



The Original and Future Moon

Carle M. Pieters

Shoemaker Lecture

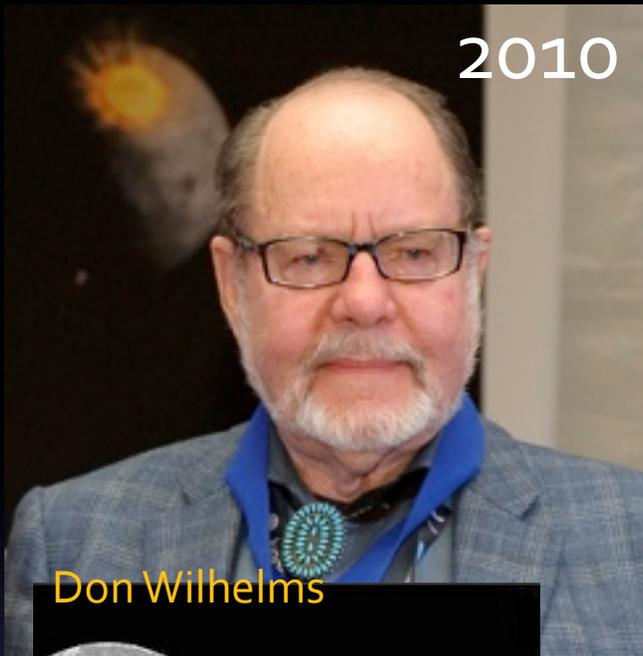
Exploration Science Forum, July 21, 2015

Shoemaker Medal

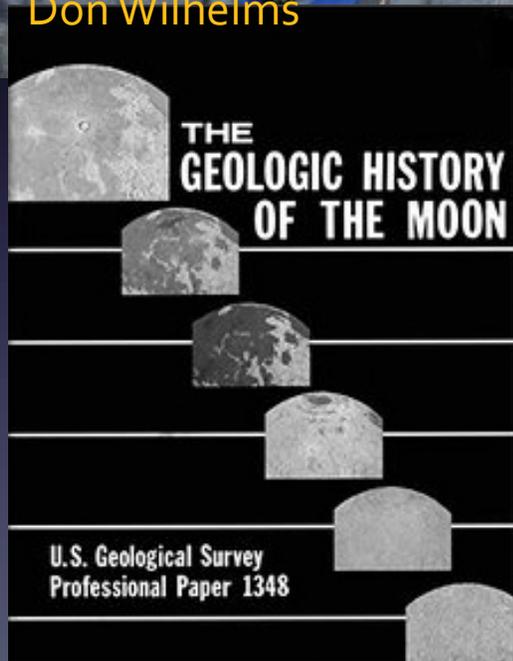


Carolyn and Gene Shoemaker

2010



Don Wilhelms



2011



G. Jeff Taylor

ORIGIN OF THE MOON



ed. W. K. HARTMANN R. J. PHILLIPS G. J. TAYLOR

2013



Bill Hartmann

Shoemaker Medalists



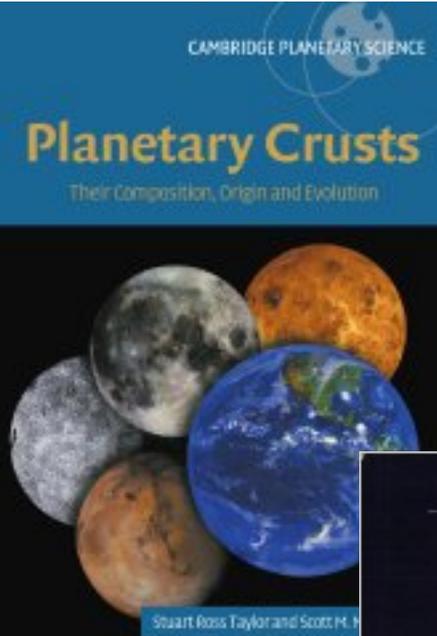
2012

PLANETARY SCIENCE:
A LUNAR PERSPECTIVE

S Ross Taylor



Destiny or Chance
our solar system and
its place in the cosmos
STUART ROSS TAYLOR



Planetary Crusts

Their Composition, Origin and Evolution

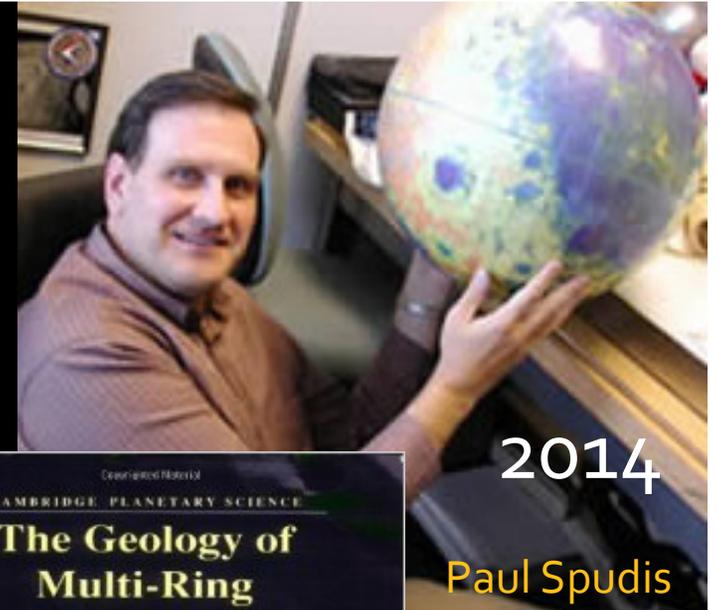
Stuart Ross Taylor and Scott M. Taylor



Solar System Evolution

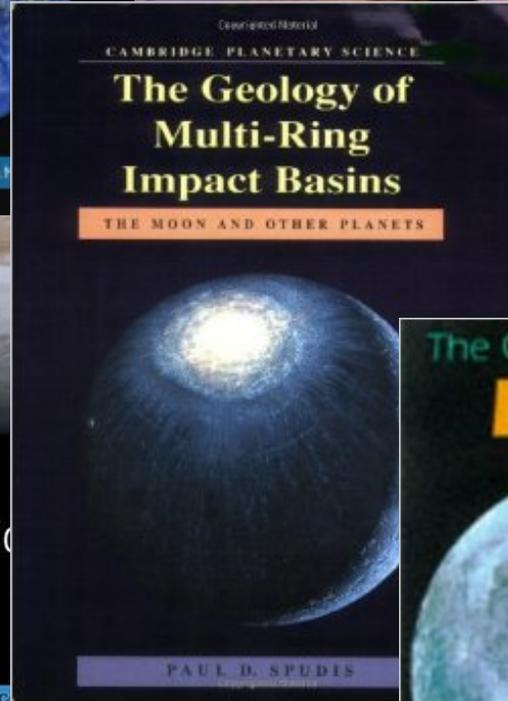
A New Perspective second edition

Stuart Ross Taylor



2014

Paul Spudis

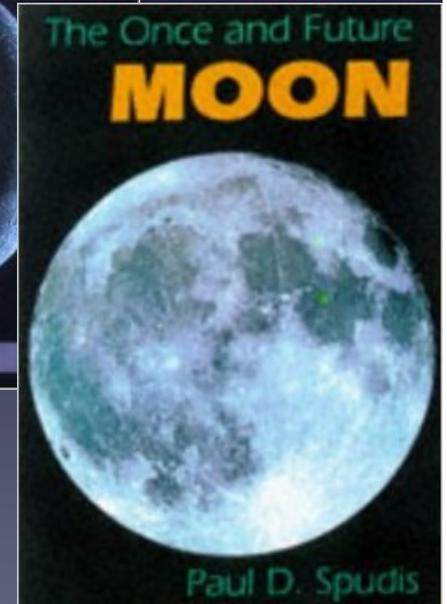


Celestial History of
CAMBRIDGE PLANETARY SCIENCE

The Geology of
Multi-Ring
Impact Basins

THE MOON AND OTHER PLANETS

PAUL D. SPUDIS

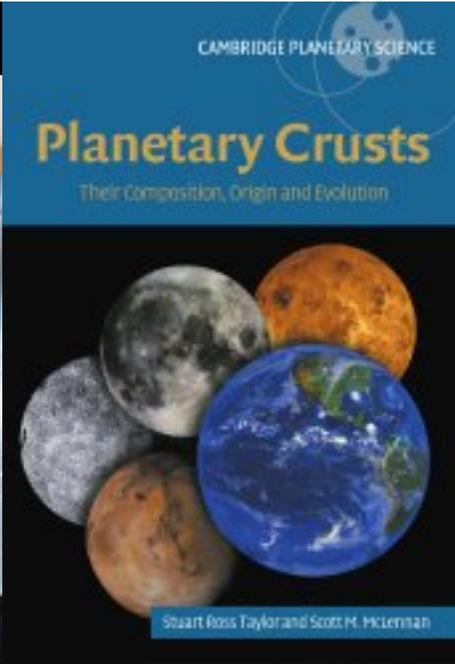


The Once and Future
MOON

Paul D. Spudis



2012



2014

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2015

The Original Moon....

Addendum: The Moon in our Future

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The Original Moon

ORIGIN OF THE MOON



The Original Moon

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Four and a half aeons ago

a dark, dusty cloud deformed.

Sun became star; Earth became large,

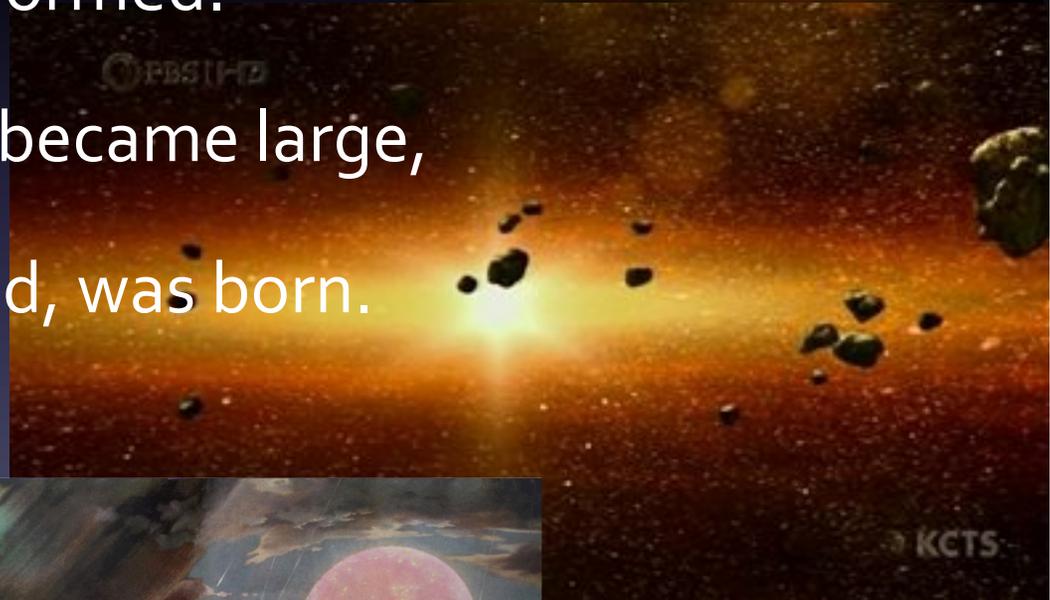
and Moon, a new world, was born.

The Original Moon

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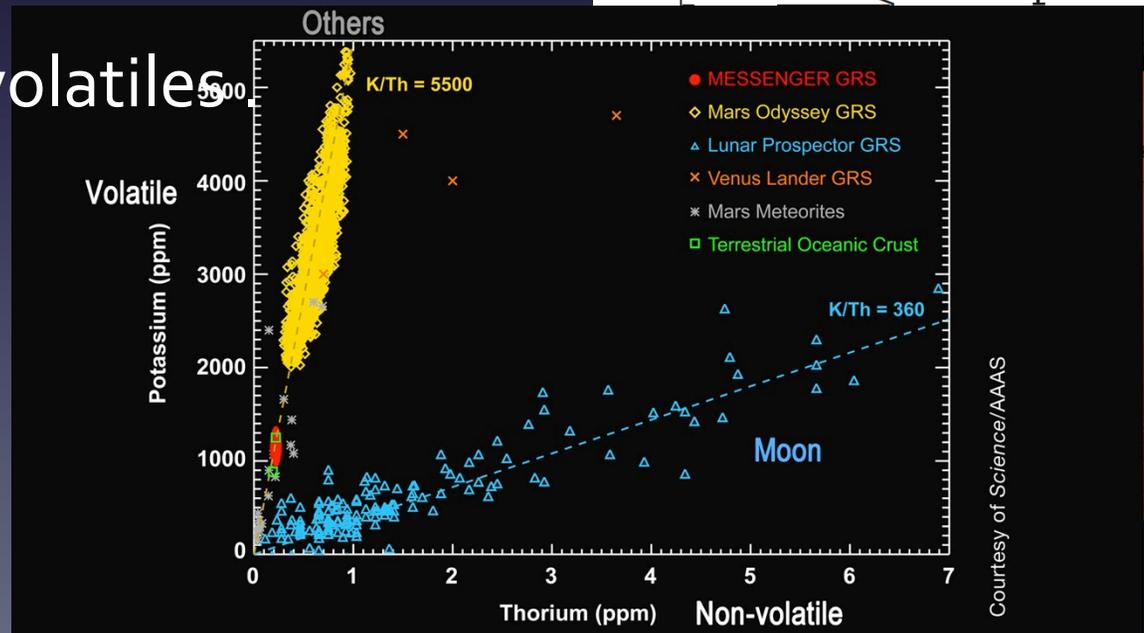
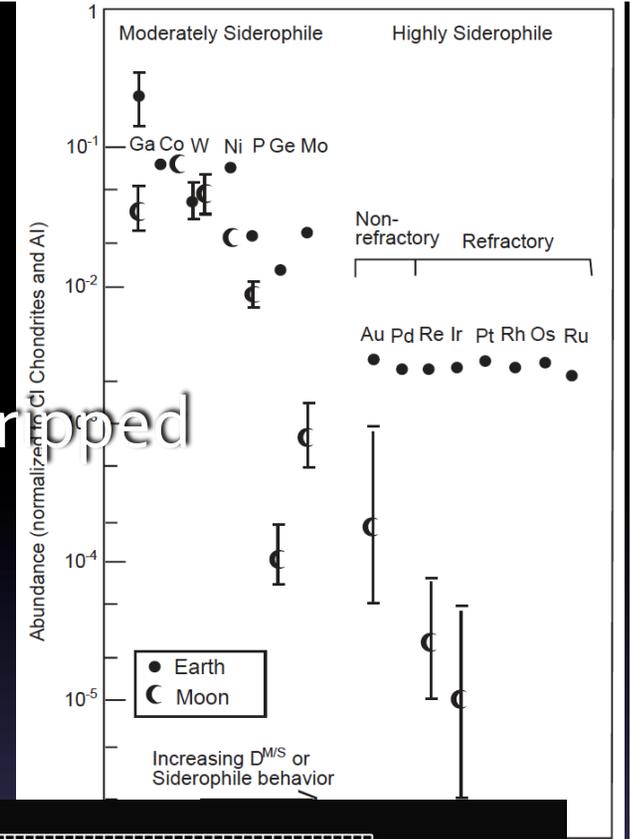


This Earth/Moon pair, once linked so close,
would later be forced apart.

Images of young intimate ties,
we only perceive in part.



Both Earth and Moon were strongly stripped
of their mantle siderophiles,
But Moon alone was doomed to thirst
from depletion volatiles



Courtesy of Science/AAAS

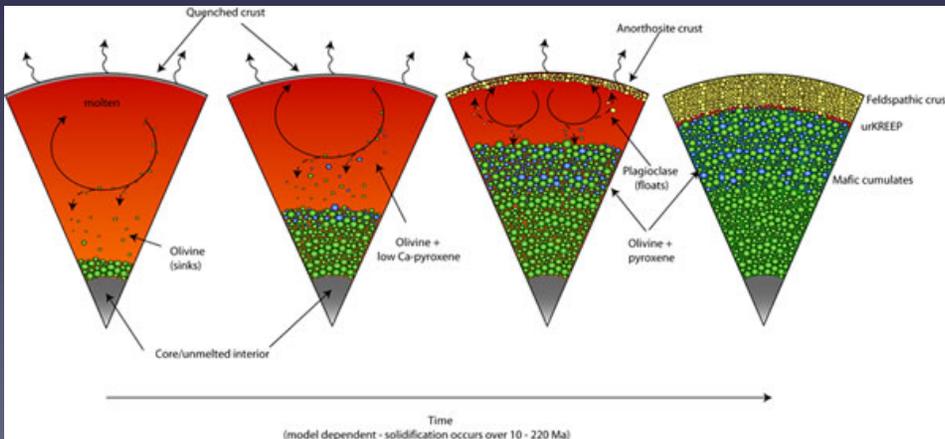
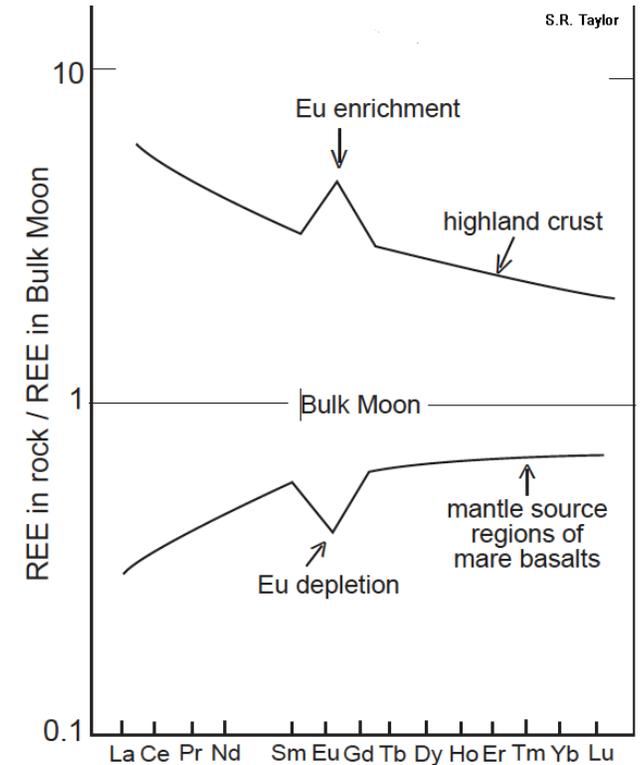
Moon holds secrets of ages past
when planets dueled for space.



As primordial crust evolved
raw violence reworked Moon's face.

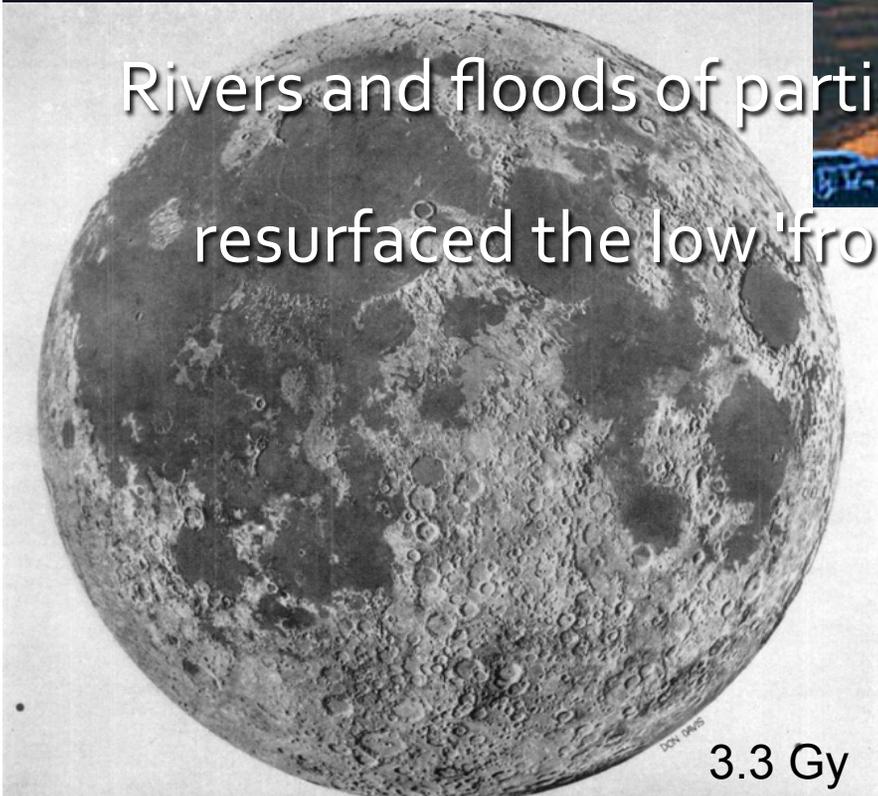


After the first half billion years
 huge permanent scars appeared.
 Ancient feldspathic crust survived
 with a mafic mantle mirror.



But then there grew from half-lived depths
a new warmth set free inside.

Rivers and floods of partial melt
resurfaced the low 'frontside'.



3.3 Gy

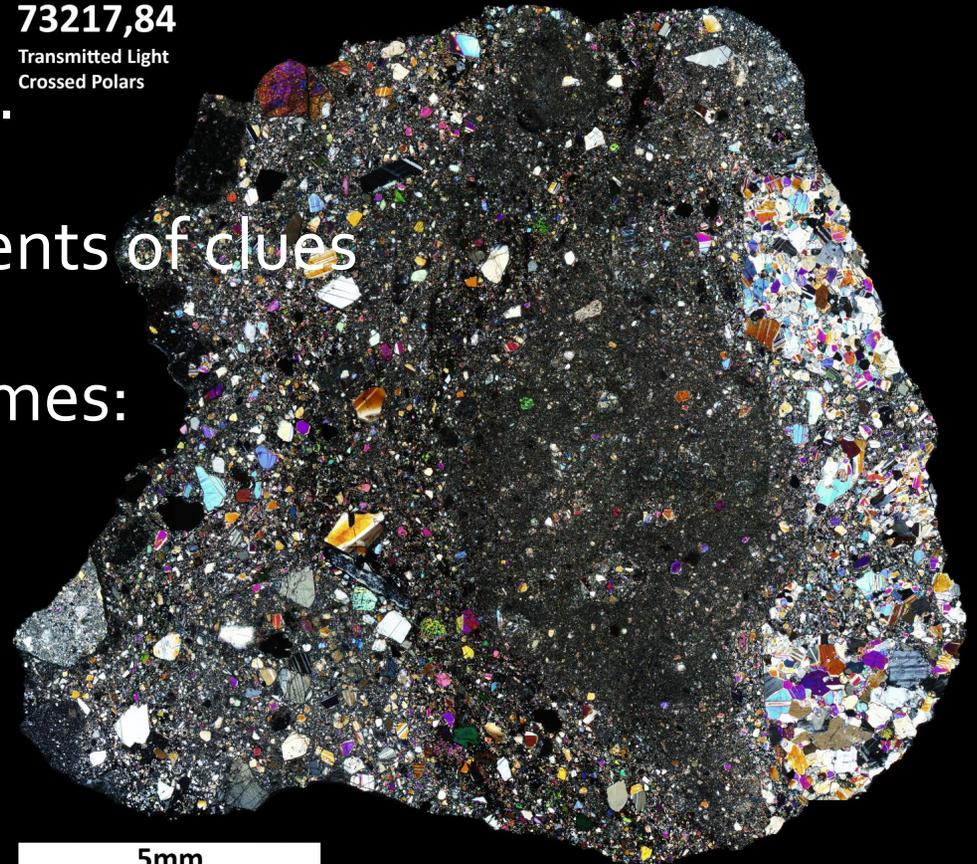


Thus evolved the Original Moon
in those turbulent times.

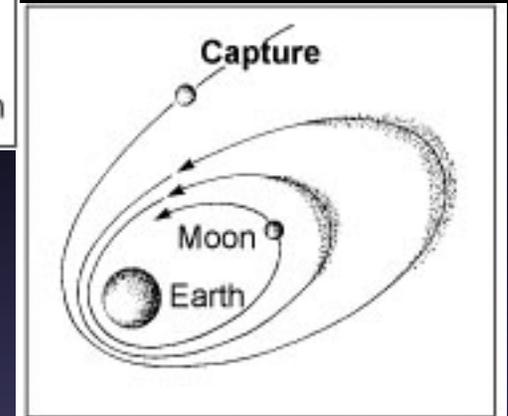
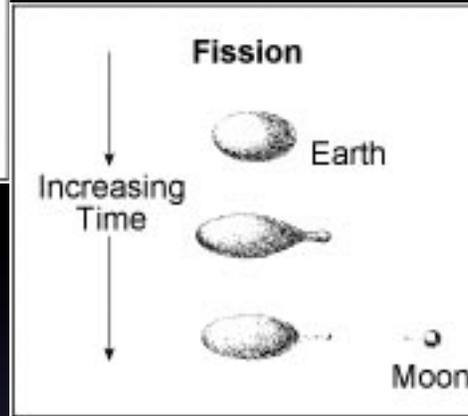
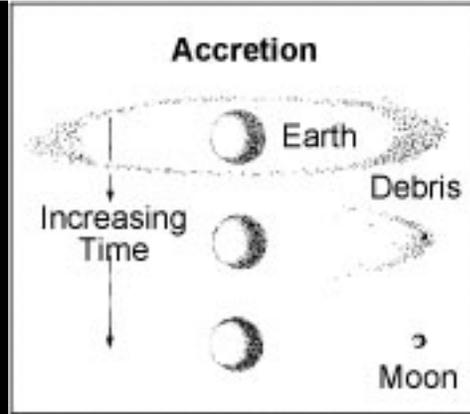
Now we paint from fragments of clues
the reasons and the rhymes:



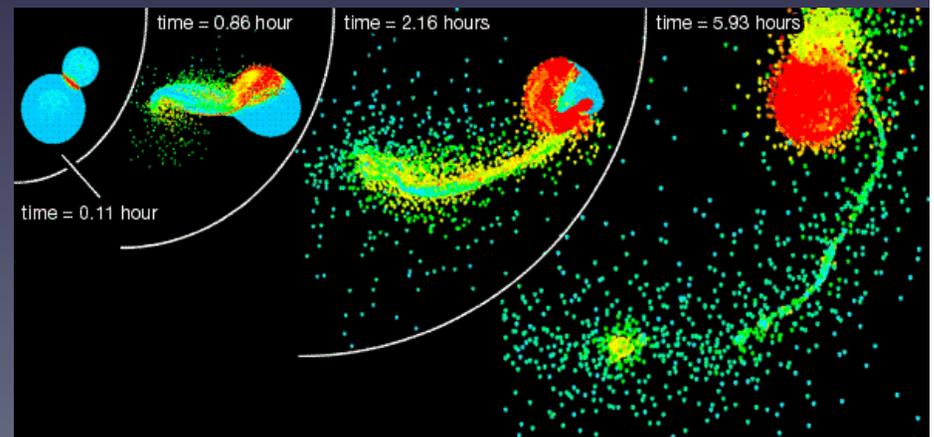
73217,84
Transmitted Light
Crossed Polars







Sister planet;
 Modified clone;
 Captured migrant;
 Big Splash disowned?





The Truth in some or all of these
will tickle, delight,
temper, and tease.



ORIGIN OF THE MOON



ed. W.K. HARTMANN R. J. PHILLIPS C. J. TAYLOR

1986.....

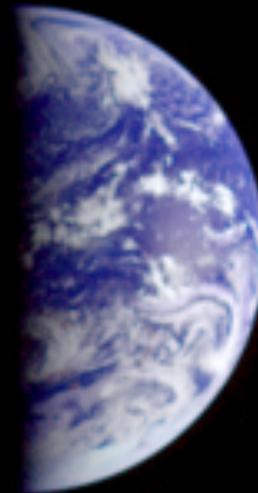
ORIGIN OF THE MOON



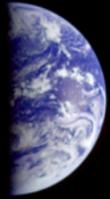
ed. W.K. HARTMANN R. J. PHILLIPS C. J. TAYLOR

~30 Years Later.....

We've learned a lot, and....



need to finish what was started.....



Addendum....



Addendum....

This Earth-Moon pair may be *unique* –

But we have not learned that yet.

Let us explore what's right next door
and move out.... with no regrets.





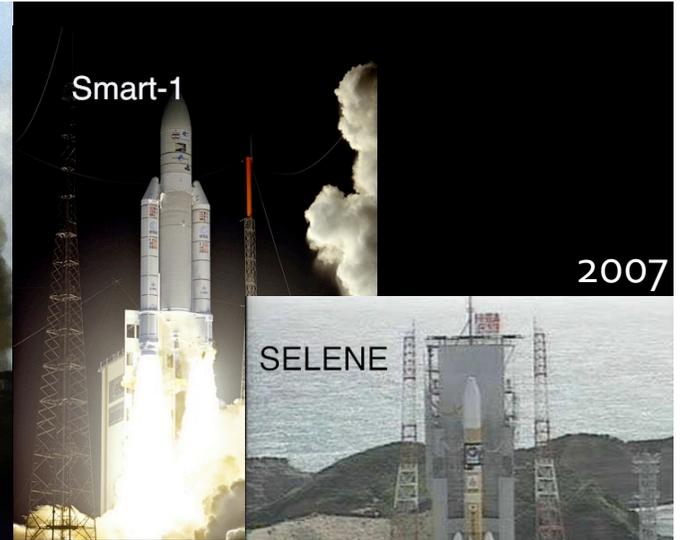
Apollo 17

1972.....

... 1994



Clementine



Smart-1

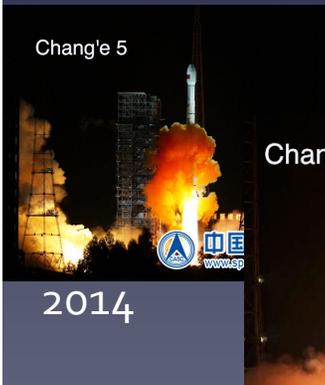
2007



SELENE

We must recall all that we've learned
about this dual planet home.

Space travel is hard, and we know
we will not do it alone.



Chang'e 5

2014



Chang'e 3



LADEE



GRAIL



Chang'e 2



LRO

2010

WWW.NEWS.CN

But now we have tremendous tools
to assist us on our way.



Nature provides Moon special rules:

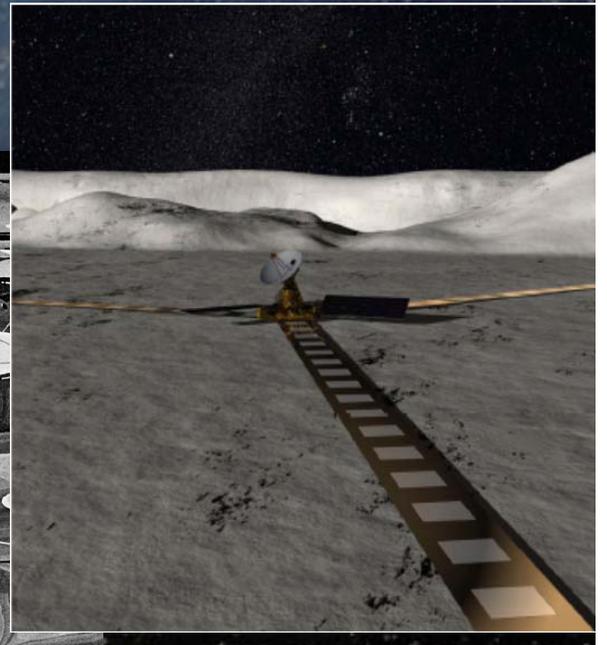
seven hundred-hour days.

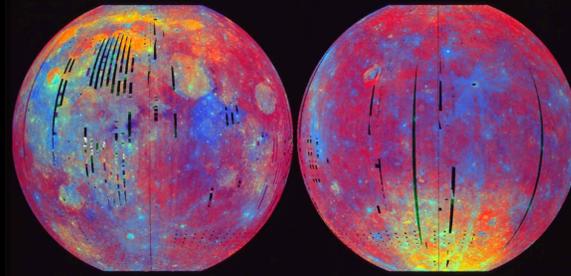
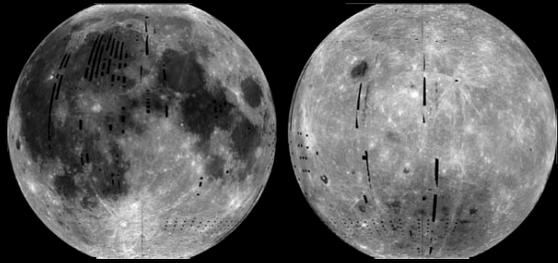




The day time brings power-rich light
to probe Earth-Moon history.

The night time brings deep dark hours
to probe cosmic mystery.



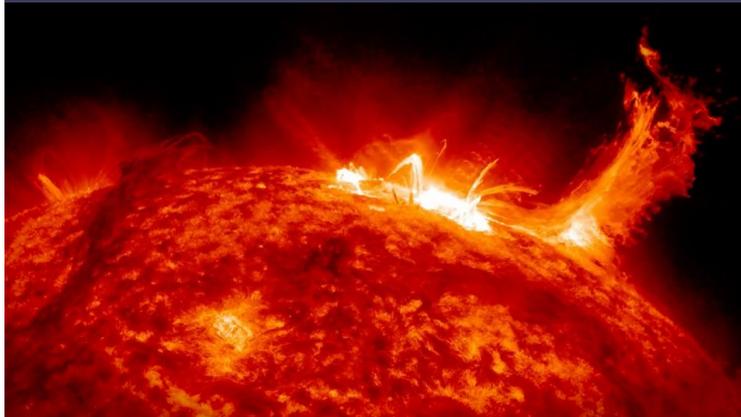
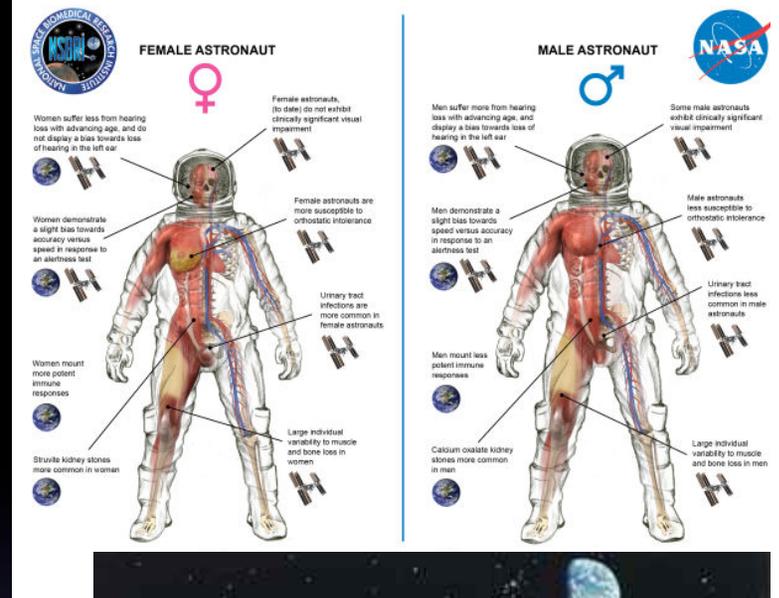


Whether Moon's near side or far side,
there's more than enough to do.

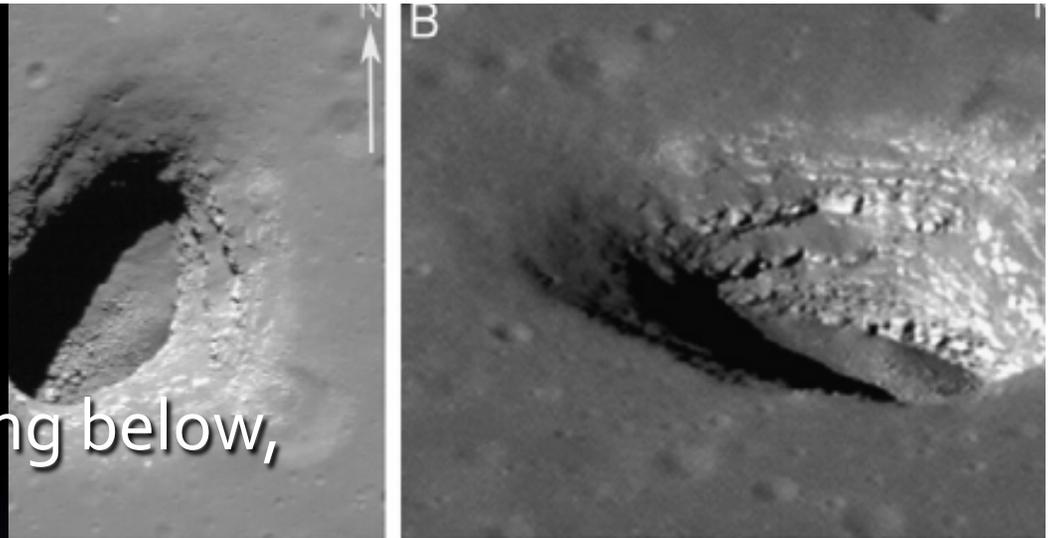
With diverse soil and 3-D prints,
there's ample resources too.



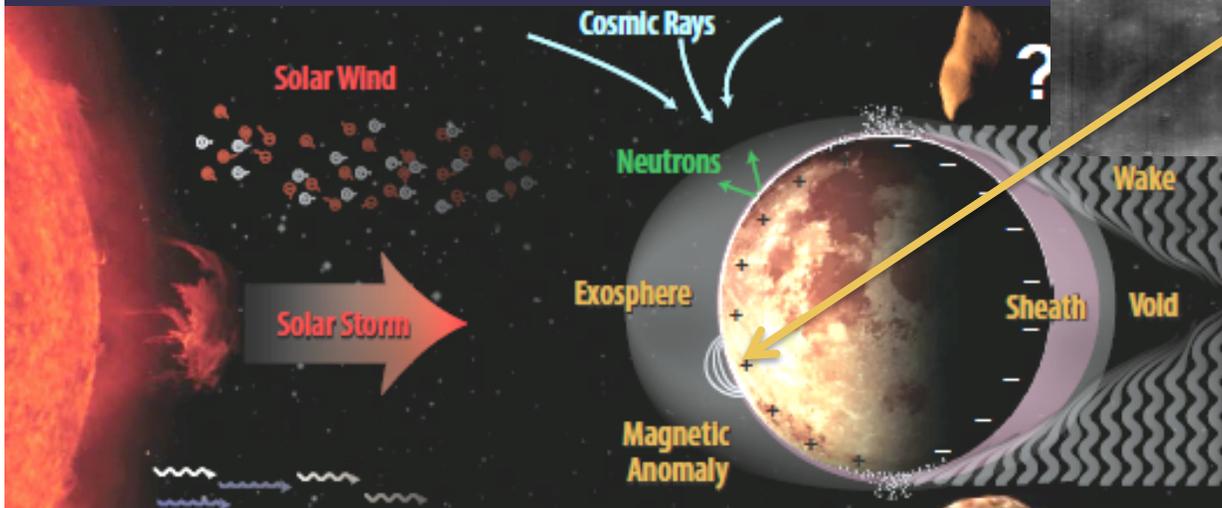
Special spots provide safe havens
from deadly radiation.
One's a hole, another a swirl
with safety implications.



The hole protects by being below,
a thick layered lava shield.



The swirl deflects ions with charge
By its strong magnetic field.



Exploration seeds human goals
that we know will blossom soon.

How can you think anything else
but to *first* live on the Moon?



Our path to Mars ...and beyond
Will start with Moon ...and move on.



The future is built
one step at a time,
and we intend to help.

