Lunar Science Studies using Lunar Samples

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382 kg returned from the lunar surface: rocks and regolith. ~66 lunar meteorites.
Lunar Samples for Science

Minimal mass used – preserve for future generations.
Take advantage of technological developments.
New analyses to test old hypotheses.
New analyses to test new hypotheses.
Ground truth for orbital data.
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“THE GIFT THAT KEEPS ON GIVING”

Petrography/Mineralogy:

Petrographic Description, EMP mineral compositions – 1970s, 1980s;
Trace element determinations on crystals (SIMS) – 1980s, 1990s;
Trace element determinations on crystals (LA-ICP-MS), Crystal Size Distributions, Crystal Stratigraphy - 1990s, 2000s.

FOV = 2 mm
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Isotopic Studies:

1970s = Rb-Sr, U-Th-Pb

1980’s = Sm-Nd, Lu-Hf

1990s-2000s = 142Nd; W-Hf.
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1990s = Trace Elements

2000s = Volatile Contents
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Geotechnical Properties
Shear strength tests – modifying the “ASTM” procedure (too much sample).

Magnetic Properties
Geodynamo or not? Impact processing.

Impact Properties
Impact flux of the inner solar system

Moon is the Rosetta Stone for Inner Solar System Exploration and Science
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Combination of Sample and Orbital Data

Ground truth for global (orbital) data sets.

Orbital data sets inform us of areas where we need sample return.

Targeted sample return (e.g., SPA Basin; Aristarchus; Marius Hills; PSRs) will answer more detailed science and exploration questions.

Targeted sample returns may require curation developments.

Robotic sample return will return much less mass than Apollo – need to do more with less.

Take advantage of technology developments both for in situ analyses and analyses in terrestrial labs.