

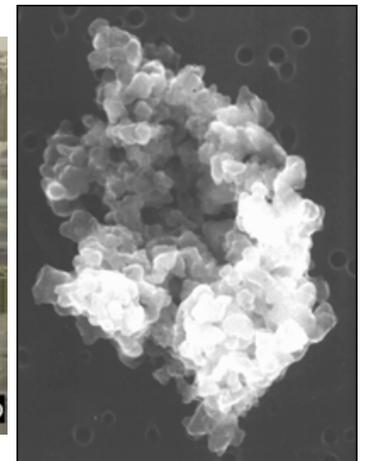


*“Dedicated to maximizing planetary sample science while protecting the integrity of NASA-collected extraterrestrial materials”*

# Report to the Planetary Science Subcommittee

March, 2016

Hap McSween, Chair



# CAPTEM

*Curation and Analysis Planning Team for Extraterrestrial Materials*

## CAPTEM

*Chair: Hap McSween  
(University of Tennessee)*

Some changes!

Lunar Sample  
subcommittee

*Chair: Alan Treiman  
(LPI)*

Stardust  
subcommittee

*Andrew Westphal  
(UC Berkeley)*

Genesis  
subcommittee

*Larry Nyquist  
(JSC)*

Cosmic Dust  
subcommittee

*Hope Ishii  
(U Hawaii)*

Asteroid  
Sample  
subcommittee

*Kevin McKeegan  
(UCLA)*

*Space-exposed  
Hardware  
(ad hoc)*

*Jeff Taylor  
(U Hawaii)*

Meteorite  
Working  
Group

*Conel Alexander  
(Carnegie Inst)*

Informatics  
subcommittee

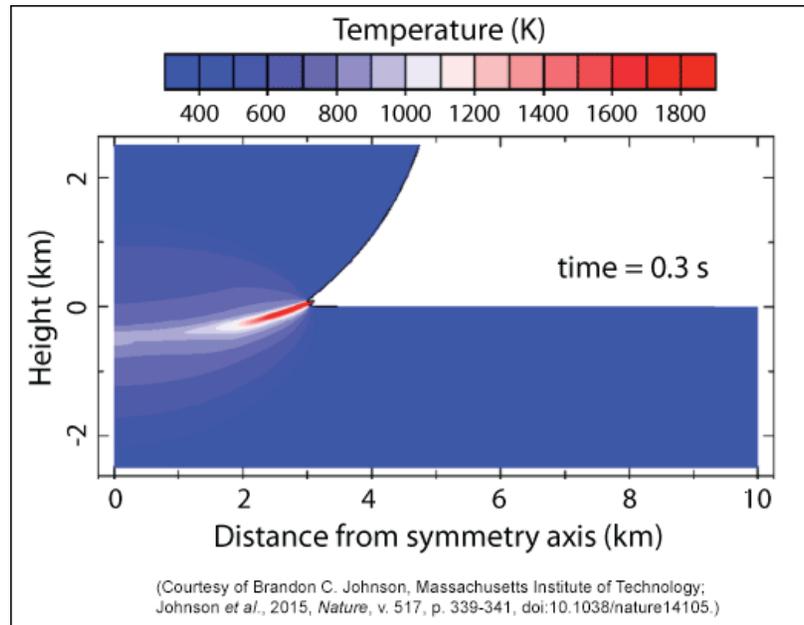
*Andrew Westphal  
(UC Berkeley)*

*Additional Members: James Day (UCSD), Juliane Gross (U Houston), Rhianon Mayne (TCU), Devon Schrader (ASU), Dimitri Papanastassiou (JPL), Aaron Burton (JSC, Secretary)*

## **Next CAPTEM meeting March 19**

- Review JSC Astromaterials curation and allocation activities
- Briefing on three-agency ANSMET agreement to continue collection/curation of Antarctic meteorites
- Review newly established Microparticle Impact Curation Lab (space-exposed hardware collection which can have collection surfaces for extraterrestrial materials)
- Consider scientific data management standards for the sample analysis community

A new idea suggests that chondrules could have formed as the result of impact jetting caused when large planetesimals collided during planet formation.

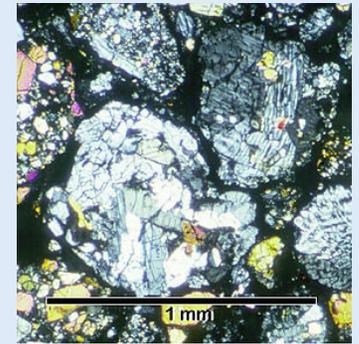


Graph shows 2D view of computer simulation of the jetting process at the interface of two colliding objects. The jet is hot enough to be molten.

## Forming Chondrules by Impact Jetting

Chondrules are mysterious millimeter-sized rocky droplets in chondritic meteorites.

They formed during the first 5 million years of the Solar System, have diverse chemical compositions, cooled slowly (5–3000 K/hour), and accreted in abundance.

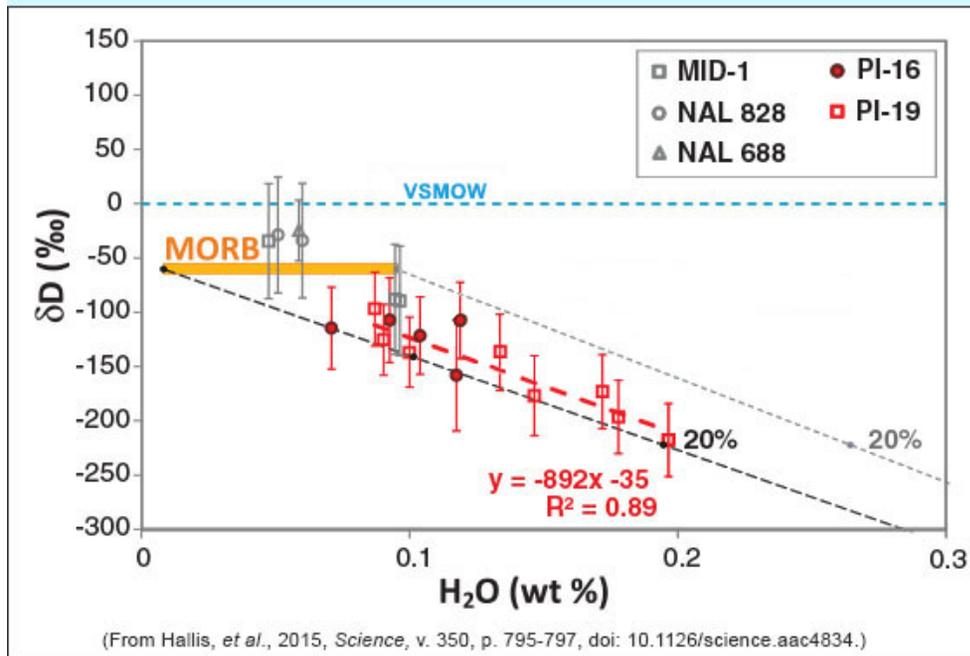


A new idea for the origin of chondrules depicts their formation as a consequence of planetary accretion: Large planetesimals (> 1000 km in diameter) accrete by impacting one another. During the first stage of such an impact event, molten material is jetted from the point of impact. As the jet disperses, little droplets of silicate melt form, making mysterious little objects that cosmochemists have studied for decades.

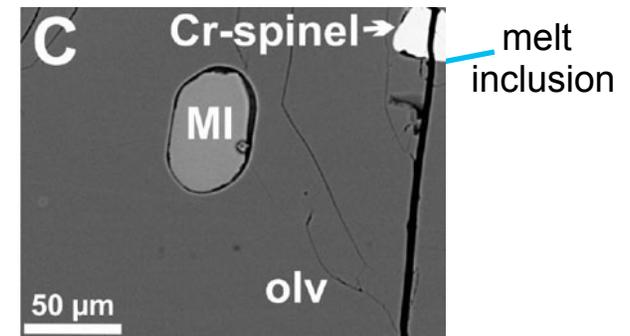
Johnson et al. (2015) *Nature*

### Primeval Water in the Earth

Hydrogen-isotope Ratios of Baffin Island and Icelandic Basaltic Melt Inclusions versus Water Content



Melt inclusions in basalts from Baffin Island, Canada, are thought to be derived from primordial regions of the deepest mantle. They contain the lowest deuterium/hydrogen (D/H) ratios of any mantle-derived rock; red circles and squares on the graph.



The Baffin Island data point toward materials with low D/H arriving early in Earth's accretion. It appears that the upper reaches of Earth, including the upper mantle, reflect atmospheric-ocean interactions whereas the deep regions inside Earth reflect its primordial components derived from the protosolar nebula, the cloud of gas and dust from which all the planets formed.

## **Current Issues of Concern**

- Impact of possible delays in Discovery and especially New Frontiers AOs to potential sample return missions that could be launched in the next decade
- Continued funding pressure on extraterrestrial materials research and great interest in the NRC review of NASA's R&A reorganization
- Participation in the AGs white paper on mission participating scientists