



Sampling the SPA Basin

Some Considerations Based on the Apollo Experience

Paul D. Spudis
Applied Physics Laboratory

***Workshop on Science Associated with the
Lunar Exploration Architecture***

February 27- March 2, 2007

How do you best sample the Moon?

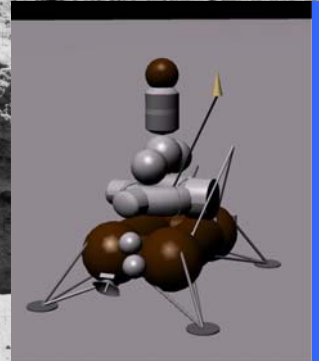
Samples without context
have limited value

Bulk planet properties,
inventory of compositions

Context requires either
geologic field work or a
simple regional setting

Robotic missions tend to
provide less context than
human field study

cf. Luna 20 and Apollo 16

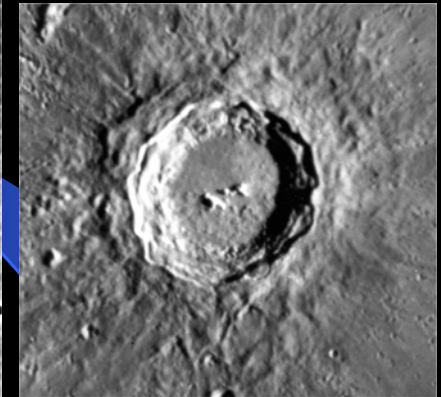
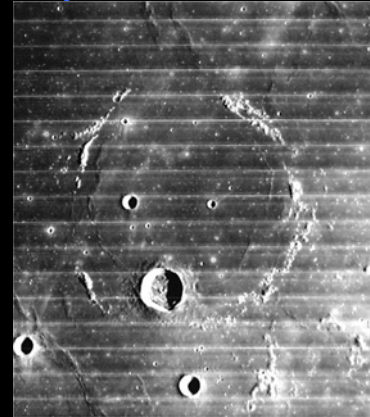


Types of Exploratory Targets

Reconnaissance

Geologically simple sites where a “grab sample” of rocks and regolith can address and solve scientific issues

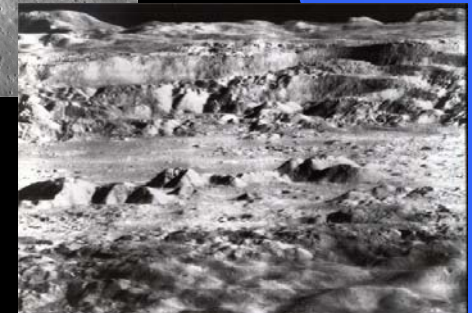
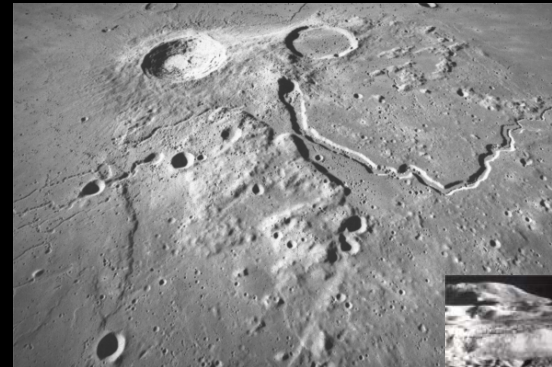
Example: youngest mare lava flow, impact melt floor of fresh crater, regional pyroclastics



Field Study

Complex, multi-unit sites having a protracted evolution. Require human interaction, sampling, mapping, re-visiting field sites

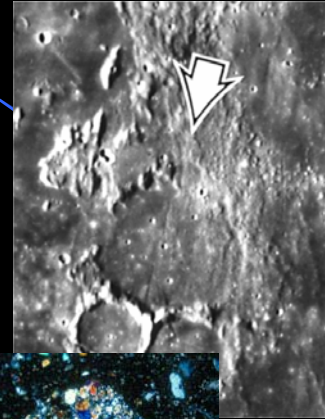
Examples: basin ejecta blanket, Aristarchus plateau, crater central peaks



Apollo Highlands Sampling

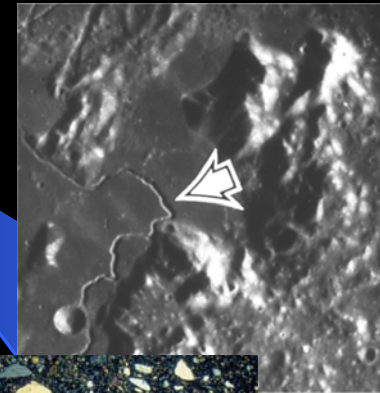
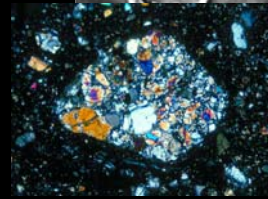
Apollo 14 – Fra Mauro

Sent to sample Fra Mauro Fm (Imbrium ejecta)
Returned complex breccias; basaltic, KREEP-rich
Which samples are Imbrium basin primary ejecta?



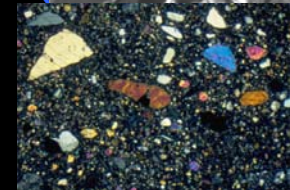
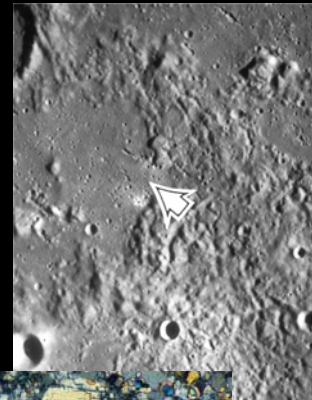
Apollo 15 – Hadley-Apennines

Sample front (deep Imbrium rim material)
Anorthosite, KREEP basalts, mafic impact melts
Which samples represent Imbrium basin melt?



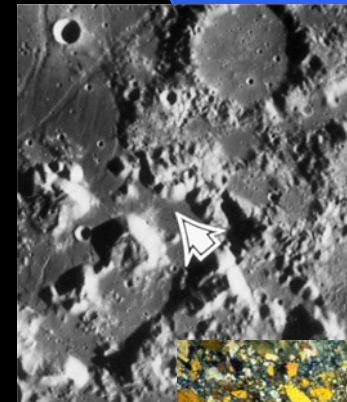
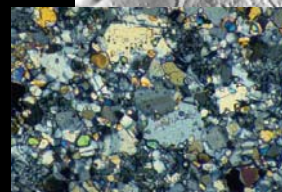
Apollo 16 – Descartes

Sent to sample highland volcanic rocks
Anorthositic debris, breccias, some mafic melts
(VHA)
Basin-related? If so, which ones?



Apollo 17 – Taurus-Littrow

Sample rim massifs of Serenitatis basin
Mafic melt “sheet” (poiks); other melts (Imbrium?)
Mg-suite plutonics
Serenitatis basin? Any Imbrium basin material? If so, which samples?



South Pole-Aitken basin

Basin 2500 km diameter; 13 km deep - partial ring structure preserved

Basin massifs near south pole

Mafic unit associated with basin floor

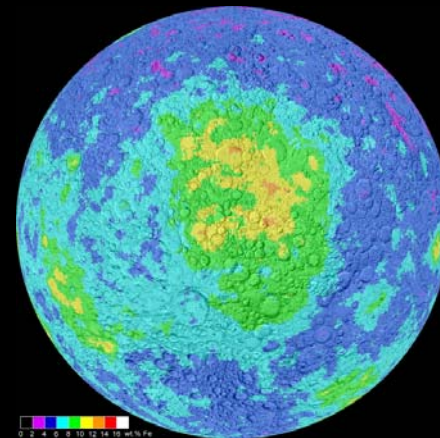
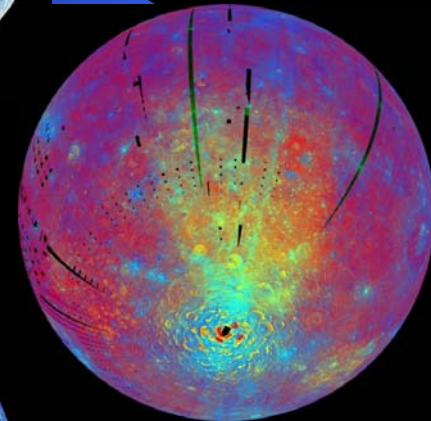
Oldest basin on Moon
(underlies all others)

Resolve cataclysm

Need basin impact melt

Little evidence for mantle exposed or excavated (what would it look like?)

Origin of mafic anomaly



Questions

Would a robotic sample return to SPA get the right samples?

Possibly, if correct site is selected

Even if it did, would we recognize the right samples?

Not likely; we still debate the provenance of Apollo samples, even the best-controlled ones

Can we address SPA scientific issues from a lunar outpost at the south pole?

Most definitely; SPA basin massif near pole, Shackleton crater excavates near-rim basin floor materials

Long-term access allows field work, analysis, re-visits, as in terrestrial field study

