

ADVANCED CURATION OF CURRENT AND FUTURE EXTRATERRESTRIAL SAMPLES.

Carlton C. Allen. NASA Johnson Space Center, Houston, TX
77058 USA carlton.c.allen@nasa.gov

Curation of extraterrestrial samples is the critical interface between sample return missions and the international research community. Curation includes documentation, preservation, preparation, and distribution of samples.

The current collections of extraterrestrial samples include:

- Lunar rocks / soils collected by the Apollo astronauts
- Meteorites, including samples of asteroids, the Moon, and Mars
- “Cosmic dust” (asteroid and comet particles) collected by high-altitude aircraft
- Solar wind atoms collected by the Genesis spacecraft
- Comet particles collected by the Stardust spacecraft
- Interstellar dust collected by the Stardust spacecraft
- Asteroid particles collected by the Hayabusa spacecraft

These samples were formed in environments strikingly different from that on Earth. Terrestrial contamination can destroy much of the scientific significance of many extraterrestrial materials. In order to preserve the research value of these precious samples, contamination must be minimized, understood, and documented. In addition the samples must be preserved – as far as possible – from physical and chemical alteration.

In 2011 NASA selected the OSIRIS-REx mission, designed to return samples from the primitive asteroid 1999 RQ36 (Bennu). JAXA will sample C-class asteroid 1999 JU3 with the Hayabusa-2 mission. ESA is considering the near-Earth asteroid sample return mission Marco Polo-R. The Decadal Survey listed the first lander in a Mars sample return campaign as its highest priority flagship-class mission, with sample return from the South Pole-Aitken basin and the surface of a comet among additional top priorities. The latest NASA budget proposal includes a mission to capture a 5-10 m asteroid and return it to the vicinity of the Moon as a target for future sampling.

Samples, tools, containers, and contamination witness materials from any of these missions carry unique requirements for acquisition and curation. Some of these requirements represent significant advances over methods currently used. New analytical and screening techniques will increase the value of current sample collections. Improved web-based tools will make information on all samples more accessible to researchers and the public.

Advanced curation of current and future extraterrestrial samples includes:

- Contamination Control – inorganic / organic
- Temperature of preservation – subfreezing / cryogenic
- Non-destructive preliminary examination – X-ray tomography / XRF mapping / Raman mapping
- Microscopic samples – handling / sectioning / transport
- Special samples – unopened lunar cores
- Informatics – online catalogs / community-based characterization