Curation of Extraterrestrial Samples: What are the Main Issues?

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Curation mainly consists in the collection, handling, documentation, preparation, preservation ("into the indefinite future"), and distribution of samples for research. Curation of extraterrestrial samples (and especially in the case of mission returned samples), due to their rarity and pristine state, should follow some very strict rules.

Meteorites have been curated for a few hundreds of years, being part of natural history collections (the oldest meteorite collection, initiated in 1778, being located at the NHM Vienna), whereas the curation of mission returned samples is only about 45 years old, with the return of lunar samples in the framework of the Apollo program.

In the case of meteorites, no planetary protection measurements are taken and they are typically stored in ambient conditions (very rarely in N_2 cabinets) after basic characterization. Meteorites are in contact with a large number of materials, liquids (in some cases the cutting is even done with tap water), and other unknown/undocumented contaminants.

In the case of mission returned samples, in order to preserve the scientific value of these precious samples, contamination, but also physical and chemical alteration must be minimized, understood, and properly recorded (i.e., a record should capture every action carried out on the sample). They are permanently stored in high-level clean environments in inert gas conditions to prevent alteration. Specific handling, sub-sampling, and preparation techniques should be developed and adapted for the different types of samples. In the case of (possibly) biohazardous samples, sterilization such as by dry heat and/or gamma radiation (knowing that it is detrimental to some scientific investigations) should be envisaged.

The main identified issues are in the handling and preparation of the samples, but also in the sampling and storing of gas and of all other adsorbed volatiles traces of extraterrestrial organic material, as well as in the sterilization methods.

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