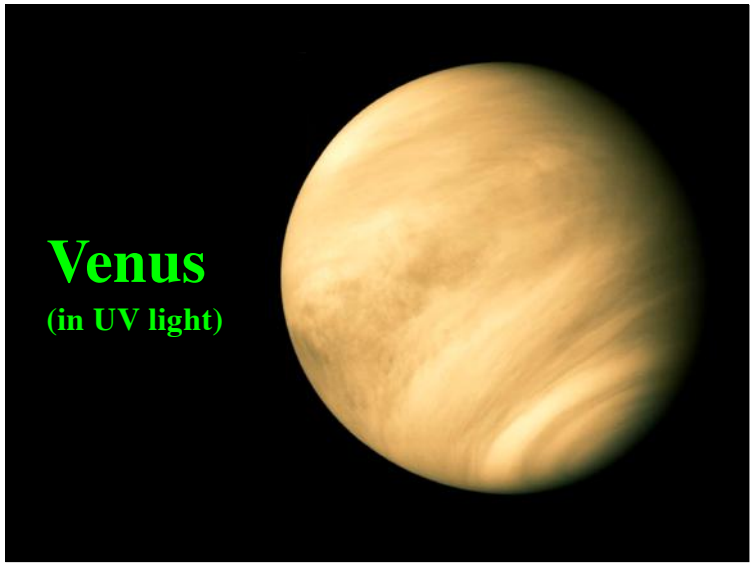


Basic information

Density (avg): 5.2 g/cm^3

Distance from Sun (avg): 0.723 AU

Orbital Period: 225 Earth days

Rotation Period: 243 days + retrograde

Albedo: *0.76 (!)*

Moons: 0

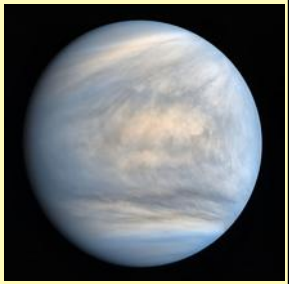
Atmosphere: *much* thicker than Earth's

Tilt of rotational axis: 177º

Venus *"The Evening (Morning) Star"*

- named for *Roman goddess* of love
- ***retrograde*** rotation
- a *featureless disk* from Earth
- *extremely* bright:16 x ***Sirius!***

(eg) *"Evening (Morning) Star"*

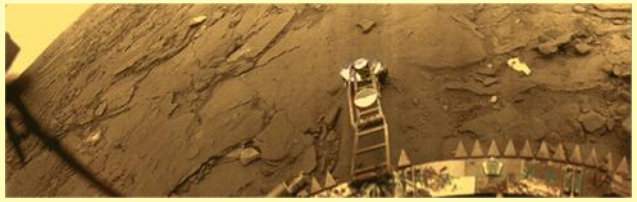


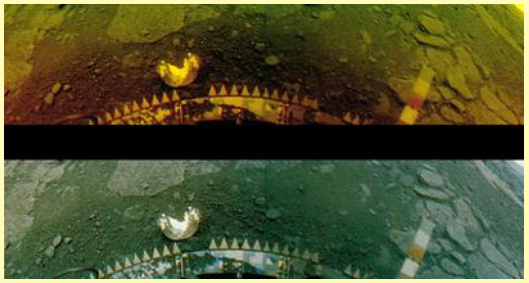
- *perpetual*, *planetwide* cloud
- a possible preview of Earth's (*distant*) future?

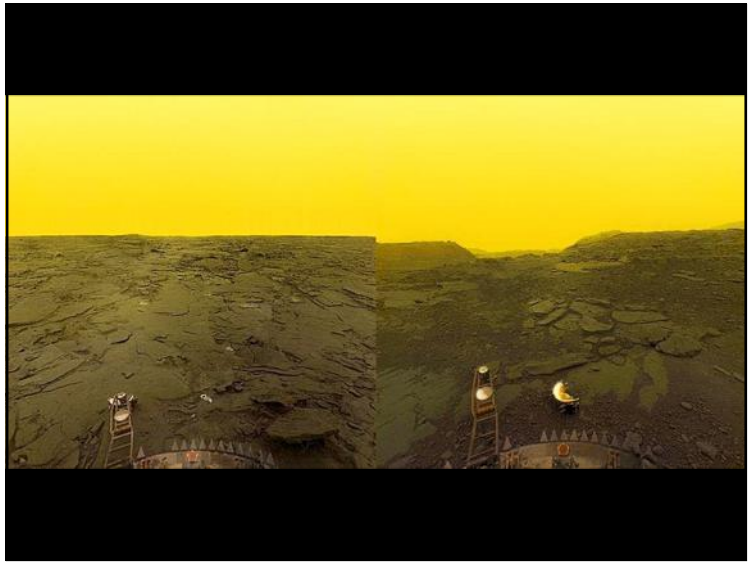
Exploring Venus

- ***Galileo*** noted *phases* via his telescope *(1610)*
- ***Venera*** *landers, orbiters (1961-1984)* *USSR*
- ***Mariner 5*** *flyby (1960's)* *NASA*
- ***Pioneer*** *orbiter (1978)*
- ***Magellan*** *orbiter (1990-94)*
- *radar* mapping *resolution* of ~ *100m*
- ***Venus Express*** *orbiter (2006-2014)* *ESA*
- *atmospheric* observations from 250+ km

• *surface* images: *Russian Venera landers*





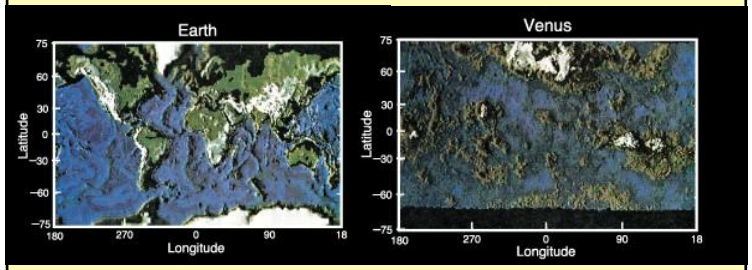


CLICKER: If plate tectonics operated on Venus as on Earth, we'd expect Venus to have … ?

(a) distinct plates/plate boundaries
(b) active volcanism & spreading centers
(c) mountain chains along some plate boundaries
(d) all of the above

Surface Features

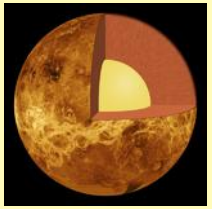
Earth (oceans removed) **Venus** (*has no water*)



• **blue** (*low*), **green** (*near* "sea level"), white (*high*)

Q: *Major differences? Implications?*

Interior Structure

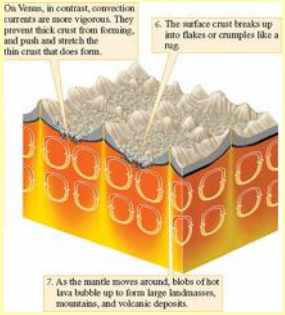


- *no seismic data*
- similar *size/mass/density* – layers?

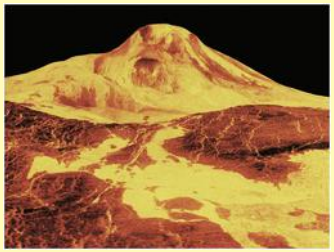
- *no water* to facilitate a *plastic upper mantle*
- ***no*** *evidence of plate tectonics*

- *high surface temperatures*
- *crust* is *thinner* (?) than ***Earth***

- crust *too hot* & *soft* to move as a rigid body; "***flakey tectonics***"



Volcanism

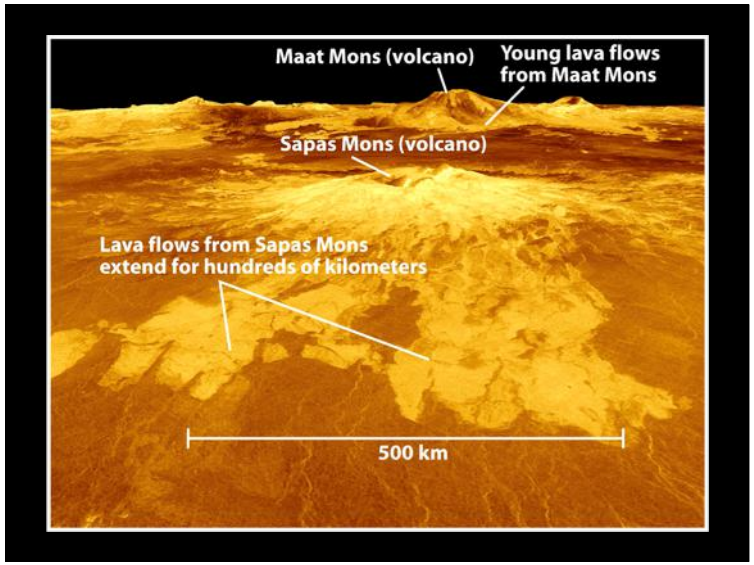


- ***vigorous*** (?) ***convection*** of *mantle* creates "random" ***volcanism***

- highest mountains: ***Maxwell Montes*** (~ 11 km)

- *planetwide volc plains* (~80%); *young* (~500 My)
- *crater counts/dist'n* (more than Earth, *uniform*)

- surface "roughness", atmospheric SO_2 – young?
- ***ongoing*** flows <100 My (?)



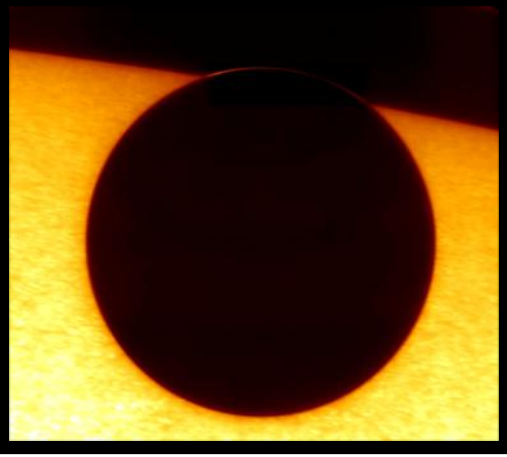
Atmosphere

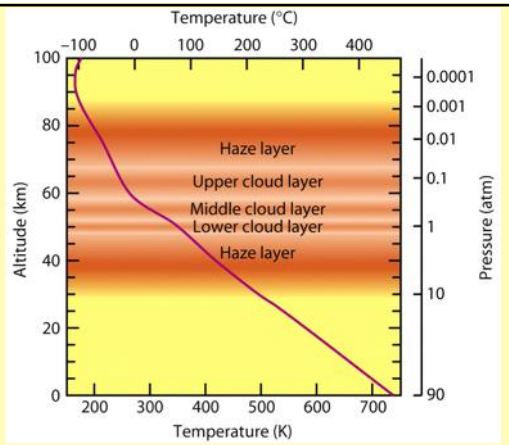
- source: *volcanism*

	Venus	Earth	Mars
Nitrogen (N_2)	3.5%	78.08%	2.7%
Oxygen (O_2)	almost zero	20.95%	almost zero
Carbon dioxide (CO_2)	96.5%	0.035%	95.3%
Water vapor (H_2O)	0.003%	about 1%	0.03%
Other gases	almost zero	almost zero	2%

- atmospheric pressure: ~100 x Earth's
- like being 1 km (*~3000 feet)* below the ocean

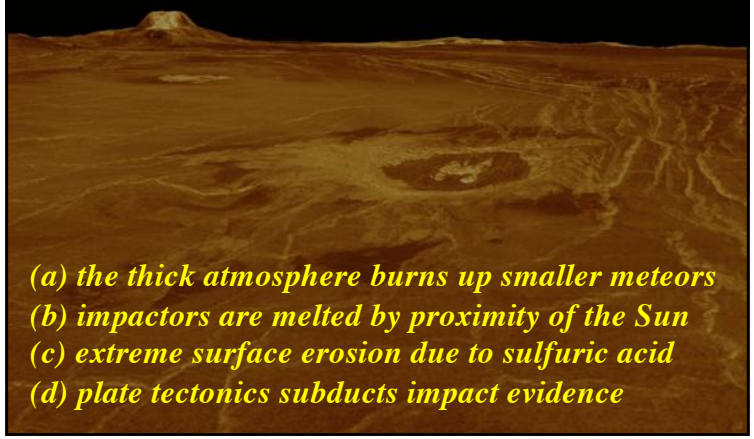
Venus (June 8, 2004)





- note *thickness* of *clouds*, *temperature*
- *sulfuric acid rain* (~car battery!) *vaporizes*

CLICKER: ***We see few small diameter craters on Venus because … ?***



(a) the thick atmosphere burns up smaller meteors
(b) impactors are melted by proximity of the Sun
(c) extreme surface erosion due to sulfuric acid
(d) plate tectonics subducts impact evidence

Temperatures: A Runaway Greenhouse

- "*daytime*" temp: 740 K (467˚C)

(eg) ***hotter*** than ***Mercury***!

- "*nighttime*" temp: 740 K - *why the same?*
- *no liquid oceans* or *plant life* to absorb CO_2
- H_2O vapour & CO_2 *trap* heat

(eg) *works like your car interior on a hot day*

CLICKER: The very high surface temperatures on Venus are due to a "runaway" greenhouse effect. Why did this process begin on Venus?

(a) an extremely slow rotation period
(b) a high albedo
(c) proximity to the Sun
(d) continuous, ongoing volcanic activity

Magnetic Field

Q: *Do we expect Venus to have a magnetic field?*

- ***Venus*** has a (*molten*) *iron core* (high *density*) but ***no*** *magnetic field*

- *rotation rate* is *too slow?*
- *lack* of *core convection?*