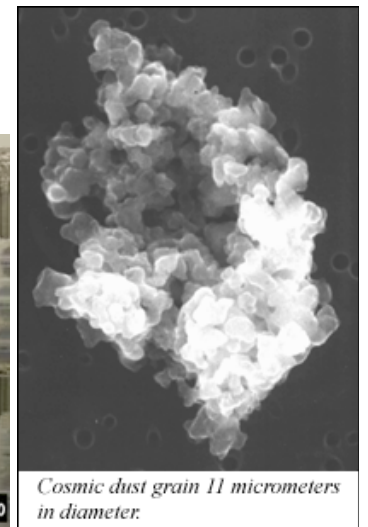




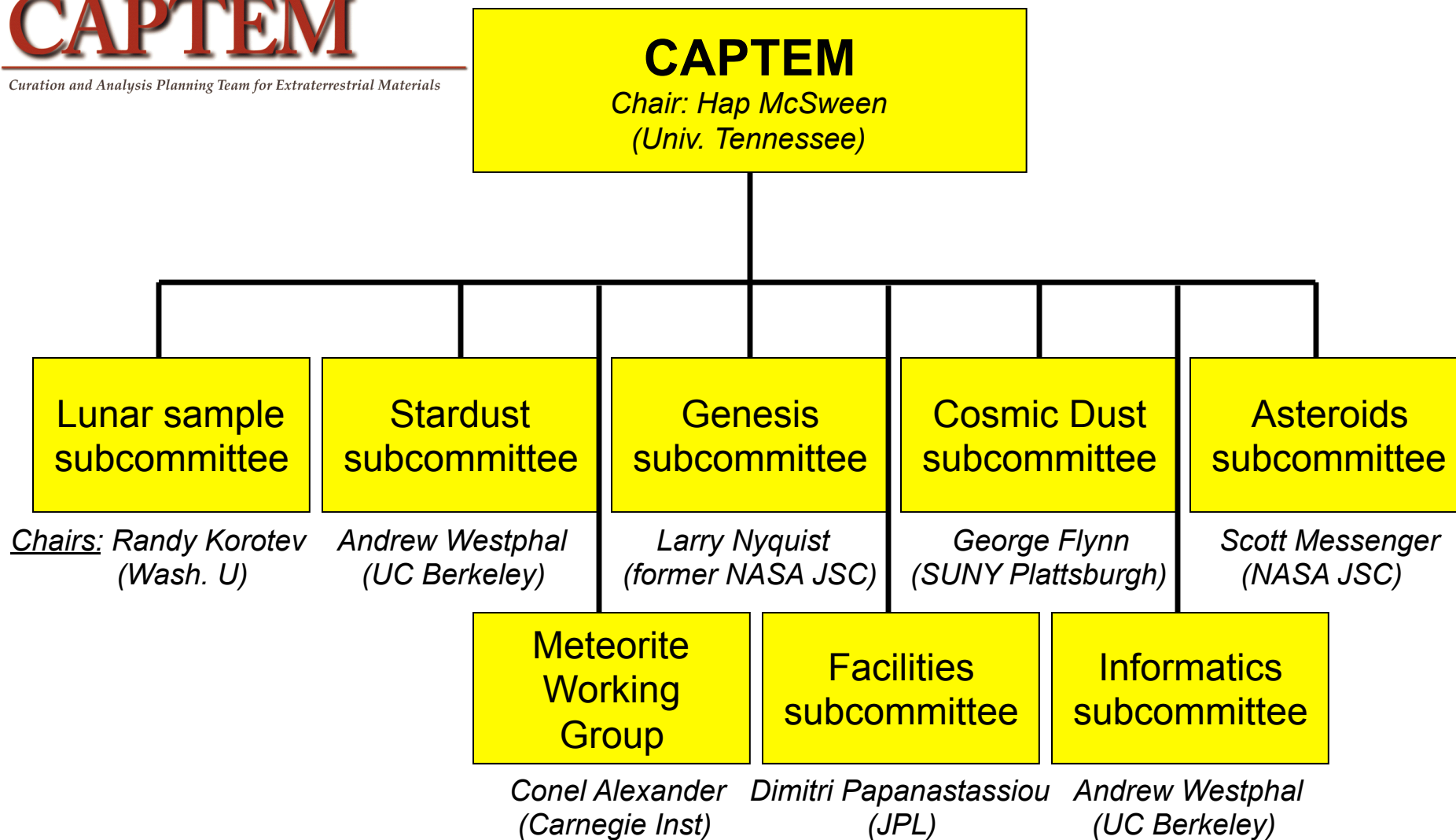
***“Dedicated to Maximizing Planetary Sample Science
While Protecting the Integrity of NASA Collected Extraterrestrial
Materials”***

Report to the Planetary Science Subcommittee Sep 3-4, 2014



CAPTEM

Curation and Analysis Planning Team for Extraterrestrial Materials



Additional Members: Amy Gaffney (LLNL), Tim Grove (MIT), Paul Warren (UCLA), Justin Simon (JSC, Secretary)

September 5, 2014

Sample Allocations: Mar 2013-Mar 2014

- Lunar Allocations:
 - 341 splits and 388 microprobe mounts to 44 investigators
- Antarctic Meteorites:
 - 478 samples to 72 investigators
- Stardust Allocations:
 - 22 samples to 6 investigators
- Genesis Allocations:
 - 333 samples to 7 investigators
- Cosmic Dust Allocations:
 - 67 particles to 5 investigators
- Hayabusa Allocations:
 - 1 allocation in progress

Recent CAPTEM Activities

- Reviewed JSC Astromaterials Curation plan for annual inventories of allocated samples; plan is now active and most investigators are responding (a few foreign investigators are delinquent)
- JSC is responding to CAPTEM Informatics subcommittee findings by consolidating curation databases and upgrading the public website
- CAPTEM lunar curation task force conducted site inspection of lunar sample curation and is completing a report on curation cleanliness protocols in light of emerging analytical techniques
- E/PO efforts continuing – 75 lunar and 7 meteorite displays, 23 lunar and 10 meteorite thin section sets, K-12 lunar and meteorite discs, 240 visits to lunar curation laboratory (including 3 cosmonauts and 8 new US astronauts) in the last year

Recent CAPTEM Activities

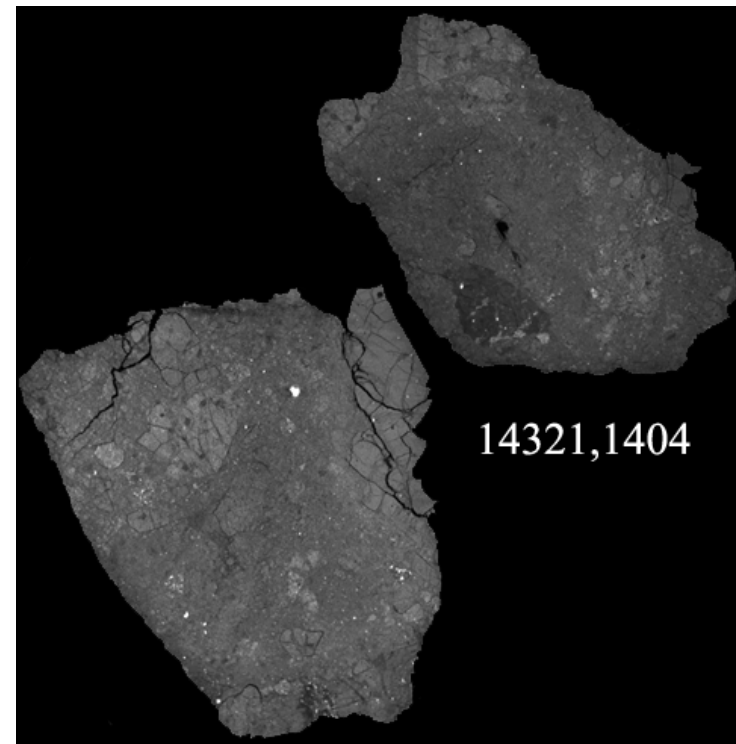
- CAPTEM Asteroid Retrieval Mission (ARM) task force completed a requested study, with findings focused on sample selection, acquisition, and handling protocols to maximize science return
- CAPTEM recommended that JSC make acquisition of a Micro-CT scanning facility a high priority; instrument would improve sub-sampling of lunar and meteorite samples
- CAPTEM changed the name of its Hyabusa subcommittee to Asteroid subcommittee, adding responsibility for the Hyabusa 2, OSIRIS-REx, and other future sample-return missions from asteroids
- CAPTEM is presently revising its Charter to include MWG and add appendices on how each subcommittee makes its findings
- CAPTEM co-sponsored a successful workshop: Vesta in the Light of Dawn, Feb 3-4, 2014, at the LPI

Lunar samples

- JSC has reduced the number of samples out from 11,000 to 7,000, making a backlog in checking samples back in
- Need a micro-CT scanning capability to improve sub-sampling of lunar rocks (also useful for meteorites and Mars samples)

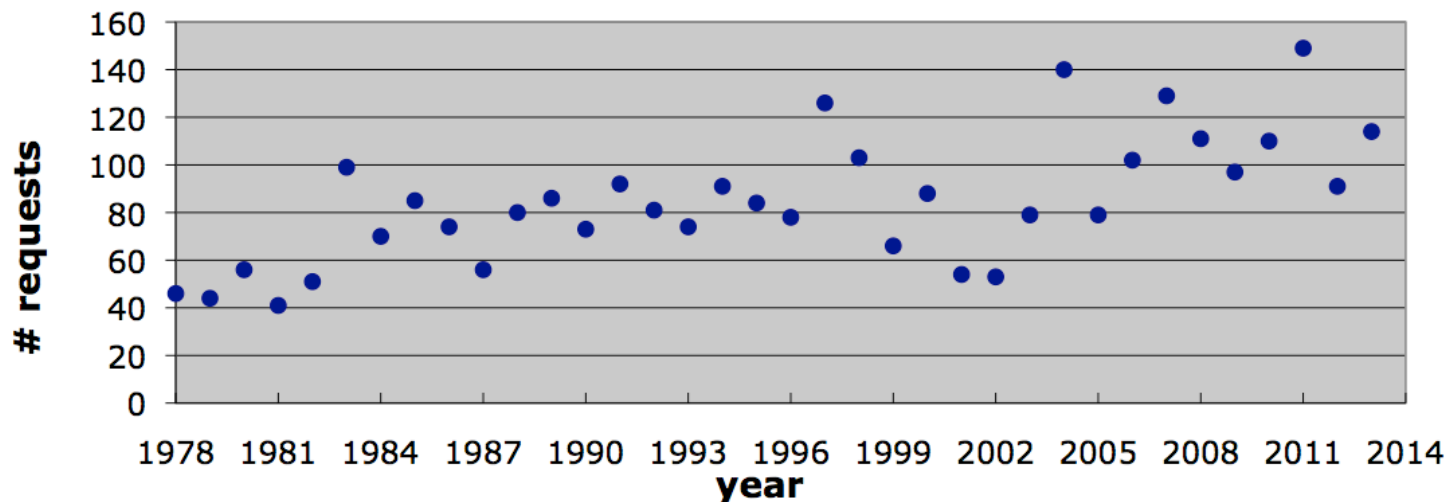


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Meteorite Working Group

- 335 Antarctic meteorites collected in the 2013/14 season could not be transported, so curation will use the time for informatics
- Total ANSMET meteorite recoveries are now 20,700!
- Sample requests are steadily increasing



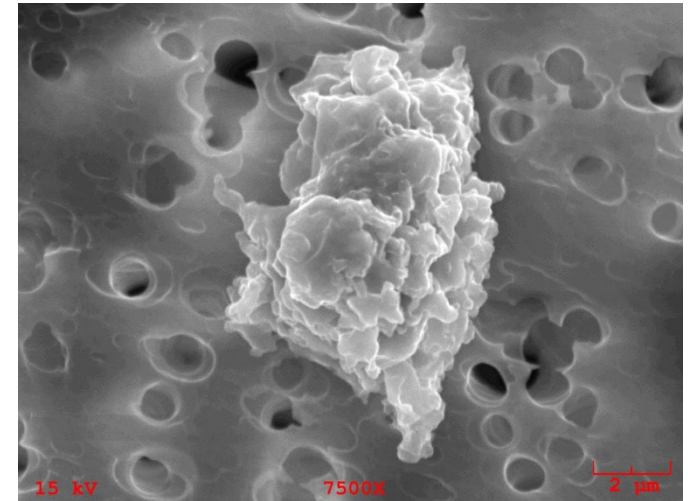
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Cosmic Dust

- Preliminary analysis on 2012 Draconid particles collected opportunistically from Comet Giacobini-Zinner



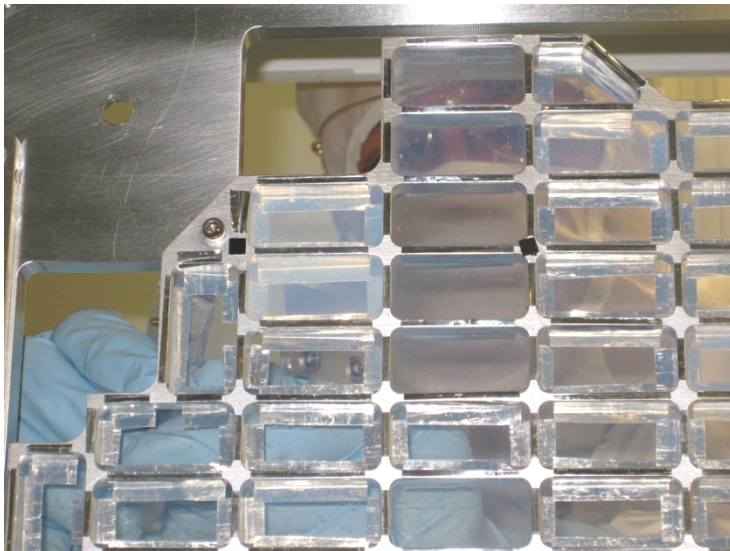
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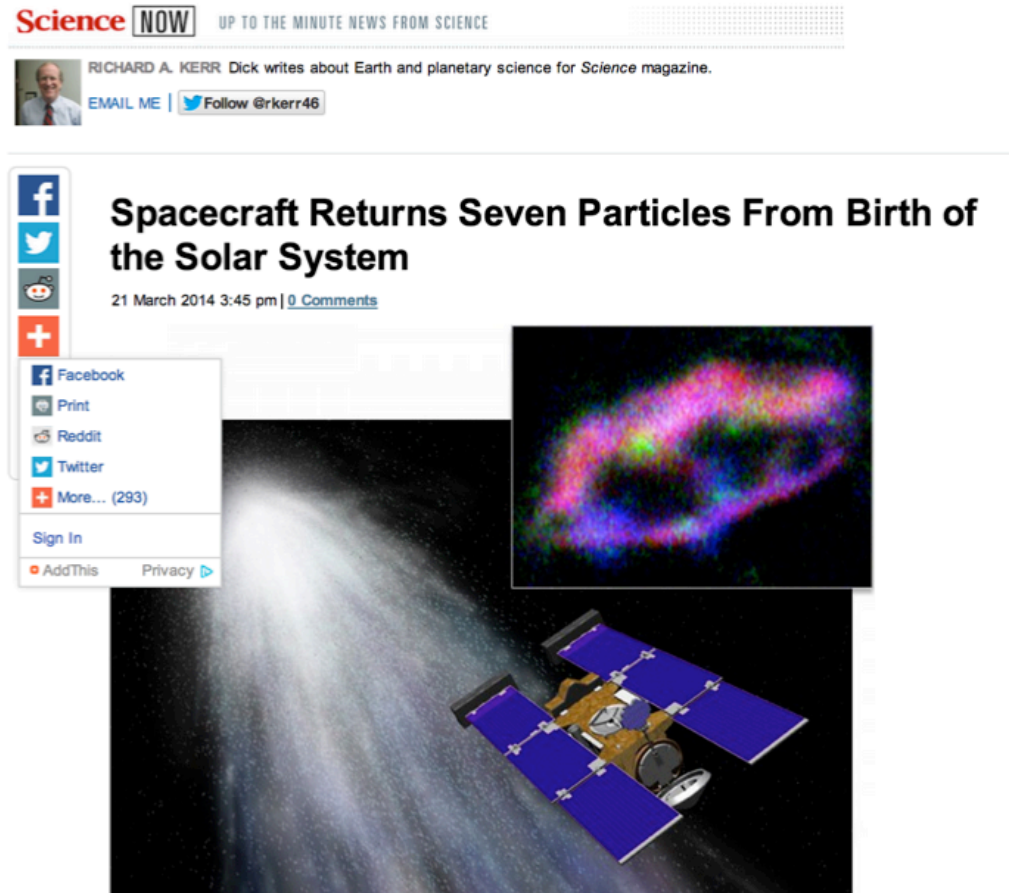
- Preliminary analysis on Kwajalein dust (does collection oil on aircraft wings contaminate isotopes and organics?)
- Collectors will be moved to Mona Loa volcano (to eliminate sea salt)

Stardust

- Will co-sponsor a Timber Cove IV meeting in conjunction with METSOC at Berkeley in 2015
- 48 refereed publications in the last three years



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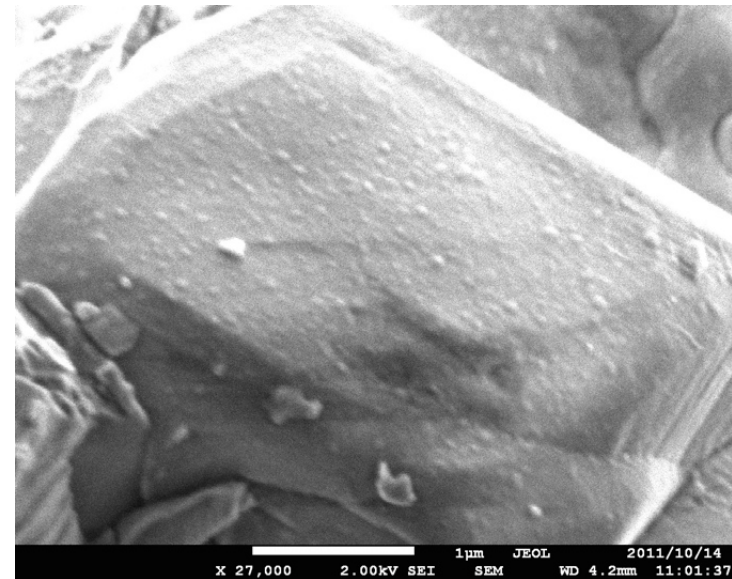


Hyabusa (now Asteroids)

- JSC now has 25 grains
- Anticipate NASA receiving uncharacterized samples, if JAXA curator can be persuaded
- OSIRIS-REx sample curation (asteroid Bennu) passed CDR



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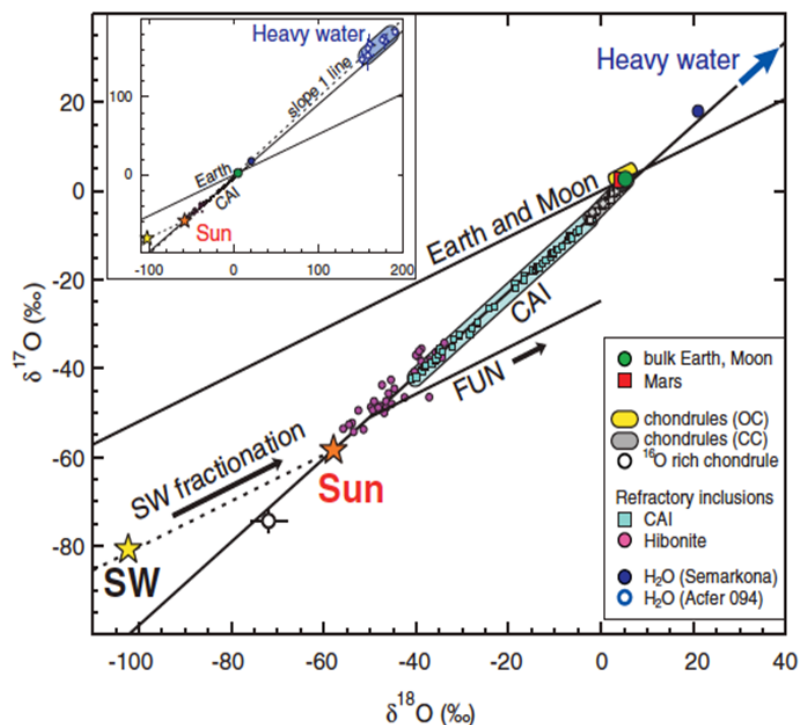


Genesis (solar wind)

- New discovery: Genesis data (more accurate than spacecraft measurements) now show that solar wind photosphere fractionation occurs for low first-ionization-potential elements
- Investigators are now working on solar D/H, which was not anticipated to be possible before the mission



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Science Highlight

New analytical technology allows new discoveries in “old” Apollo samples: Basin-forming impact-melt rocks at Apollo 17 site

- Two distinct types of impact-melt rock were found at the Apollo 17 site: “aphanitic” and “poikilitic.”
- Long thought to represent 2 different basin-forming impacts 3.9 billion years ago.
- New study examined HSEs - “highly siderophile elements” - by thermal ionization mass spectrometry. HSEs derive from the impactor forming the melt.
- Finding: “There is no statistical difference between the aphanitic and poikilitic samples in terms of HSE ratios.”
- Hence, there’s no evidence for two for 2 different impacts.



Aphanitic sample 73235



Poikilitic sample 75235

Reference

Sharp, M., et al. (2014) Characterization of the dominant impactor signature for Apollo 17 impact melt rocks. *Geochimica et Cosmochimica Acta*, doi: <http://dx.doi.org/10.1016/j.gca.2014.01.014>

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First direct sampling of an asteroid's regolith

Asteroidal particles returned from asteroid Itokawa by the JAXA Hayabusa spacecraft represent the first direct sample of an asteroidal surface. Keller and Berger showed that several particles resided within the surface regolith of Itokawa for 10^3 - 10^4 years, based on observations of damage tracks produced by interactions with energetic solar flare ions. These particles also retain thin layers of atomic damage resulting from direct exposure to the solar wind. These particles show clear differences in the space weathering effects from lunar regolith grains (of similar exposure durations) that commonly preserve vapor deposits and melt spherules.

L.P. Keller and E.L. Berger (2014) Transmission Electron Microscope Investigation of Space Weathering Effects in Hayabusa Samples, LPSC 45, #1935

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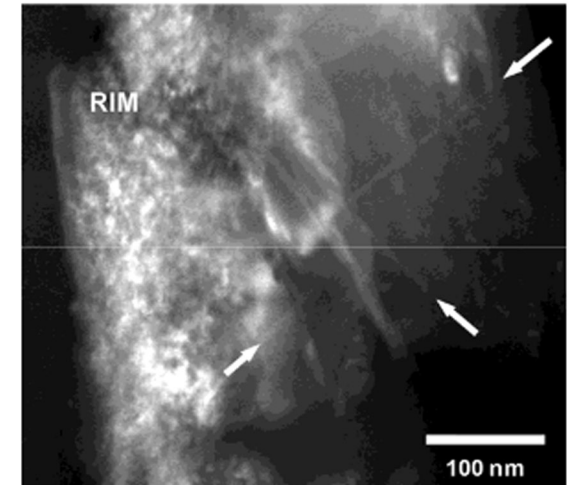


Figure 1. Dark-field STEM image of the disordered rim on the olivine in RA-QD02-0211. The arrows indicate solar flare tracks.

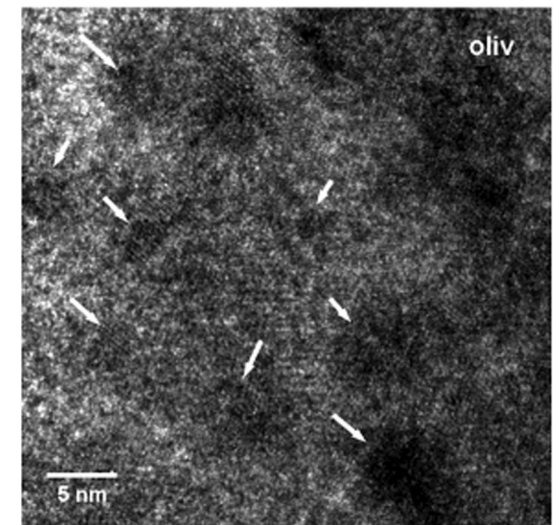
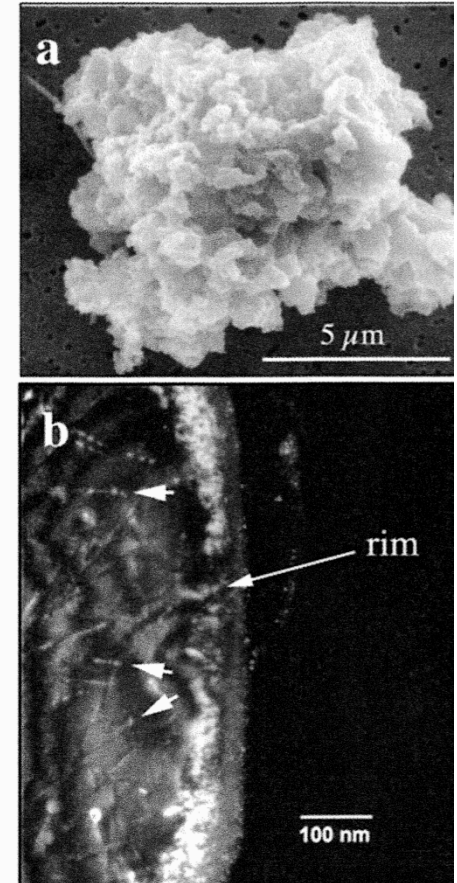


Figure 2. High resolution TEM image of the disordered rim on the olivine in RA-QD02-0211. The arrows indicate individual 2-5 nm Fe^0 particles in the crystalline olivine.

Science Highlight

The Origin of Water in Solar System Bodies

This study answered a four-decade-old question by showing that hydrogen ions in the solar wind react with oxygen in the silicate minerals of interplanetary dust particles (IDPs) to form water. Some IDPs, collected by NASA high-altitude research aircraft, are the most primitive samples of early Solar System material available for laboratory examination. The water was detected in the ~100 nanometer thick rims, roughly one-thousandth the width of a human hair, produced on the surfaces of these IDPs by solar wind irradiation. This result demonstrates that the solar wind can produce water in the silicate surface materials of airless bodies including the Moon and asteroids, and that the high flux of IDPs early in Solar System history could add water to the Earth and to other planets and moons.



U220A19 (top) and TEM image (bottom) of the ~100 nm solar wind irradiated rim that was analyzed for H₂O.

J. P. Bradley et al. (2014) Detection of solar wind produced water in irradiated rims on silicate minerals. *Proc. Nat. Acad. Sci.*, 47(4), 525-549.

September 5, 2014

Current Issues of Concern

- Scientific impact of delayed return of Antarctic samples
- Any consequences of new JSC Astromaterials policy on scientific collections, as mandated by OSTP
- Complete the integration of MWG into CAPTEM, following approval of a new three-agency agreement
- Need for a regular cadence of Discovery missions, some of which acquire and return extraterrestrial samples
- Effects of R&A reorganization on sample research, and of JSC reorganization on astromaterials curation