PERSERVING SAMPLES AND THEIR SCIENTIFIC INTEGRITY – INSIGHTS INTO MSR FROM THE ASTROMATERIALS ACQUISITION AND CURATION OFFICE AT NASA JOHNSON SPACE CENTER.

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Introduction: The Astromaterials Acquisition and Curation Office at NASA Johnson Space Center (JSC), in Houston, TX (henceforth Curation Office) manages the curation of all past, present, and future extraterrestrial samples returned by NASA missions and shared collections from international partners, preserving their integrity for future scientific study while providing the samples to the international community in a fair and unbiased way. The Curation Office also curates flight and non-flight reference materials and other materials from spacecraft assembly of sample return missions that would have the potential to cross-contaminate a present or future NASA astromaterials collection. These materials are primarily collected during the assembly, test, and launch operations (ATLO) phase and after flight during the recovery and curation phase. In addition, the Curation Office curates non-flight, flight-like, and flown witness plates for sample return missions. These reference materials and witness plates provide the scientific community with the fundamental ability to reconstruct the contamination/alteration history of the sample collection through the course of the mission, with the overall goal of strengthening the scientific conclusions drawn from the study of returned materials.

Contamination Knowledge: The information gained from characterizing the physical, biological, inorganic, and organic chemical properties of reference materials and witness plates is defined as the Contamination Knowledge (CK) of the sample collection. Unlike the data collected for Contamination Control (CC) and Planetary Protection (PP), CK is exclusively concerned with preserving reference materials and witness plates for study by future scientists upon sample return. Although data collected for CC and PP purposes can be complementary to CK, they are two separate data sets with distinct objectives. A robust collection of samples for CK is necessary to allow the martian material in a returned sample to be distinguished from terrestrial contamination.

Biological Investigations Broaden Collection's Requirements: Unlike other sample collections, Mars Sample Return (MSR) requires the curation of samples for biological investigation. The addition of biological experimental endpoints to sample return campaign objectives broadens the requisite range in preservation environments (e.g. inert ultra-pure nitrogen gaseous environment at 18°C versus <-80°C) and types of CK samples. Some of the types of biological CK samples the Curation Office requires include, but are not limited to:

1) Un-analyzed swabs and wipes in sterile containers stored at ≤ -80°C.
2) All recirculation filters from the clean rooms used for rover and rover hardware assembly and all filters from the laminar flow benches used to assemble sample intimate hardware. Packaged in sterile Teflon bags and frozen at -80°C.
3) Witness plates collecting airborne contamination within the assembly cleanrooms stored at ≤ -80°C.

Collecting and curating unanalyzed samples will minimize the possibility that current analysis and extraction techniques destroy or alter the samples or otherwise inhibit yet to be developed measurements. It has been Curation Office policy since the Apollo missions to preserve as many pristine samples as possible for future scientific research [1,2].

Conclusions: Although CK is required to be collected for all stages of the MSR campaign, the CK for the Mars 2020 mission is the most critical for understanding contamination in the returned samples given the intimacy between the samples and the Mars 2020 hardware. Rigorous collection of CK and derived blanks for all possible contamination sources and pathways particularly those in the SCS, is essential for mission success.

References: [1]. NASA 1965 *Summer Conference on Lunar Exploration and Science, Falmouth, Massachusetts,* 421. [2] Allen C. et al. (2011), *Chemie der Erde – Geochemistry, 71,* 1–20.