



# Moon 101

By: Savannah Zielinski, Angelina Mills,  
Nathan Boehning, Todd Bowles, and  
Tommy Stegmaier

**EarthRise** NASA/JPL/MSSS

# Formation of the Moon

## Impact Theory

- Became popular in 1984 at conference in Kailua-Kona, Hawaii
- What happened?
  - > Large impactor struck the Earth off-centered
  - > Earth's gravitational pull slowed the impactor enough for it to hit again
  - > During the second impact the Impactor lost the majority of its core
  - > The debris that was put into the Earth's orbit from this collision accumulated to become the moon

# Evidence for the Impact Theory

- ◎ Similarity between the Earth and moons composition
- ◎  $O_2$  Isotopes
- ◎ Low metal content of moon and high metal content of the Earth

# Formation of the Moon: Unsupported Theories

Hypotheses	Synopsis	Negating Evidence
<b>Double Planet</b>	Earth and Moon were simultaneously accreted from the same region of the nebula.	<ul style="list-style-type: none"><li>•24 hour rotation or lack of volatiles on the moon.</li><li>•Similar composition of the moon and Earth's core.</li><li>•Amount of metal in the moons core compared to the amount of metal in the Earth's core.</li></ul>
<b>Capture</b>	Earth's gravity pulled the moon into its orbit.	<ul style="list-style-type: none"><li>•Collided into the Earth</li><li>•Cast out of the orbit</li></ul>
<b>Fission</b>	Earths rotational velocity was so great; a part of the earth was flung off, creating the moon.	<ul style="list-style-type: none"><li>•Not possible to reach the necessary angular momentum</li><li>•Proportion of Earths metal content to the moon do not match.</li></ul>

# Highlands vs. Maria

## ◎ Highlands

- > Formed when the Moon was still molten
- > Low in density > Floated to the top

## ◎ Maria

- > Formed after the crust was formed
- > Volcanic activity
- > impactor

# Composition of the Moon

## ◎ Basalts

- > High in metal content Fe & Ti
- > Primary rock making up Maria and the inner layers (Mantle)
- > Higher density
- > Low albedo > making them darker
- > More Ti, the darker

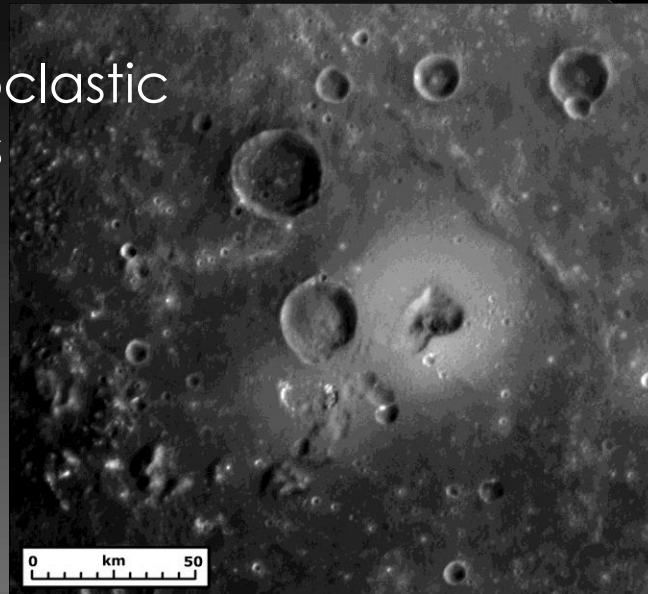
## ◎ Anorthosites

- > Silicates and Feldspars
- > Make up the highlands
- > Lower density
- > High albedo > making them lighter in color

# Volcanism

## ◎ Shields

- > Convex
- > Occur in mare basins
- > Diameters range from 2.5 – 24 Km
- > Heights range from 100 – 250 Km
- > Low pyroclastic materials



## ◎ Cinder Cones

- > Explosive
- > High pyroclastic materials
- > Found in fracture lines on the surface

# Rilles

◎ 3 types of rilles

> Sinuous Rilles



> Arcuate Rilles



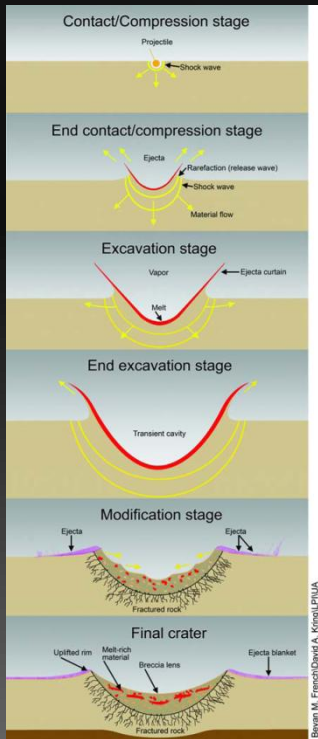
> Straight Rilles



# Craters

## Simple Craters

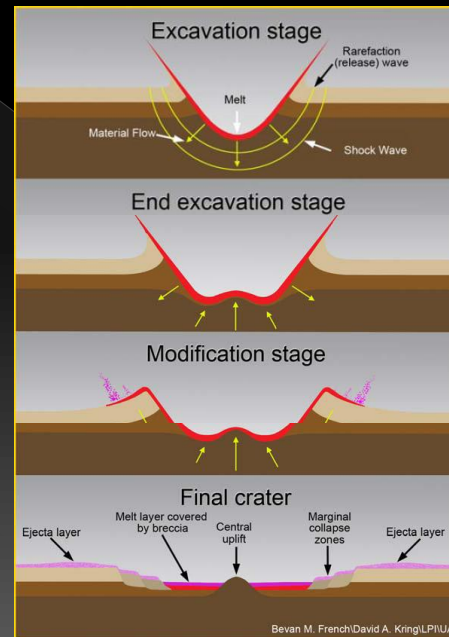
- > Smooth, bowl-shaped interiors



Impactor=Smaller Diameter  
Usually has a raised ridge surrounding it.

## Complex Craters

- > Flat floors, terraced walls, central peaks



Impactor=larger diameter

•Impactor “punches” through the surface expelling lava

# Lunar Cataclysm

- The formation of over 1700 craters 100Km in size or greater
- Took place about 3.9 BYA
  - > Majority of impact rocks collected from the Apollo missions are 3.9 Billion Years Old
    - Could be inaccurate because all Apollo missions were around lunar basins.
  - > Lunar Meteorites helped prove the date of Lunar cataclysm
    - Regolith Breccias
- Earth was also effected
  - > Possible explanation for the lack of evidence of life on earth older than 3.85 BYA

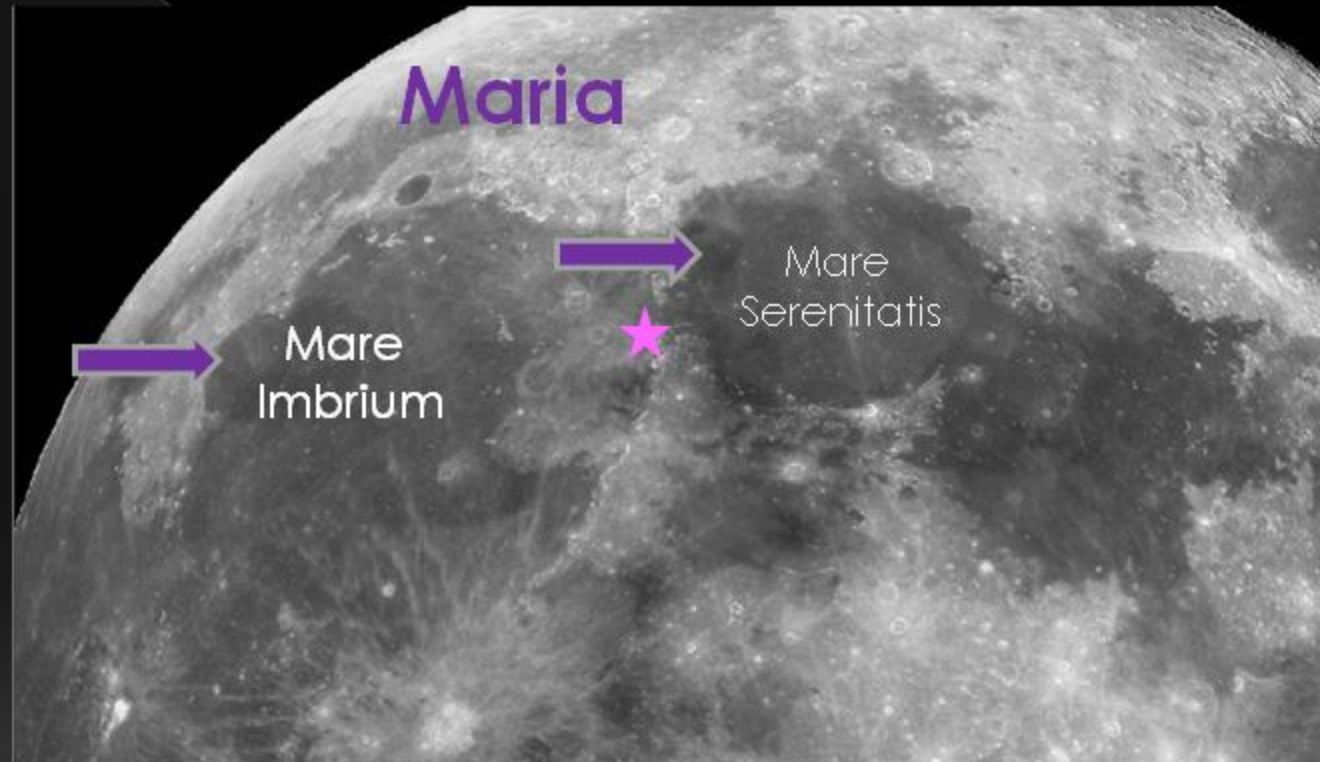
# Apollo 15

- Crew:
  - > David R. Scott
  - > Alfred J. Worden
  - > James B. Irwin
- Launched
  - > July 26, 1971 at 9:34 am
- Primary objective
  - > Study Apennine Mountain front.
  - > Sample Hadley Rille.
  - > Look at the dark mare material of Palus Putredinis.
  - > Observe the complex of domical hills in the mare.

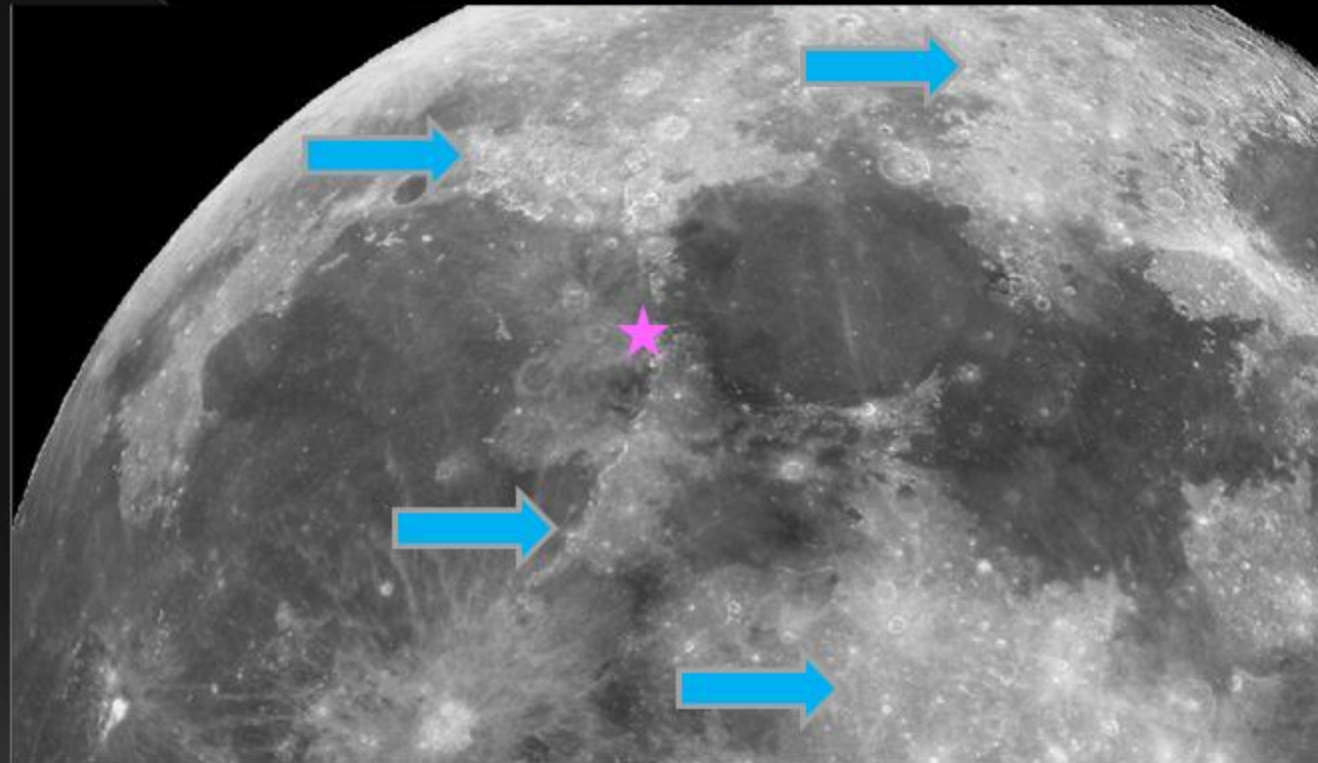


★ ← Represents where the Apollo 15 landing site is on the maps that follow this slide.

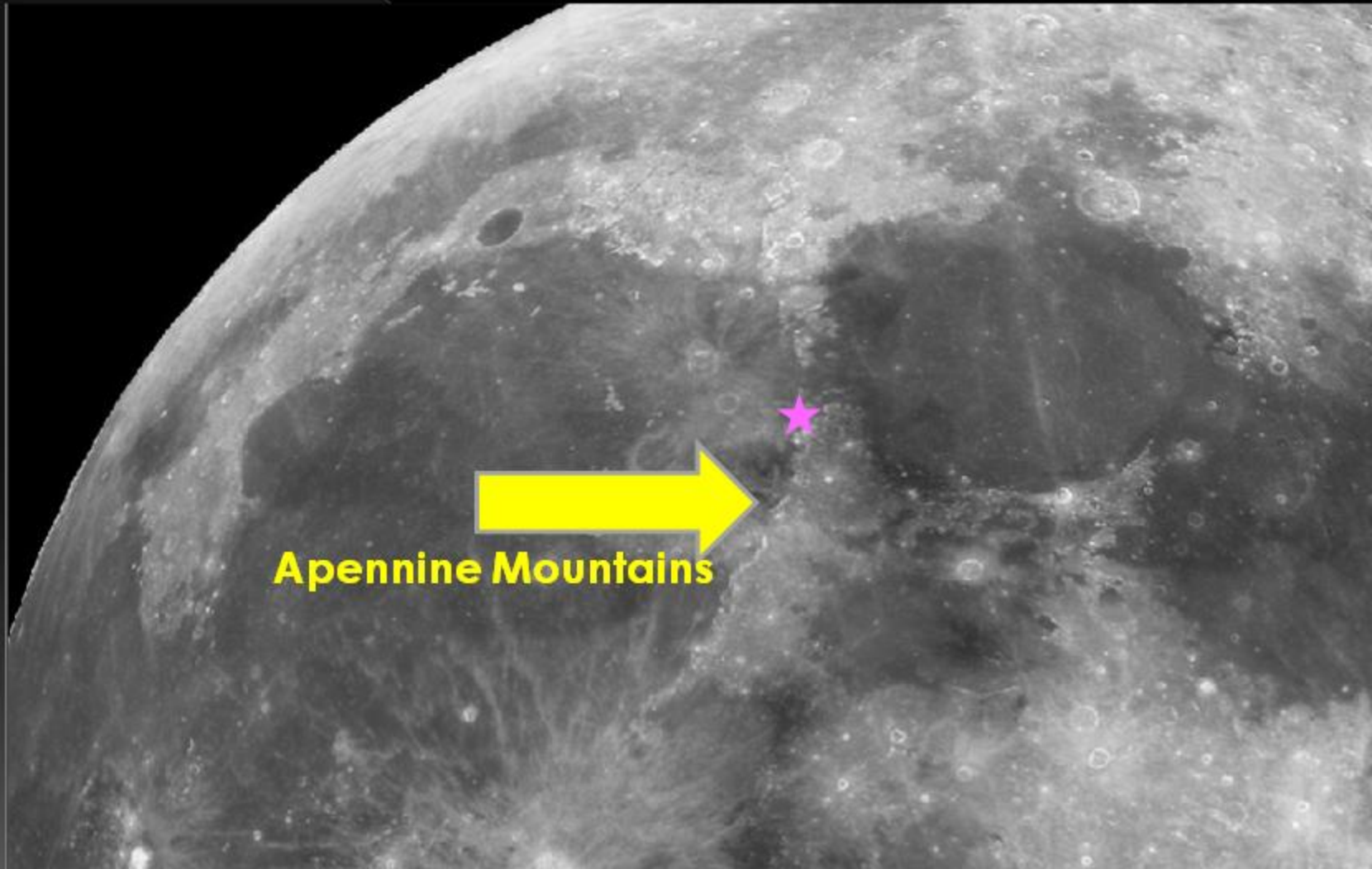
# Apollo 15



# Apollo 15 Highlands

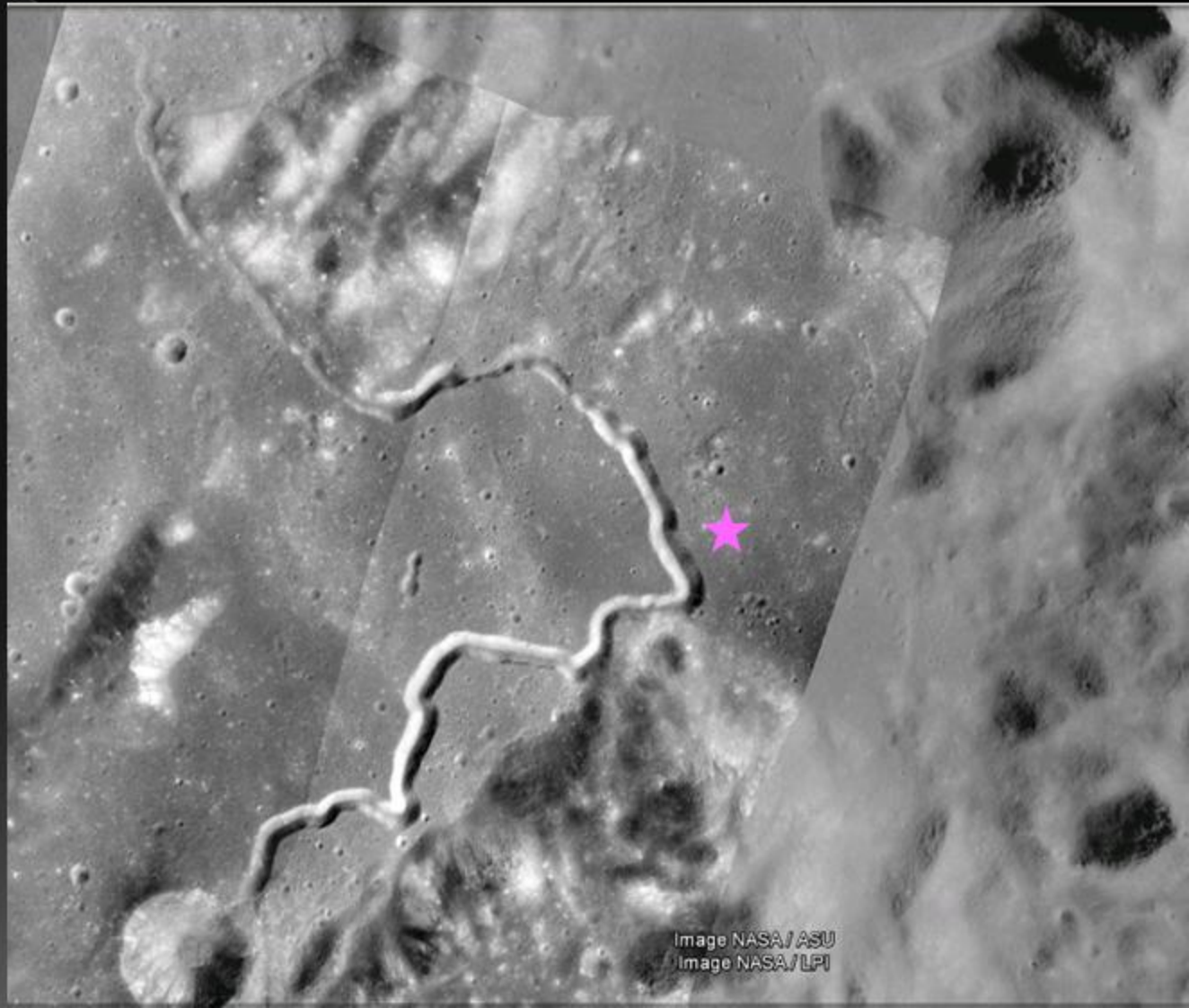


# Apollo 15

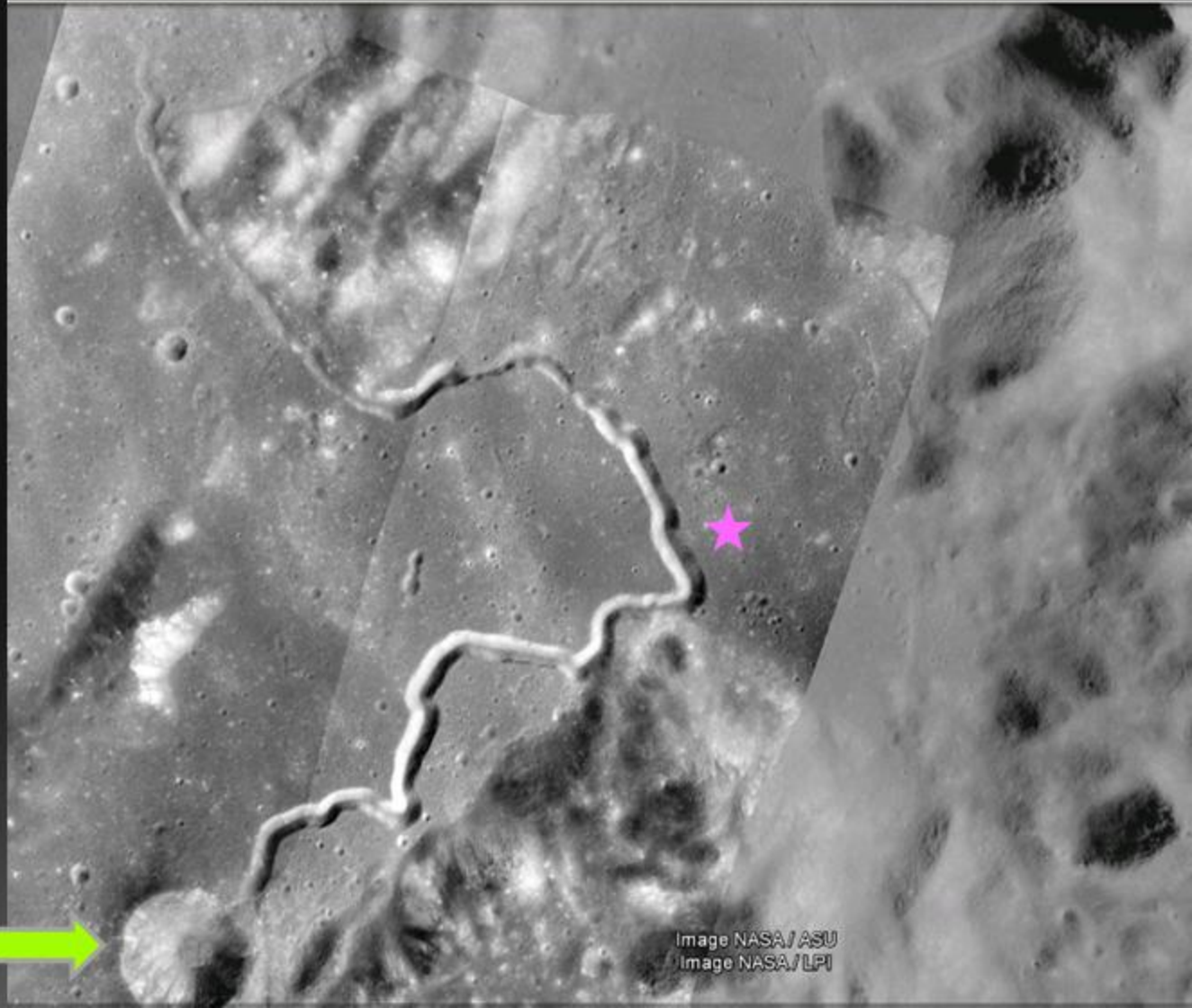


**Apennine Mountains**

# Apollo 15



# Apollo 15



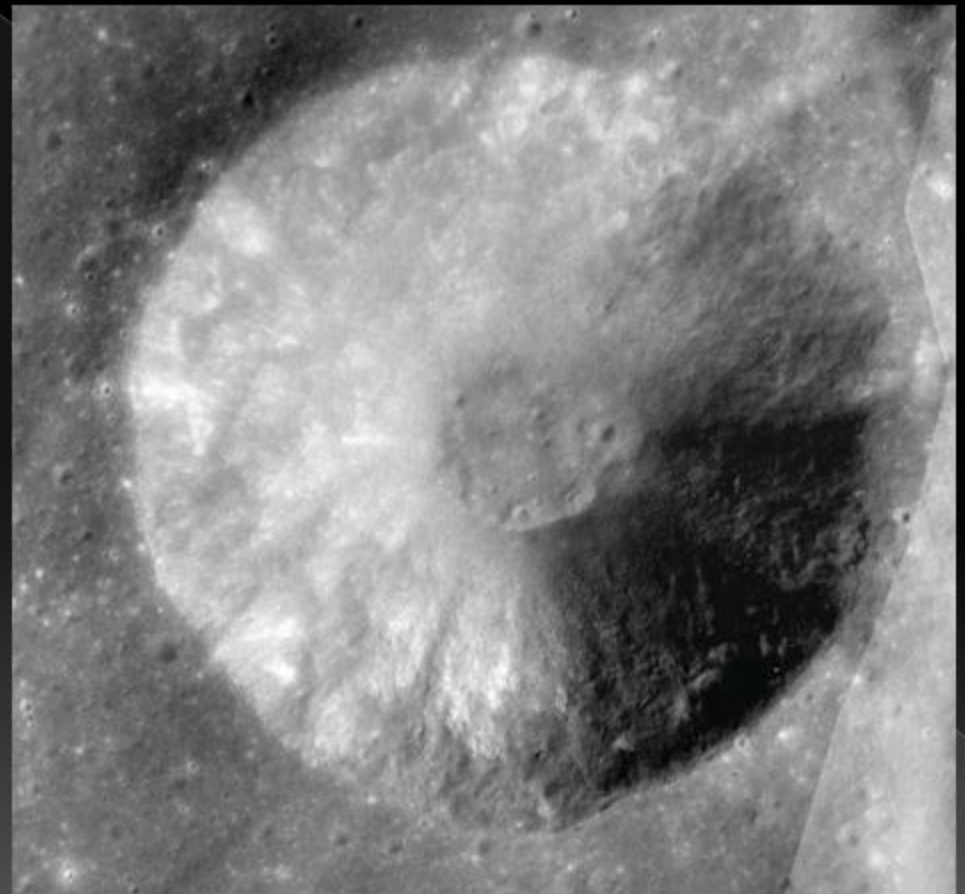
**Complex  
Crater**



Image NASA / ASU  
Image NASA / LPI

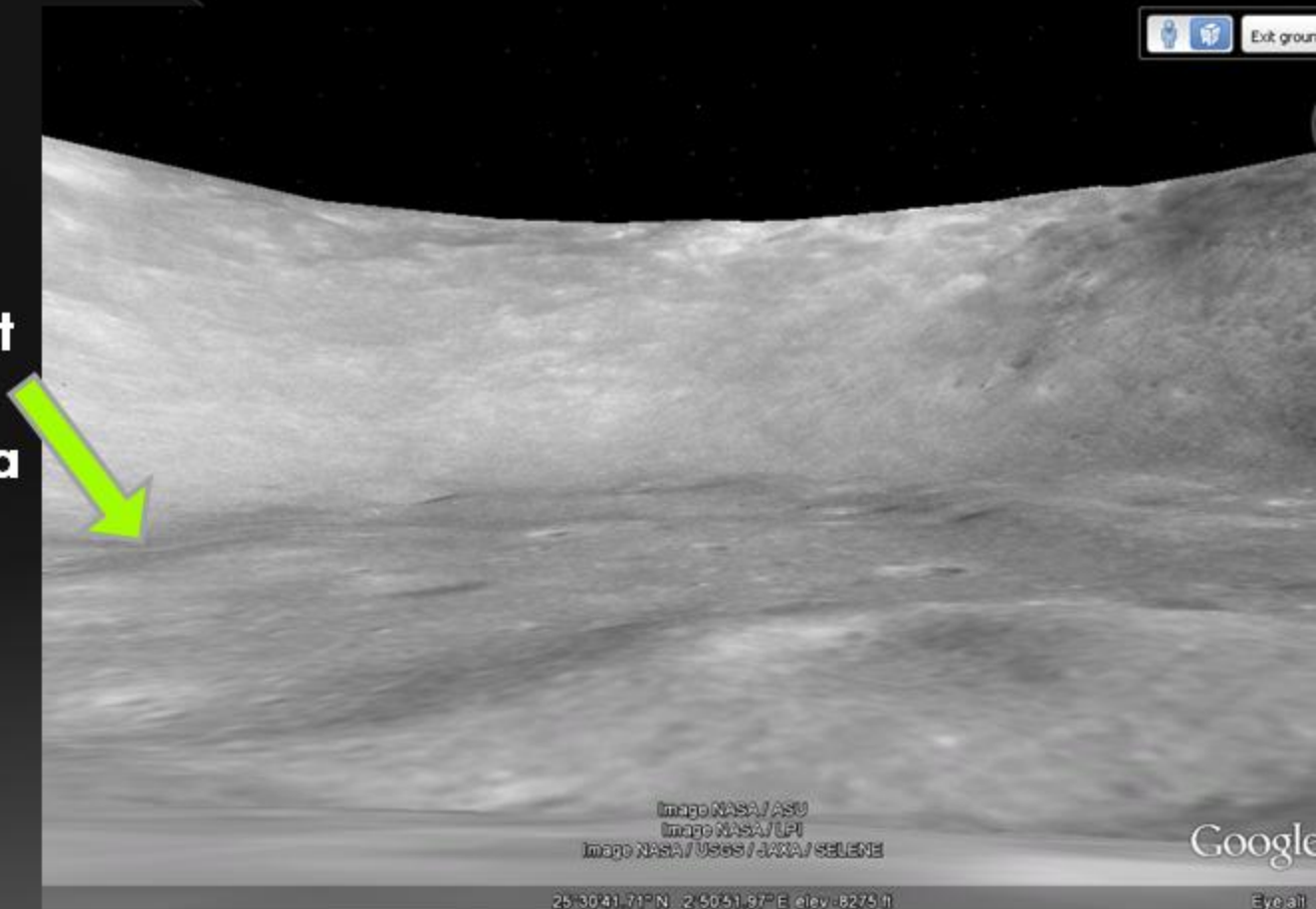
# Apollo 15

**Complex  
Crater:  
Complex  
because it  
has a flat  
floor with a  
slow,  
gradient,  
central  
peak.**



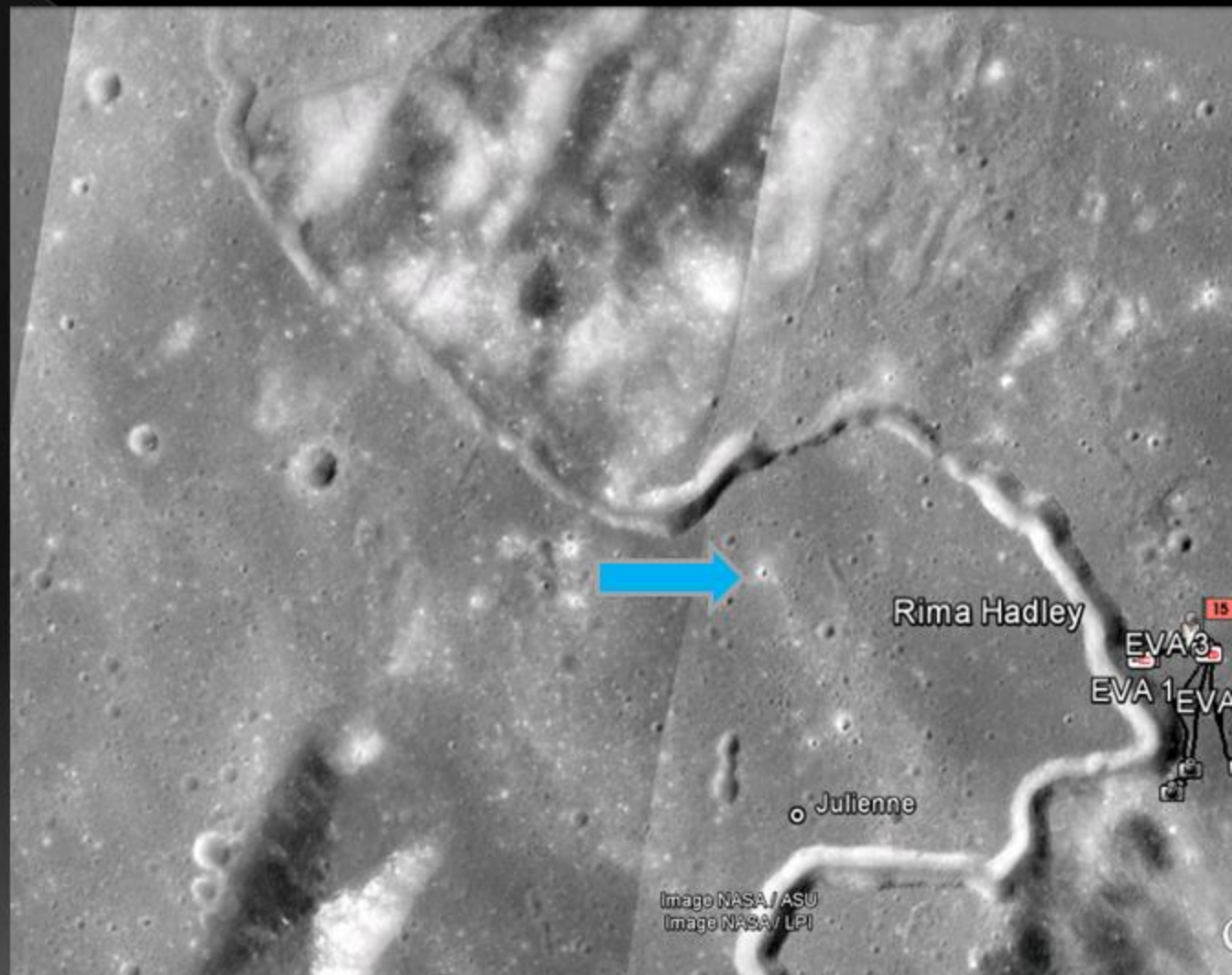
# Apollo 15

**Complex Crater:  
Complex because it has a flat floor with a slow, gradient, central peak.**

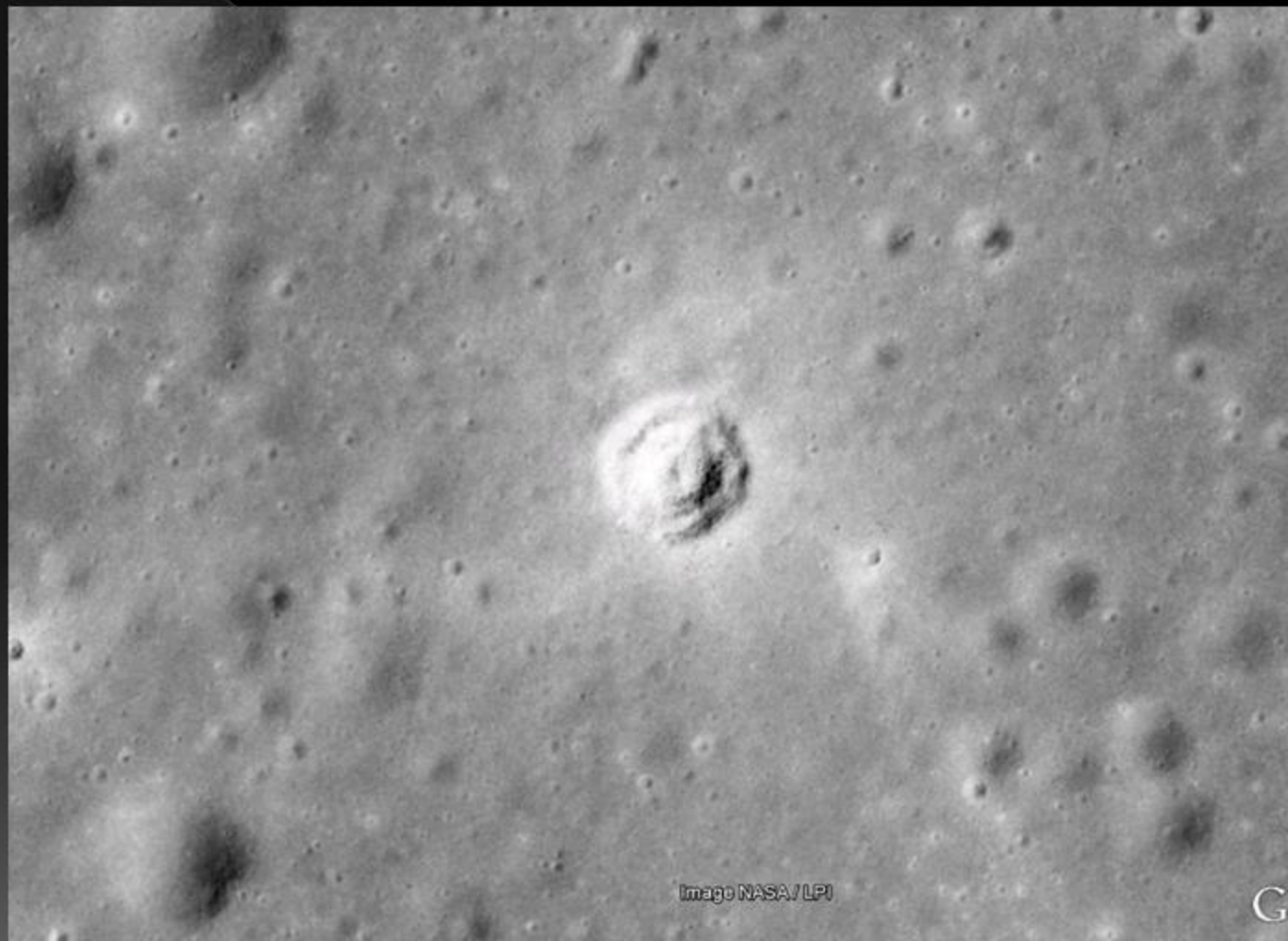


**Google Earths Ground Level: can see the slow gradient**

# Apollo 15

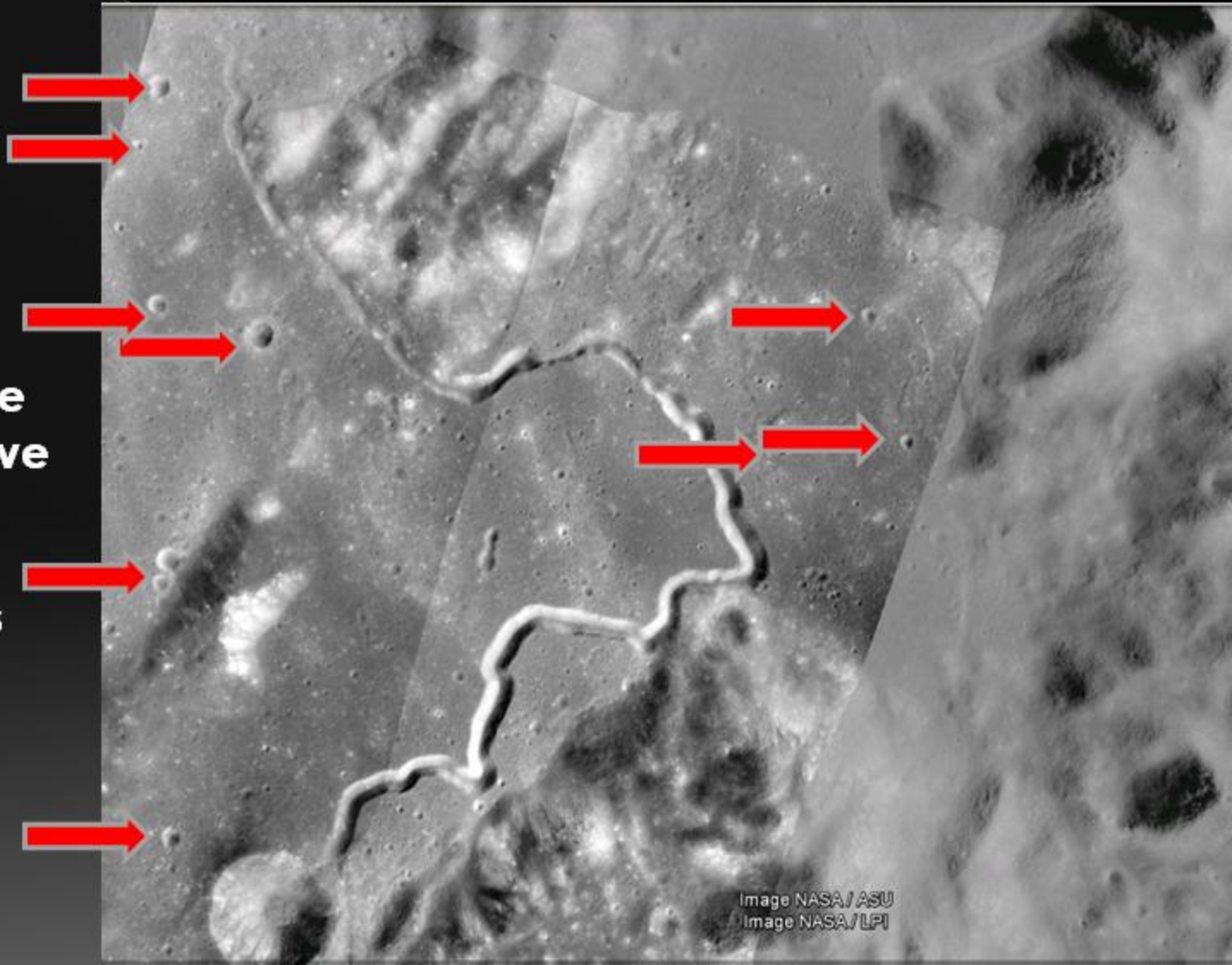


# Apollo 15



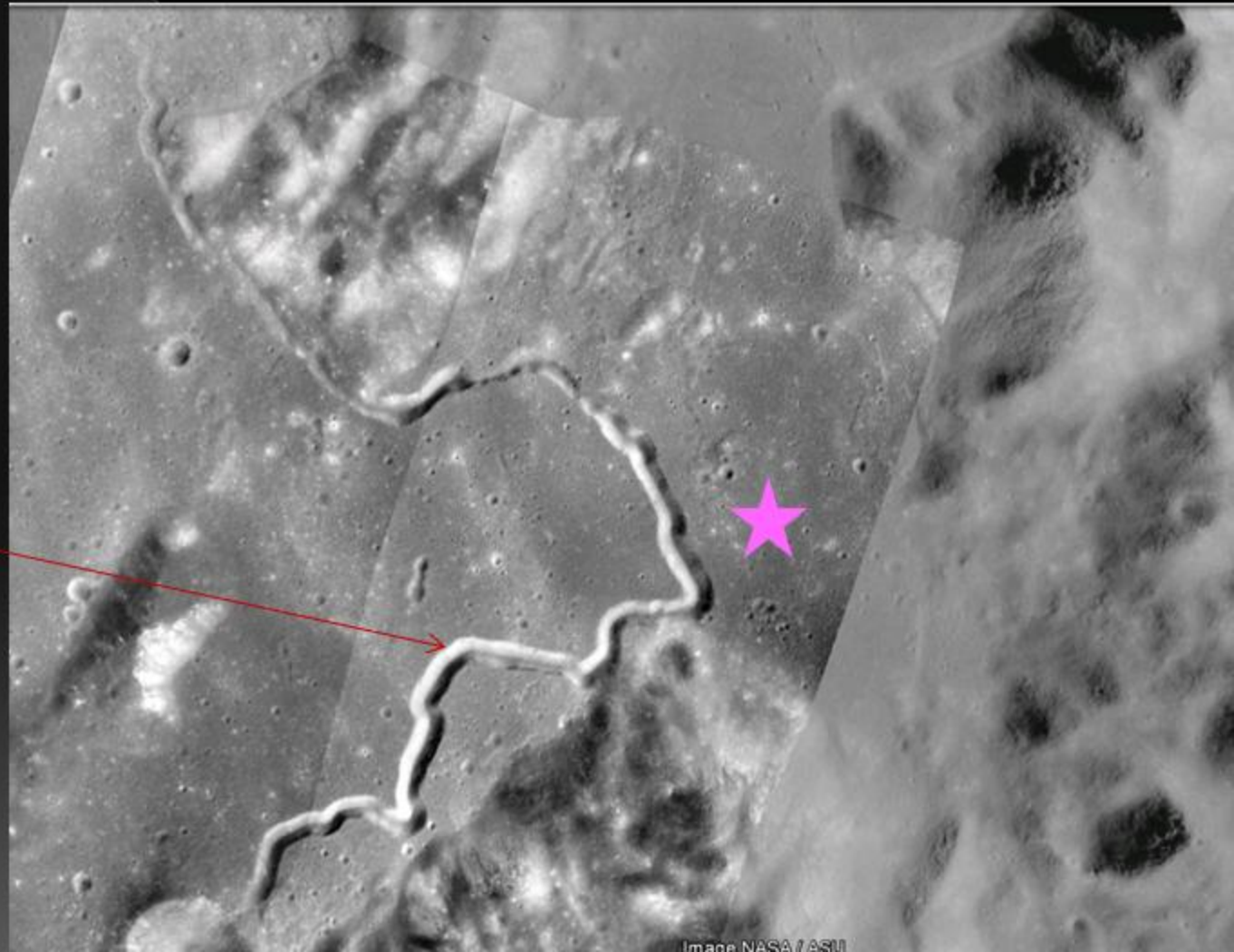
# Apollo 15

**Simple  
Craters  
because  
they have  
bowl  
shaped  
interiors**



# Apollo 15

Arcuate:  
Because  
there are  
no  
branches  
and on  
edge of  
mare



# Citations

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