CAPTEM

Curation and Analysis Planning Team for Extraterrestrial Materials

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Planetary Science Advisory Committee
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CAPTEM

- a community-based, interdisciplinary forum for discussion and analysis of matters concerning the collection and curation of extraterrestrial samples, including planning for future sample return missions.

- a standing review panel, charged with evaluating proposals requesting allocation of all extraterrestrial samples contained in NASA collections.

- allocation sub-committees are each responsible for one or more of NASA collections of ET samples.

- In its role as an analysis group, CAPTEM may also organize ad hoc or standing subcommittees to address specific issues. In principle, this includes supporting human exploration objectives and their implications for architecture planning and activity prioritization for future exploration of planetary surfaces.

CAPTEM 2018

- Chair: Kevin McKeegan (UCLA), Vice-chair: TBD (March meeting)
- Secretary: Liz Rampe (JSC)

Sub-committee chairs

- Lunar: Alan Treiman (LPI)
- Genesis: Larry Nittler (CIW)
- Stardust: Rhonda Stroud (NRL)
- Asteroids: Munir Humayun (FSU)
- Cosmic Dust: Hope Ishii (UH)
- Informatics: Sam Lawrence (JSC)
- Meteorite Working Group: Noriko Kita (U Wisconsin)

at-large members

- Devin Shrader (ASU), Juliane Gross (Rutgers U), James Day (UCSD), Arya Udry (UNLV)

coordinators

- Facilities: Kevin McKeegan (UCLA)
- Space Exposed Hardware: Jeff Taylor (UH)

recent CAPTEM activities

- approved updated charter
- provided input for long-term planning and mid-decadal review
  - Planetary Science Vision 2050 workshop
  - NAS/Space Studies Board, Committee on Extraterrestrial Sample Analysis Facilities
  - Vision and Voyages Progress Review Committee
- initiated review of Stardust curation and allocation
  - JSC site visit Jan. 29-30 led by Rhonda Stroud
- consulted on JSC/ARES preparations for asteroid samples from upcoming missions: *OSIRIS-REx, Hyabusa 2*
- initial discussions of advanced curation initiatives
  - small particles, organics, volatiles, potential bio
  - microbial ecology of JSC clean labs
- ongoing discussions of Informatics

Curation, Analysis, and Planning

Hyabusa 2 (Ryugu, 2020)

- JAXA and NASA will develop a mutually agreed Joint Sample Exchange Curation and Analysis Plan.
- 10% of total return coming to JSC no later than 1 year after return of Hayabusa 2.
- JSC Curators will visit JAXA Curation facility in 2018 to begin work on this plan.

OSIRIS-Rex (Bennu, 2023)

- CAPTEM will assemble a subcommittee to review the OSIRIS-REx and Hayabusa2 curation plans

Mars

- RSSB (Returned Sample Science Board)
- Contamination Control Planetary Protection Working Group (CCPPWG)
- Ken Farley to discuss Mars2020 @ spring CAPTEM meeting

current CAPTEM issues for PAC

analytical capabilities and facilities

- CAPTEM will continue to anticipate working with NASA HQ on developing an investment strategy for needed future analytical capabilities and facilities

informatics

- a community survey on data formats and practices was put on hold because the Planetary Science Division asked ARES to define requirements for a notional Astromaterials submission-based data repository for NASA-funded research.
- PI's supported for data archiving?

Mars: curation facility preparation

Questions/potential issues for an "accelerated" MSR:

- 10 year lead time? JSC/Astromaterials currently about 1 year into preliminary planning. budget?
- Should CCPPWG activities be overseen by CAPTEM?

plans for 50th anniversary of Apollo 11 ?

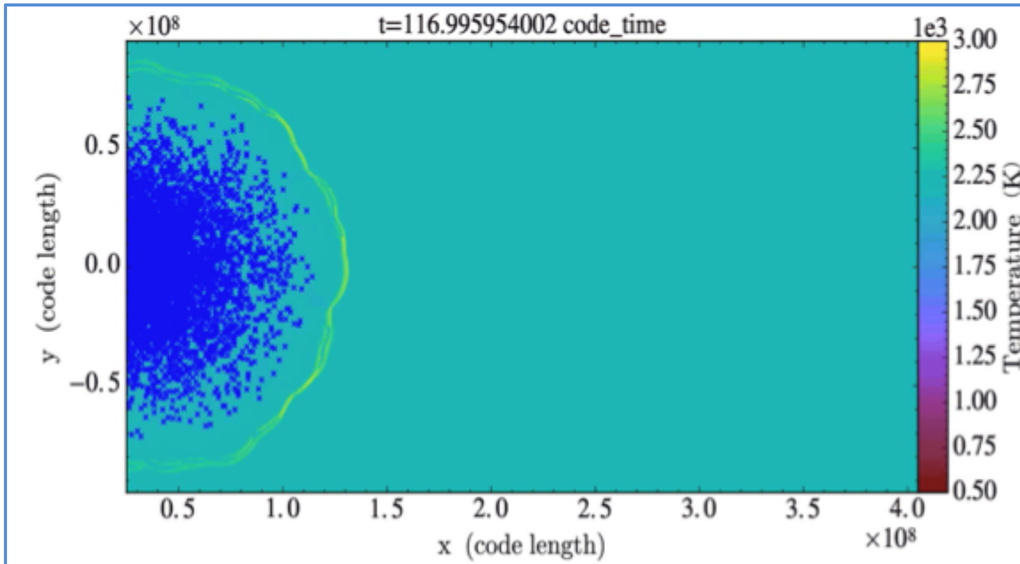
Accretional Layers Preserved in a Meteorite

(From Garvie, L. A. J. *et al.*, 2017, *Icarus*, v. 292, p. 36-47, Fig. S1, slice ASU#1580_1. doi: 10.1016/j.icarus.2017.03.021.)

The Isheyevo carbonaceous chondrite has millimeter- to centimeter-thick laminations composed of different amounts of silicate versus Fe-Ni metal grains.

These remarkable laminations are a preserved record of planetary accretion.

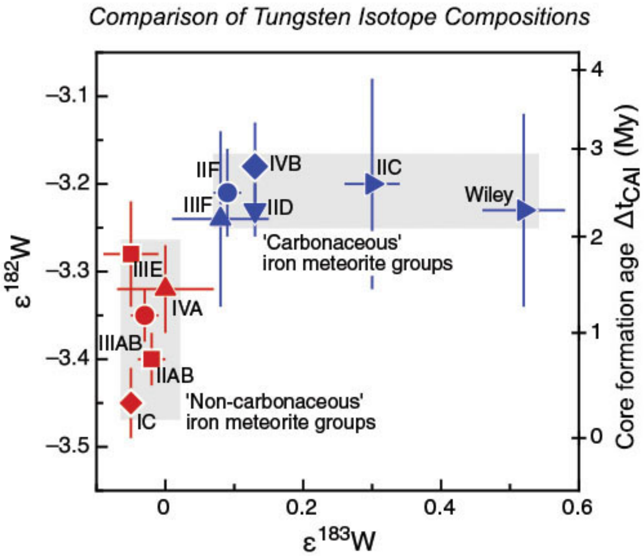
A sweep-up model explains the laminations in Isheyevo based on computer simulations of ejecta plumes in nebular gas. Silicate and metallic particles in a plume of impact debris from a glancing collision accreted, layer by layer, onto the surface of the surviving planetesimal (Isheyevo's parent asteroid) that spun downrange through the plume.



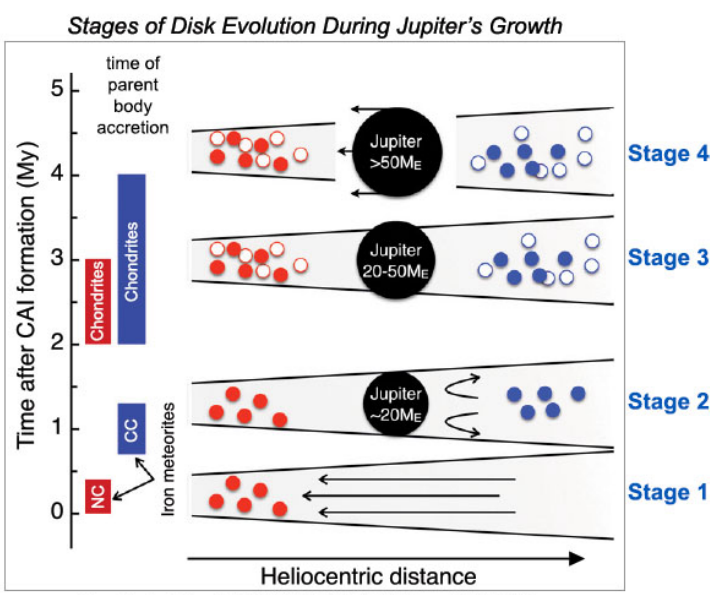
PSRD presents

http://www.psrd.hawaii.edu/Oct17/Isheyevo-accretion.html

Meteorite Formation Times and the Age of Jupiter



(From Kruijer, T. S., *et al.*, 2017, *PNAS*, doi: 10.1073/pnas.1704461114.)



(From Kruijer, T. S., *et al.*, 2017, *PNAS*, doi: 10.1073/pnas.1704461114.)

Tungsten isotope abundances for iron meteorites fall into two distinct groups that also include carbonaceous chondrites (CC) and non-carbonaceous chondrites (NC) plus Mars, Earth, and the Moon. The higher ε^{182}W shows that iron cores formed in the CCs 2-4 My after cores formed in the NCs.

Age and Formation of Jupiter

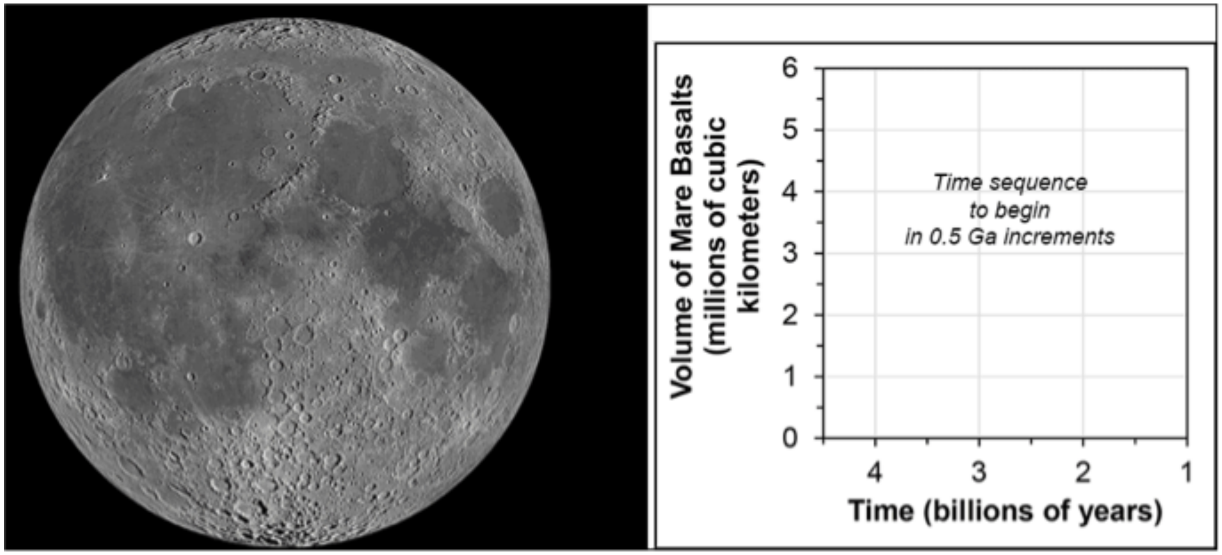
Stage 1: During the first 0.4 Ma the NC iron meteorite parent bodies accreted. The CC reservoir had not formed yet and nothing blocked the flow of gas from far beyond Jupiter towards the inner part of the disk.

Stage 2: By about 1Ma after CAIs, Jupiter had grown to 20 Earth masses, preventing inwards migration of solids, and the CC iron meteorite bodies had accreted.

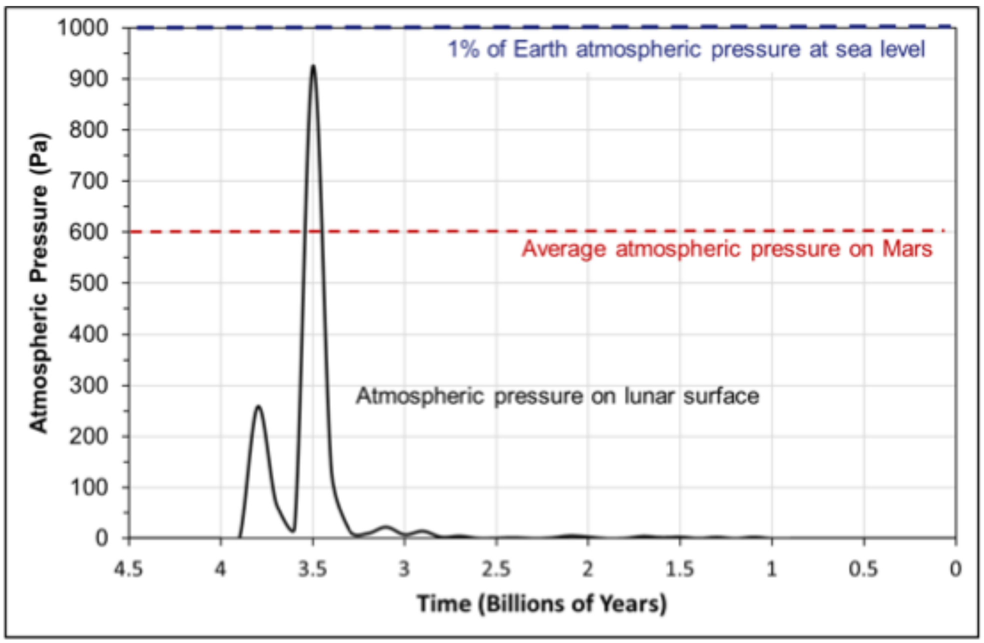
→ Jupiter's core took only 1 million years to accrete.

Stages 3 & 4: Jupiter grew by accreting gases and creating a gap in the disk. NC chondrites parent bodies accreted in the inner part of the disk while CC chondrite parent bodies accreted beyond Jupiter.

Volcanism and an Ancient Atmosphere on the Moon



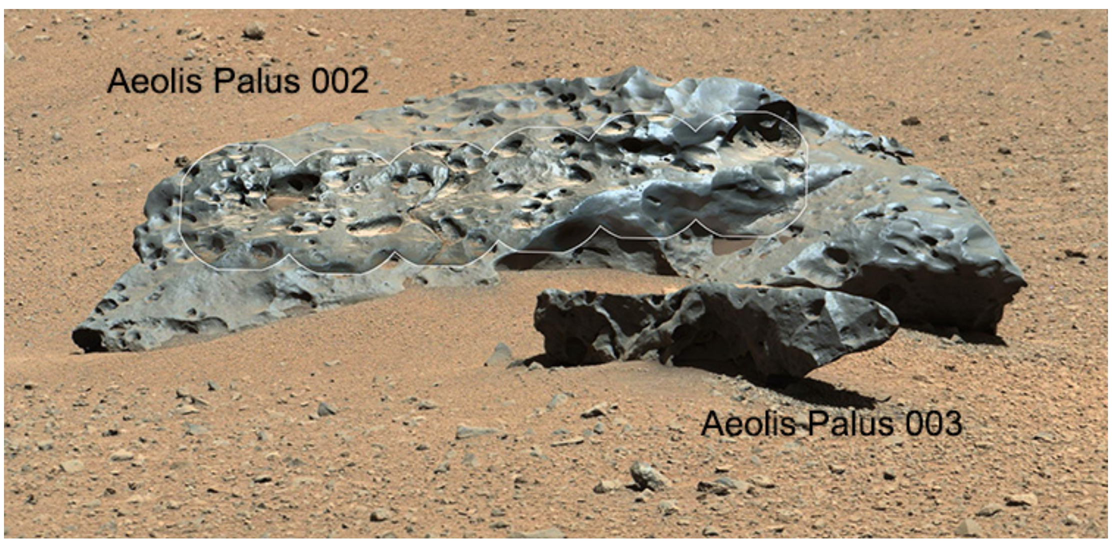
Time sequence of the eruption of mare basalt lavas, adapted from Figure 1 in Needham and Kring (2017). Note the sharp peak in eruptions before 3.0 billion years ago, with most of the action occurring about 3.5 billion years ago.



At the peak of mare basalt volcanic activity at 3.5 billion years ago, the pressure would be higher than the mean pressure on Mars and almost 1% of the atmospheric pressure on Earth's surface at sea level.

Iron Meteorites Found While Exploring Mars

An interesting scientific use of the meteorites found on Mars is that metallic iron oxidizes easily, providing a way to monitor the planet's past climate. Such studies are still young, but the concept that nature has dropped climate monitors on Mars is fascinating.



Asteroids that struck Mars, Earth and the Moon long ago provide information about the flux of objects from the asteroid belt, and perhaps beyond. We might find pieces of ancient Earth on the Moon, perhaps dating to the time when life was just getting started.

PSRD presents

http://www.psrd.hawaii.edu/CosmoSparks/Nov17/irons-on-mars.html