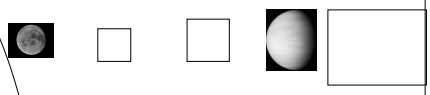
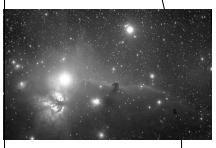
The Terrestrial Planets

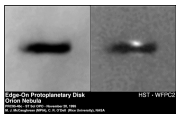
Moon Mercury Mars Venus Earth



Formation of the Solar System I

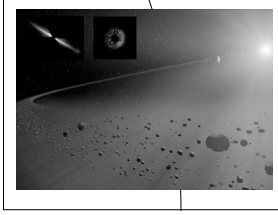
- Nebula = cloud of gas & dust
- Contracts under self-gravity
- Flattens into disk: solar nebula
- Dust is vaporized



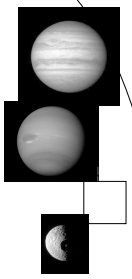


Formation of the Solar System II

- Dust condenses
- Dust sticks together to form rocks
- Rocks collide to form planets

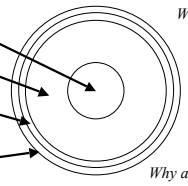


4 Kinds of Planets



	Density	Composition
Jovian	About 1	H, He
Uranian	1.5	Water
Terrestrial	3-5	Iron, rock
"G"	2	Rock, ice

Structure



Which layer is densest?

Least dense?

Why are they arranged this way?

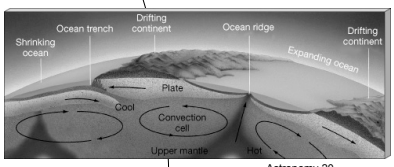
Process: **differentiation**

Heating of Core

Impacts (accretion)
Differentiation
Radioactivity

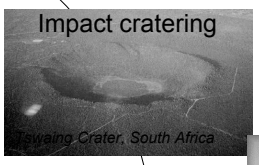
Cooling of Core

1) Conduction
2) Convection
3) Eruption



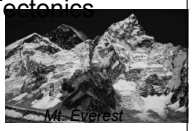
Surface Processes

Impact cratering



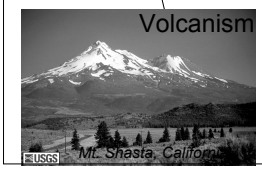
Tswaing Crater, South Africa

Tectonics



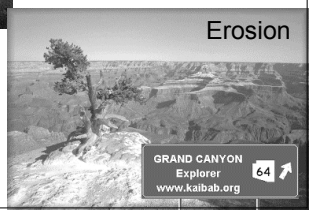
Mt. Everest

Volcanism

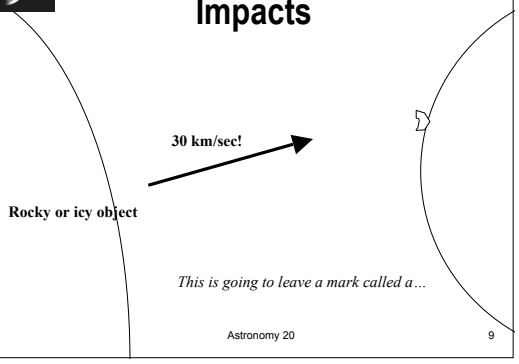


Mt. Shasta, California

Erosion



Impacts



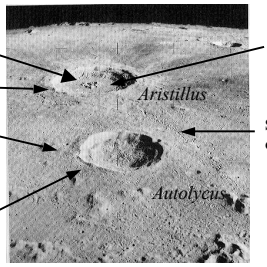
Terrestrial Planets

Impact Crater

Barringer Meteor Crater, Arizona

Terrestrial Planets

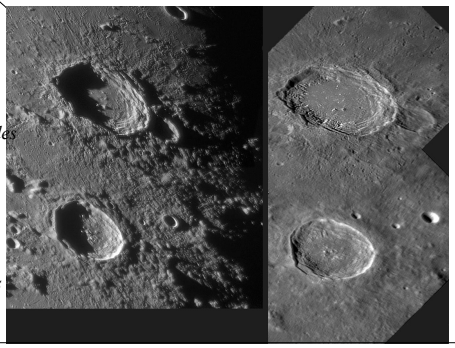
Crater Features



The Moon

Terrestrial Planets

Impact Craters



Aristoteles

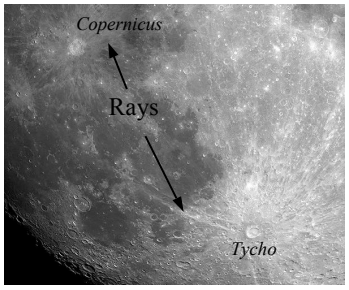
Eudoxus

Terrestrial Planets

Rays

- Darken after about 100 million years.
- Best seen at local noon.

How can you find the youngest craters on the Moon?

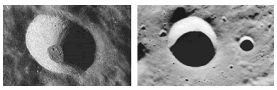


Moon

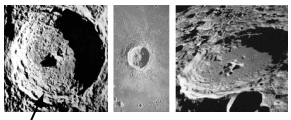
Terrestrial Planets

Crater Sizes

Simple craters < 25 km



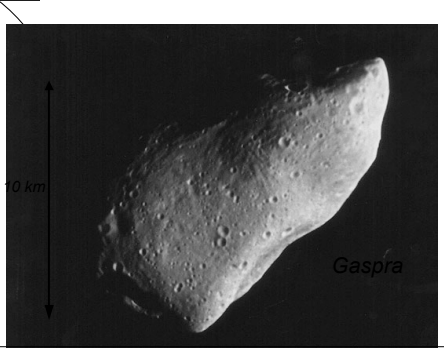
Complex craters - 25- 300 km



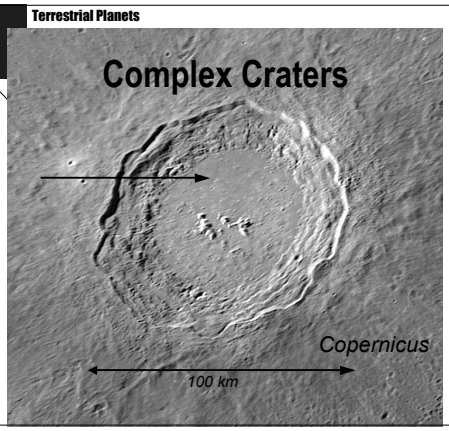
This puppy is the size of the L.A. basin!

Terrestrial Planets

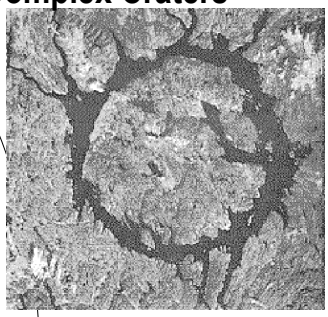
Simple Craters



Complex Craters

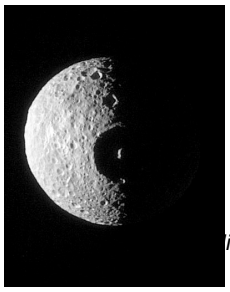


Complex Craters

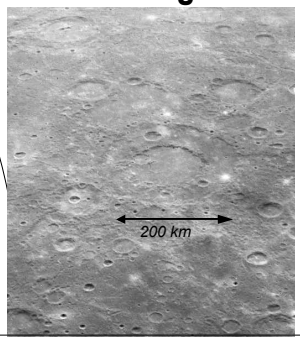


Manicougan impact crater, Quebec

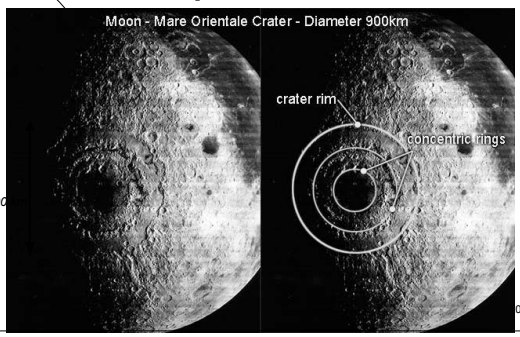
Complex Craters



Double-ringed craters



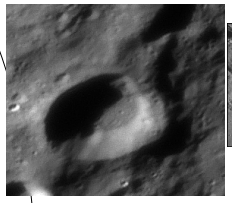
Impact Basins



Check Question

- *Which crater is largest?*

1



2

3

Terrestrial Planets

Volcanism

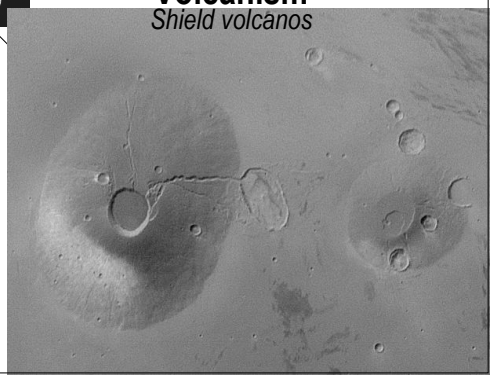
Earth

- Volcanic plains
- Shield volcanos
- Stratovolcanos

Terrestrial Planets

Volcanism

Shield volcanos



Terrestrial Planets

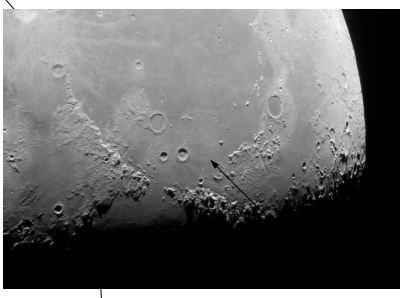
Volcanism

Stratovolcanos

Fujiyama

Terrestrial Planets

Volcanism
volcanic plains



Terrestrial Planets

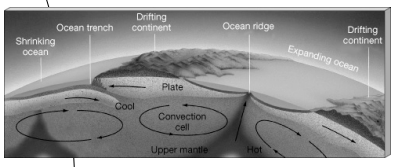
Tectonics

Long's Peak, Colo

Terrestrial Planets

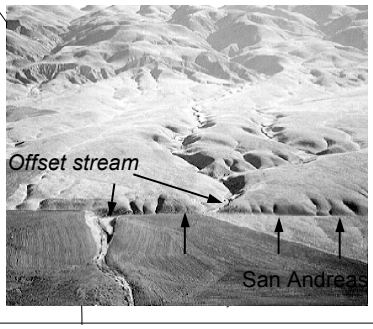
Tectonics
Plate tectonics

- Lithosphere
- Plates
- Convection in mantle



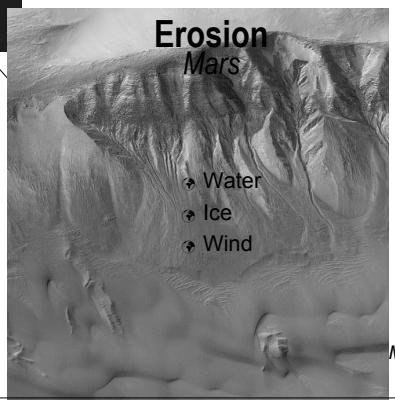
Tectonics

A plate boundary



Erosion

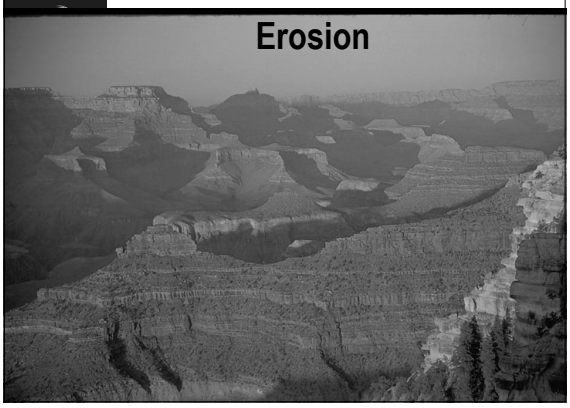
Mars



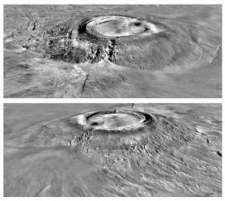
- Water
- Ice
- Wind

Mars

Erosion



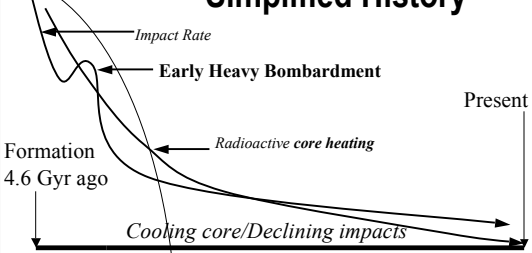
Check Question



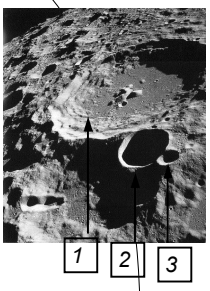
Q. This mountain is an example of:

1. *Impact cratering*
2. *Volcanism*
3. *Tectonics*
4. *Erosion*

Simplified History



How to measure ages?



- Relative dating –
  - *Principle of Superposition*
- Rough dating
  - *Crater counts*
- Absolute dating –
  - *Radioisotopic dating of rocks.*

Principle of Superposition

Can you order the events?

A. Volcanic Eruption

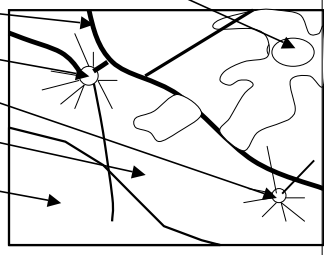
B. Fault

C. Crater

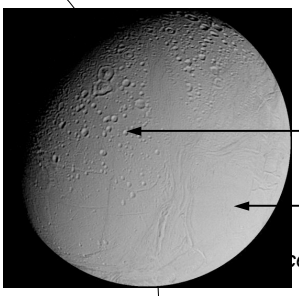
D. Crater

Hills

Cratered Terrain



Crater counts



The older the surface, the more craters.

Old

Young

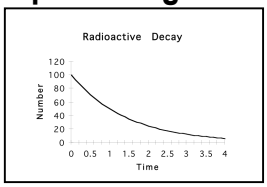
celadus

Radioisotopic Dating

X → **Y**

Parent Element

Daughter Element

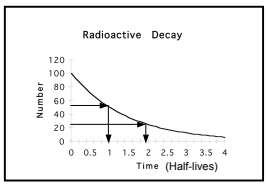


A radioactive element decays into a daughter element at a predictable rate, regardless of temperature.

Half-life

X → Y

Half-life – *time it takes for 1/2 of X to decay into Y.*



Examples of radioactive isotopes:		Half-life
	$^{238}U \rightarrow {}^{206}Pb$	4.5 Gyr
	$^{40}K \rightarrow {}^{40}Ar$	1.3 Gyr
	$^{14}C \rightarrow {}^{14}N$	6,000 yrs

Radiocarbon Dating

Carbon-14 decays to Nitrogen-14
Half-life = 6000 years

Year	C-14	N-14	Fraction left
0	8000	0	
6,000	4000	4000	1/2
12,000	2000	6000	1/4
18,000	1000	7000	1/8

Example Question

Element X decays into element Y with a half-life of 10 million years.

How old is a rock that is found to be 1/4 X ?

The Age of Meteorites

- **Meteorites** are rocks that fall from space.
- Most meteorites are about the same age.
- Age = 4.56 billion years.
- This is the age of the solar system.

SIZE