An Introduction to Lunar Geology

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Ferminians

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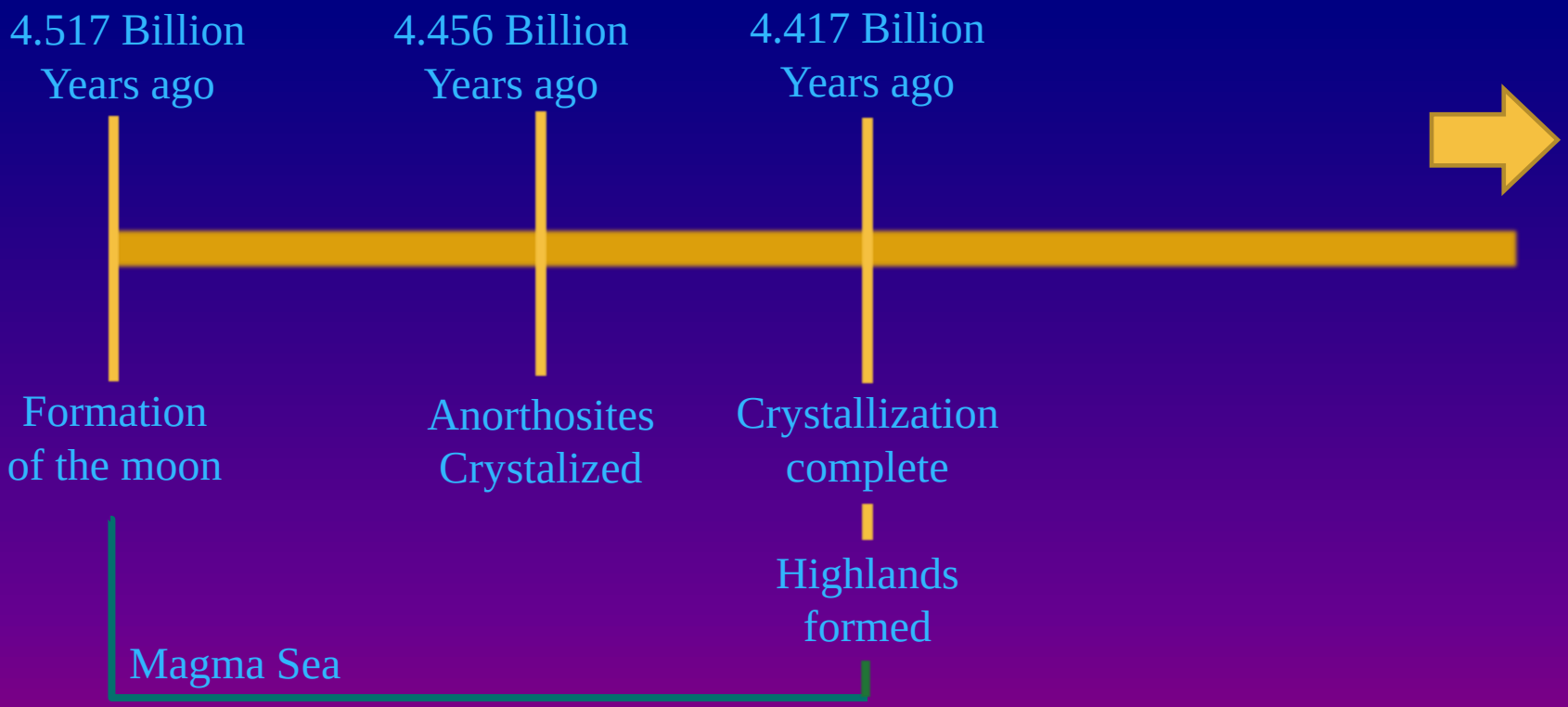
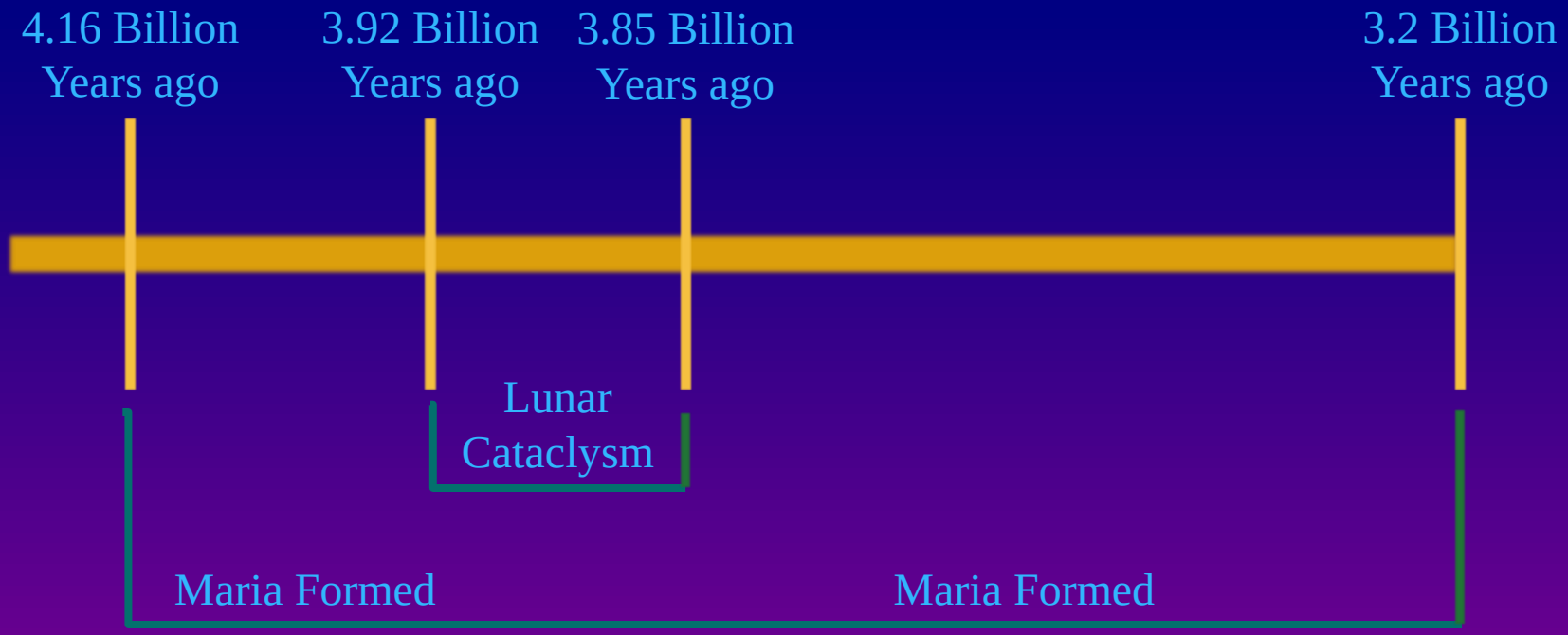
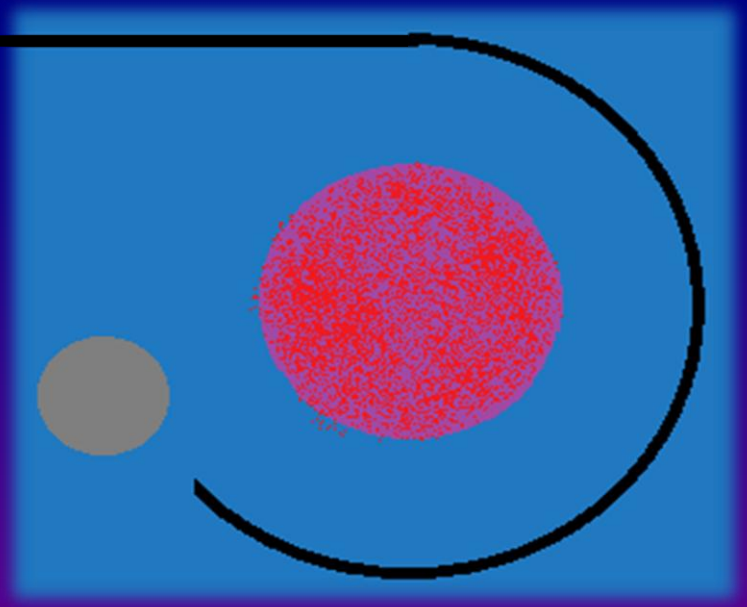


The History of the Moon



The History of the Moon

The Capture Hypothesis

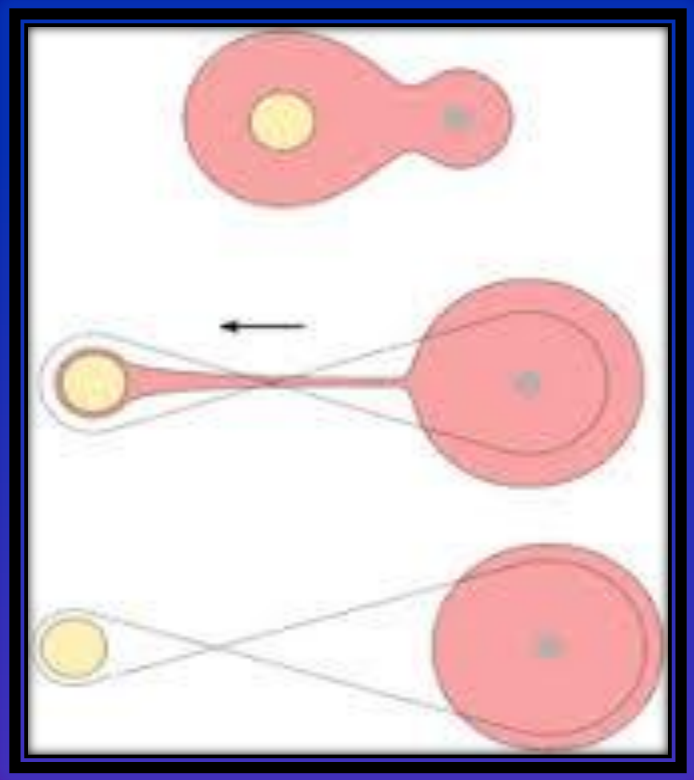


- Acquired a fully formed moon

- Possible, but….
  - Statistically improbable
  - Earth and moon have similar Oxygen isotopes

The Double Planet Hypothesis

- Earth and moon formed simultaneously
- Strengths
  - Explains the similar oxygen isotope composition
- Flaws!
  - Does not explain the moon's small core
  - Difference in the amount of volatiles and non volatiles
  - Earth's rotation…Why?
  - The orbiting ring of debris orbited



- Moon formed from rapidly spinning Earth
- Pros:
  - Explains The moon's small metallic core
  - Accounts for the similar oxygen isotope composition
- Cons:
  - 2.5 hour rotation of the earth required
  - Bodies have different chemical compositions

Fun Fact: Earlier scientists believed the Pacific Ocean was "a birth scar" left by the separation of the moon

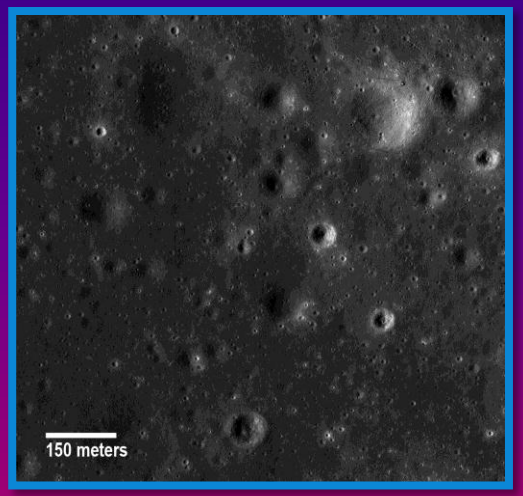
The Fission Hypothesis

- Formed from the debris of a large-scale impact
- Explains:
  - The ratio of volatiles to nonvolatile
  - The identical oxygen isotopic composition
  - The angular momentum and angle of the Earth's rotation
- *Natural part of planetary formation*

The Giant Impact Hypothesis

The Lunar Highlands

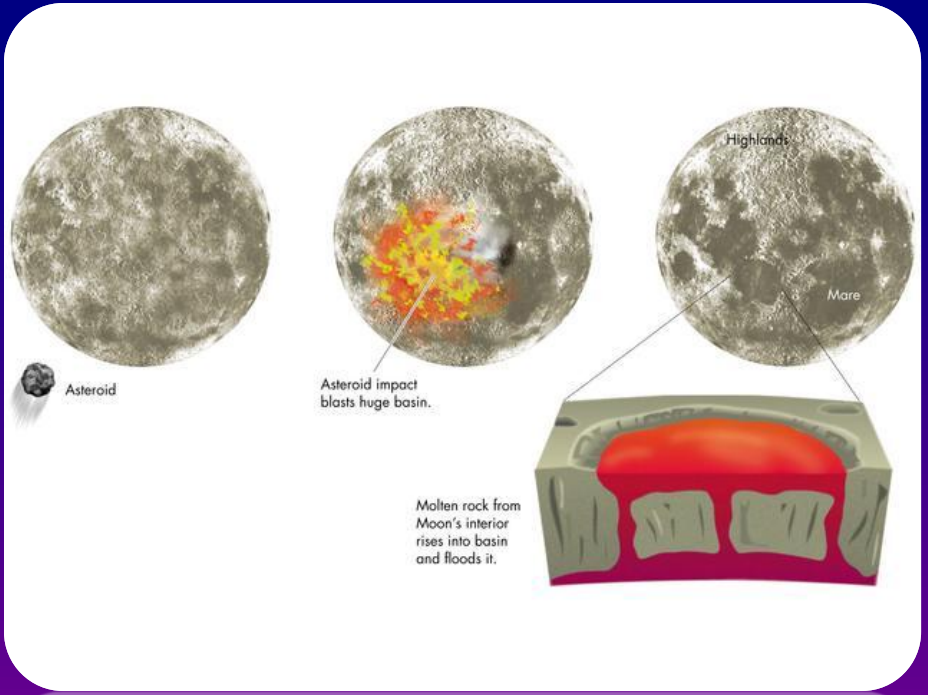
- Formed from magma sea 4.4 b.y.a
- Predate the Maria by 800 m.y
- The elevated and more rugged regions
- Cover 80% of the visible surface
- Heavily cratered
- Feldspar rich and contain low density rocks
- High albedo



- Smooth, dark flood-plains
- Cover 16% of the moon's surface
- Less impact cratering than the highlands
- Basaltic composition
- Bear resemblance to Earth's volcanic terrains
- Home numerous morphologies

The Lunar Maria

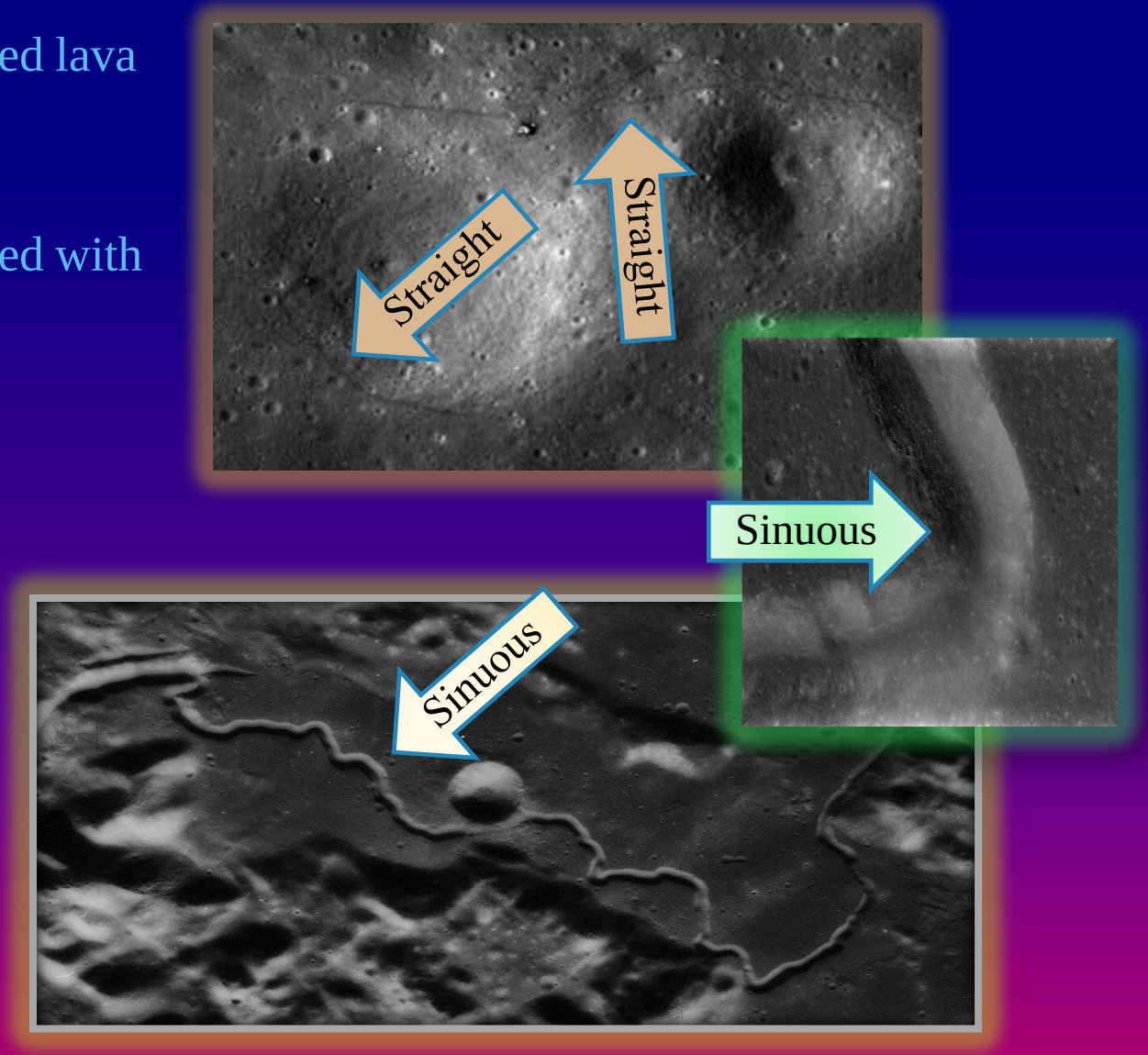
- Created by volcanic eruptions 3.5 b.y.a
- Partial melting of the crust formed magma
- Heat produced by radioactive materials
- Occurred 60 to 500 meters below the surface
- Magma pooled in basins



Formation of the Lunar Maria

Rilles

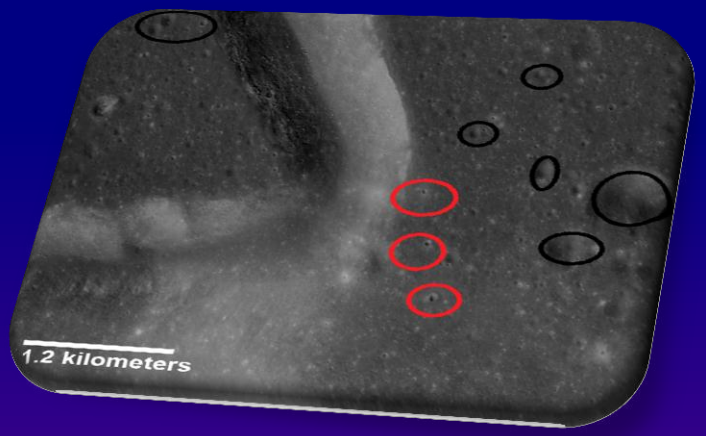
- Lava channels/collapsed lava tubes.
- Often connected/aligned with endogenic craters.
- Three Types of Rilles
  - Arcuate rilles
  - Sinuous rilles
  - Straight rilles

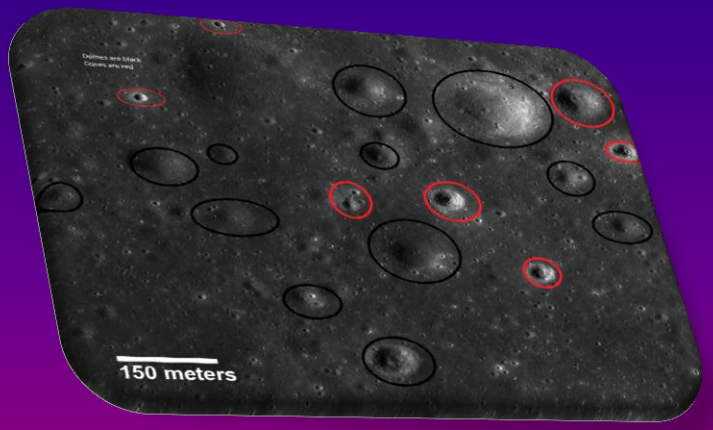


Cones & Domes

Domes

- Large shallow land forms
- Topped by smooth ringed craters
- Low profiles suggest fluid volcanism
- Some have summit craters or fissures.
- Heights vary from 100 to 250 m
- Diameters range from 2.5 to 24 km



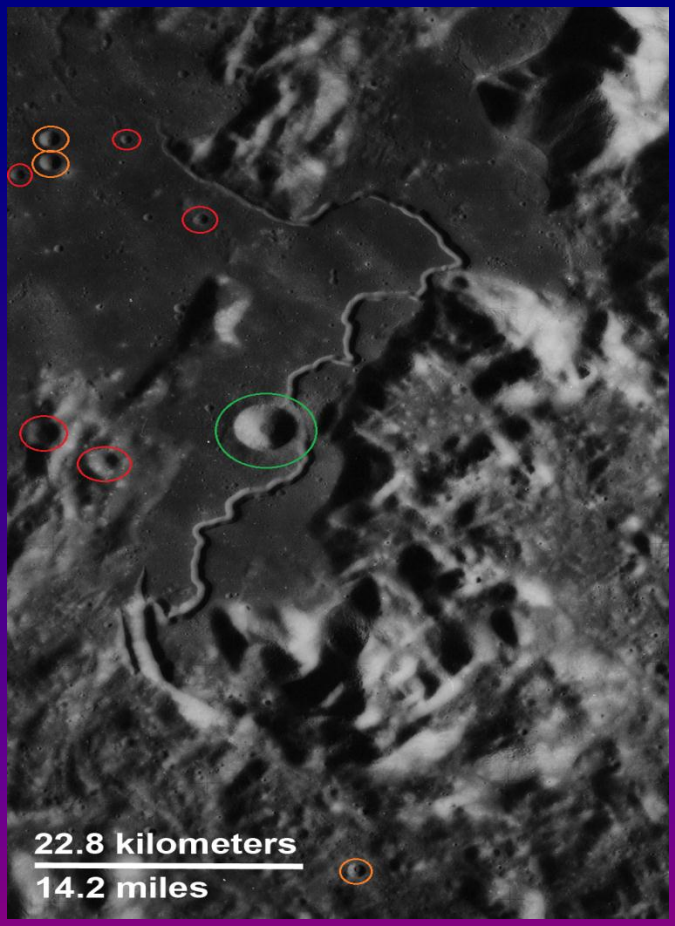


Cones

- Steep, rough surfaced features
- Cinder cones formed from lava bombs
- Volume of each is smaller than the total Basalt erupted from it
- Often associated with Rilles
- Less than 100 meters high
- Diameters range from 2-3 km
- They have a low albedo.

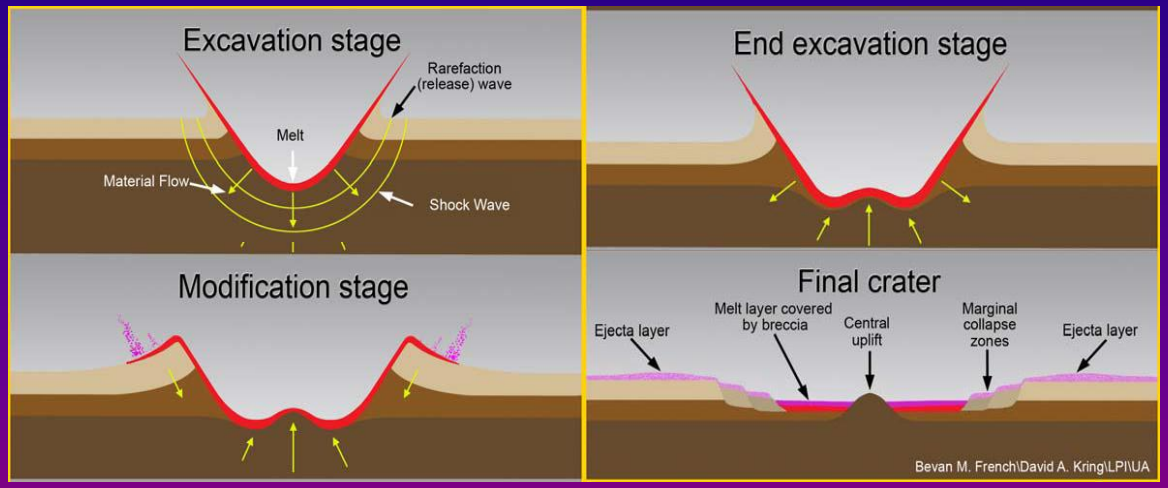
Impact Cratering

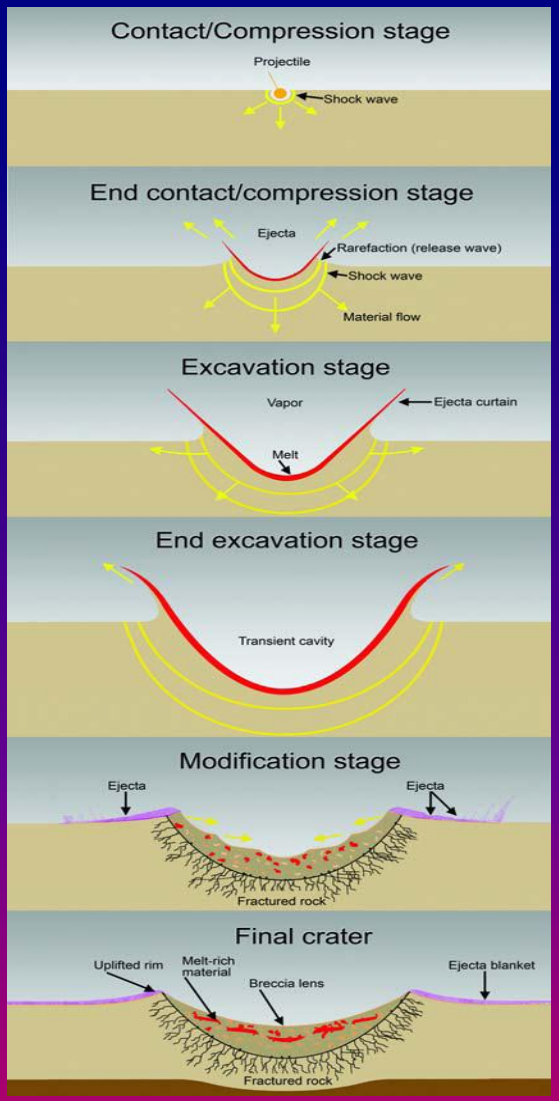
- Five types of craters
  - Simple
  - Complex
  - Central peak basins
  - Peak ring basins
  - Multi ring basins



Three Phases to the Impact Process

1. The compression phase
2. The excavation phase
3. Modification phase





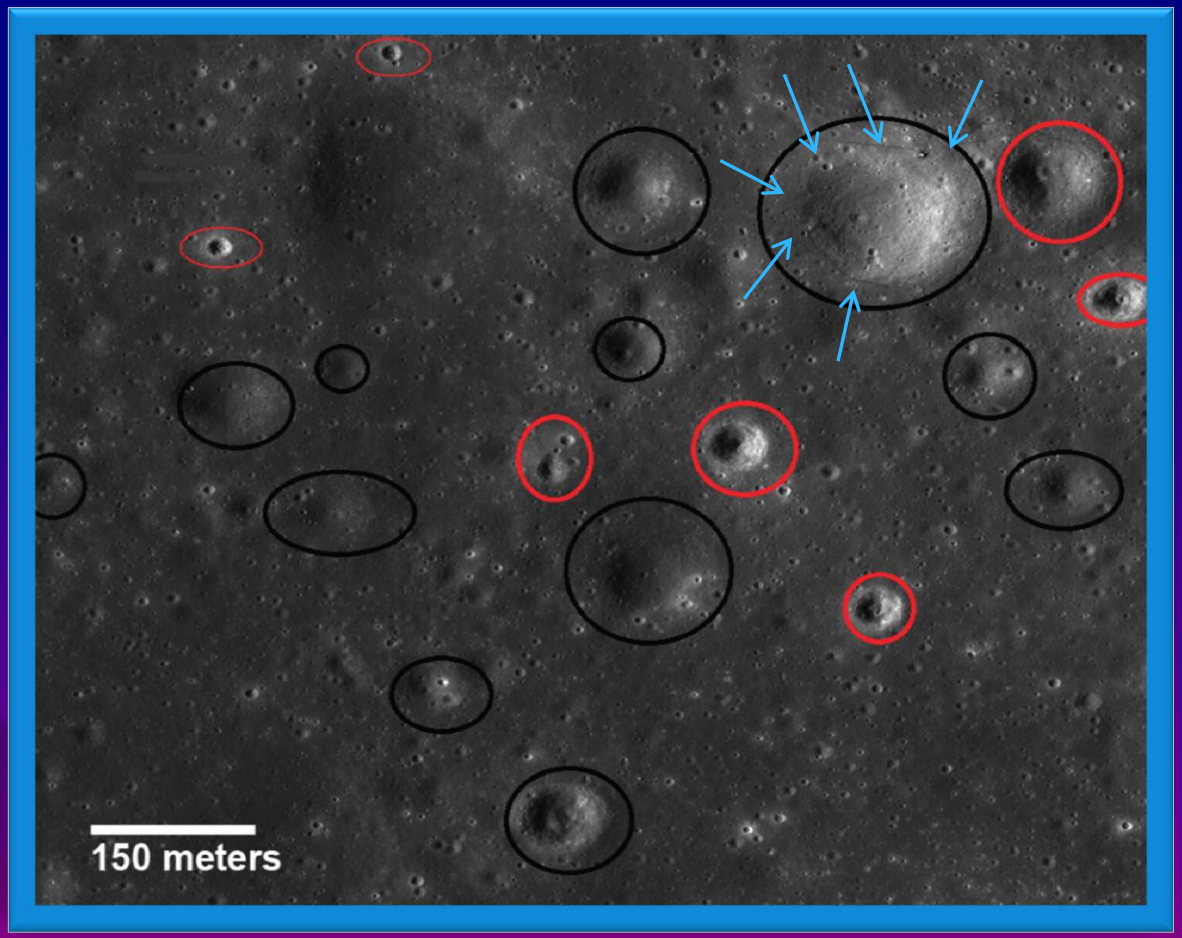
Impact Cratering

Maria

Straight Rilles

Cones

Domes



Conclusion: Image 1

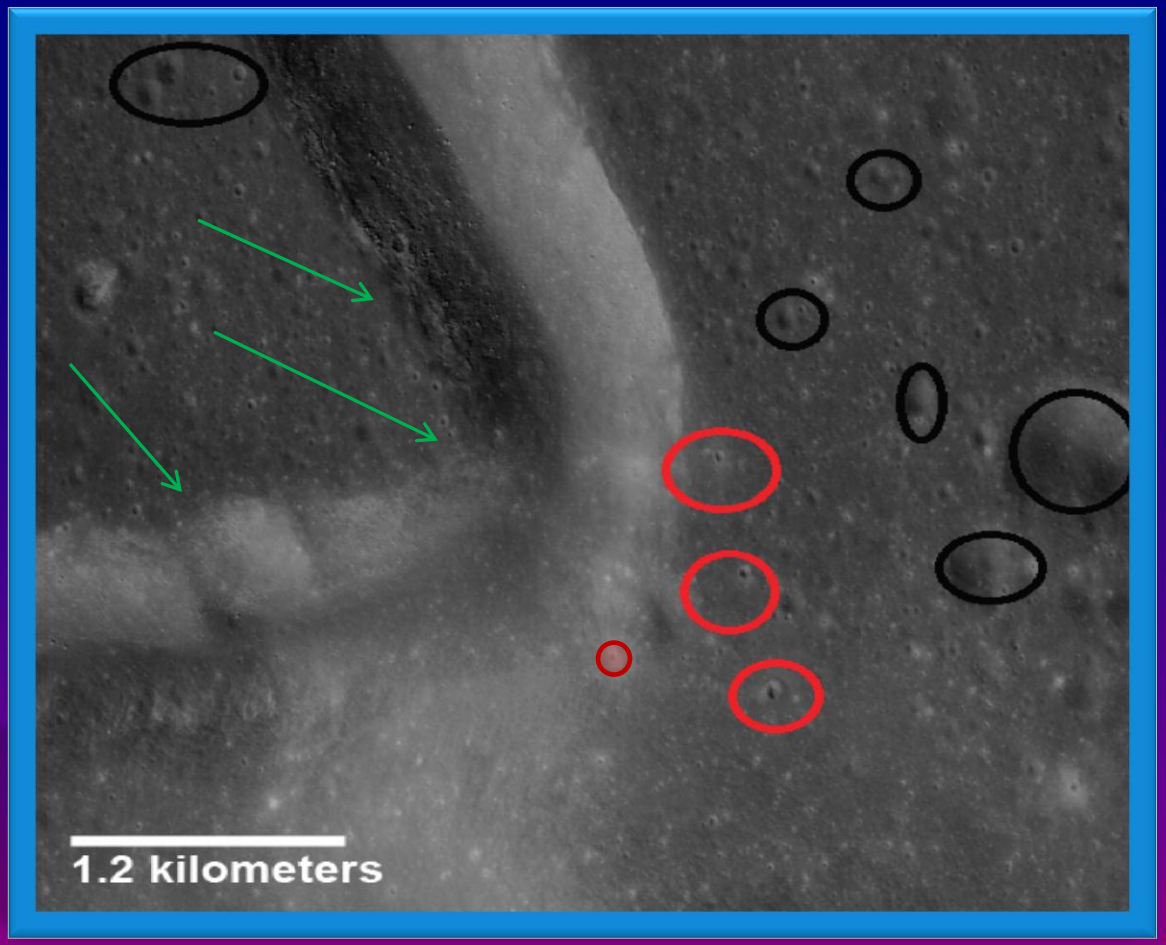
Maria

Sinuous Rilles

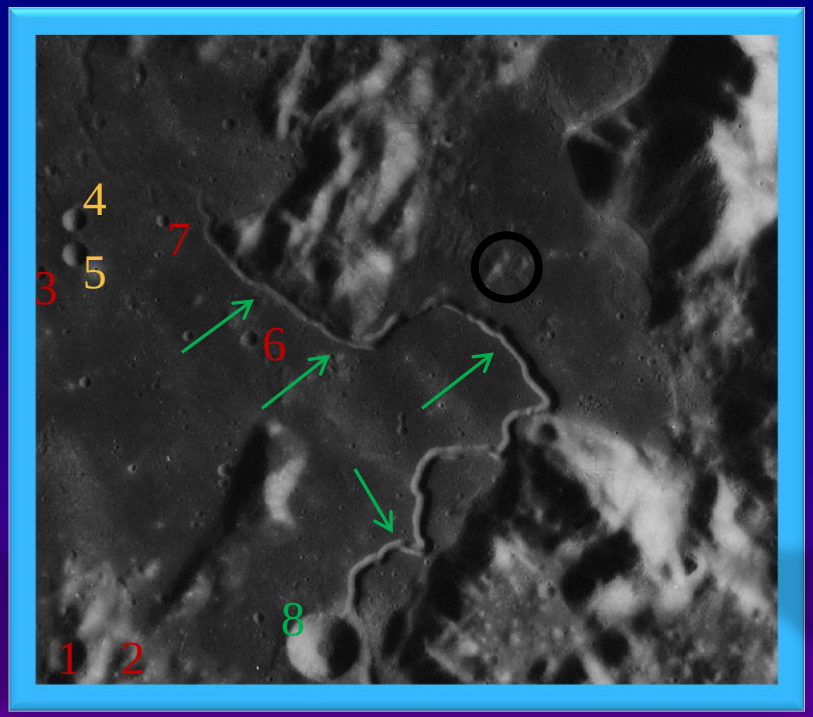
Cones

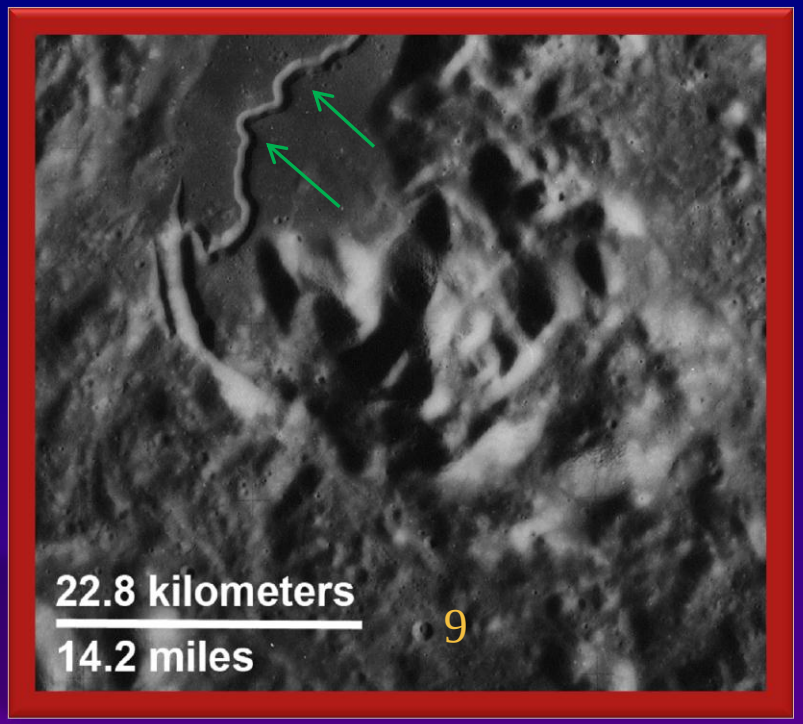
Domes

Simple Craters



Conclusion: Image 2





Maria

Highlands

Sinuous Rilles

Domes

Simple Craters
Complex Craters
Peak Ring Basins

Conclusion: Image 3

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