

In-situ Optimized Substrate Witness Plates for Lunar Processes

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Introduction: Environmentally conscious stewardship of extraterrestrial resources and surfaces that hold promise with respect to scientific content and resource extraction has been recognized as an imperative. We suggest a low-footprint means of exploring key questions for sustainable exploration, witness plates that we call "Biscuits". Some of the exploration techniques that may be used for scientific and operational studies are relatively ambiguous regarding how key processes are operating at present versus in the past.

Capturing Key Processes on the Moon: Many measurements obtain cumulative but degenerate information integrated over an unknown time. Modeling and additional proxies may be able to intelligently put bounds on the temporal variation of processes, rather than methods that uniquely capture the present-day value or magnitude of these processes. It is with some of these considerations in mind that we propose the use of in-situ artificial substrate witness plates that can be used alongside more familiar methods to probe key processes in critical areas of exploration for both operational and scientific purposes. We propose to build upon the lessons and utility from past experiments like those put in place during the Apollo program. These Biscuits should be thought of as controlled, calibrated samples that can be used to simultaneously record information regarding several different processes over time periods that are critical for exploration and science but that are often logistically difficult to observe. We use models to demonstrate that, using a preliminary design our team has formulated, these Biscuits can place meaningful bounds on several key processes, including water transport and hydroxylation, solar wind activity, and micrometeoroid flux. Data are extractable either through analysis upon return to Earth, or using future in-situ instrumentation that does not require vast improvement in detection thresholds. Biscuits can serve as a key measurement tool that supplements other observational methods, and can do so in a manner that encourages sustainable exploration of the planetary surface, both enabling long term informed exploration

and minimizing environmentally damaging externalities of exploration. Since these Biscuits do not necessarily require active electronics, have a relatively small and adaptable physical dimension and mass, and do not require active communication, they can preserve a low environmental footprint while providing spatially distributed observations in sensitive areas such as in and around a PSR or around a habitation module for Lunar surface exploration efforts. These Biscuits are also highly customizable; substrates can be geared towards operational studies (for example, testing different potential building materials) or towards key scientific questions (for example, by using substances that optimally record hydration or micrometeorite flux).

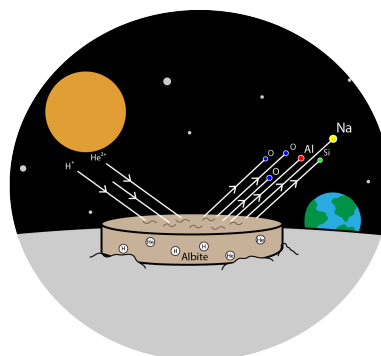


Image credit: Shaun Morrissey/EIMM.

Design your Biscuit:

- What processes do you want to target (location specific)?
- What structural materials and coatings need more testing?
- You can design a calibrated sample

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