Storage and Usage of Analogue Samples in an Extraterrestrial Sample Curation Facility

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One particular challenge concerns the handling of extraterrestrial materials returned to Earth in a curation facility. The facility needs to serve at least three major purposes: (1) initial inspection and characterisation of extraterrestrial materials, (2) preparation and allocation of samples for analysis in internal and external laboratories, and (3) long-term storage of such materials. Each of these points needs special equipment for sample handling, manipulation, analysis and storage. In addition, samples from planets or asteroids will need different kinds of treatment. Analogue samples are important for testing handling protocols and may be crucial in monitoring effects from long-term storage.

We are presently expanding the list of existing analogue samples, based on a review of the literature. The criteria for determining analogue rocks and minerals include characteristics, such as the kinds of physical and chemical properties expected for returned samples from potential target materials. The major focus here clearly lies on non-biological analogue samples.

While, so far, analogue samples are kept outside existing curation facilites, we follow the approach to keep them inside a curation facility for immediate accessibility and for long-term storage. In order to accommodate different returned sample materials, we are considering two distinct handling and storage areas within a curation facility. One "normal" non-sterile area for returned samples without restrictions for planetary protection, and a sterile area for samples returned from Mars that are restricted. Analogue sample collections would ideally be kept separately in both areas. The collection in the non-sterile area could be larger and a small collection of the most essential analogue types could be stored in the sterile area. In addition to the analogues used for testing handling procedures, we recommend keeping a pure, clean sample for monitoring purposes in these areas in order to evaluate any potential forward or cross contamination, e.g., of biological signatures.

The physical requirements on the curation facility for storage conditions of analogue samples are expected to be minimal. In the event of returned samples from Mars, a mirror sterile area that would allow testing protocols with biological analogues without compromising the returned samples should be considered.

Keywords: Sample analogues, Planetary materials, Storage and curation, Handling protocols.