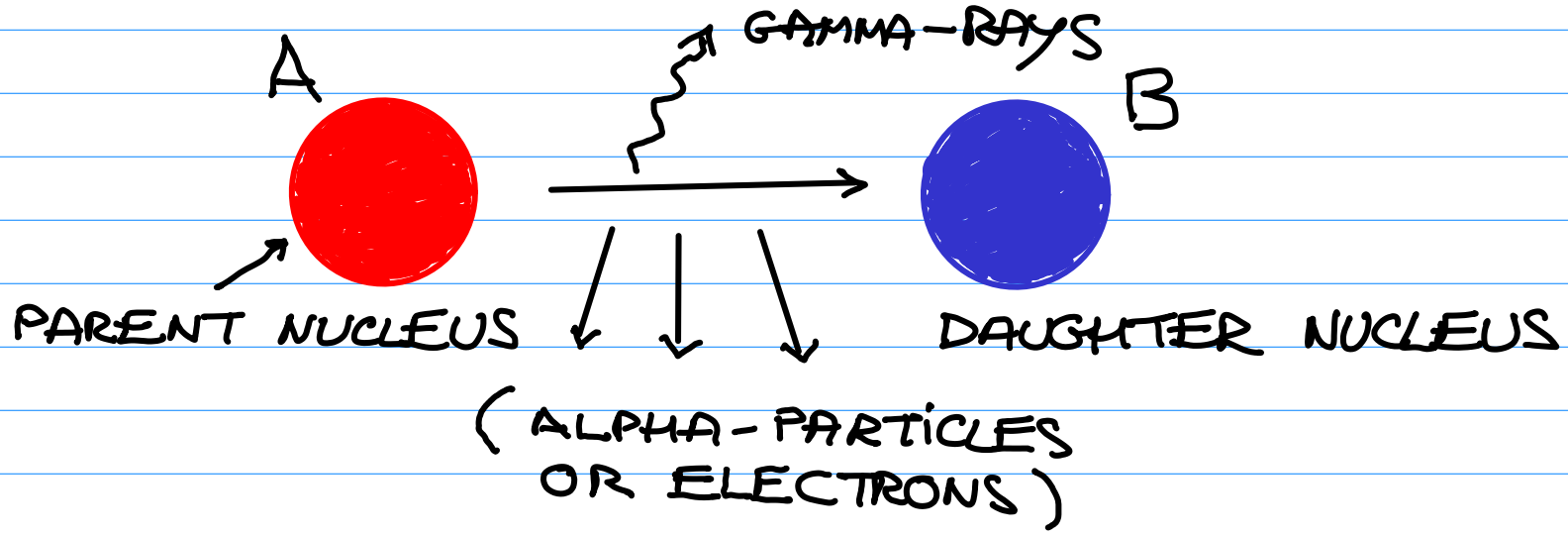
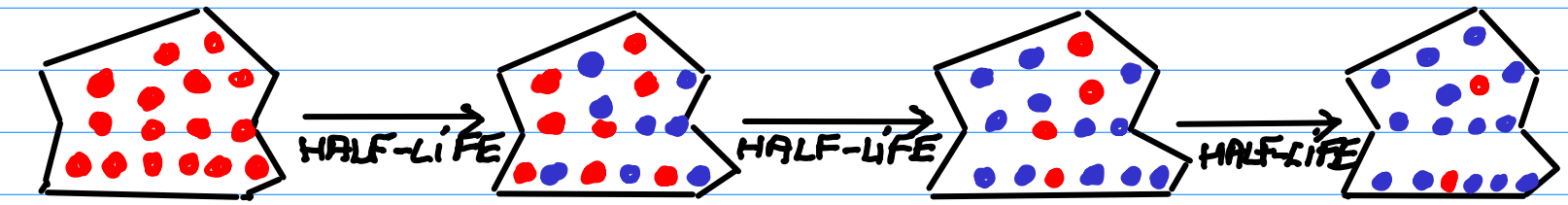
How old is the Solar System?

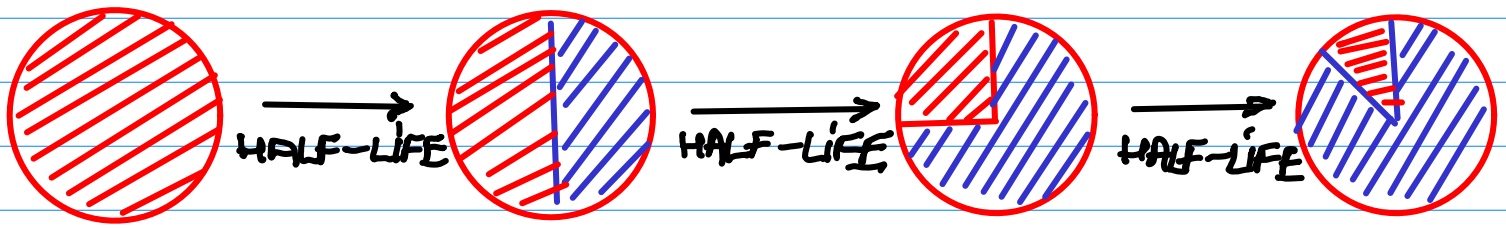
Radiometric dating:



A rock:



Percentage of A:



METHOD OF ROCK DATING: COMPARE THE RELATIVE AMOUNTS OF A AND B AND DEDUCE THE AGE OF THE ROCK FROM THE KNOWN HALF-LIFE OF A.

EXAMPLES:

PARENT	DAUGHTER	HALF-LIFE
^{14}C	^{14}N	5,730 y.
^{40}K	^{40}Ar	1.248 BILL. y.
^{238}U	^{206}Pb	4.47 BILL. y.
^{232}Th	^{206}Pb	14.0 BILL. y.
^{87}Rb	^{87}Sr	48.8 BILL. y.
^{147}Sm	^{143}Nd	106 BILL. y.

EARTH:

- MOST OLD ROCKS ARE 2.5-3.8 BILLION YEARS OLD

- EARTH'S OLDEST KNOW ROCKS ARE IN CANADA AND ARE 4.031 ± 0.003 BILLION

YEARS OLD

- ISOLATED CRYSTALS (BUT NO COMPLETE ROCKS) AS OLD AS 4.4 BILLION YEARS HAVE BEEN FOUND IN AUSTRALIAN SHIELD

CONCLUSION: THE AGE OF THE EARTH IS AT LEAST 4,4 BILLION YEARS

MOON: 3.16 BILLION Y. (LUNAR MARIA) – – 4.5 BILLION Y. (HIGHLANDS)

METEORITES: 4.55 BILLION YEARS

SUN: THEORETICAL CALCULATIONS OF THE PROBABLE AGE BASED ON ITS MASS AND LUMINOSITY GIVE 4.6 BILLION YEARS.

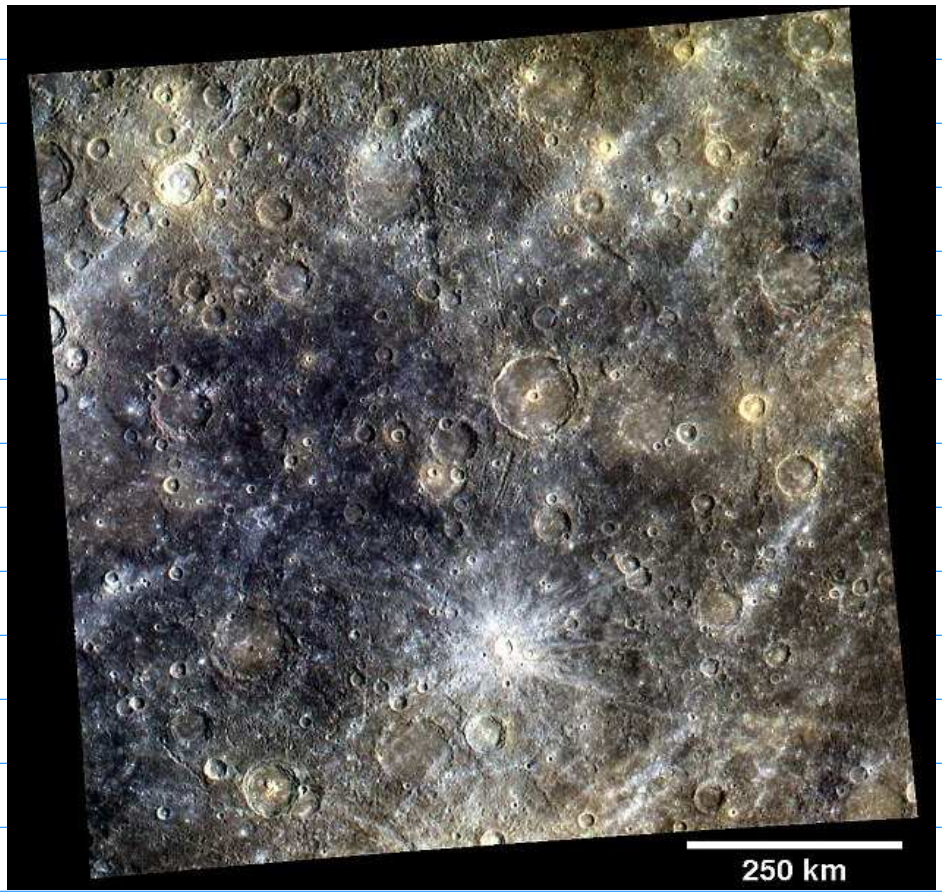
CONCLUSION: SOLAR SYSTEM FORMED ABOUT 4.6 BILLION YEARS AGO

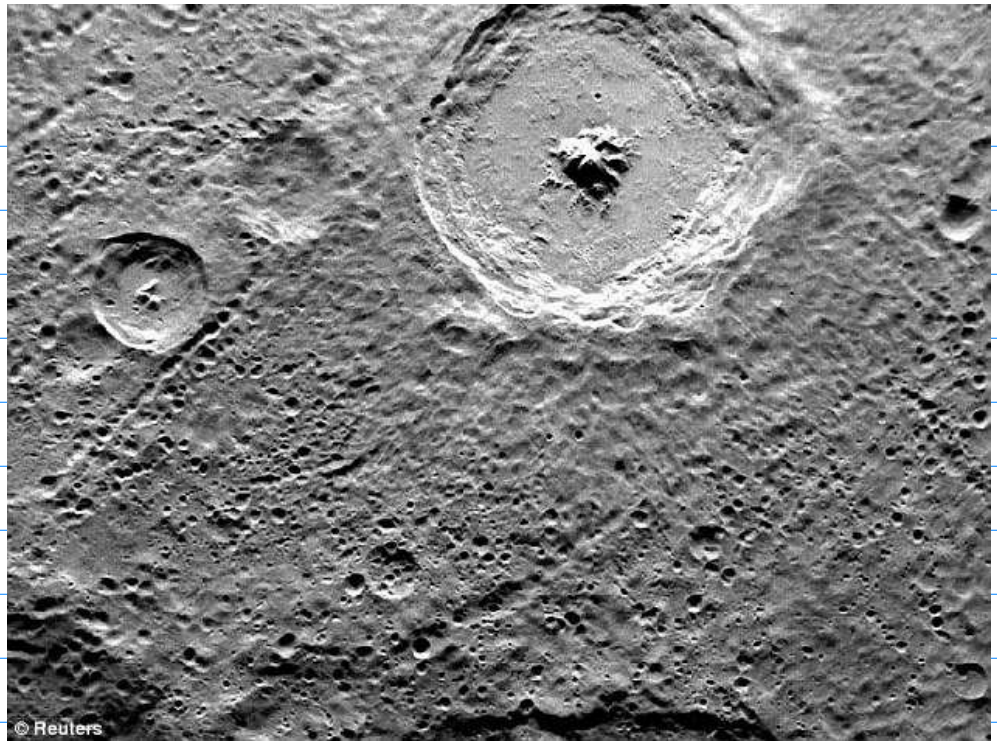
AFTER THE PLANETS WERE FORMED FURTHER EVOLUTION INVOLVES:

INTENSE BOMBARDMENT BY LEFTOVER DEBRIS

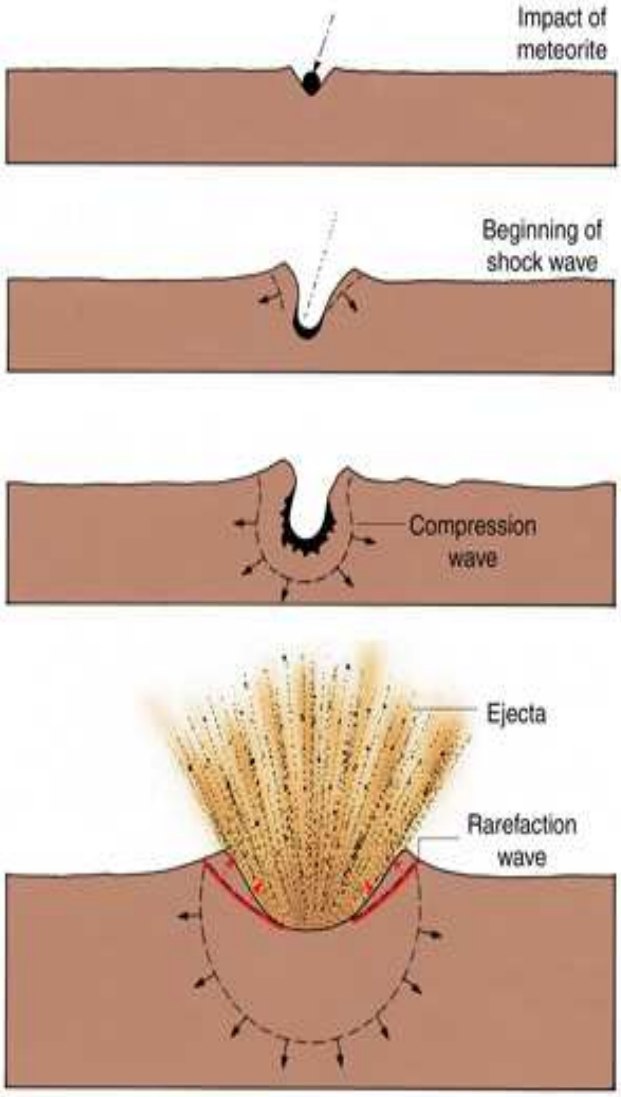
EVIDENCE: IMPACT CRATERS ON MERCURY, VENUS, EARTH AND MARS AND ON NEARLY ALL PLANETARY SATELLITES

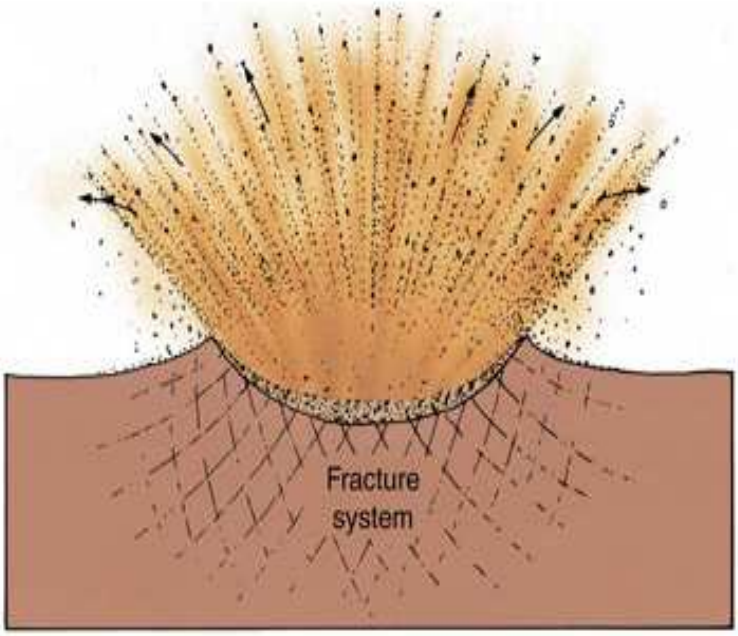
MERCURY:

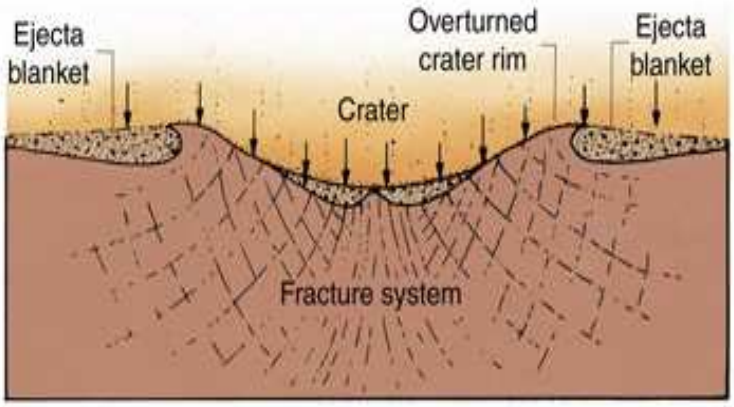




NOTE THE CENTRAL PEAK

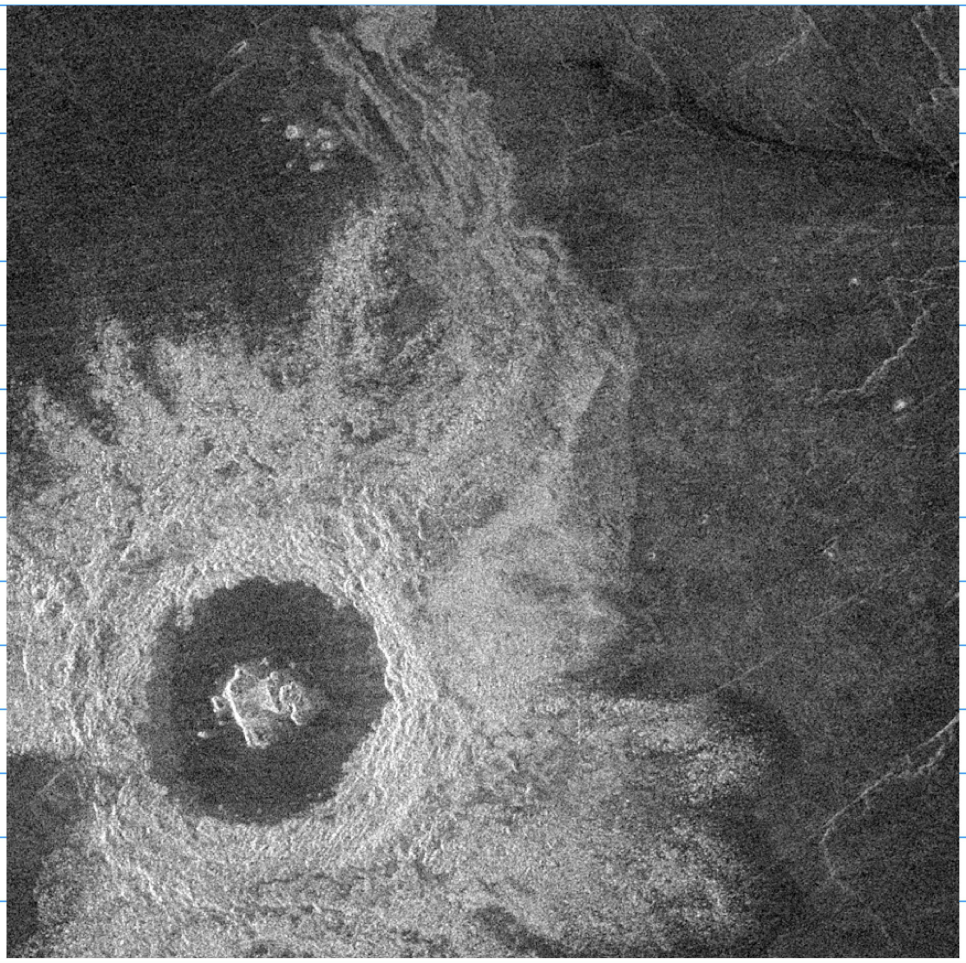






NOTE: THE FLOORS OF IMACT CRATERS ARE LOWER THAN THE SURROUNDING SURFACE.

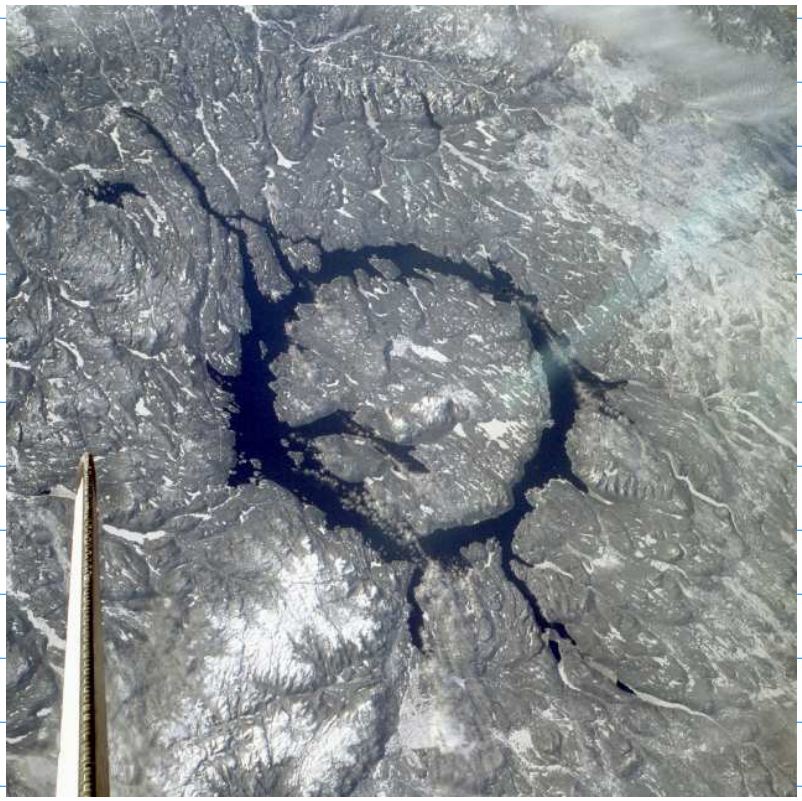
VENUS:



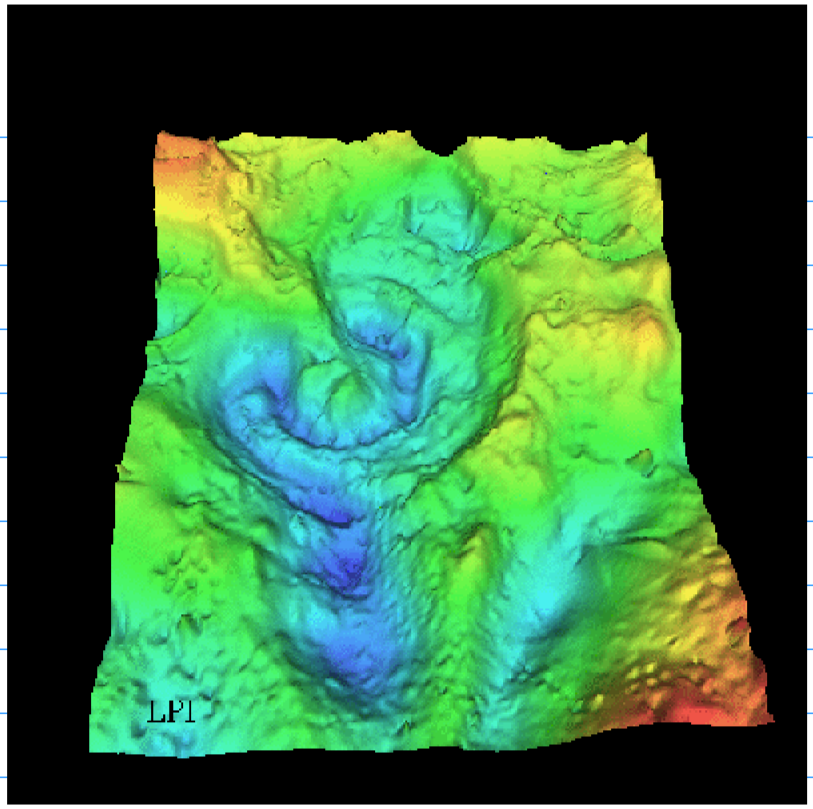
FOSSEY CRATER

EARTH :

ARIZONA

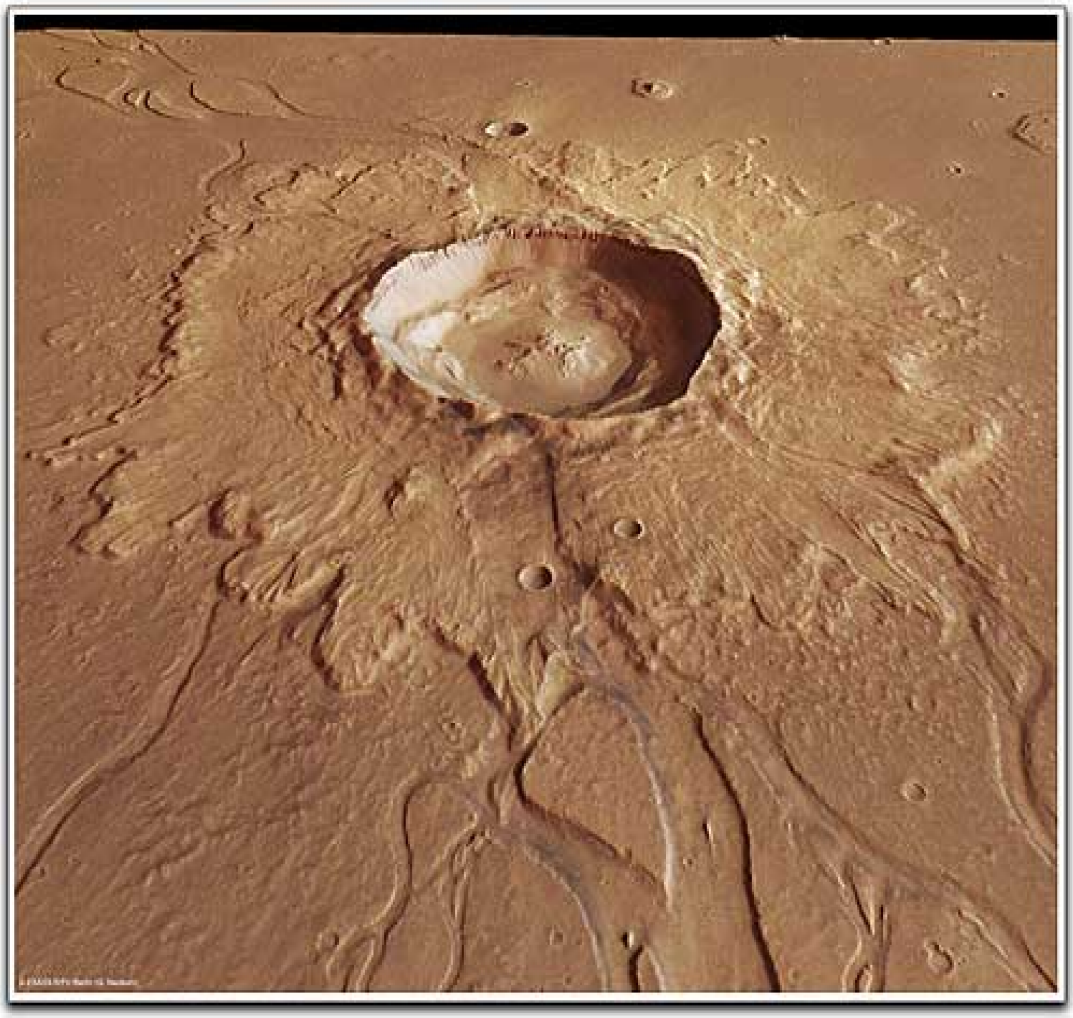


QUEBEC



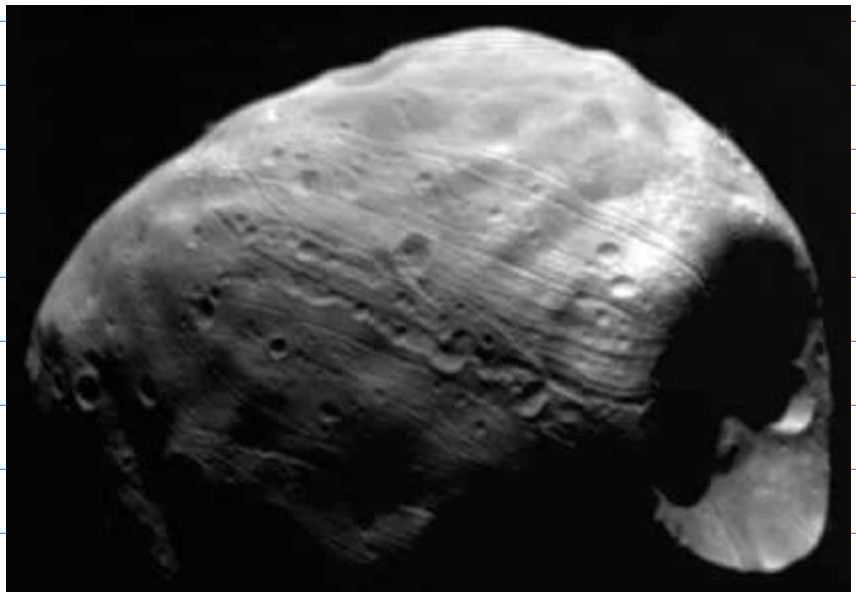
YUCATÁN PENINSULA, MEXICO

MARS:



Moon:

Phobos and Deimos:



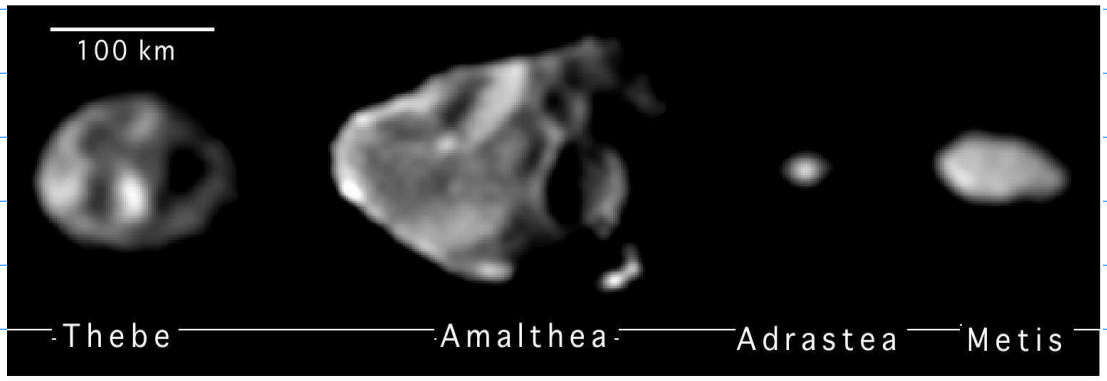
Phobos

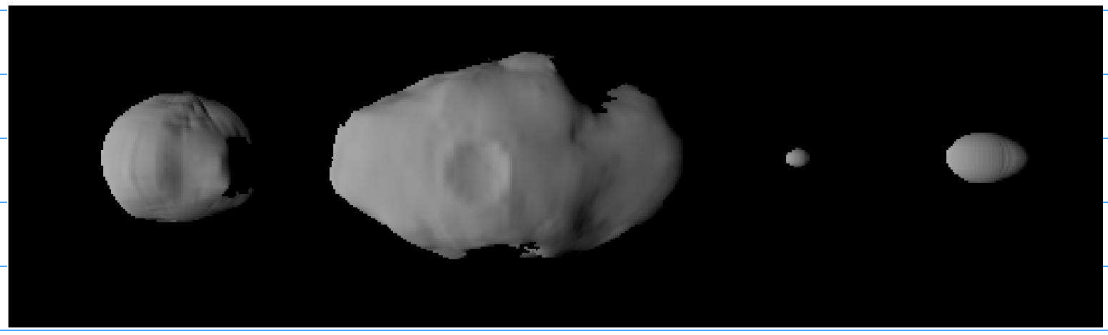
DEIMOS

JUPITER :

CALLISTO

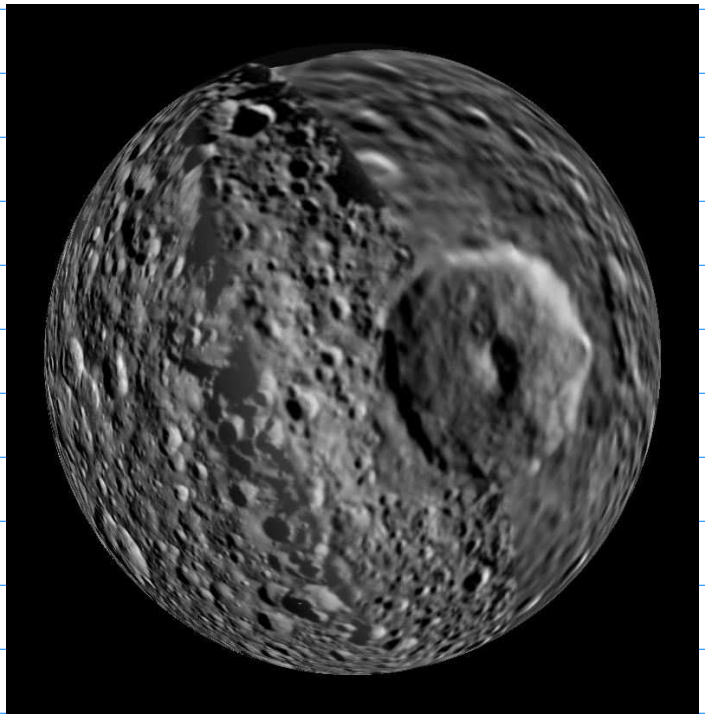
SMALLER MOONS





SATURN :

MIMAS

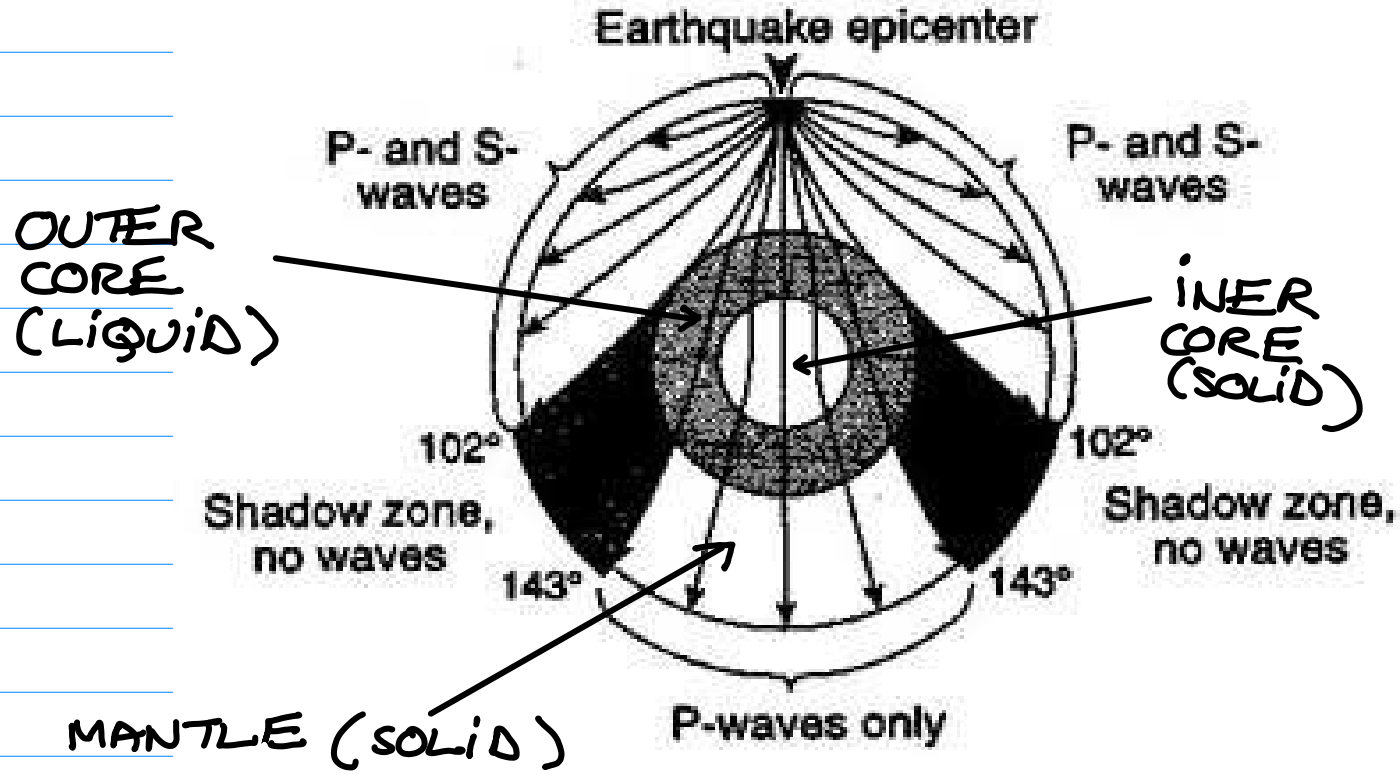


MELTING OF THE INTERIOR AND VOLCANISM

THE HEAT GENERATED BY RADIOACTIVE DECAY PROCESSES OF ^{40}K, ^{238}U, ^{232}Th MELTED THE INTERIOR OF TERRESTRIAL PLANETS.

CONSEQUENCES OF MOLTEN CORE:

- **DIFFERENTIATION**: THE HEAVY MOLTEN METALS (IRON, NICKEL) SINK AND LIGHT SILICATE ROCKS FLOAT TO THE SURFACE.



PROBING THE EARTH'S INTERIOR USING THE SEISMIC WAVES:

P (PRESSURE) - WAVES PROPAGATE THROUGH BOTH SOLID AND LIQUID

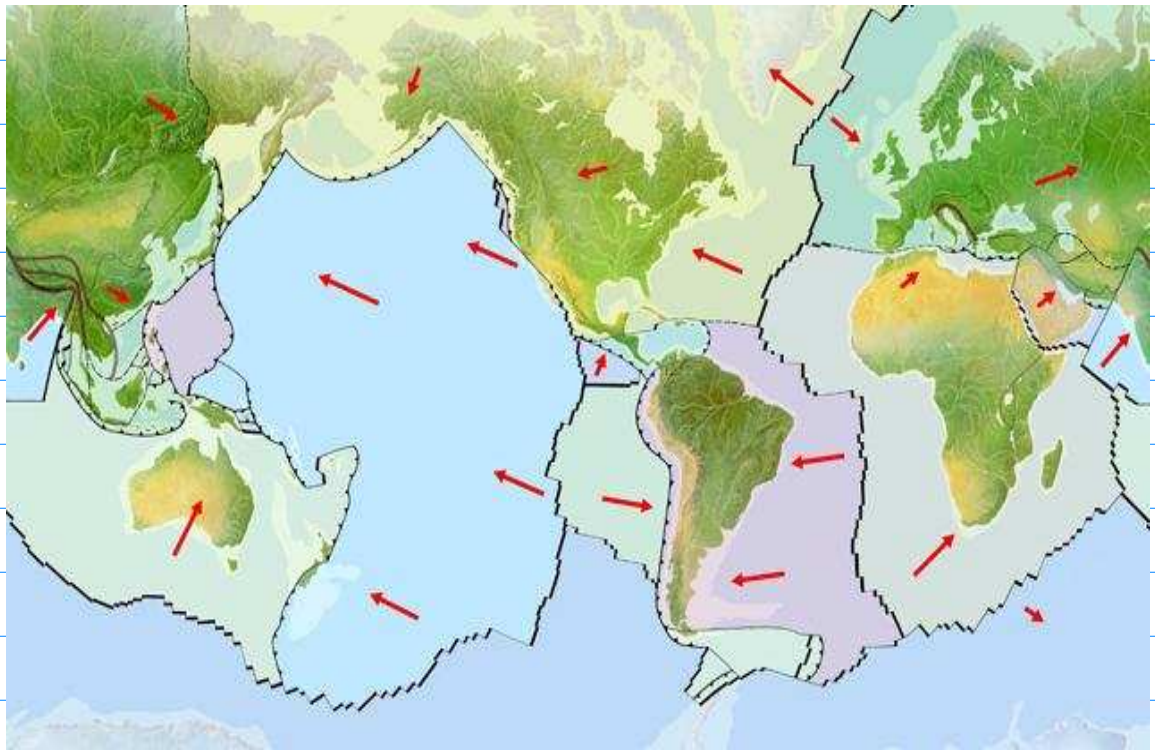
S (SHEAR) - WAVES CAN PROPAGATE ONLY THROUGH SOLID

INER CORE - RADIUS 1,200 km

OUTER CORE - RADIUS 3,500 km

- <u>PLATE TECTONICS</u> (CONTINENTAL DRIFT):

THE TOP ROCK LAYER IS SOLID AND IT MOVES IN LARGE PLATES



First proposed by Alfred Wegener in 1912, but was ignored until 1960s.

Break-Up of Pangea: 200 Million Years Ago to Present

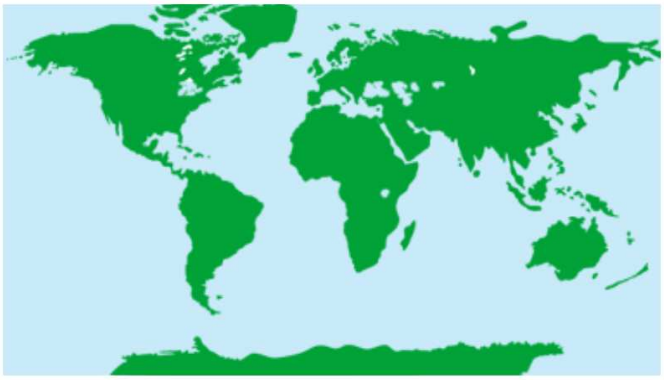
c. 200 Million Years Ago

c. 160 Million Years Ago

c. 120 Million Years Ago

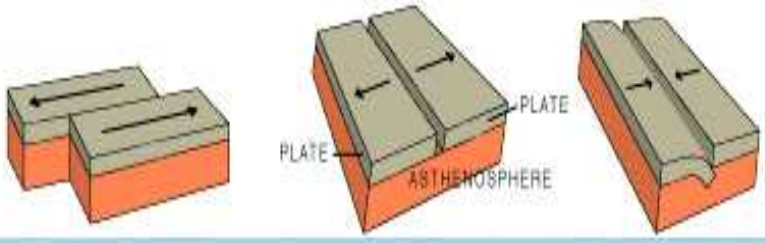
c. 80 Million Years Ago

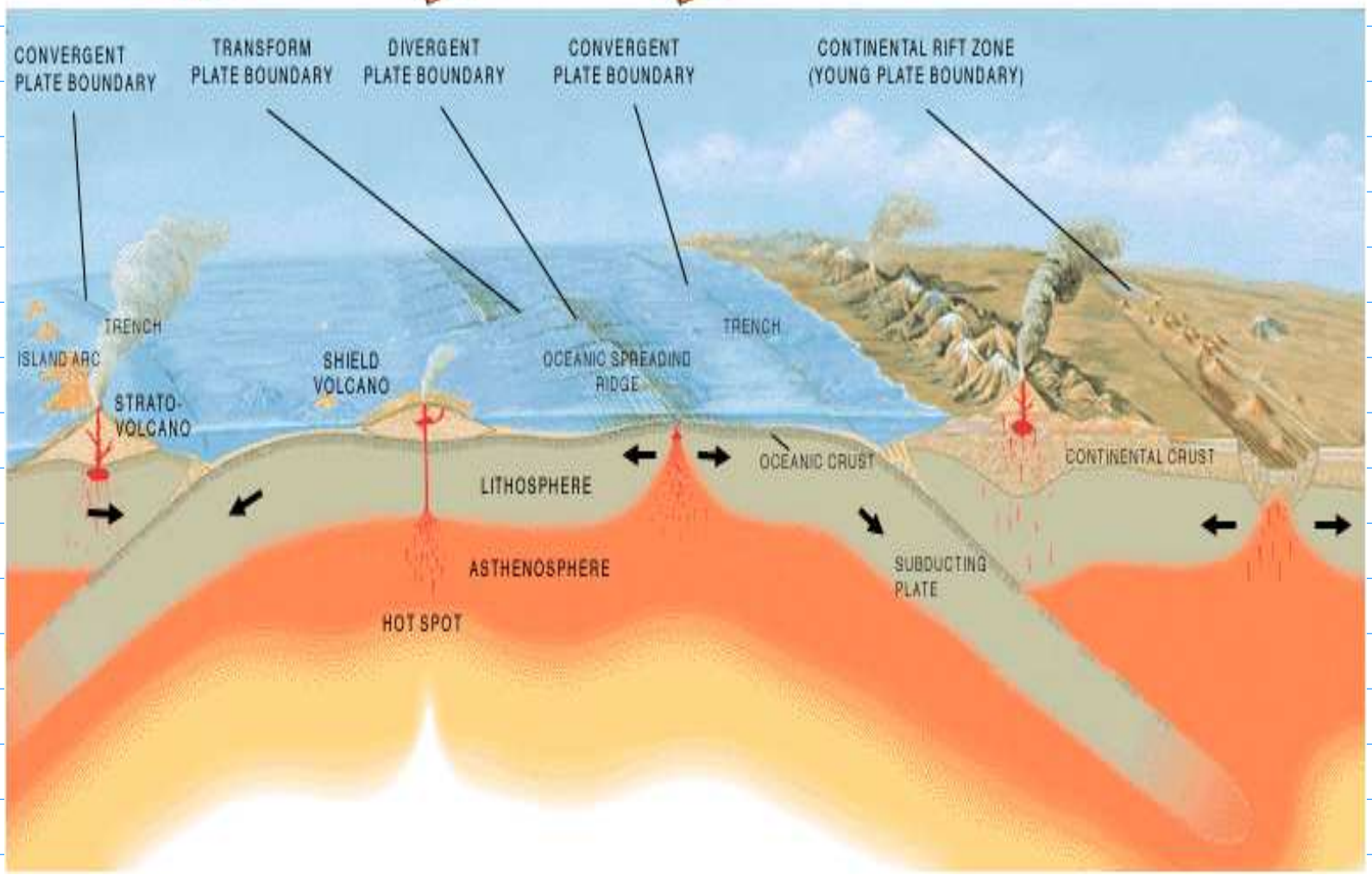
c. 40 Million Years Ago

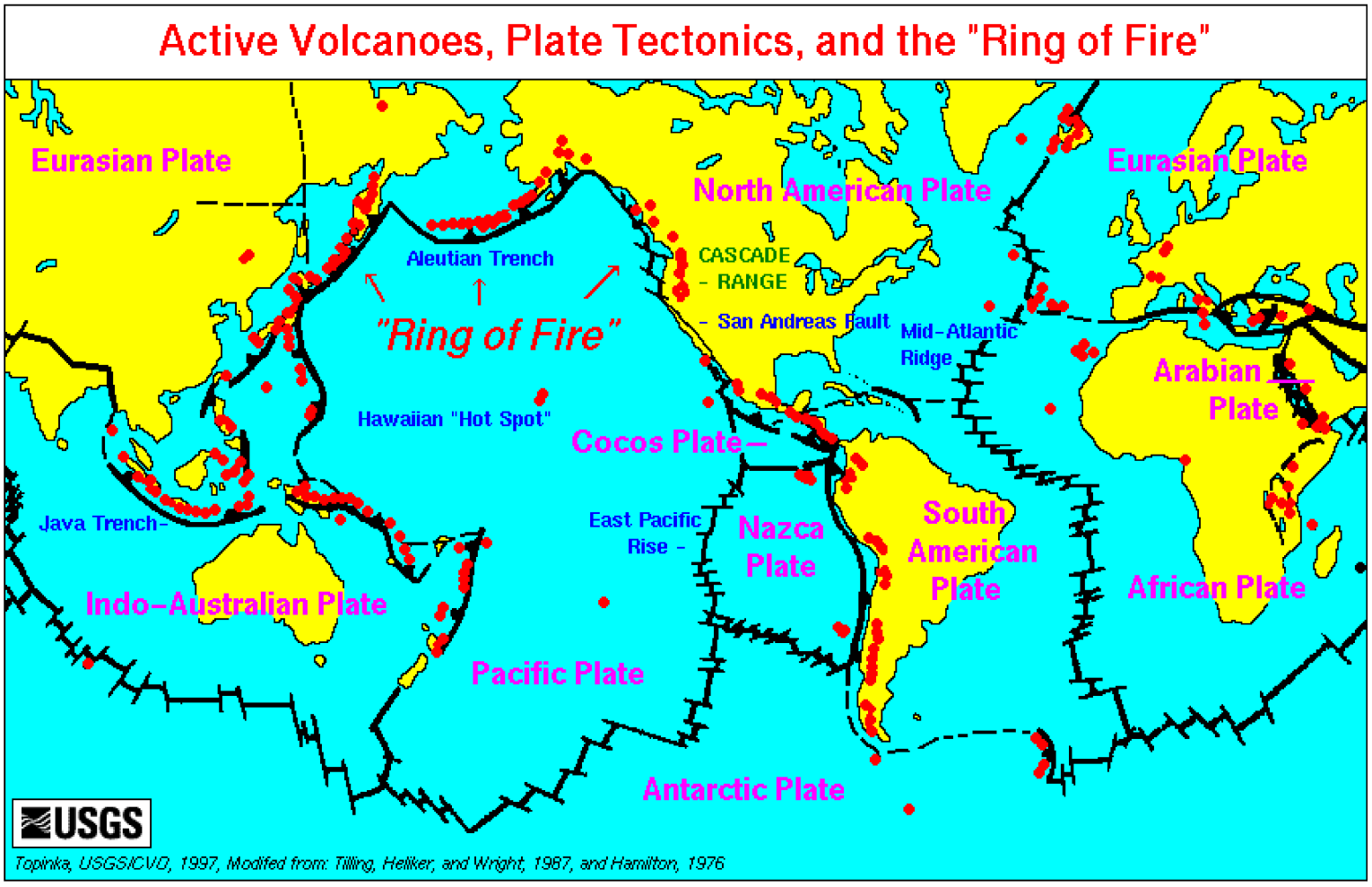


Present Day

- ACTIVE VOLCANOES, ESPECIALLY ALONG THE BOUNDARY OF TWO PLATES

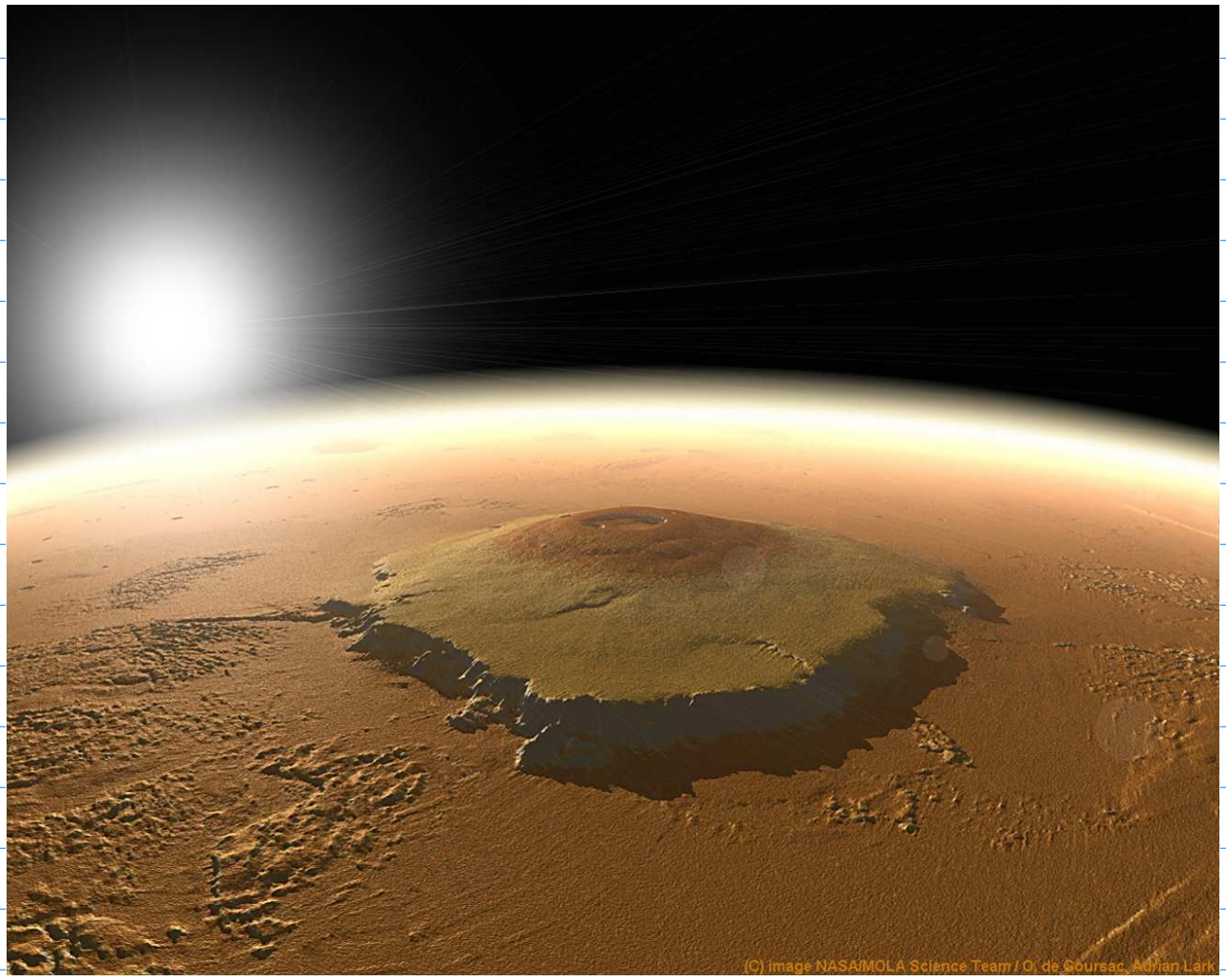






NOTE: THE FLOORS OF VOLCANIC CRATERS ARE HIGHER THAN THE SURROUNDING SURFACE.

MARS HAS AN ENORMOUS DEAD VOLCANO



OLYMPUS MONS

SMALL BODIES (MOON, MERCURY, MARS) COOLED QUICKLY AND MIGHT HAVE A SMALL MOLTEN CORE.

VENUS HAS MORE VOLCANOES THAN ANY OTHER PLANET – OVER 1600 MAJOR VOLCANOES.