

Curating NASA's Past, Present, and Future Extraterrestrial Sample Collections

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As codified in NASA Policy Directive 7100.10F, the Astromaterials Acquisition and Curation Office at NASA Johnson Space Center (hereafter JSC Curation) is charged with curation of all extraterrestrial material under NASA control, including future NASA missions. JSC Curation curates all or part of nine astromaterial collections in seven clean room suites: (1) Apollo Samples (1969; ISO 6-7), (2) Luna Samples (from USSR; 1972; ISO 7), (3) Antarctic Meteorites (1976; ISO 7), (4) Cosmic Dust (1981; ISO 5), (5) Microparticle Impact Collection (formerly called Space Exposed Hardware; 1985; ISO 5), (6) Genesis Solar Wind Atoms (2004; ISO 4); (7) Stardust Comet Particles (2006; ISO 5), (8) Stardust Interstellar Particles (2006; ISO 5), (9) Hayabusa Asteroid Particles (from JAXA; 2010; ISO 5). In addition to the labs that house the samples, we have installed and maintained a wide variety of facilities and infrastructure required to support the clean-rooms: >10 different HEPA-filtered air-handling systems, ultrapure dry gaseous nitrogen systems, an ultrapure water system (UPW) and cleaning facilities to provide clean tools and equipment for the labs. We also have sample preparation facilities for making thin sections, microtome sections, and even focused ion-beam (FIB) sections to meet the research requirements of scientists. To ensure that we are keeping the samples as pristine as possible, we routinely monitor the cleanliness of our clean rooms and infrastructure systems. This monitoring includes: daily monitoring of the quality of our UPW, weekly airborne particle counts in the labs, monthly monitoring of the stable isotope composition of the gaseous N₂ system, and annual measurements of inorganic or organic contamination in processing cabinets. We track within our databases the current and ever-changing characteristics of >250,000 individual samples across our various collections (including the 19,141 samples on loan to 433 Principal Investigators in 24 countries). The next sample return missions that NASA will participate in are Hayabusa2 and OSIRIS-REx. The designs for a new state-of-the-art suite of clean rooms to house these samples at JSC have been finalized. This includes separate ISO class 5 clean rooms to house each collection, a common ISO class 7 area for general use, an ISO class 7 microtome laboratory, and a separate thin section lab. Additionally, a new cleaning facility is being designed and procedures developed that will allow for enhanced cleaning of cabinets and tools in an inorganically, organically, and biologically clean manner. We are also designing a large multi-purpose Advanced Curation laboratory that will allow us to develop the techniques necessary to fully support the Hayabusa2 and OSIRIS-REx missions, as well as future possible sample return missions (e.g., Lunar Polar Volatiles, Mars, Comet Surface). A micro-CT laboratory dedicated to the study of astromaterials has come online within JSC Curation, and we plan to add additional facilities that will enable non-destructive (or minimally-destructive) analyses of astromaterials in the near future (e.g., micro-XRF, confocal imaging Raman Spectroscopy). These facilities will be available to: (1) develop sample handling and storage techniques for future sample return missions, (2) be utilized by PET for future sample return missions, (3) for retroactive PET-style analyses of our existing collections, and (4) for periodic assessments of the existing sample collections.