The Moon's Features and Rocks Record Its "Life Story"

Michelle Kirchoff
Southwest Research Institute
Institute for the Science of Exploration Targets
Southwest Research Institute in Boulder

Southwest Research Institute's Planetary Science Directorate has over 60 employees and is located in the Exeter Building at 11th and Walnut in downtown Boulder, Colorado.

**Areas of research and development:**

- **Space Studies**
  - Planetary Physics
  - Planetary Atmospheres and Surfaces
  - Lunar Origin and Evolution
  - Solar Physics
  - Solar System Dynamics
  - Astronomy
  - Computer Systems
- **Space Operations**
  - Space Technologies
  - Mission Operations

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Southwest Research Institute (SwRI), based in San Antonio, Texas, is an independent, nonprofit, applied engineering and physical science research and development organization with over 3000 employees. The Space Science and Engineering Division's goals are excellence in space research and the expansion and deepening of SwRI's space research efforts.

We were recently written up in SwRI's "Tech Today", celebrating 15 years in Boulder. Click the image to the left to download the article or view it online [here](http://www.boulder.swri.edu/)

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Goal: Learn more about formation of Moon, Phobos/Deimos, and asteroid belt & history of NEAs and lunar bombardment
The Moon's Life Story
Moon's Birth: Giant Impact Theory

- Mars-sized body hits Earth obliquely
- Moon forms from debris disk

This explains:
- Mass ratio Earth-Moon
- Early Earth fast rotation speed
- Lack of iron in Moon

Iron core / stony mantle

Animation from Robin Canup
Impacts and Impact Craters

When one planetary object hits another planetary object

Speeds from 1's km/s to 10's km/s
Infant Moon: Magma Ocean

After accretion the Moon would be very hot.

In magma ocean things separate by density.

Moon Mix Activity

This explains:
- Abundance of Anorthosite at surface
- Composition of lunar magma
- Layered interior
Kid Moon: Heavy Bombardment

After solidification of the crust Moon experiences intense bombardment by large objects.

This explains:
- Age of many basins
- Structure of asteroid belt
- Lunar highlands
How do we know the “when”?

Apollo Samples + Craters!

Activities:
Rocks Tell Us The Moon's Story

Moon's Long History: Impact Paintings
Teen Moon: Volcanism

~3 billion yrs ago, magma erupted in basins

Came from below & erupted through cracks in the crust

This explains:
- Dark areas on Moon
- Lunar Basalts

07 March 2014
US Geological Survey - Hawaiian Volcano Observatory

A lava pond in Pu`u `O`o crater, on Kilauea's east rift zone, has been active for several months. The lava pond commonly experiences "gas pistoning", which is the cyclic rise and fall of the lava surface due to the buildup and release of gas.

http://hvo.wr.usgs.gov/multimedia
Adult Moon: Impacts

Activities:
Crater Creations

Future Moon:
Footsteps of Explorers

What do you see in today's moon?

Moon continues to be impacted by NEOs

This explains:
- Rayed craters
- Continued formation of regolith
- Lunar breccias
- Lunar meteorites
Thank you!

Questions?