between lunar geochemistry and terrestrial geomicrobiology arising from the analysis of lunar soils and some uncertainties in chemical evolution and the origin of life scenarios (Chela-Flores, 2011).

Unexpected isotopic heterogeneity of nitrogen was found to be remarkable in samples from Apollo and the Luna programme (Kerridge, 1975). Both the stable isotope geochemical data of the biogenic elements, as well as the noble gases trapped in lunar soils have added valuable new and relevant data. These discoveries are potential sources of information on early biological evolution on Earth. The elusive ratio of nitrogen's two stable isotopes 15N/14N has played a fundamental role in this aspect of lunar geochemistry (Owen et al., 2001). The analysis of individual grains of ilmenite suggests that 90% of all the trapped nitrogen does not originate from solar wind. We discuss the significance of these stable isotopes from the point of view of astrobiology in the light of the next generation of lunar exploration. We underline the high priority of testing the origin of non-solar nitrogen source trapped in the regolith of the lunar farside.

In current proposals of new lunar missions, the characterisation of the geochemistry at several lunar sites is a major objective (Smith et al., 2011). Some arguments are presented in favor of using novel space technologies in a search for biomarkers in geographical distinct lunar landing sites. We restrict our attention to one aspect of the science requirements for the forthcoming missions by focusing on a very limited objective: to take a closer look at the geochemical characterisation of the chemical element nitrogen on the soils of the lunar farside and the related payload issues.

References

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