

Geologic Training of Apollo Crews

**What did we do?
How well did it work?
What can we do better?**

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What Did We Do

Mission Objectives

Problem solving: The geologic thought process in field

Common language: Do you have the words that work

Observation skills: Can you describe what you see

Routine procedures:

Navigation, follow the map

Collecting, rock and soil

Sample documentation

Drive (core) tubes

Repetition

Train the Crew, Capcom, Scientists together

Classes in moon rocks, rock type recognition

Geologic Field Training

Mission	Number Trips
11	1
12	6
13	7
14	9
15	17
16	18
17	16

Each trip 3-6 days including travel time

Over 30 people participated in A-15 training

Geologic Field Training Sites

Volcanic Craters and Flows

- *Coso Hills, CA
- Colorado Plateau
- *Hawaii
- Mono Crater, CA
- *Rio Grande Gorge Taos, NM
- *Buell Park, AZ
- Tonapah, Nevada
- Pinacates, Mexico
- *Kilbourne Hole,
- *Ubehebe Crater, Death Valley, CA
- Capulin Mtn, NM
- Craters of the Moon, Idaho
- Big Bend Park, TX
- Quitman Mtns, TX
- Sunset Crater, AZ
- Sierra Blanco, TX
- *Flagstaff, AZ

Plutonic (Crustal) Rocks

- *No. Minnesota
- *San Gabriel Mtns., CA
- Stillwater, Montana
- *San Juan Mtns., CO

Craters, impact & explosion

- Sudbury Basin, Canada
- *Meteor Crater, AZ
- Reis Crater, Germany
- Sierra Madera, TX
- *Medicine Hat, Canada
- *Nevada Test Site

General, Surface Features

- *Orocopia Mtns., CA
- *Mojave Desert, CA
- Boulder City, Nevada

*** Trips for Apollo 15 Crew (Flagstaff 3 times)**

Field Equipment

Simulated PLSS

Hasselblad cameras and film magazines

Collection bags

Gnomon

Hammer

Tongs

Scoop

Rake

Sample bags

Drive Core tubes

Traverse maps

VOX head sets

FM transceivers

Portable Antenna

Tape recorders

Rover type vehicles

500mm Hasselblad

Special sample containers

How Well Did It Work

Confidence in their understanding the mission science objectives and knowledge of how to succeed

Astronauts became a stakeholder in achieving objectives

Confidence in the tools and how to use them effectively.

Highly subscribed timeline requires high efficiency and focus on objectives

What can we do better in the field?

GPS like navigation, location and mapping aids

Sample documentation techniques and procedures that relieves the astronaut of much of this task

Some analytical tools to help astronaut discriminate rock types in the field

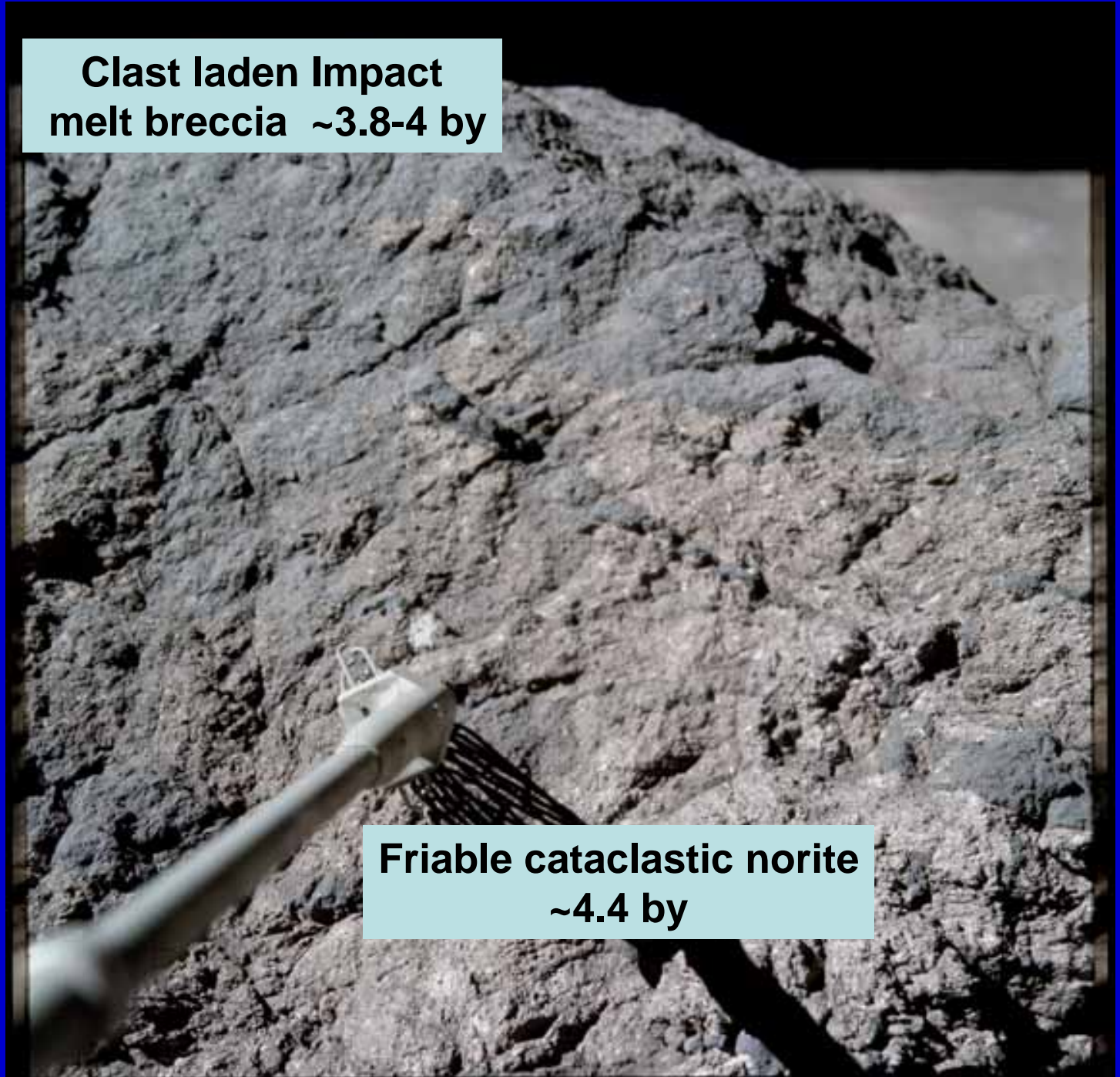
**Sampling tool that allows easy sampling of large boulders
hand held drill**

Improve sample return containers to minimize weight yet maintain isolation from cabin and Earth environments

Improved small sample containers for totally sealed samples similar to the SESC but with better seals

**Clast laden Impact
melt breccia ~3.8-4 by**

**A-17
Station
7
Boulder**



**Friable cataclastic norite
~4.4 by**

What can we do at Outpost?

**Develop ability to examine samples and to Hi-grade
for return to Earth**

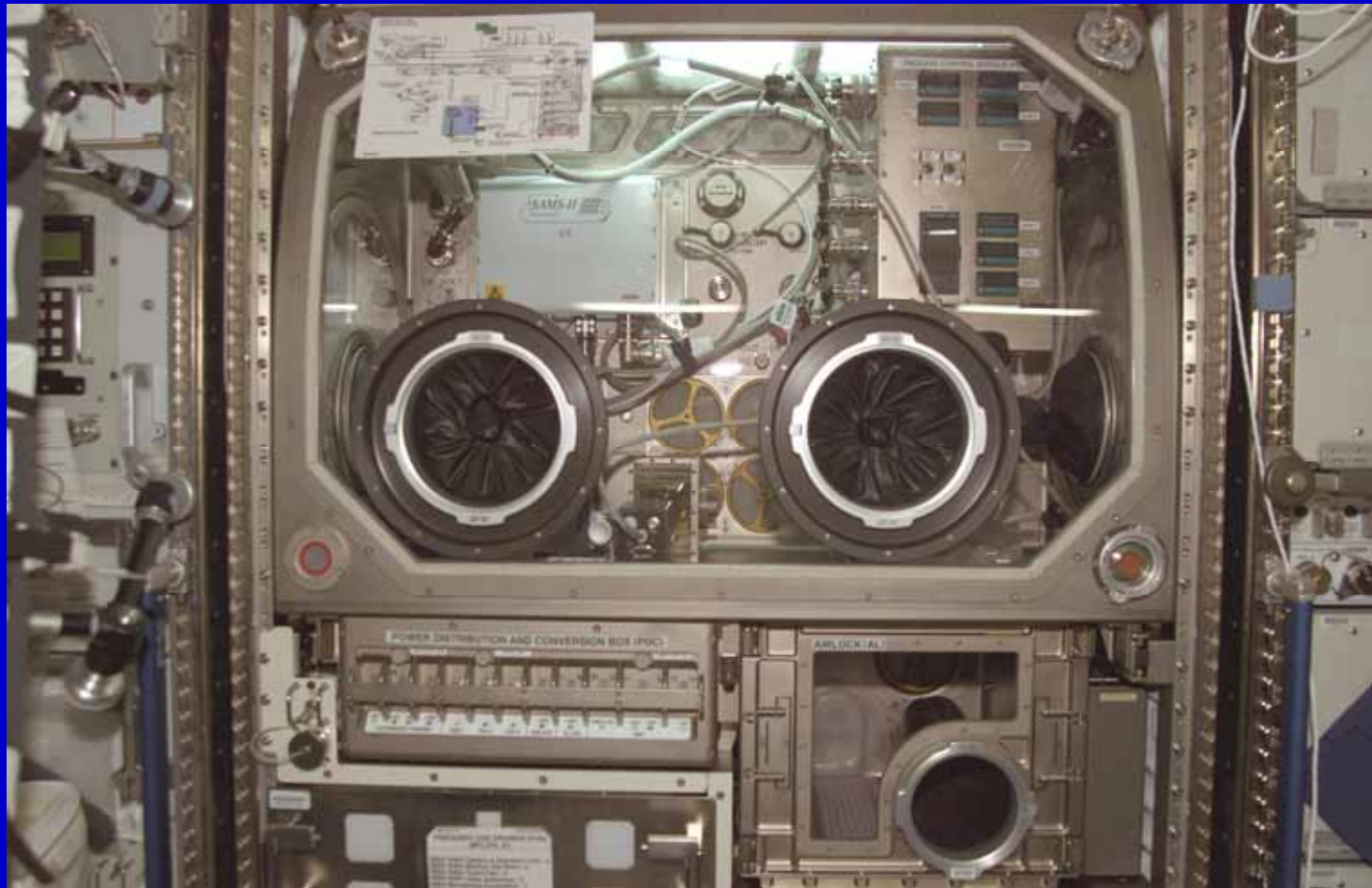
For Sortie mission this may not be possible

In habitat use glove box for examination

**Training to be able to distinguish rocks types by
observation and with chemical analysis instrument**

**Develop means for interaction with science back room
by transmission of information**

Microgravity Science Glovebox aboard the International Space Station



Rock splitter used in Advanced Curation Studies



**Broken surface of high titanium basalt 71536,
intergranular texture: plagioclase laths intergrown with
near equant pyroxene and ilmenite**



Thermo Scientific NITON XL3t, handheld XRF analyzer configured for analysis of mine samples

