

Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System (B)
Forward Planning for the Robotic Exploration of Mars (B4.2)

**ANALOGUE SAMPLES IN AN EUROPEAN SAMPLE CURATION FACILITY
- THE EURO-CARES PROJECT.**

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The objective of the H2020-funded EURO-CARES project (grant agreement n° 640190) was to create a roadmap for the implementation of a European Extraterrestrial Sample Curation Facility (ESCF) that would be suitable for the curation of samples from all possible return missions likely over the next few decades, i.e. from the Moon, asteroids and Mars.

The return of extraterrestrial samples brought to Earth will require specific storage conditions and handling procedures, in particular for those coming from Mars. For practical reasons and sterility concerns it might be necessary for such a facility to have its own collection of analogue samples permitting the testing of storage conditions, and to develop protocols for sample preparation and analyses. Within the framework of the EURO-CARES project, we have

created a list of the different types of samples that would be relevant for such a curation facility.

The facility will be used for receiving and opening of the returned sample canisters, as well as for handling and preparation of the returned samples. Furthermore, it will provide some analysis of the returned samples, i.e. early sample characterisation, and is expected to provide long-term storage of the returned samples. Each of these basic functions requires special equipment. Equipment, handling protocols and long-term storage conditions will strongly depend on the characteristics of the materials, and on whether returned samples are from the Moon, Mars or an asteroidal body. Therefore the different types and aspects of analogue samples one need to be considered, i.e. the nature of the materials, which analogues are needed for what purpose, what mass is needed, and how should the analogue samples be stored within the facility.

We distinguished five different types of analogue samples: analogue (s.s.), witness plate, voucher specimen, reference sample, and standard. Analogues are materials that have one or more physical or chemical properties similar to Earth-returned extraterrestrial samples. Reference samples are well-characterised materials with known physical and chemical properties used for testing. They may not necessarily be the same materials as the analogues defined above. Standards are internationally recognised, homogeneous materials with known physical and chemical properties that are used for calibration. They can also be used as reference samples in certain circumstances. They may be made of natural materials but are often produced artificially. A voucher specimen is a duplicate of materials used at any stage during sample acquisition, storage, transport, treatment etc., e.g. spacecraft materials (including solar panels), lubricants, glues, gloves, saws, drills, and others. In addition, Earth landing site samples (from the touch down site) would be necessary in case of doubtful analysis, even if normally this type of contamination is not expected. Finally, a witness plate is defined as material left in an area where work is being done to detect any biological, particulate, chemical, and/or organic contamination. It is a spatial and temporal document of what happens in the work area.

Analogue materials could be solids (including ices), liquids or gases. These could contain biological (extant and/or extinct) and/or organic components. They could be natural materials, e.g. rocks or minerals, or could be manufactured, such as mixtures of different components, which may be biologically and/or organically doped. Analogues with appropriate sample size and nature will be well-suited for testing and training of sample handling procedures, and for transport protocols. The training of science and curation teams also requires reference samples and standards. Long-term storage needs special witness plates and voucher specimens. Developing and testing sample preparation protocols needs all sample types.