



The Planet Within

*Exploring the Worlds
Beneath Our Feet*

Penelope J. Boston

Director, Cave & Karst Studies Program
New Mexico Inst. Mining & Tech., Socorro, NM
&

Chief Academic Advisor
National Cave & Karst Research Institute
Carlsbad, NM USA

Lessons from the Caves of Earth

Caves are not rare!

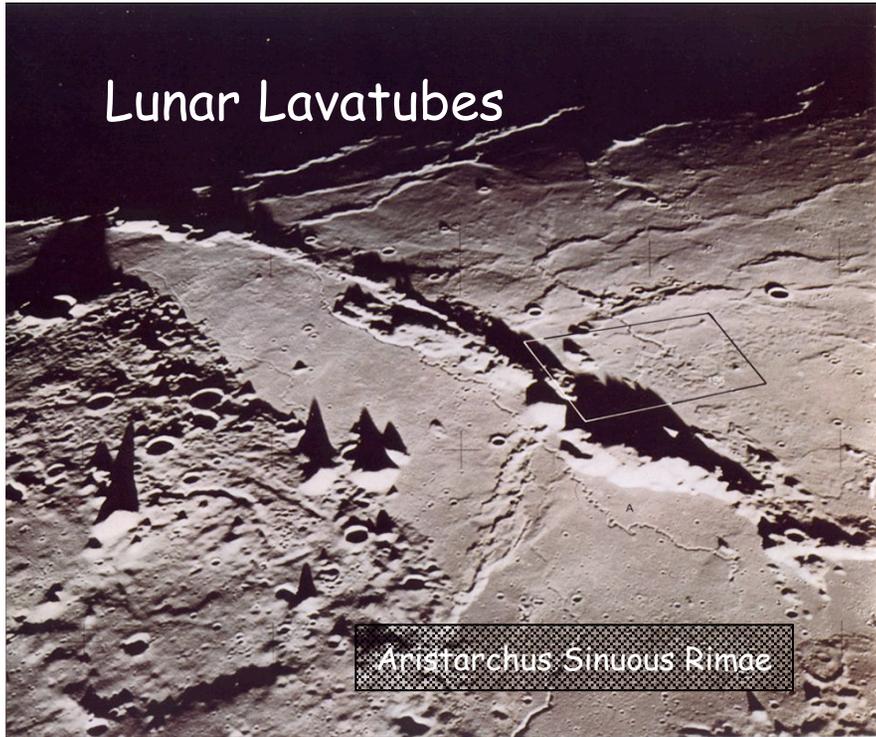
In every major rock type

Many ways to make caves



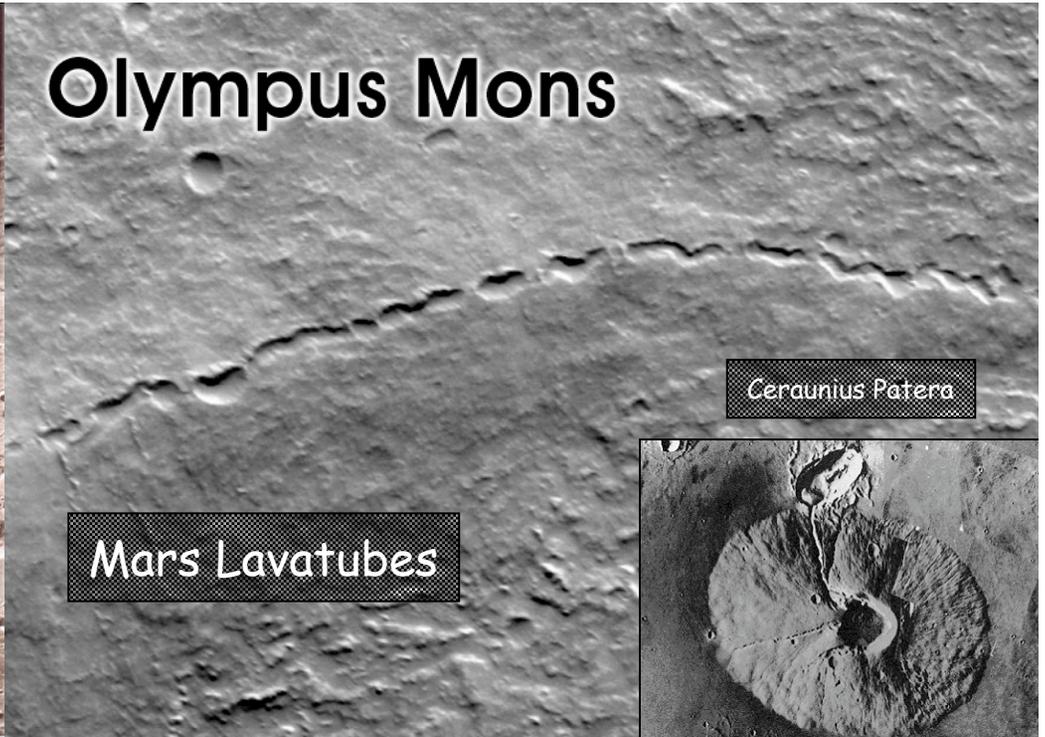
Photo by David Modisette

Lunar Lavatubes



Aristarchus Sinuous Rimae

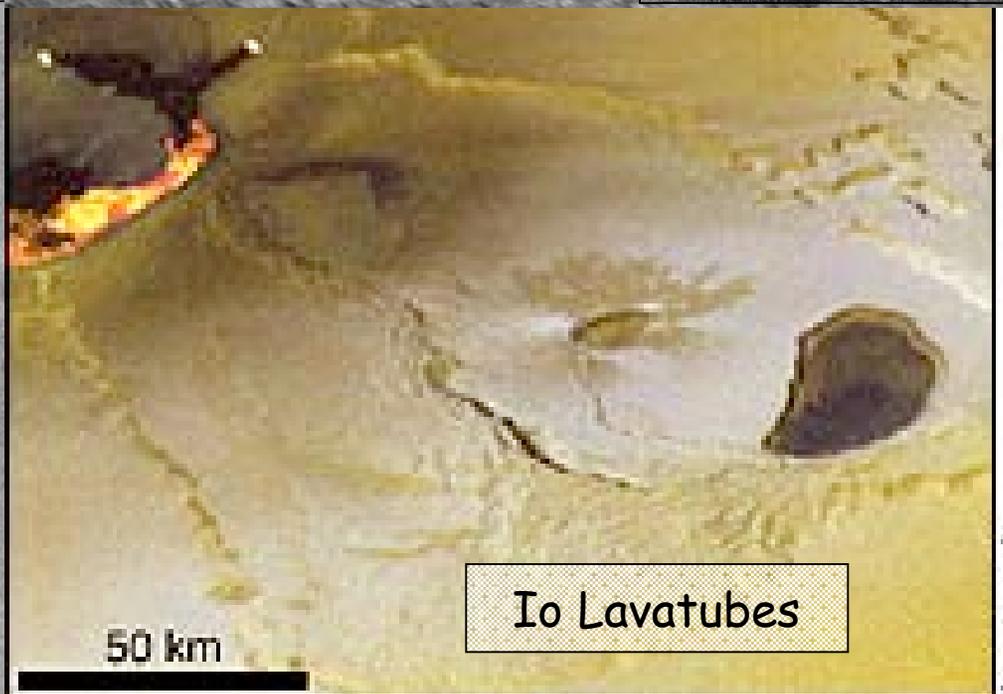
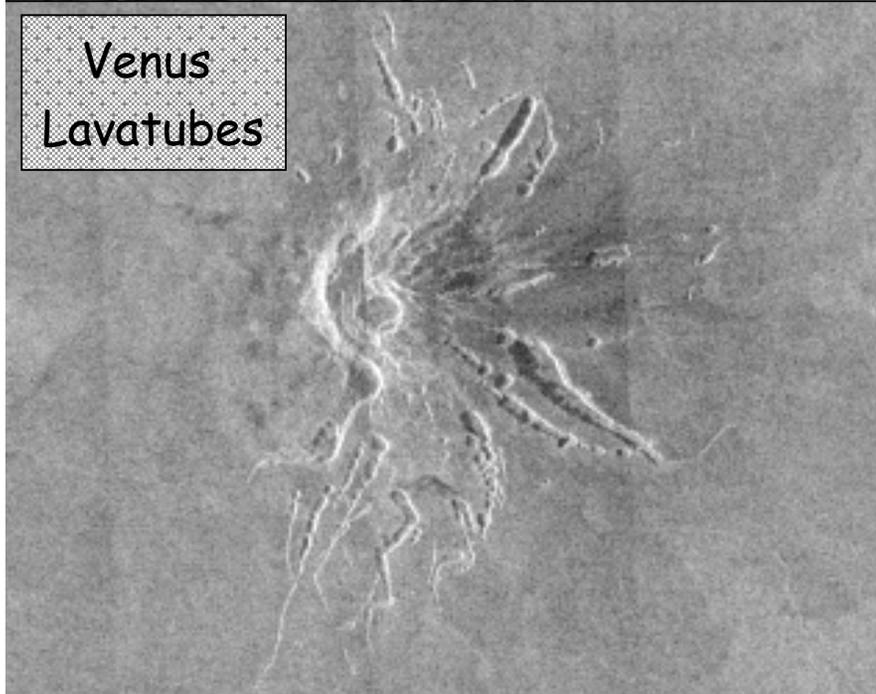
Olympus Mons



Ceraunius Patena

Mars Lavatubes

Venus
Lavatubes



Io Lavatubes

50 km

(NASA)

Lavatubes are Places Usable by Astronauts!



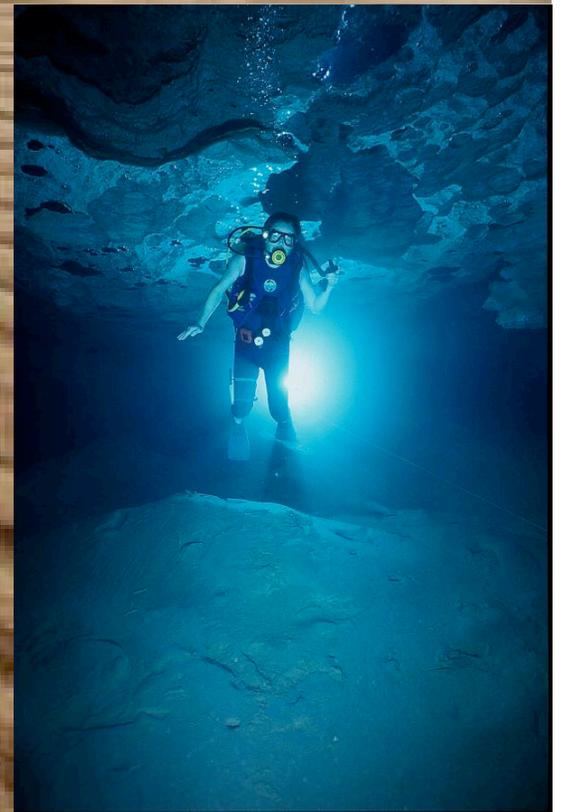
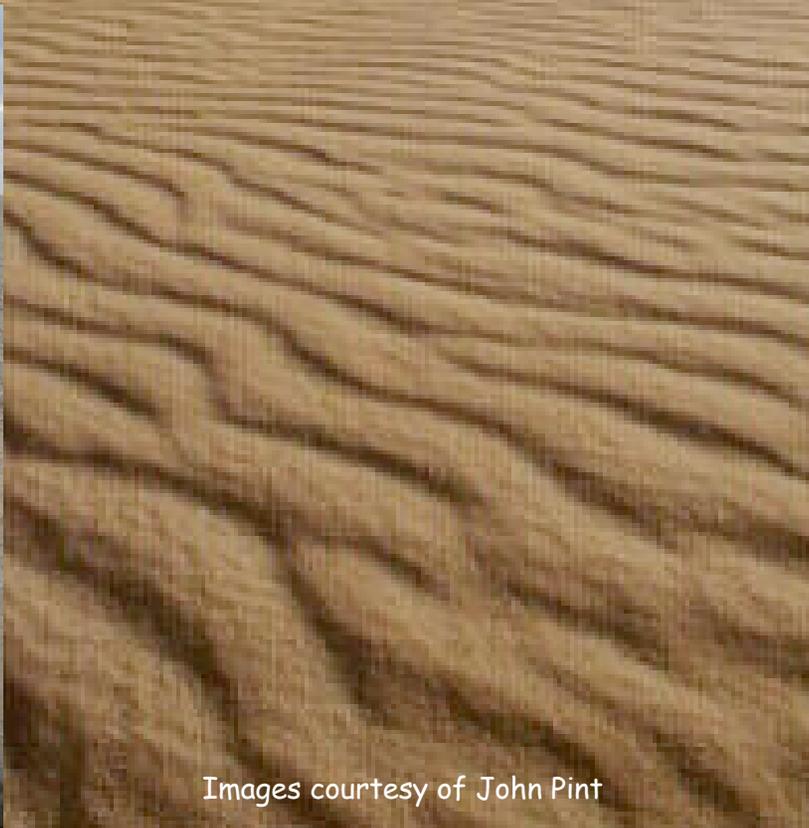
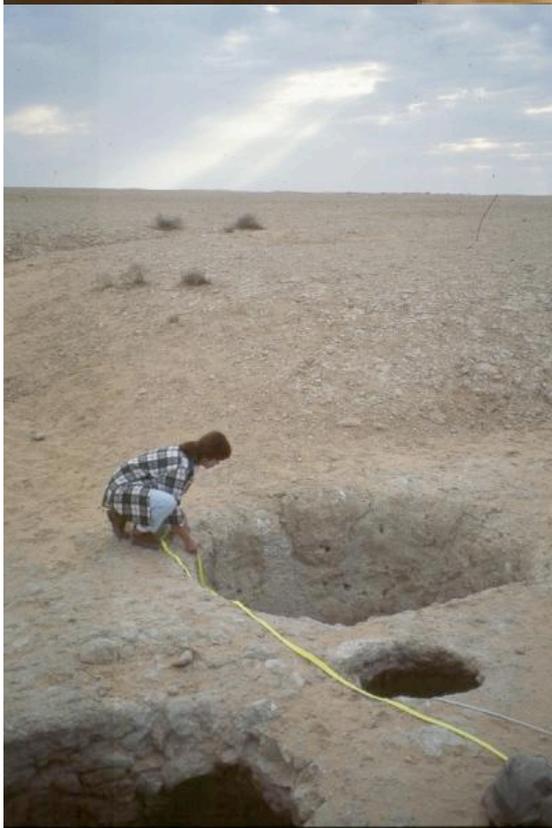
Radiation protection
Natural pressure vessel



(NASA)

Cave Environments

Caves can be **radically** different from surface



Images courtesy of John Pint

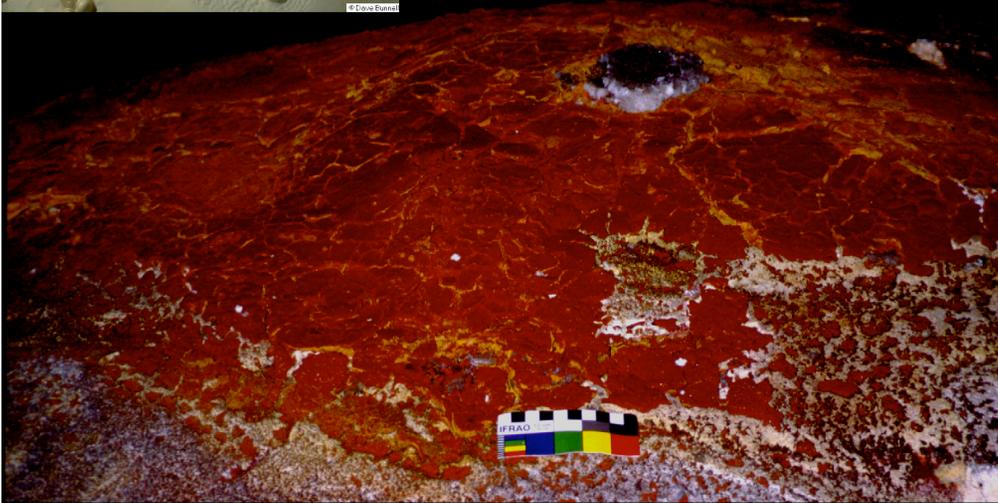
Cave Environments

- No sunlight
- High humidity (~98-100%)
- Temperatures relatively constant
- Low nutrients (usually)
- Mineral-rich
- No weather



Photo by David Jagnow

Unique Mineral Formations



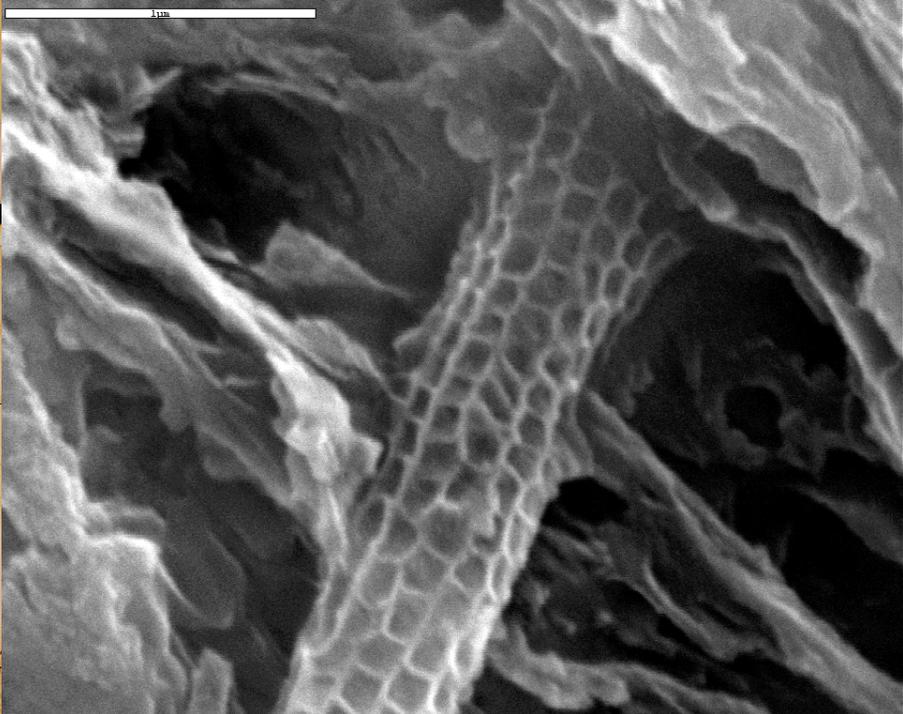
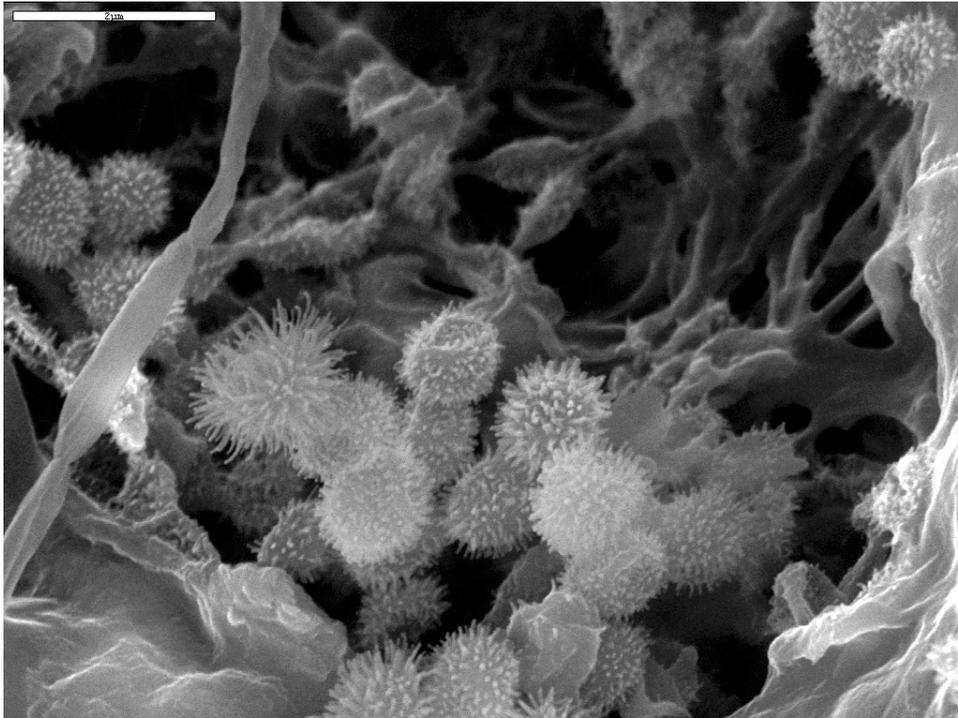


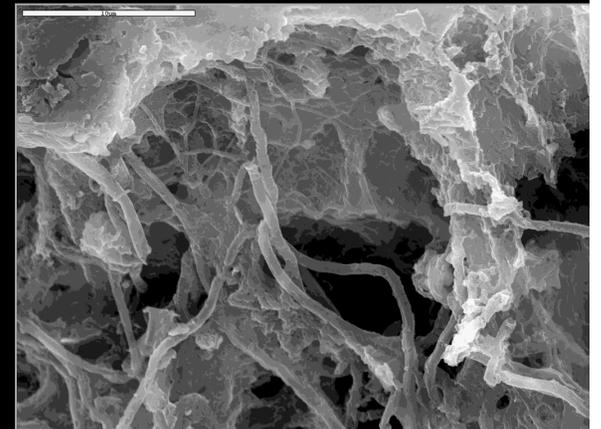


Photo by Larry McLaughlin

Biosignatures

- Physical fossils
- Isotopic signals
- Climate record
- Geochemical traces
- In situ* lithification

Hidden Cave Pool Finger



In these subterranean worlds,

***WE** are the **alien lifeforms** barely able to cope*

while the natives happily flourish....

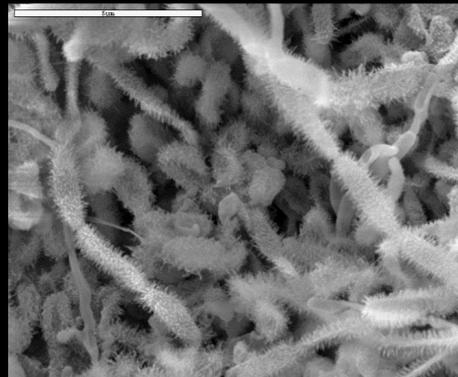


Image courtesy of National Geographic Society

We are trying to write *The Field Guide to Unknown Life...*



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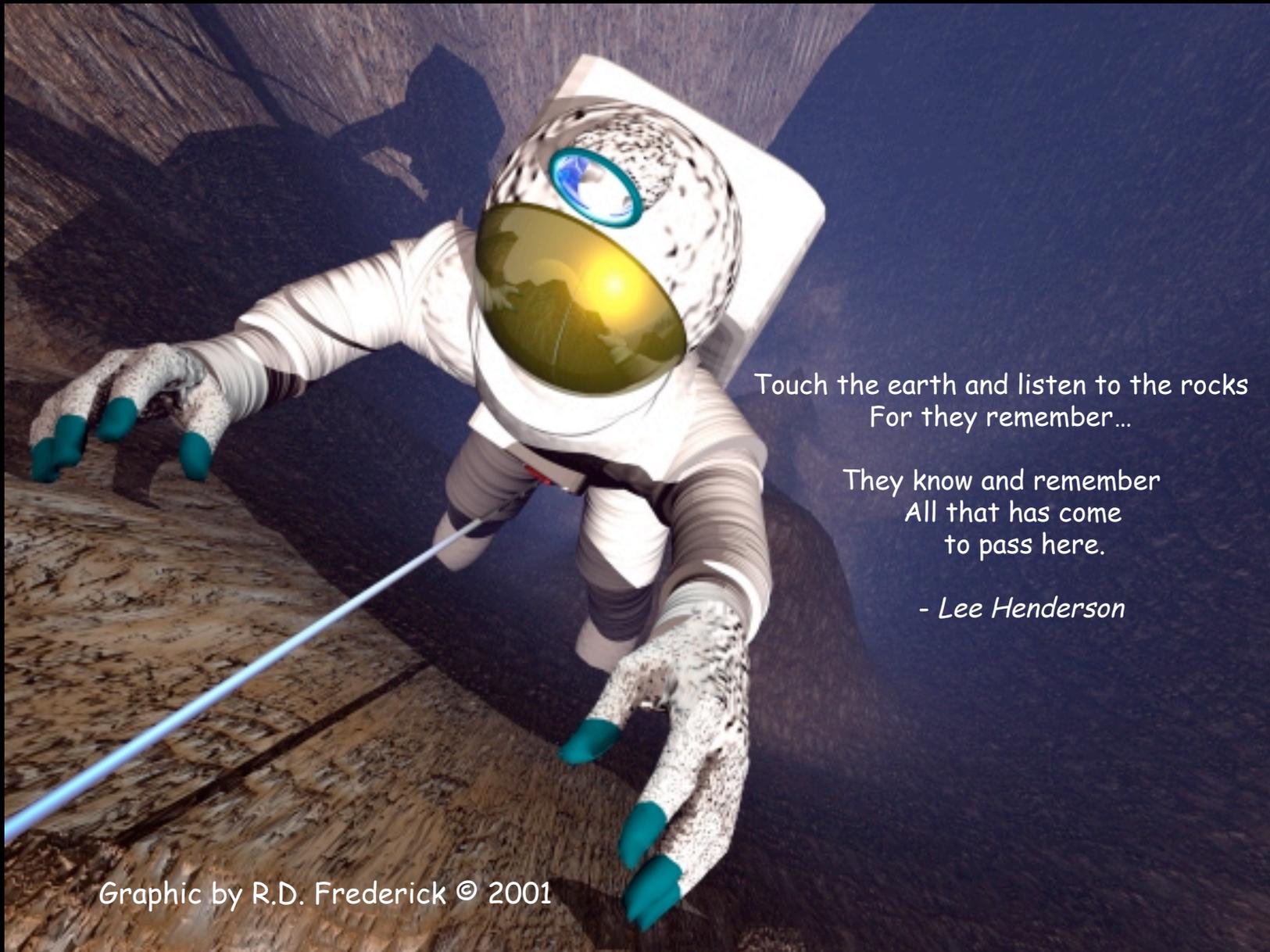


In many caves,
we operate in extreme environments
with sensitive "alien" biology...



This is practice
for our future
on Mars and beyond....

The Caves of the Solar System Await Us!



Touch the earth and listen to the rocks
For they remember...

They know and remember
All that has come
to pass here.

- *Lee Henderson*

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