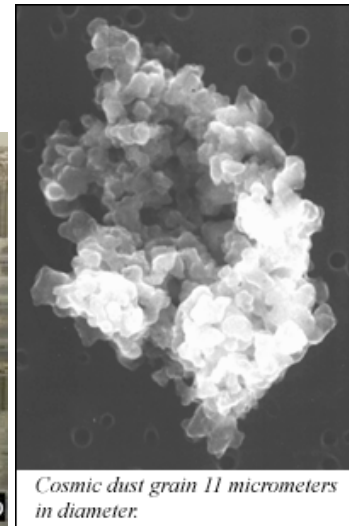
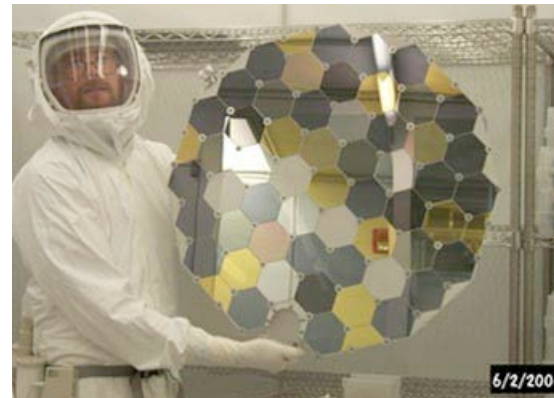
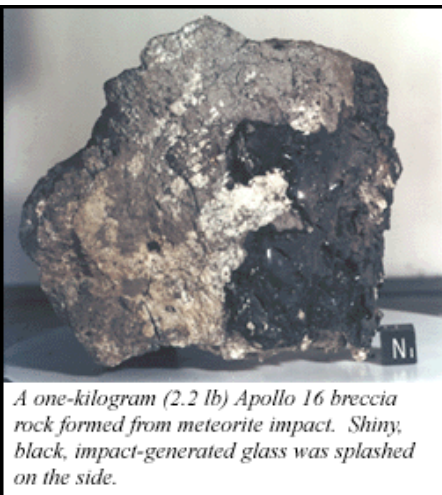


# CAPTEM

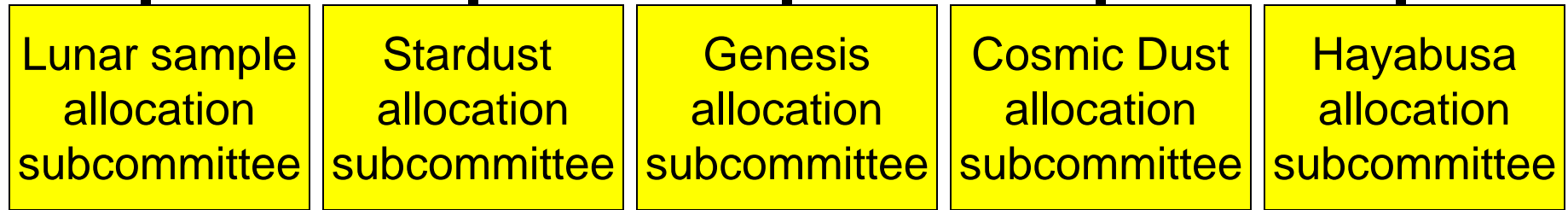
Curation and Analysis Planning Team for Extraterrestrial Materials

***“Dedicated to Maximizing Planetary Sample Science  
While Protecting the Integrity of NASA Collected  
Extraterrestrial Materials”***

## **Report to the Planetary Science Subcommittee January 26, 2011**



## CAPTEM Committee *Chair: M. Wadhwa*



Chairs: Lars Borg (LLNL)    Andrew Westphal (UC Berkeley)    Andrew Davis (U Chicago)    George Flynn (SUNY Plattsburgh)    Scott Messenger (NASA JSC)

Facilities subcommittee: Chair, Dimitri Papanastassiou (JPL)

Additional Members: Justin Hagerty (USGS), Brad Jolliff (Washington U), Mac Rutherford (Brown U), Steven Symes (U Tennessee, Chattanooga), Allan Treiman (LPI)

**Last meeting of the CAPTEM held November 17-18, 2010**  
**Next meeting to be held in March 12-13, 2011**

## Sample Allocations Since July 2010

- **Lunar Allocations:**
  - 32 requests: 28 approved, total 366 samples
- **Stardust Allocations:**
  - 9 requests: 9 approved, total 32 samples
- **Genesis Allocations:**
  - Flown samples: 2 requests: 2 approved, total 6 samples
  - Reference materials: 2 requests: 2 approved, total 4 samples
- **Cosmic Dust Allocations**
  - 1 request: 1 approved, total 10 samples

## Current Issues

- Spin up of the Hayabusa allocation subcommittee.
- Stardust sample curation review report completed.
- The Lunar Simulant Working Group report completed.
- Other CAPTEM sponsored activities:
  - Timed Collection Workshop scheduled after the Stardust II meeting (Timber Cove, CA; Feb 2011)
  - Workshop on the Importance of Solar System Sample Return Missions (Houston, TX; March 2011)
  - Workshop on “A Wet vs. Dry Moon” (Houston, TX; June 2011)

## Hayabusa allocation subcommittee



- JAXA's Hayabusa spacecraft was launched in May 2003, rendezvous with asteroid Itokawa in Sept 2005, sample collection, return to Earth in June 2010.
- As per the NASA-JAXA MOU, a random subset of the Hayabusa samples (10%) will be transferred to NASA (within 12 months of return as per agreement).

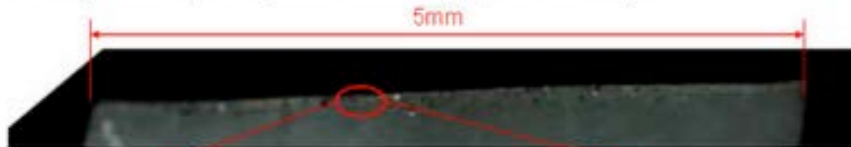


# CAPTEM

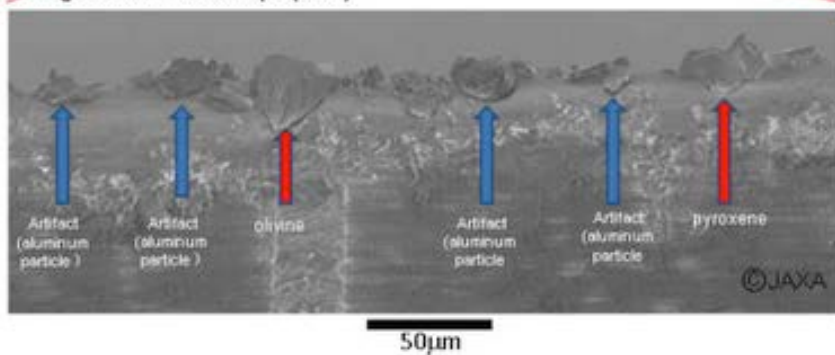
Curation and Analysis Planning Team for Extraterrestrial Materials

The special spatula observed by scanning electron microscope (SEM)

1. The edge of the special spatula observed by optical microscope



2. A closeup picture of a portion highlighted by a red circle, which is observed by scanning electron microscope (SEM)



- **Hayabusa allocation subcommittee**: Chair, Scott Messenger (NASA JSC); other members: Conel Alexander (DTM), Rhian Jones (UNM), David Joswiak (UW), Tomoki Nakamura (Tohoku University), Andrew Westphal (UC Berkeley).

- Subcommittee is currently in the process of drafting the curation, handling and allocation policies document.

*February 1, 2011*

## Stardust Curation Status

- Stardust returned samples of Comet Wild 2 in January 2006.
- CAPTEM initiated a review of the status of curation of these samples.
- Review Team: D. Burnett (Caltech, Chair), A. Brearley (UNM), L. Nyquist (NASA JSC), D. Papanasstassiou (JPL), S. Sutton (U Chicago/ANL).
- Report completed in November 2010.



Stardust (Comet Wild 2) Samples: Returned in 2006; thousands of cometary grains in 1000 cm<sup>2</sup> of aerogel.

# Stardust Curation Review Report

## FINDINGS:

- Curation and allocation of Stardust samples is the most difficult of all the returned sample collections.
- Perception of possibly serious problems with Stardust curation and allocation. At present, no crisis in allocation and curation processes and procedures, however...
- On a longer time scale, improvements are required.
- Unlike the other collections, basic characterization of Stardust samples requires instruments that are not routinely available to the Curatorial Facility.
- The Stardust Curatorial Web Site is a valuable source of information but needs a major upgrade to improve its content and searchability.



# Stardust Curation Review Report

## RECOMMENDATIONS:

- **Recommendation #1.** Implementation of allocations must not be single string. At least 2 persons must be available at all times with the skills necessary to provide samples to PIs.
- **Recommendation #2.** Simplify requests to PIs to the minimum required for future allocations, e.g. location, size estimate, and mineral identification. An email to the Curator close to the time of analysis is minimally inconvenient to the PI.
- **Recommendation #3.** Priorities must be set and resources allocated such that the Web Site upgrades are completed in 2010.

# Charter from the PSS to the LEAG-CAPTEM Simulant Working Group

**“The PSS recommends that a comprehensive study be undertaken by LEAG and CAPTEM to define the types of simulants that the various communities require in order to facilitate important lunar investigations, as well as to preserve the Apollo lunar sample collection for future generations.”**

**Report will address:**

- 1) what is needed for lunar simulants;**
- 2) what lunar simulants already exist;**
- 3) protocols for their proper usage; and**
- 4) needs for Apollo lunar samples.**

# LEAG-CAPTEM Simulant Working Group

## Working Group members:

- Larry Taylor, Univ. of Tenn., LADTAG, Lunar Soil Expert (Chair)
- Yang Liu, Univ. of Tenn., Lunar Soil & Simulant Characterizer
- Jennifer Edmunson, MSFC, Simulant Engr.
- Carole McLemore, MSFC, ISRU/Dust Project Manager
- Doug Rickman, MSFC, Simulant developer and tester
- Gary Lofgren, JSC, Lunar Sample Curator
- Dave McKay, JSC, LADTAG, Lunar Soil Expert (Dust/Biomedical)
- Jerry Sanders, JSC, ISRU Head Honcho
- Bob Ferl, Univ. of Florida, Bio Expert
- Bob Gustafson – ORBITEC, Simulant Engr.
- Chip Shearer, (ex-officio) (CAPTEM Chair)
- Mini Wadhwa, (ex-officio) (CAPTEM Chair)

# **“Report on Status of Lunar Regolith Simulants and Demand for Apollo Lunar Samples”**

## **LEAG-CAPTEM Simulant Working Group**

### **SUMMARY OUTLINE:**

**Inputs: Documents from MSFC Simulant Office;  
Visit to Lunar Simulant group at NASA/MSFC by Chair;  
Lunar Applications of Mining & Mineral Beneficiation  
Workshop (MN, Oct 2010);**

**Simulant History: Minnesota Lunar Simulant (Paul Weiblen, 1970-);  
JSC-1 (1993-4; all gone)**

**Engr./ISRU Studies: Major Problem = Little appreciation of uniqueness of lunar samples;**

### **CURRENTLY AVAILABLE LUNAR SIMULANTS:**

**JSC-1A (= JSC-1) 2005; production = James Carter; ORBITEC/  
JSC distribution;**

**Over 30 Lunar Simulants worldwide; most made by users;  
NU-LHT (2009-2010; MSFC = 2<sup>nd</sup> simulant developed since 2005)**

### **SUGGESTIONS FOR THE FUTURE:**

**Planetary Simulant Advisory Team**



## **Existing Lunar Simulants:**

There are >30 lunar simulants that have been produced to date  
Users have developed a tendency to make their own simulants  
Little to no control or knowledge by MSFC.

## **Need for Lunar Simulants:**

Engg. Tests involving large scale soil moving; trafficability  
Oxygen production

As TRL of project increases, so does the need for more closely  
controlled lunar properties

Symbiosis between science and engineering is a major factor  
that needs further work

## **Need for Apollo Lunar Samples in Engr./Bio/ISRU Studies:**

Few needs for a real lunar sample with which to experiment

Needs include:

- 1) characterization of biological interactions, levels, including human health and toxicity
- 2) mineral beneficiation studies using magnetic and electrostatic processes (effects of nanophase Fe)
- 3) dust mitigation by electrostatic/magnetic means.



# SUGGESTIONS FOR THE FUTURE

Suggestions to ESMD/SMD for the Simulant program in the future:

## Planetary Simulant Advisory Team (PSAT)

An advisory panel of experts in lunar science and actual properties of lunar soils is absolutely and desperately needed, to mesh with simulant surface-system engineering (e.g., civil engr.).

## Location of PSAT:

Possible Centralization of Lunar Simulant Program (~PSAT) into Astromaterials Research & Exploration Science (ARES) at JSC.

## What if the NASA AOs for relevant programs stated:

~10% of project's budget should be set aside for simulant development, *coordinated with the PSAT*, plus a statement that the *final product of the overall engr. project must meet PSAT approval?*

## New Initiatives

- Finalization of curation, handling and allocation policies for the Hayabusa samples to be transferred to NASA. First Hayabusa samples are expected to be allocated by end of this year!
- Update of the Long-Term Curation and Maintenance Plan for the JSC curation facilities.
- New opportunities for upper stratospheric timed collections (new cometary materials).

## Science Highlights (Planetary Materials/Cosmochemistry)

- Return of the Hayabusa spacecraft with “micro” samples of asteroid Itokawa! New results anticipated at the Lunar and Planetary Science Conference in March.



*February 1, 2011*



## Recent research highlights:

### 1) New insights into the origin of the Solar System

- Dauphas, N., Remusat, L., Chen, J. H., Roskosz, M, Papanastassiou, D. A., Stodolna, J., Guan, Y., Ma, C., and Eiler, J. M. (2010) Neutron-rich chromium isotope anomalies in supernova nanoparticles. In *The Astrophysical Journal*.
- Bouvier, A., Wadhwa, M. (2010) The age of the Solar System redefined by the oldest Pb–Pb age of a meteoritic inclusion. In *Nature Geoscience*.

### 2) The Moon – wet or dry?

- McCubbin, F. M., Steele, A., Hauri, E. H., Necvasil, H., Yamashita, S., and Hemley, R. J. (2010) Nominally hydrous magmatism on the Moon. In *Proceedings of the National Academy of Sciences*.
- Sharp, Z. D., Shearer, C. K., McKeegan, K. D., Barnes, J. D. & Wang, Y. Q. (2010) The chlorine isotope composition of the Moon and implications for an anhydrous mantle. In *Science*.