Pieces of minerals, rocklets, and glass welded together by shock-melt glass

Courtesy – Dave McKay

Mare-Soil Agglutinates

Gas Vesicule

Ilmenite

Volcanic Glass Bead

Agglutinitic Glass

Rocklet

Polished section as viewed in Reflected Light

SEM

100 µm

50 µm

L.A. Taylor; SRR-2005
SEM BSE-Image of Mare Agglutinitic Glass

Milky Way of Metallic np-Fe

all white beads = Fe$^0$

1 $\mu$m

Courtesy – Dave McKay

L.A. Taylor; SRR-2005
Vapor-Deposited Nanophase Fe⁰ on Plagioclase

NP-Fe⁰ Imparts Magnetic Susceptibility to Normally Diamagnetic Feldspar

SiO₂-rich glass

Fe metal

Plagioclase

10 nm
100 Å

 Courtesy: Lindsay Keller

L.A. Taylor; SRR-2005
Abundance of Nano-phase Fe\textsuperscript{0} in Lunar Soil Increases as Grain Size of the Particles Decreases;

Magnetic Susceptibility of Soil Particles Increases as Grain Size Decreases;

Virtually All <10 \( \mu \)m Particles are Easily Attracted by a Simple Hand-held Magnet.

L.A. Taylor; SRR-2005
Lunar Dust Effects: Must be Addressed before any Human Presence on the Moon can be Fully Evaluated.

- Potential for *coatings*, on seals, gaskets, optical lens, windows, electrical components, et cetera;
- *Abrasiveness*, with regards to friction-bearing surfaces;
- Potential for *settling* on all thermal and optical surfaces, such as Solar cells and mirrors; and
- *Physiological effects* on humans, especially with respect to the lungs, the lymph system, and potentially the cardiovascular system, in the case of extremely fine particles.

**SOLUTION:** Magnetic brushes

L.A. Taylor; SRR-2005
There is an entire subculture of people who derive pleasure from putting strange things in microwave ovens.

- Table grapes produce glowing plasmas;
- Soap bars mutate into abominable soap monsters;
- Compact discs incandesce;
- Even ‘Wet Poodles’ have been known to “explode.”
Microwave Heating of Lunar Soil

NanoPhase Fe$^0$ in Silicate Glass
so small as to be below the effective “skin depth” of microwave penetration; makes for

GREAT MICROWAVE COUPLING!

Lunar soil in your kitchen microwave oven will melt [~1200 °C], BEFORE your tea-water boils [100 °C]!!

L.A. Taylor; SRR-2005
2.45 GHZ MULTI-MODE MICROWAVE CHAMBER. Multimode chambers (your kitchen microwave oven) have 3-4 magnetrons but random energy distributions and produce inefficient heating.
2.45 GHz Full Wave-Guide Microwave Unit

- Flexible Waveguide
- 3-Port Circulator
- 3-Stub Tuner
- Short Dummy Load
- Magnetron
- Dual Power Monitor
- Precision Sliding Short Circuit
- Applicator Chamber

Prof. Taylor Vodka From Russian colleagues

L.A. Taylor; SRR-2005
### MICROWAVABILITY OF APOLLO 17 SOIL VERSUS LUNAR SOIL SIMULANT

<table>
<thead>
<tr>
<th>2.45 GHz Wave-Guide</th>
<th>Pellet Size (mm)</th>
<th>Beam Power (watts)</th>
<th>Time to Reaction (sec)</th>
<th>Maximum Temp (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apollo 17 70051</strong> (&lt;45 µm)</td>
<td>6 X 6</td>
<td>250</td>
<td>20</td>
<td>1353</td>
</tr>
<tr>
<td><strong>JSC-1A</strong> (&lt;50 µm)</td>
<td>6 X 6</td>
<td>500</td>
<td>55</td>
<td>1215</td>
</tr>
</tbody>
</table>

70051 Reacted FASTER (20 Vs 55 sec) at HALF the Power

70051 Reached a HIGHER Temperature (1353 Vs 1215 °C)

L.A. Taylor; SRR-2005
2.45 GHz Wave-Guide Microwave of Apollo 17 Soil 70051

Temperature (°C)

Time (s)

1353 °C

Run-Away Begins

L.A. Taylor; SRR-2005
Synthesis of Lunar Glass Simulant with NanoPhase Metallic Fe

TEM Photos

All Black Dots are Nanophase Fe

See POSTER: “Lunar Agglutinitic Glass with Nanophase Fe” By Liu, Taylor, Thompson, Patchen, Hill, & Park

L.A. Taylor; SRR-2005
LUNAR SOIL PROCESSING & PRODUCTS

SINTERING and MELTING

Creating Smooth-Sintered to Glassy Surfaces on the Moon

Microwave Source
Parabolic Metal Reflector
Primary Cone of Microwaves

L.A. Taylor; SRR-2005
LUNAR SOIL PROCESSING & PRODUCTS

SINTERING and MELTING

- Roads & Pads
- Antenna Dishes
- Shielding
- Welding
- Recovery of Volatiles
- Glass Fiber Production
- Oxygen Production

SUGGESTIONS ??

L.A. Taylor; SRR-2005
THE HELL WITH ALL THIS BAA SHINANIGANS!" says new Lunar Astronaut Taylor!