



# Astromaterials Curation Data Initiatives

Astromaterials Acquisition and Curation Office  
Astromaterials Research and Exploration Science Division (ARES)  
Exploration Integration and Science Directorate  
NASA Johnson Space Center

*Input developed by Dr. Cynthia Evans and Nancy Todd*

# NASA's Astromaterials – *Setting the Stage*



*Sample science forms a critical base for planetary science and understanding solar system evolution*

- NASA's Johnson Space Center curates all of NASA's extraterrestrial samples
  - Responsibility dictated by NPD 7100.10E and derivative documents
- Our charge is to preserve, protect and provide
  - Conserve these samples for current and future scientific research, and maintain their scientific, cultural and political value
  - Accomplished through end-to-end mission support, detailed planning, and **controlled archival of astromaterials collections and associated hardware, and associated data.**



# NASA's Astromaterials Collections

- We curate several different Astromaterials collections:
  - Apollo Lunar Samples
  - Antarctic Meteorite Collection (ANSMET)
  - Cosmic Dust from the Stratosphere
  - Stardust Comet and Interstellar Grains
  - Genesis Solar Wind
  - Hayabusa
- Samples from various bodies in the solar system:
  - Moon (Apollo, meteorites)
  - Mars (meteorites)
  - Asteroids (meteorites, cosmic dust, Hayabusa)
  - Comets (Stardust, cosmic dust)
  - the Sun (Genesis)
  - Interstellar dust streams (Stardust, cosmic dust)

*Each collection is unique*

- The integrity of the samples from each collection is a result of the early partnership between curation scientists and the mission scientists and engineers

# Challenges for Astromaterials Databases



- To support planetary science research on these samples, various data types are managed
  - Descriptive data of the missions for sample and analysis context
  - Descriptive data of the collections for overview of samples available
  - Information about each sample for scientists to determine the right sample for allocation to study
  - Inventory and handling history of each sample
- The Astromaterials Curation Databases
  - Each astromaterials collection developed a unique database with different technical requirements and implementation  
[\[http://curator.jsc.nasa.gov/\]](http://curator.jsc.nasa.gov/)
  - Curate >20TB of sample data
  - The variety of data, the evolving data-recording media over the years (1960s to present), and different database architectures made finding and using data across the individual collections difficult for the scientific community.
- The Astromaterials Acquisition and Curation Office has several informatics initiatives that address these challenges.

# Public Access to Information



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SAMPLE COLLECTIONS

SAMPLE REQUEST DEADLINES

CURATION NEWS

EDUCATION SAMPLES

PERSONNEL

ABOUT CURATION

ARES

*The Astromaterials Acquisition and Curation Office is responsible for the curation of extraterrestrial samples from NASA's past and future sample return missions. Our mission includes the documentation, preservation, preparation, and distribution of samples from the Moon, asteroids, comets, the solar wind, and the planet Mars.*



**Lunar Sample and Photo Catalog Updated**  
The Lunar Sample Database was updated in March 2015, and now includes Luna mission samples.

[Read More...](#)



## Astromaterials Acquisition & Curation Office



Lunar



Meteorites



Stardust



Genesis



Cosmic Dust



Space Hardware



Hayabusa

- Freedom of Information Act
- NASA Privacy Policy, Accessibility and Important Notices
- Information-Dissemination Priorities and Inventories

- Equal Employment Opportunity Data Posted Pursuant to the No Fear Act
- Budgets, Strategic Plans and Accountability Reports
- USA.gov
- Download Adobe Reader



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Website Curator: Nancy S. Todd  
Last Updated: Apr 10, 2015  
[Site Map](#)

# Examples of Data Access



**CURATION | Lunar**

Home → Lunar Samples → Lunar Sample Compendium

### THE LUNAR SAMPLE COMPENDIUM

Compiled by Charles Meyer  
for  
Astromaterials Research & Exploration Science (ARES)

**Contents**

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Basalt	Breccia	Plutonic	Soil	Core	SCR	Thin	Display
Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16	Apollo 17	Luna	
Lunar basalts are samples of extrusive lava flows of volcanic magma.							
10003	10017	10020	10022	10024	10029		
10031	10032	10044	10045	10047	10049		
10050	10057	10058	10062	10069	10071		
10072	10092	12002	12004	12005	12006		
12007	12008	12009	12011	12012	12014		
12015	12016	12017	12018	12019	12020		
12021	12022	12031	12035	12036	12038		
12039	12040	12043	12045	12046	12047		
12051	12052	12053	12054	12055	12056		
12061	12062	12063	12064	12065	12072		
12075	12076	12077	14053	14071	14072		

- SAMPLE REQUESTS / RETURNS
- OUR COLLECTION
- SAMPLE CATALOGS
  - Apollo Sample and Photo Database
  - Apollo Sample Catalog PDFs
  - Lunar Core Photographs
  - Lunar Core Drive Tubes Summary
- SAMPLE COMPENDIUM AND NEWSLETTER
  - Lunar Sample Compendium
  - Lunar News
- Lunar Curation Contacts

External Links  
▶ Apollo Lunar Surface Journal

Lunar Sample Catalog & Photo Database  Quick Search  Search Samples  Search Photos  View Samples By Mission  View Catalog PDFs

**Quick Search Bar**

**Search for Lunar Samples**

Enter all or part of a sample number to search for sample data.

**Search for Photos**

Search By:

Sample Number

Photo Number

Enter all or part of a sample or photo number to search for photos.

Search Text

View results as:

Photo List

Gallery

## APOLLO SAMPLE CATALOGS

Apollo Sample Catalogs Available in PDF Format

	Pub. Number	Authors
Apollo 11 Catalogs		
Apollo 11 Sample Catalog (2 <sup>nd</sup> Ed.)	JSC-12522	F.E. Kramer, D.B. Twedell, W.J.A. Walton, Jr.
The Apollo 11 Drive Tubes		J. Allton
Apollo 14 Catalogs		
Apollo 14 Sample Catalog	JSC-14240	I.C. Carlson, W.J.A. Walton
Apollo 14 Coarse Fines (4-10mm): Sample Location and Classification	JSC 12922	F.E. Kramer and D.B. Twedell
Apollo 15 Catalogs		
Apollo 15 Sample Catalog Part 1 Part 2 Part 3	JSC-20787	G. Ryder
Apollo 15 Coarse Fines (4-10 mm): Sample Classification, Description, and Inventory	MSC 03228	B. Powell
Apollo 15 Lunar Sample Information Catalog	MSC 03209	P. Butler, Jr., M. Anderson, K. Johnston, and W.C. Pinney
Apollo 16 Catalogs		
Apollo 16 Sample Catalog Part 1 Part 2 Part 3	JSC-16904	G. Ryder, M.D. Norman
Apollo 16 Surface Sampler Data Package		L. Carrasco
Apollo 16 Special Samples		F. Horz et al
Apollo 16 Coarse Fines (4-10 mm): Sample Classification, Description, and Inventory		U. Marvin
Apollo 16 Rake Samples 67515 to 68537: Sample Classification, Description, and Inventory		J.V. Smith and I.M. Steele
Description, Classification and Inventory of Apollo 16 Rake Samples from Stations 1, 4 and 13		W.C. Pinney and G. Lotgren
Apollo 16 Lunar Sample Information Catalog	MSC 03210	P. Butler, Jr., M. Anderson, K. Johnston, and W.C. Pinney
The Cutting, Chipping & Distribution of Lunar Rock 68815		
Apollo 16 Soil Catalog - 61220		U. Marvin and A. Mosie
Breccia Guidebook #3 67915	JSC 16242	J.G. Taylor and A. Mosie
Breccia Guidebook #4 67015	JSC 16671	U. Marvin
Breccia Guidebook #5 67016	JSC 17393	M. Norman, G. Garcia
Breccia Guidebook #6 67435	JSC 18743	J.G. Taylor and A. Mosie



# Examples of Data Access



Sample Search Results

Sa...	Mission	Collection Site	Rock Type	Weight	% Prist...	Display Samples
73155	Apollo 17	Station: 2A NANSEN CRATER	Breccia Impact Melt	79.3	93.404	<a href="#">no</a>
73156	Apollo 17	Station: 2A NANSEN CRATER	Breccia Impact Melt	3.2	100	<a href="#">no</a>
73210	Apollo 17	Station: 3	Soil Unsieved	37.89	73.9	<a href="#">no</a>
73211	Apollo 17	Station: 3	Soil < 1 mm	51.95	97.093	<a href="#">no</a>
73212	Apollo 17	Station: 3	Soil 1-2 mm	3.47	100	<a href="#">no</a>
73213	Apollo 17	Station: 3	Soil 2-4 mm	2.8	100	<a href="#">no</a>
73214	Apollo 17	Station: 3	Soil 4-10 mm	2.47	92.43	<a href="#">no</a>
73215	Apollo 17	Station: 3	Breccia Impact Melt	1062	84.402	<a href="#">no</a>
73216	Apollo 17	Station: 3	Breccia Impact Melt	162.2	94.094	<a href="#">no</a>
73217	Apollo 17	Station: 3	Breccia Impact Melt	138.8	89.25	<a href="#">no</a>

Sample Details for Generic Number 73155

**Mission Information**

Mission: Apollo 17  
 Station: 2A  
 Landmark: NANSEN CRATER  
 Bag Number:  
 Original Weight: 79.30 g

**Sample Classification**

Rock Type: Breccia  
 Rock Subtype: Impact Melt  
 Description: fine-grained, clast poor

**Sample Availability**

Percent of Pristine Sample Available: 93.40 %  
 Date of Pristinity Calculation: Dec 02 2013

**Catalogs and References**

Lunar Sample Compendium

Lunar Sample Catalog

Occurrence of ANT Fragments in Lunar Soils and Breccias: Guide to Polished Thin Sections

Lunar Sample Information Catalog

Photo Number: S 73-17056  
Sample: 73155

Photo Number: S 73-17057  
Sample: 73155

Photo Number: S 73-17058  
Sample: 73155

Photo Number: S 73-17059  
Sample: 73155

Photo Number: S 73-17060  
Sample: 73155

Photo Number: S 73-17061  
Sample: 73155

Photo Number: S 73-19595  
Sample: 73155

Photo Number: S 73-23886  
Sample: 73155

# Curation Database/Informatics Initiatives (1)



- Common architecture for each Astromaterials Collection Database
  - The Astromaterials Curation Digital Repository [<http://curator.jsc.nasa.gov/>]
    - documentation about the samples and their history
      - sample processing data and images
      - preliminary characterization data
      - JSC handling and storage
      - allocation activities
  - Astromaterials Sample Tracking and Reporting Application (ASTRA) Framework
    - consolidate common functionality into a services library that manages access to data and standardizes the implementation of common processes for all collections



# Curation Database/Informatics Initiatives (2)



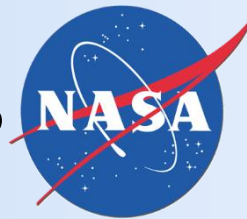
- Upgrade and add digital compendia
  - Highlight published findings on designated sets of samples such as Lunar meteorites, Martian meteorites, Lunar sample suites
- Scanning and hosting high resolution imagery of samples from historic media
  - Completing a project with PDS Imaging Node to scan and digitally archive all Apollo sample film-based images at high resolution
  - >36,000 photos of samples, including top, bottom, sides, subdivisions, stereo pairs

# Curation Database/Informatics Initiatives (3)



- Scanning and hosting additional non-digital data about samples from historic media
  - A variety of images (many formats), data packs, associated mission data that are stored as hard copy in Astromaterials Curation Data Center
- Creating mechanisms for new data, new media, new links and data synthesis tools
  - 3D imagery generated from detailed optical imaging and Micro-CT imagery
  - MoonDB, Data restoration of at-risk lunar data sets through PI involvement
    - PDS4 compliant archive
    - Model based on geochemical data through IEDA/EarthChem and PetDB
    - Includes data synthesis tools used in IEDA databases

# Summary – Astromaterials Curation and PDS



- Sample data and planetary remote sensing data are complementary (enhanced scientific understanding when linked)
- Astromaterials Data are
  - Accessible by the public
  - Part of daily Curation operations
  - Archived for security and scientific integrity
  - Actively working towards PDS compatibility when applicable
    - Ongoing dialog with PDS about additional connections between PDS and Astromaterials Curation Sample Databases