

# Curation

**How? What? Why?**

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# **Curation**

## **Integral role in Mission**

- Plan sample return containment and control contamination
- Monitor cleanliness of return containers
- Monitor transfer of return samples from reentry to curation facility

## **Returned Samples**

- Inventory and catalog for Science community
- Subdivide samples for allocation
- Secure storage
- Preservation for now and for the future

# How do we Curate

- Class 10K (1K) clean room
- Stainless Steel processing and storage cabinets
- Nitrogen atm in cabinets, <10ppm H<sub>2</sub>O, O<sub>2</sub>, Argon
- Keep samples in dedicated cabinets by mission
- Limit materials in contact with samples
  - Stainless Steel
  - Aluminum
  - Teflon
- Multiple layers of packaging
- Layer stripping during transfers
- Strict handling procedures

# Lunar Sample Building



**First Occupied in the summer of 1979,  
Now nearing 30<sup>th</sup> anniversary**

**Has preformed very well**

# State of the Lunar Facility after 28 years

## Completed since 2002

- New Remote Storage Facility at WSTF (2002)
- Lighting replaced (2003)
- Upgrade Security system (2004, continues today)
- Resurface roof (2005, no penetrations)
- Replace Liquid Nitrogen Tank (2005/06)
- Lunar Database upgrade (Complete, Dec. 2007)

## • To be completed

- Air handling control system (Fy 2008/09)
- Laboratory clean room upgrade (Fy 2008/9)

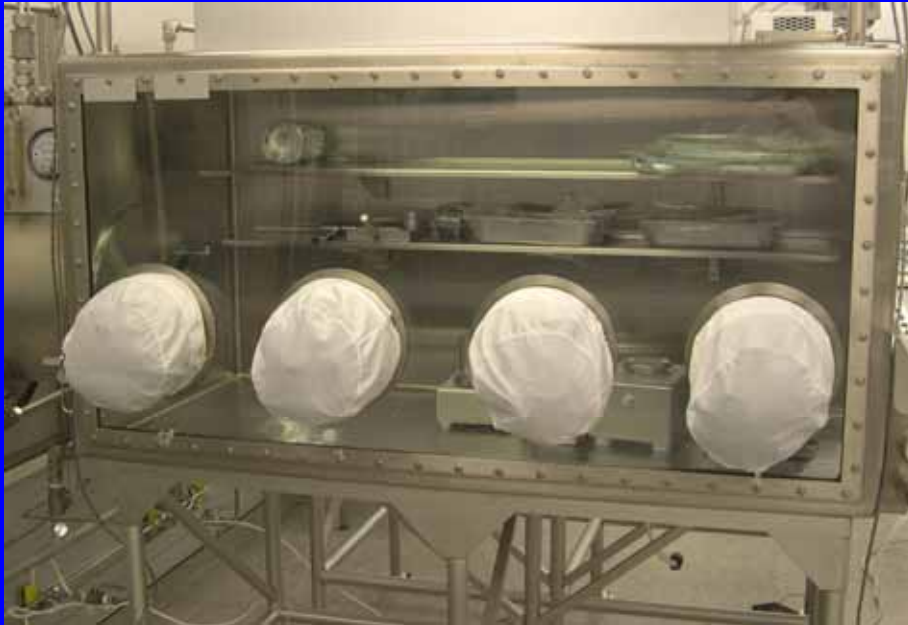
# Secure Clean Storage





# Stainless Steel Glove Boxes Flowing Nitrogen

Processing to  
class 10 cleanroom  
standards



# Apollo Lunar Sample Collection

## NASA Custody

	Kgs	Wt. %
Pristine Sample Vault & Laboratory	268	70.1
WSTF Remote Vault	52	13.5
Returned Sample Vault & Lab.	29	7.6
Consumed	13	3.4

## Outside Custody

Principal Investigators	7	1.8
Long Term Loan	10	2.6
(75 samples; 55 locations)		
Rotating Loan & Education	3	0.8
Gifts	0.26	0.1

(Presented by Nixon to Countries & States)

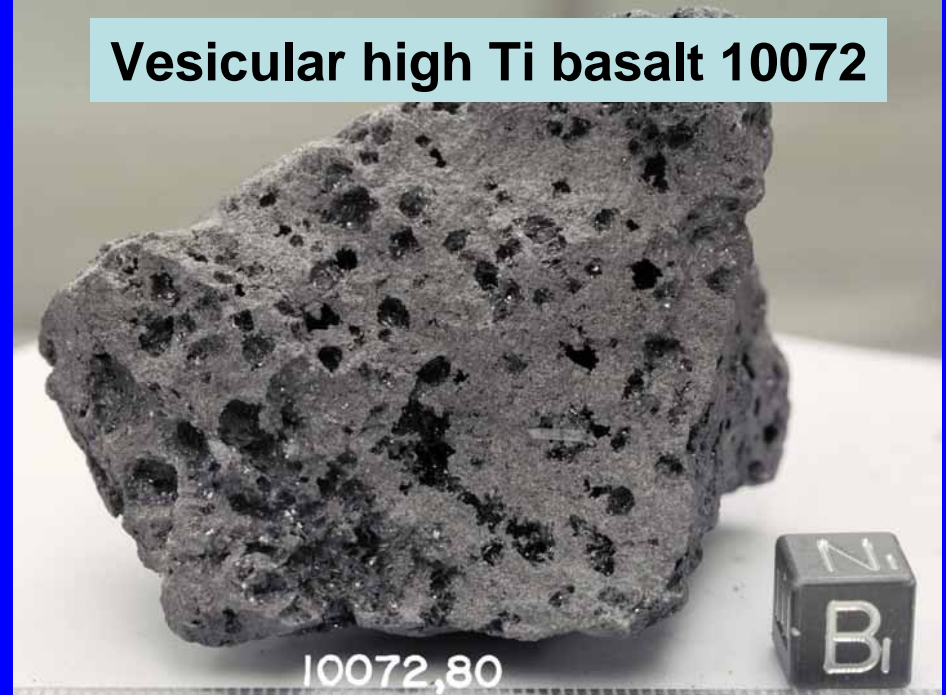


# Uniform, fine-grained basalts and impact melt rocks

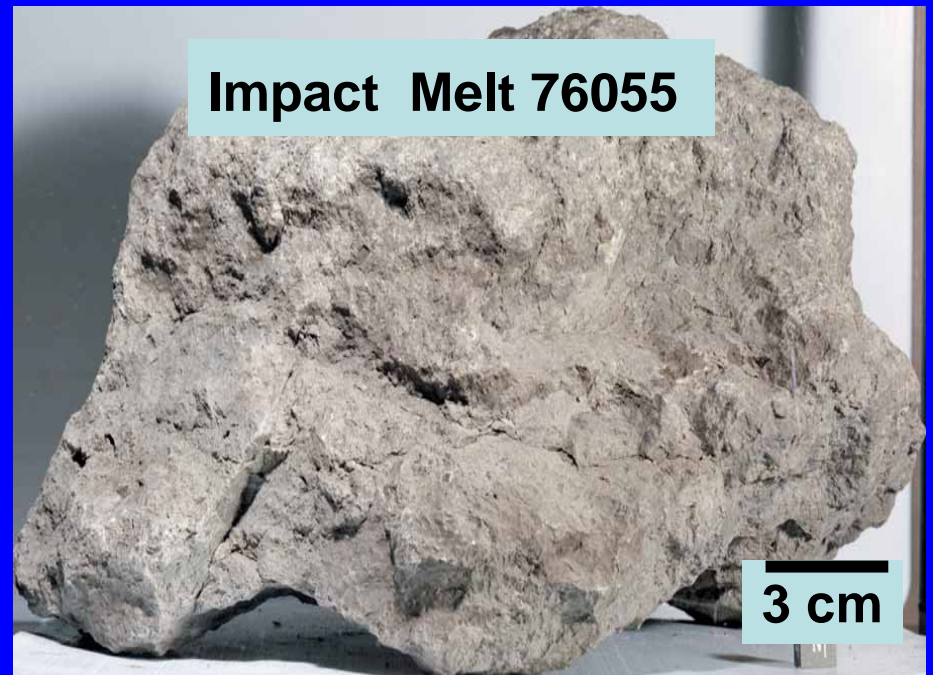
High Ti basalt 10044



Vesicular high Ti basalt 10072



Impact Melt 76055

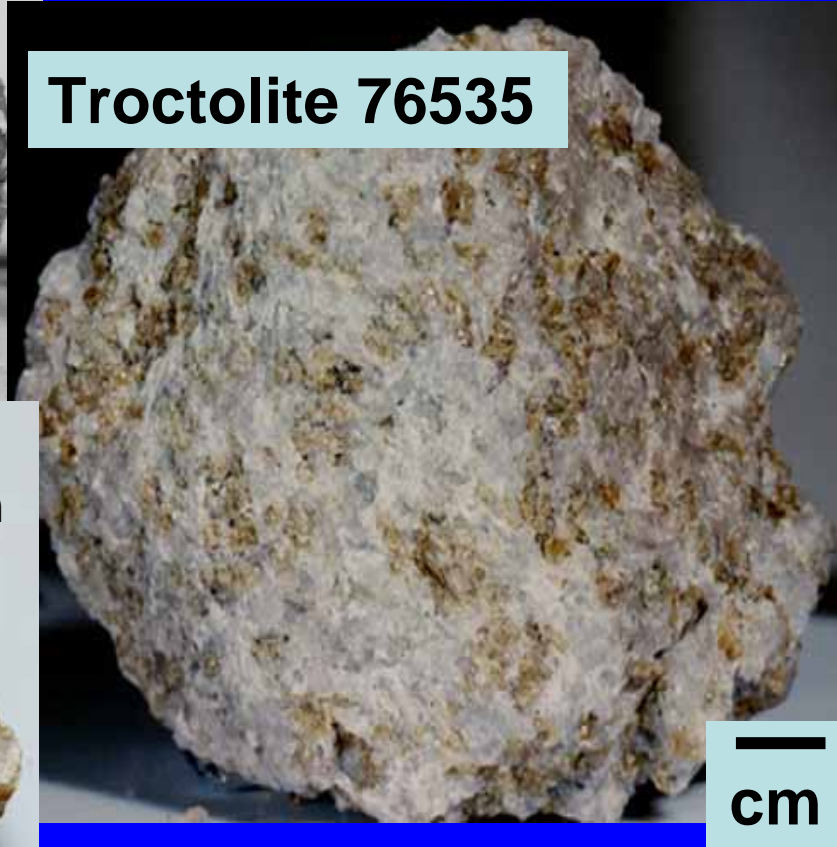


# Pristine Igneous Crustal Rocks

Anorthositic Highland Crust  
15415



Troctolite 76535



These are  
The Gems





60019



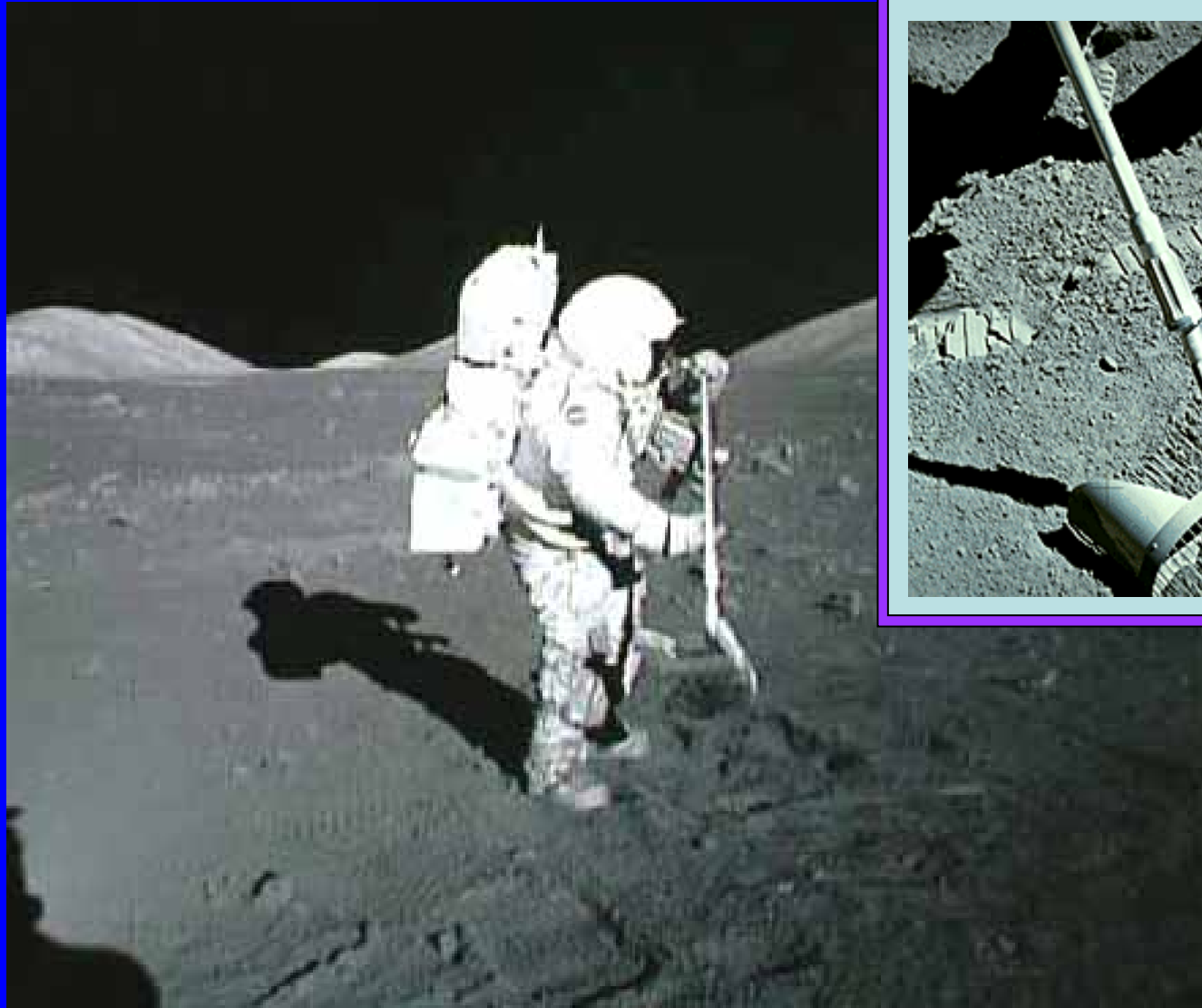
**Some Pristine  
Clasts have been  
found**

## **Clast Laden Impact Breccias**

14321



# Rake Samples



**> 1 cm rocks  
from regolith**



# Coarse Fines from Regolith

A-16  
2-4 mm



A-12  
4-10 mm

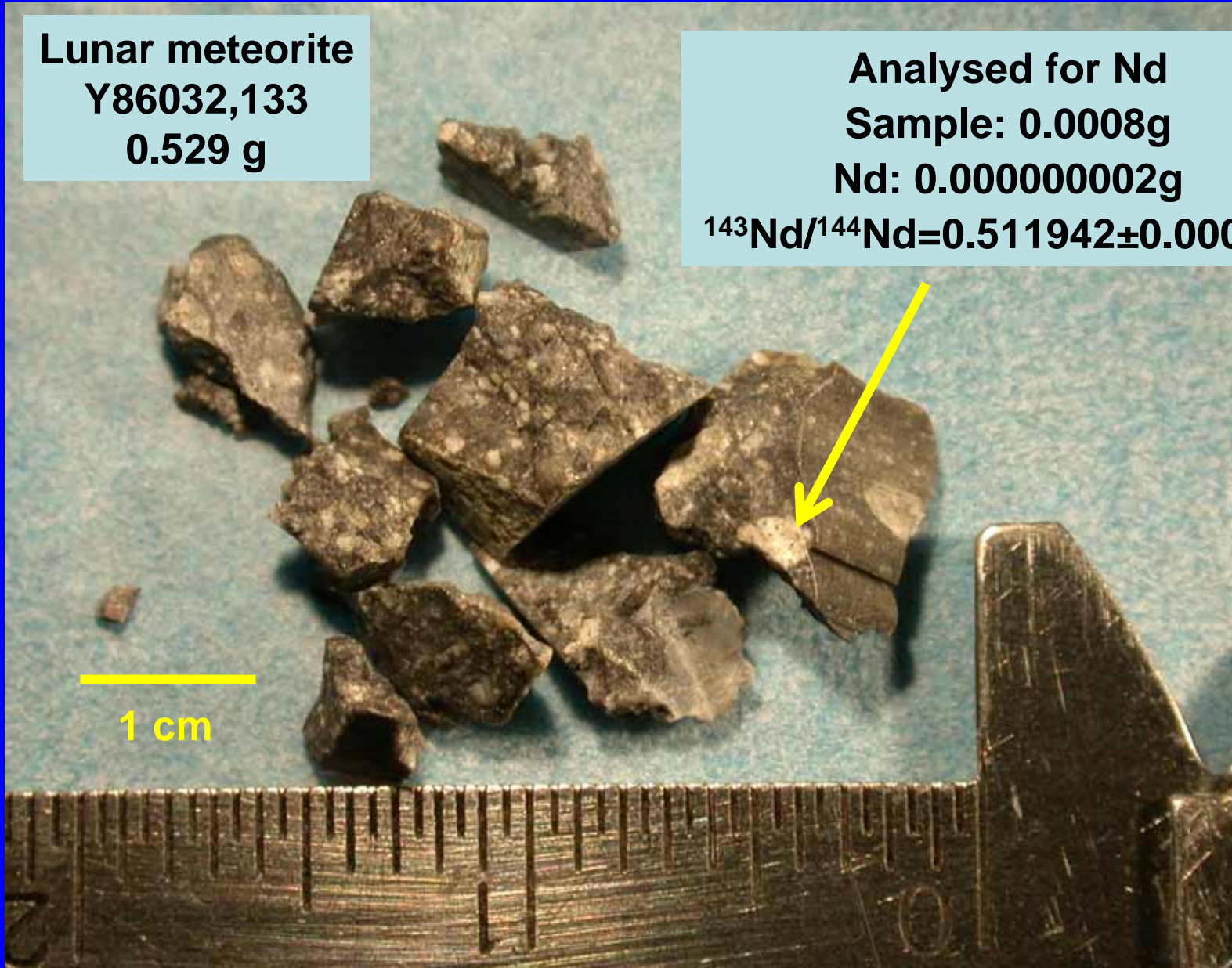


# It is a Question of Scale

Lunar meteorite  
Y86032,133  
0.529 g

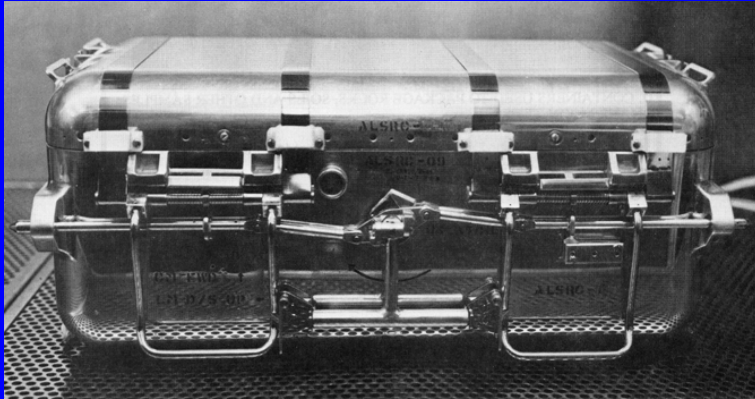
Analysed for Nd  
Sample: 0.0008g  
Nd: 0.000000002g  
 $^{143}\text{Nd}/^{144}\text{Nd}=0.511942\pm0.000038$

1 cm





# Sample Return Containers



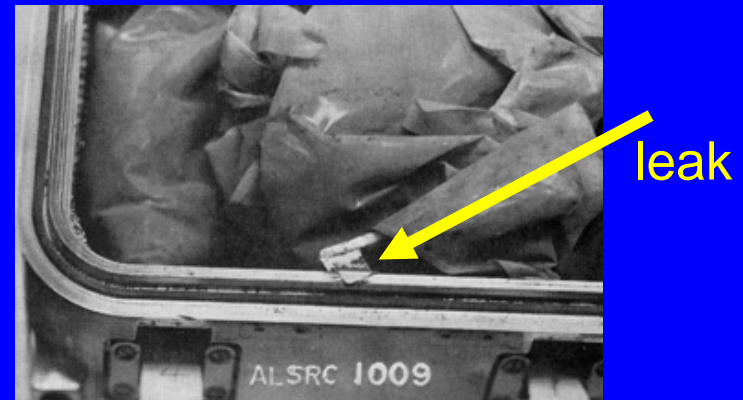
The whole box



A-14 SCR packed for travel



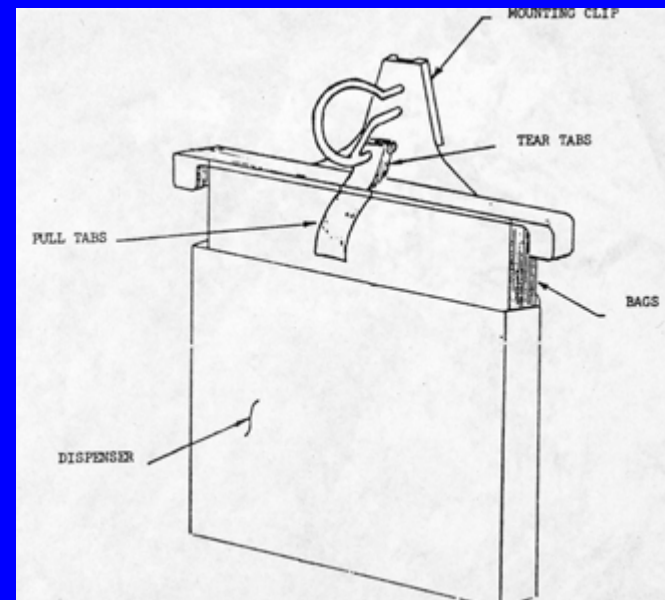
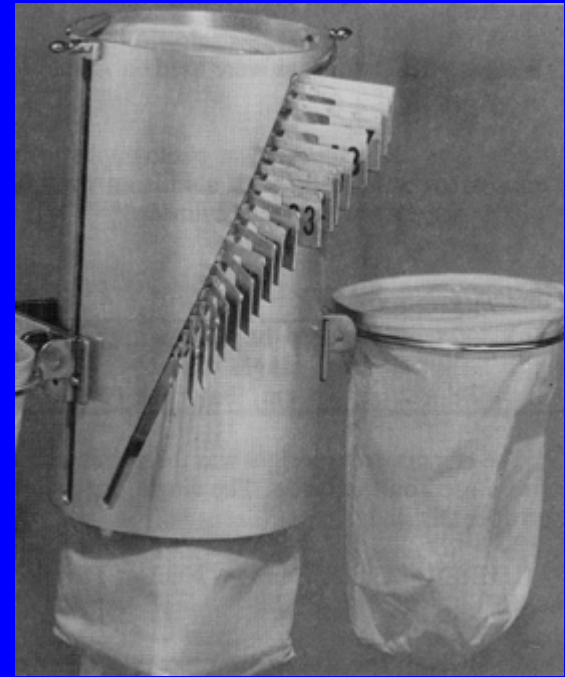
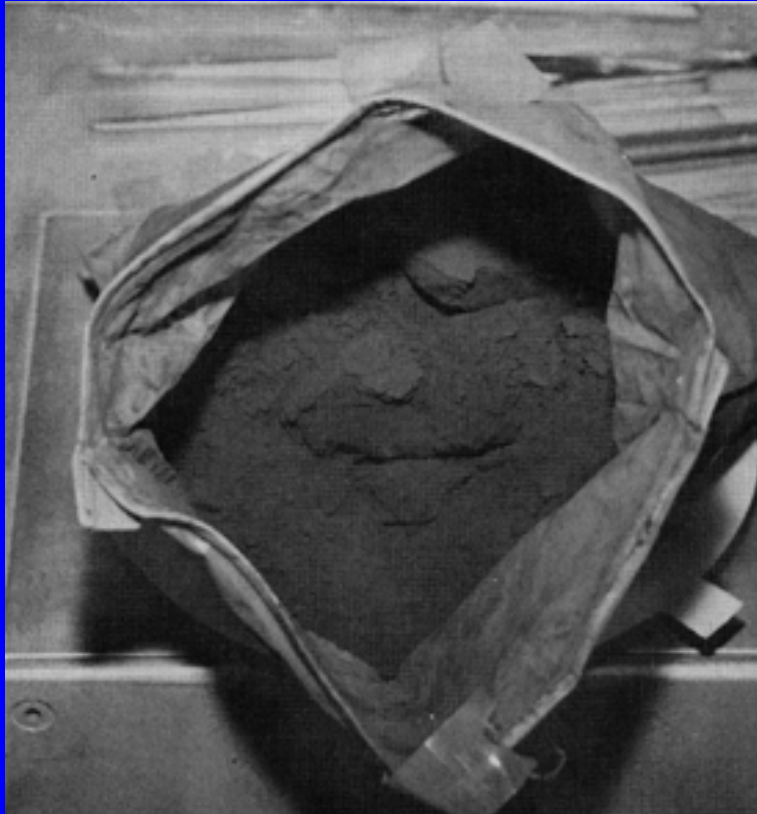
A-16 SCR prior to unloading



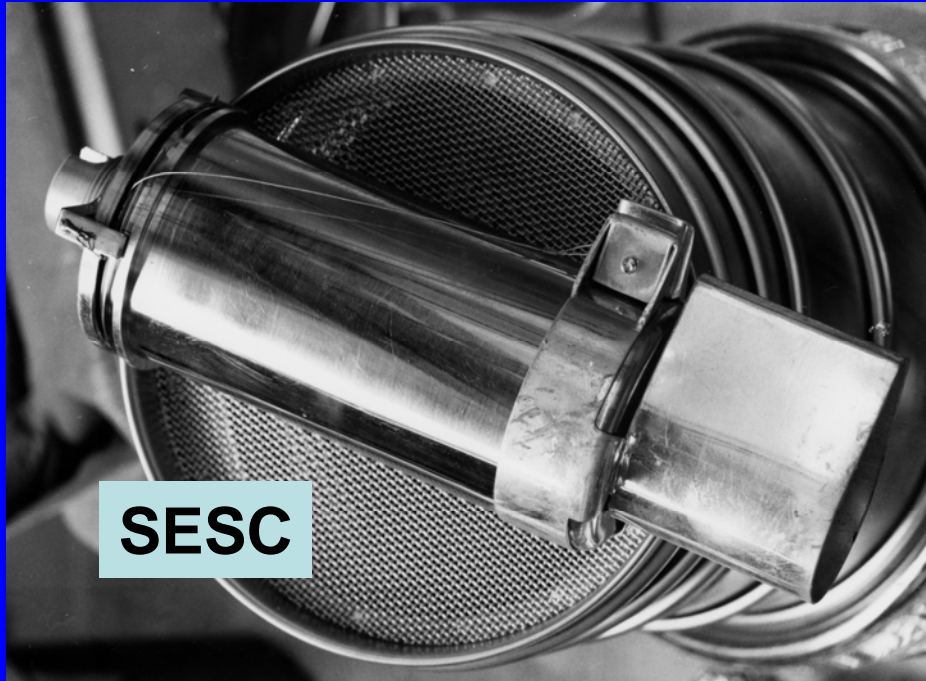


# Documented Sample bags

Al ring around top  
roll and twist seal



# Special Environment Sample Container



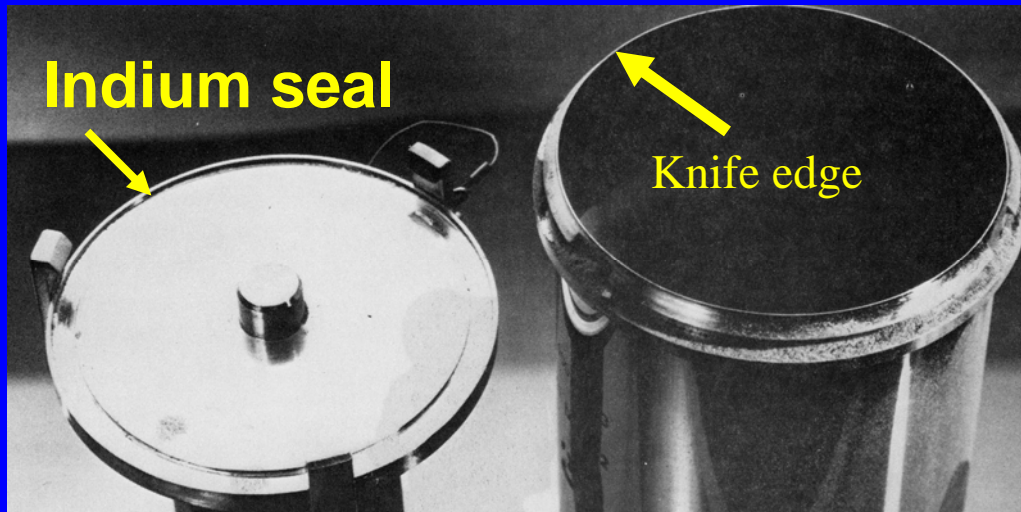
SESC

Weight = ~360 grams

Length = 21 cm

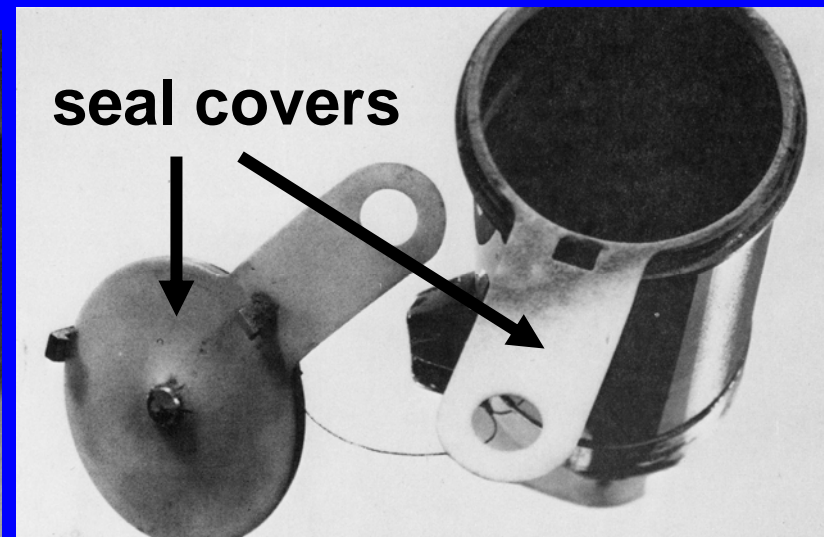
O. D = 6.1 cm

Volume = 360 cm<sup>3</sup>



Indium seal

Knife edge



seal covers

# Contamination Issues

- Indium (10%Ag) Seals, Rock Boxes, etc.
- A15 drill core, Ti alloy, threads canadized in Pb bath
- Core bit with WC cutters brazed to drill stem; W, Ni, Pb?
- MoS<sub>2</sub> grease used in LRL up to about 1972; organics
- Xylan: complex blend of organics with PTFE replaced  
MoS<sub>2</sub> about 1972; N, organics
- Band saw blade diamonds adhered in electroplated Ni;  
sawing is dry, causing heating
- Moisture & oxygen in N<sub>2</sub> usually ~5 ppm, but rises  
during processing, gloves leak; samples in  
containers are protected during storage.

# Apollo lessons learned

- **ROCKS WILL ANSWER THE BIG QUESTIONS**
- Rocks do not need to be brought back in vacuum, but need to be well sealed in appropriate bags.
- Special containers work reasonably well, but can be improved, use only for special samples, **SOILS?**
- Basalts and fine-grained melt rocks can be smaller
- Collect all the **pristine crustal rocks** possible!
- **Breccias** have variety and large samples are desirable, **may contain pristine crustal rocks**
- Rake samples **may contain pristine crustal rocks**.  
Change tine width?; Collect Robotically?
- Preventing contamination begins with initial design and requires diligent monitoring throughout manufacture, collection, and curation

# **Future Lunar Surface Sampling**

- **Curation begins with mission priorities and planning**
- **Well documented surface samples, fine-grained rocks can be smaller, clast rich breccias larger**
- **Field collected samples may be high graded later**
- **Rake samples more important? Variety**
- **Greater emphasis on outcrop or boulder samples; will give relationships between rock types . Use small drill for precise selection of samples**
- **Volatile rich samples especially regolith, use new sampling techniques and containers**

# Future Sample Return Containers

- **Rx Boxes:** limited use, special samples?
- **Teflon bags:** various sizes, improved seal, main container for returning Rxs & soils
- **Drive tubes** (4 cm): may not want as many as during Apollo
- **SS cylinders:** Improve the seal design to hold vacuum; use for special samples

# **AND MOST IMPORTANT**

**Preventing contamination begins with  
initial design and requires diligent  
monitoring throughout manufacture,  
collection, and curation**

**The community should reconsider  
the contamination issue after nearly  
40 years of experience**