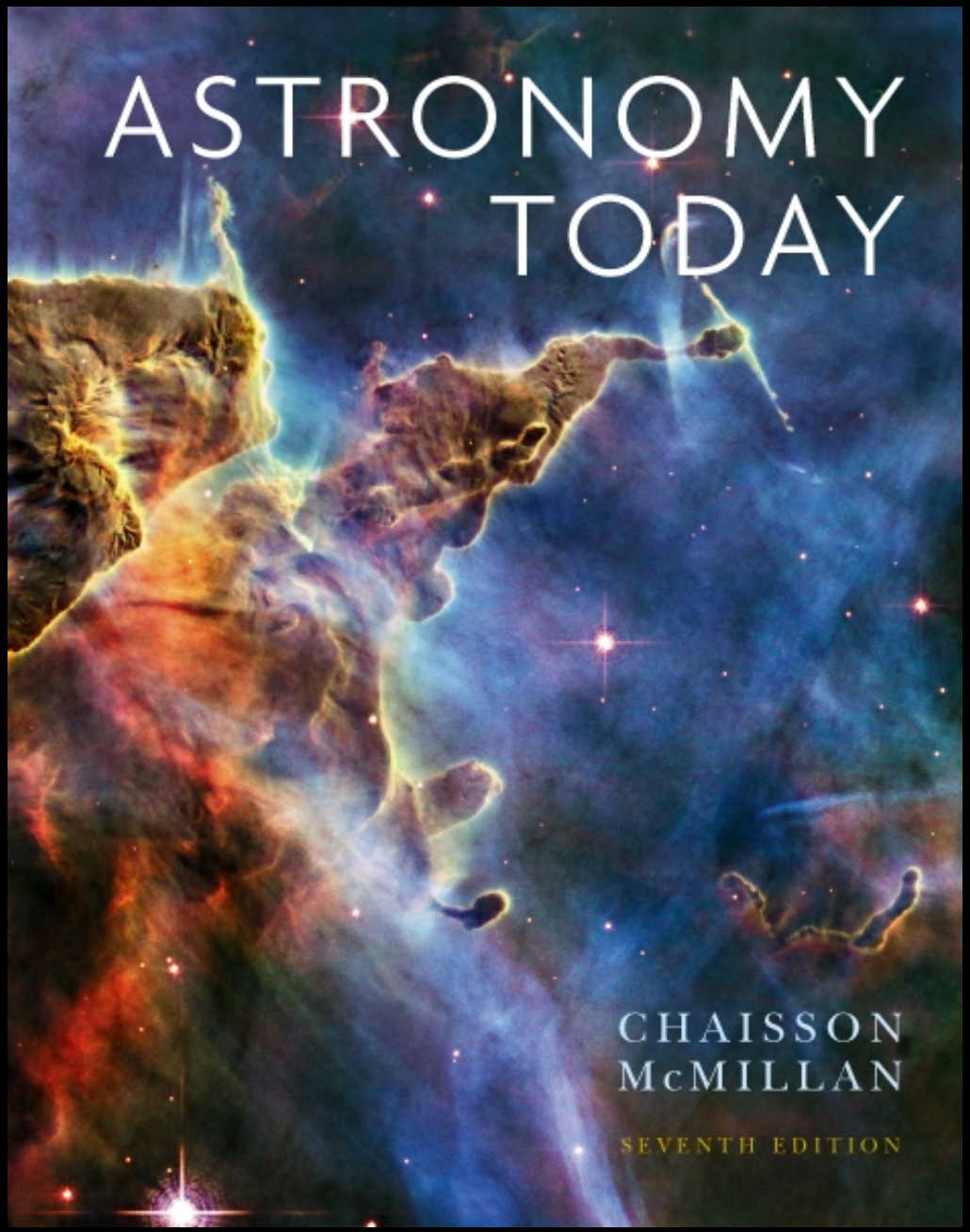


Lecture Outlines

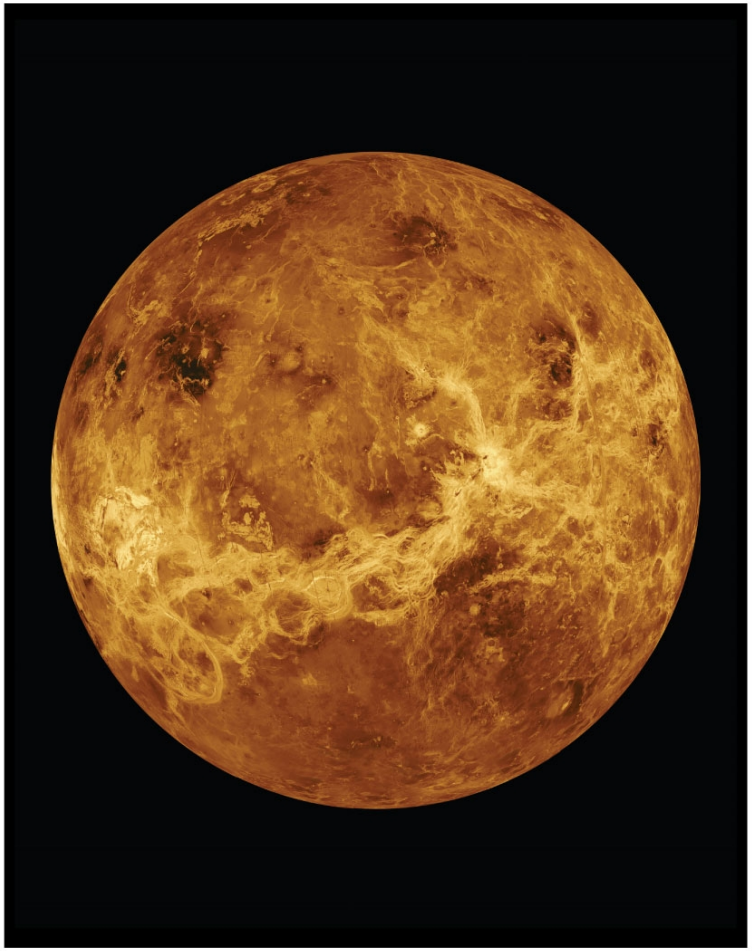
Chapter 9

Astronomy Today

7th Edition

Chaisson/McMillan

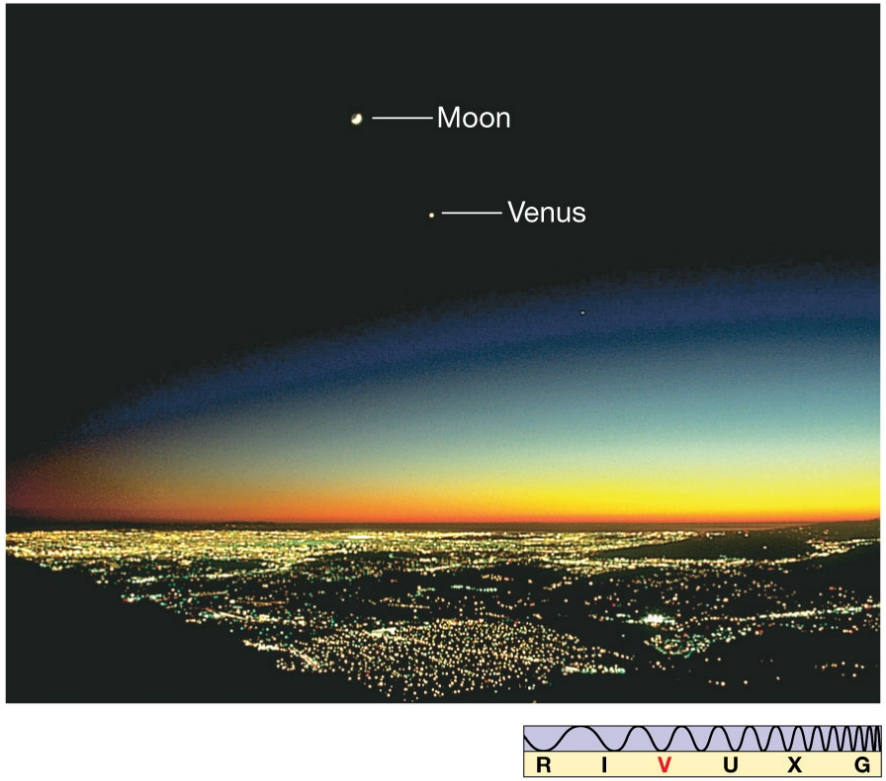
Chapter 9
Venus



Units of Chapter 9

9.1 Orbital Properties

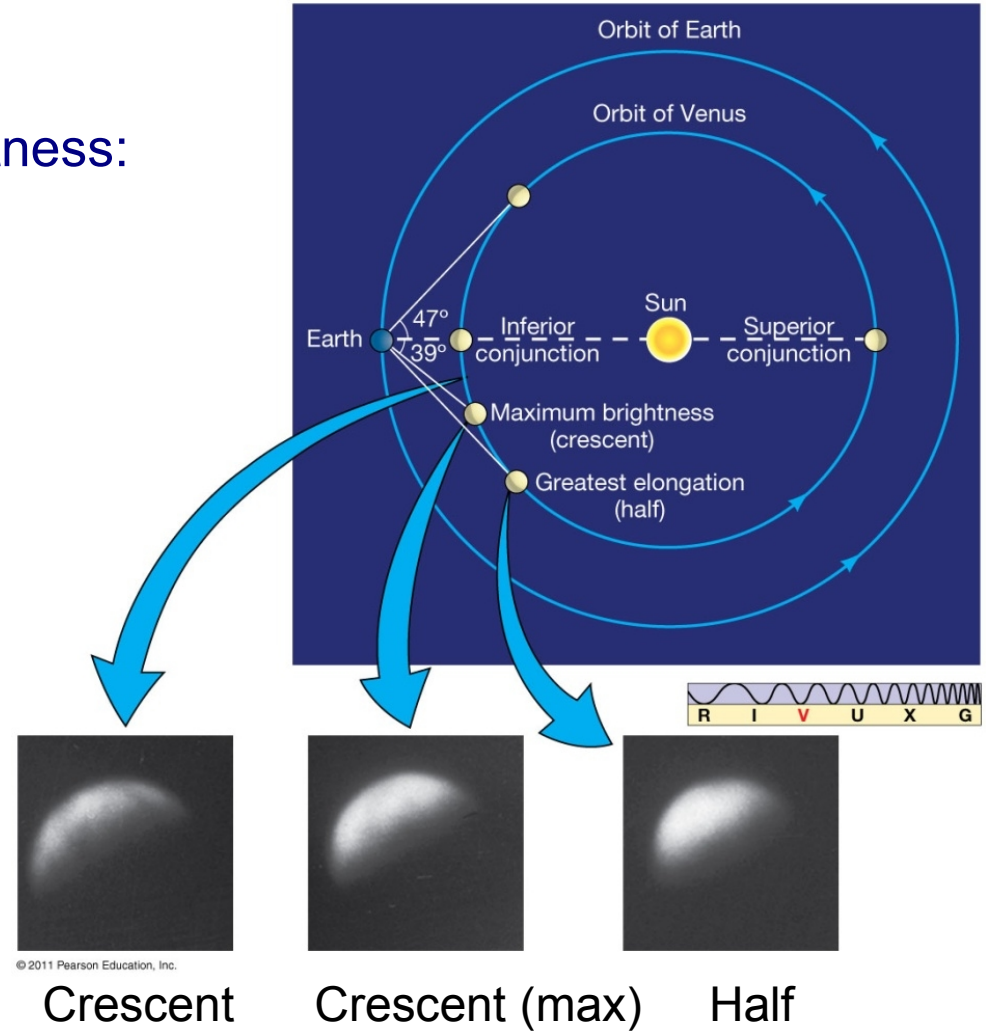
- Venus is much brighter than Mercury, and can be farther from the Sun
- Called morning or evening star, as it stays <47° from Sun
- Brightest object in the sky, after Sun and Moon



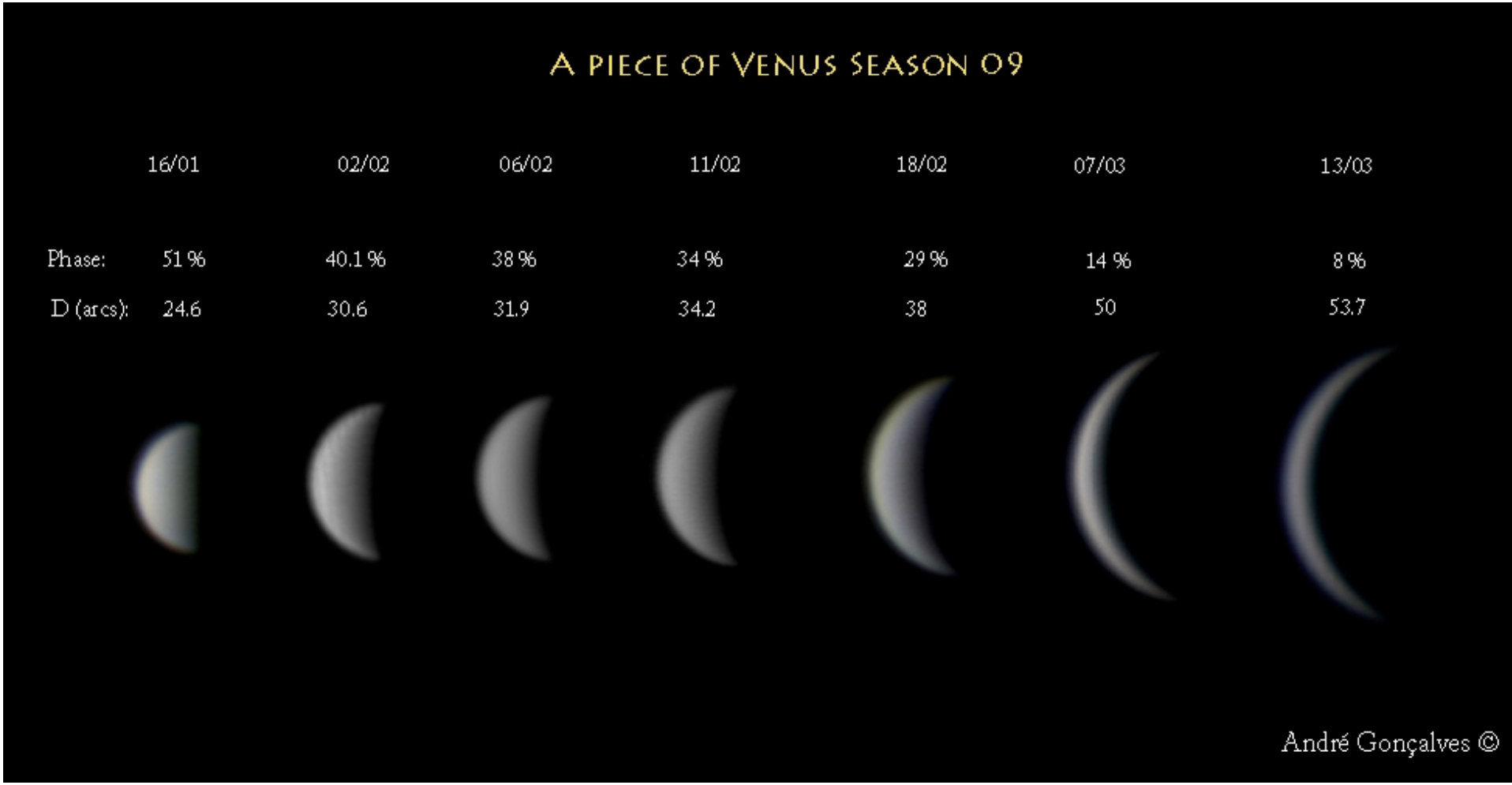
9.1 Orbital Properties

Apparent brightness of Venus varies, due to changes in phase and distance from Earth

Other factors determining brightness:
Size of planet
Distance of planet from Sun
Albedo (reflectivity)



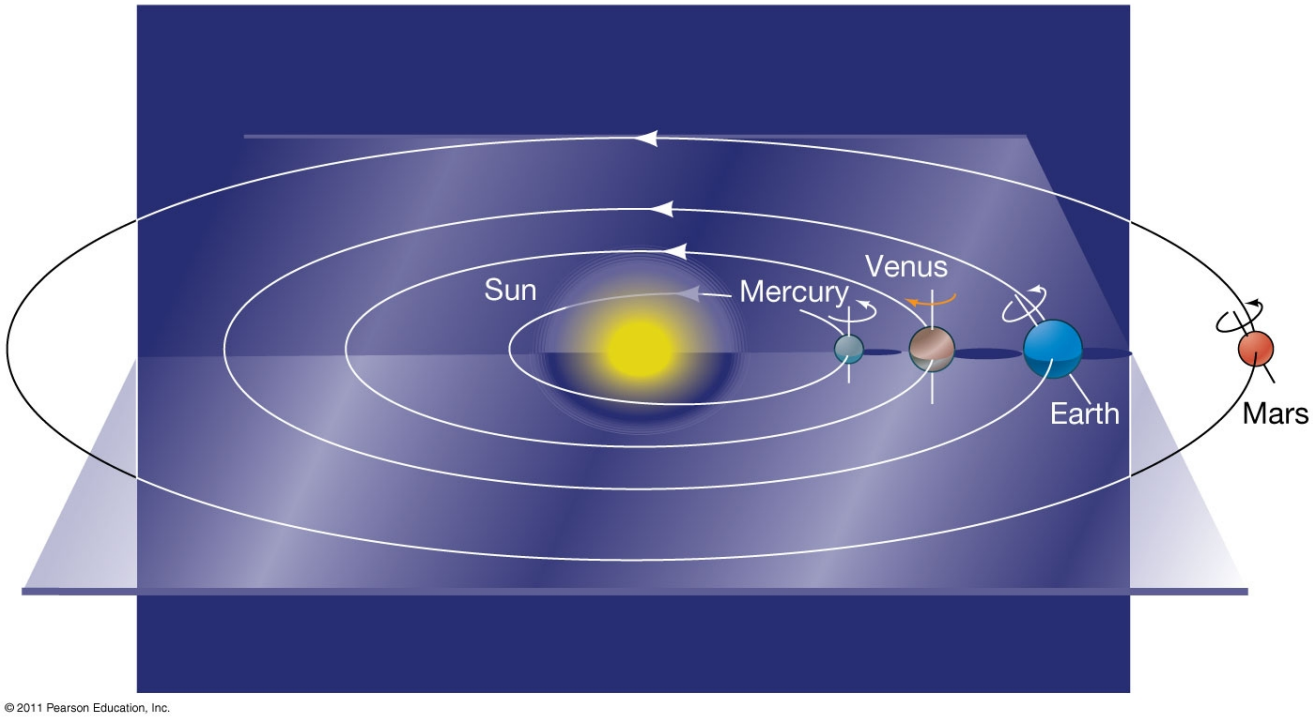
9.1 Orbital Properties



The apparent size of Venus changes with the phase.

9.2 Physical Properties

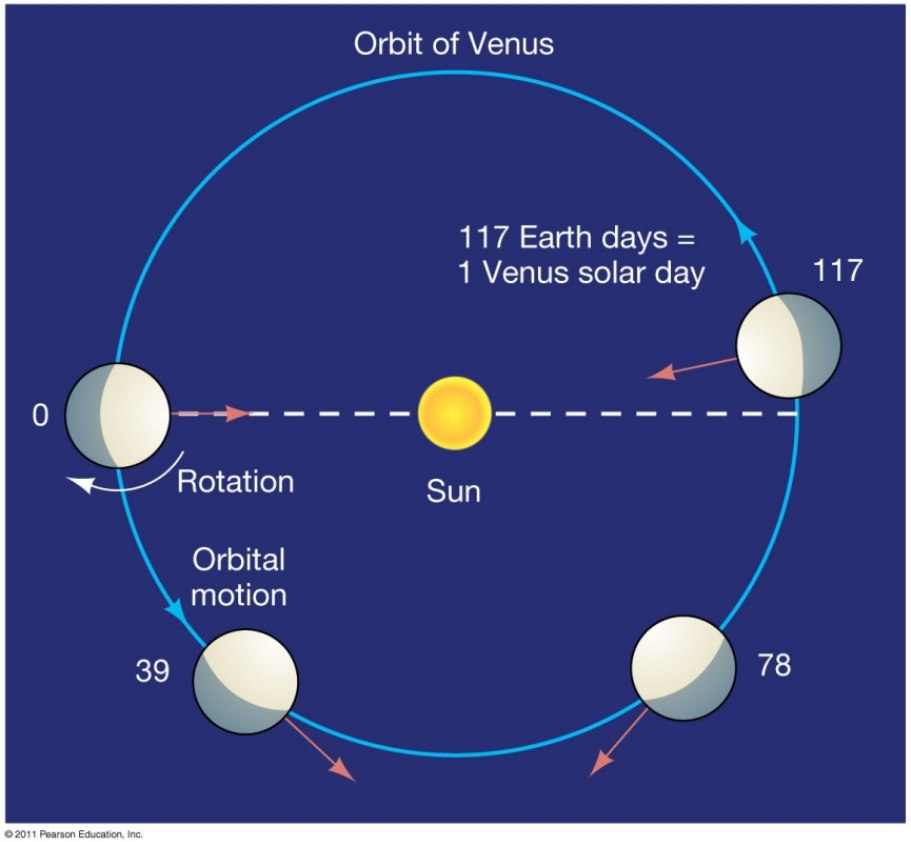
- Radius: 6000 km
- Mass: 4.9 x 10^{24} kg
- Density: 5200 kg/m^3
- Rotation period: 243 days, retrograde



9.2 Physical Properties

Slow, retrograde rotation of Venus results in large difference between solar day (117 Earth days) and sidereal day (243 Earth days); note that the solar day is a large fraction of the year, and the sidereal day is even longer than the year.

The synodic period of Venus is 583.92 d. This is 5.0015 times Venus' solar day (116.75 d). It is tempting to suspect a 5:1 tidal resonance with the Earth, but the ~4 hr difference is real.



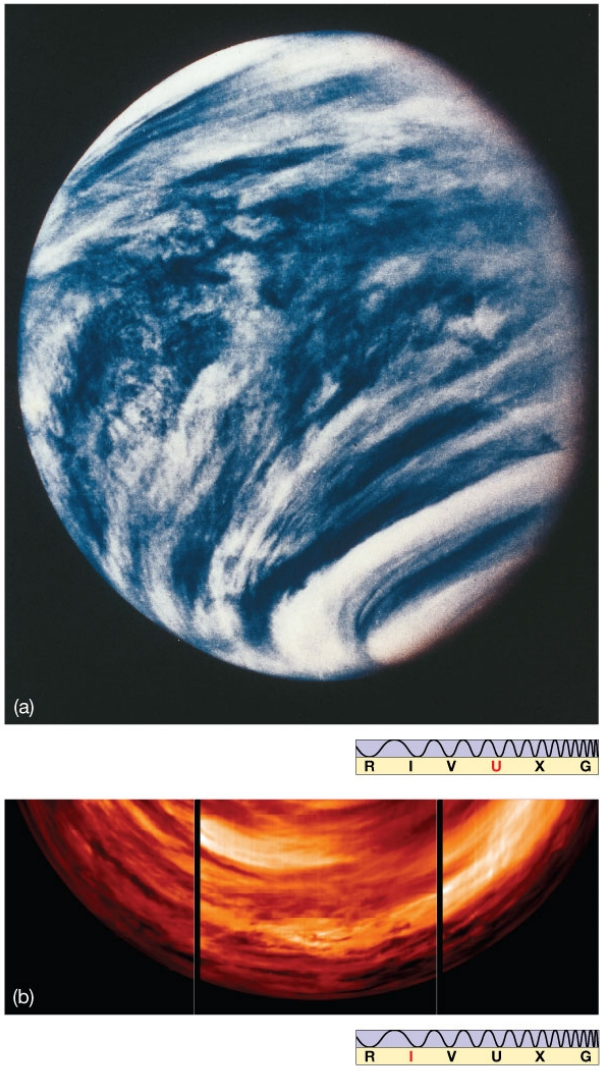
9.3 Long-Distance Observations of Venus

Dense atmosphere and thick clouds make surface impossible to see

Surface temperature is about 730 K—hotter than Mercury!

9.3 Long-Distance Observations of Venus

Even probes flying near Venus, using ultraviolet or infrared, can see only a little deeper into the clouds



9.4 The Surface of Venus

Surface is relatively smooth

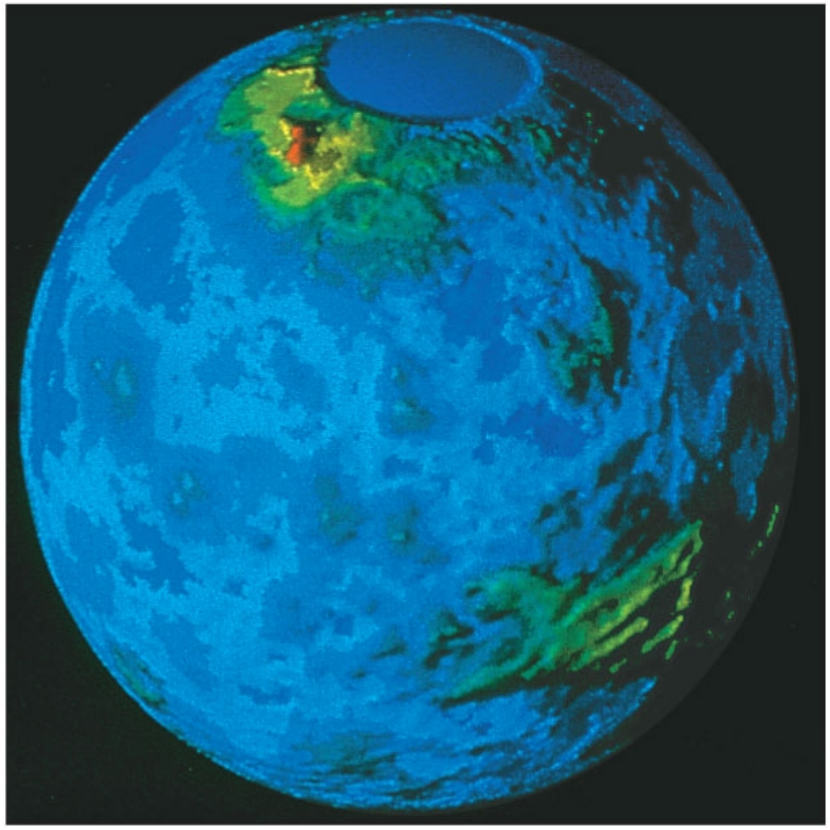
Two continent-like features: Ishtar Terra and Aphrodite Terra

No plate tectonics

Mountains, a few craters, many volcanoes and large lava flows

9.4 The Surface of Venus

Surface mosaics of Venus



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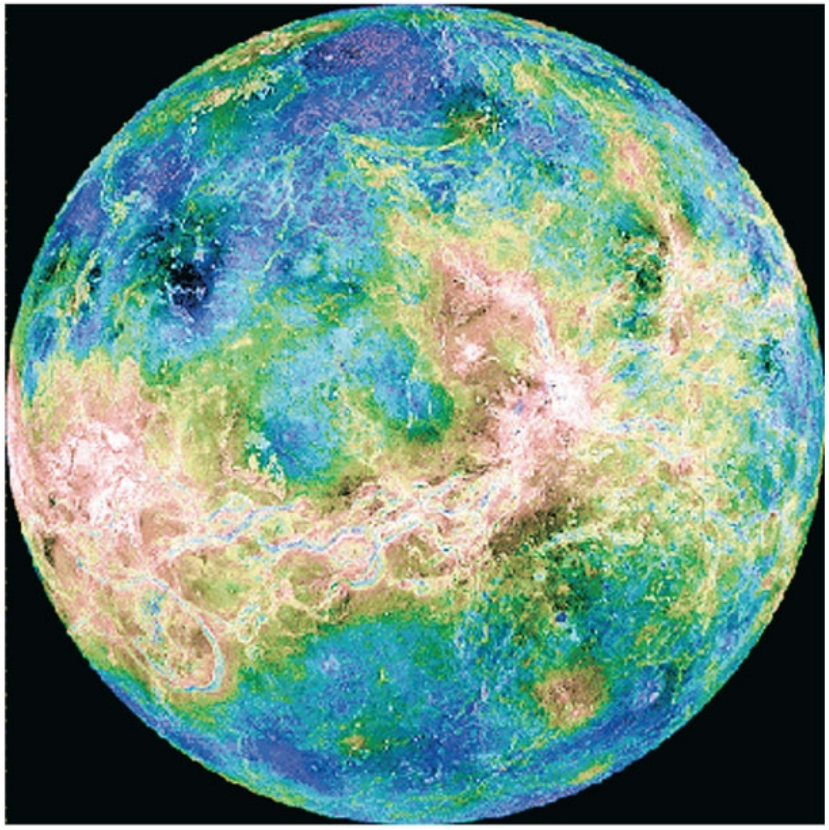
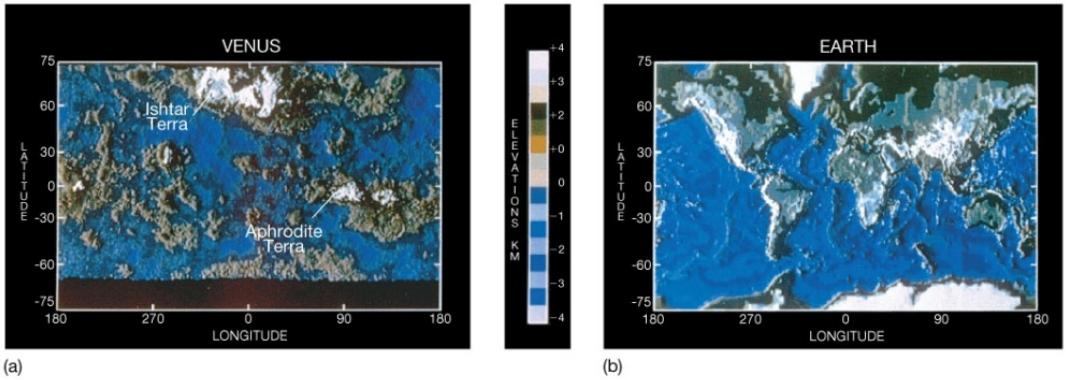


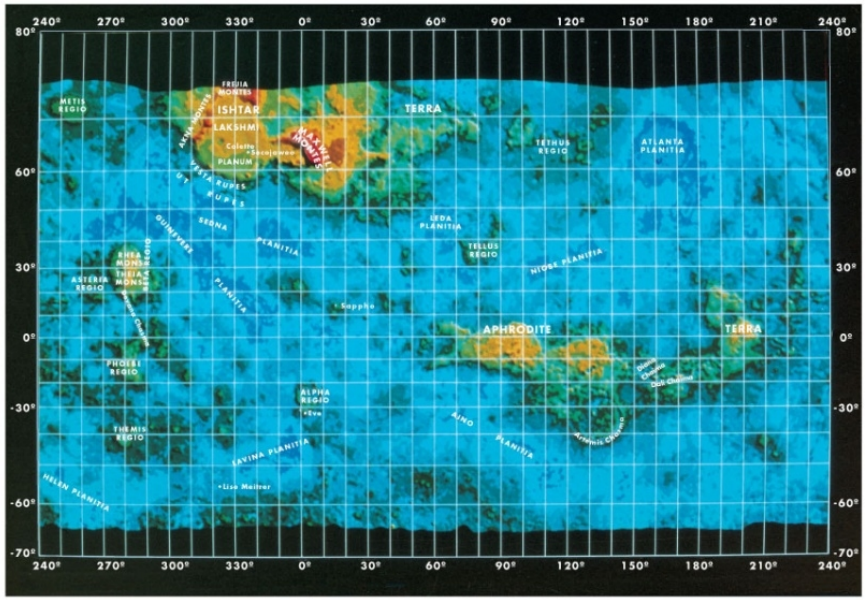
(b)

9.4 The Surface of Venus

Surface maps of Venus, with Earth comparison



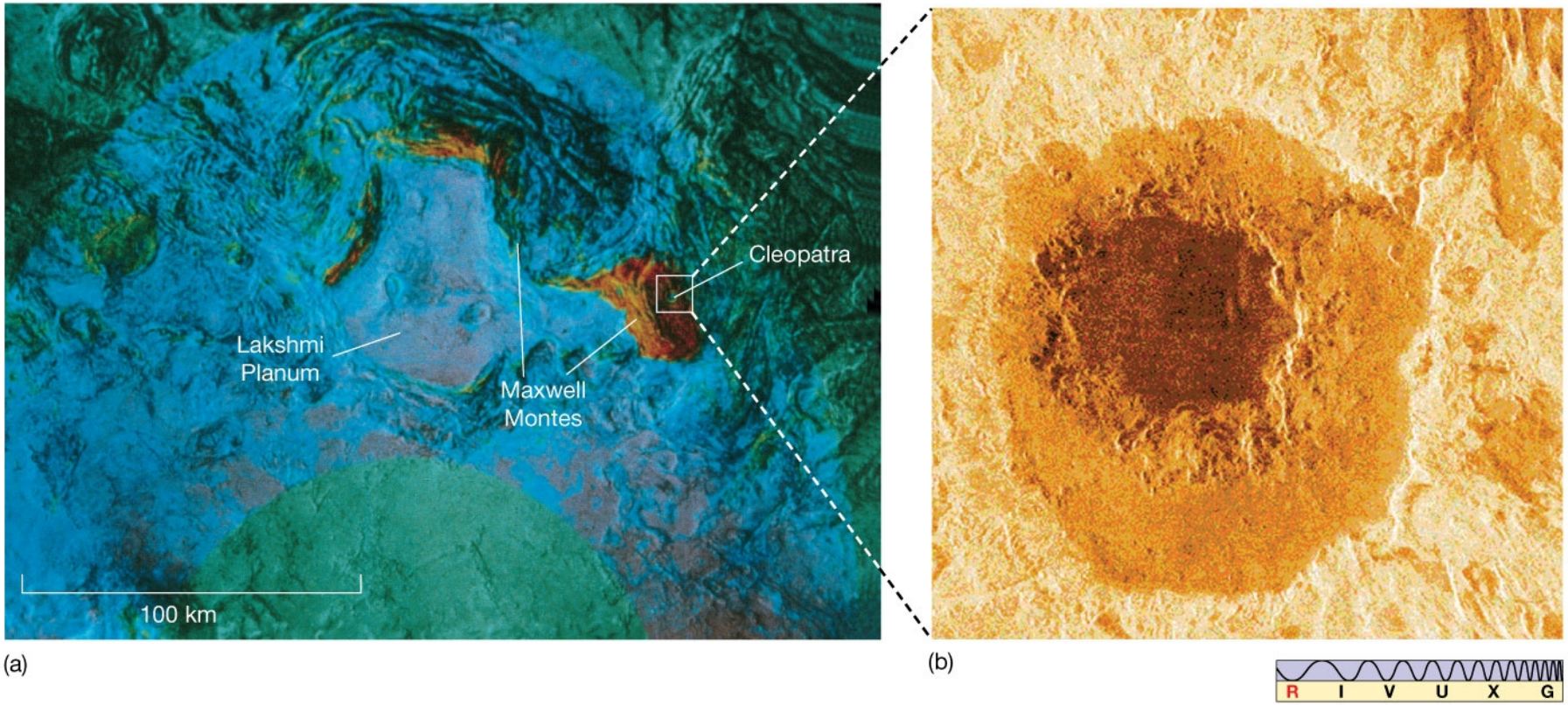
(a) (b)



(c)

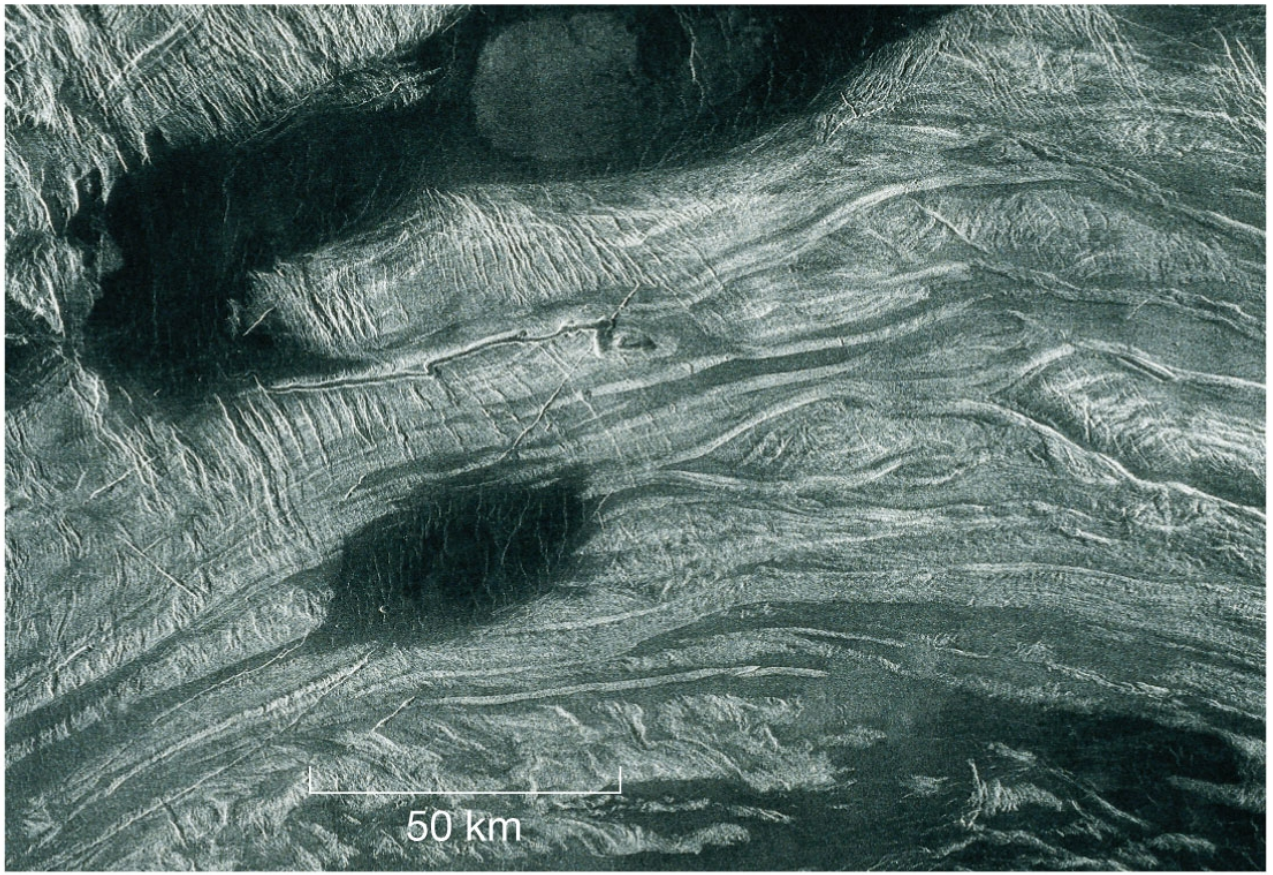
9.4 The Surface of Venus

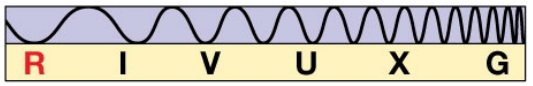
Ishtar Terra is one of two continent-sized features on the surface of Venus



9.4 The Surface of Venus

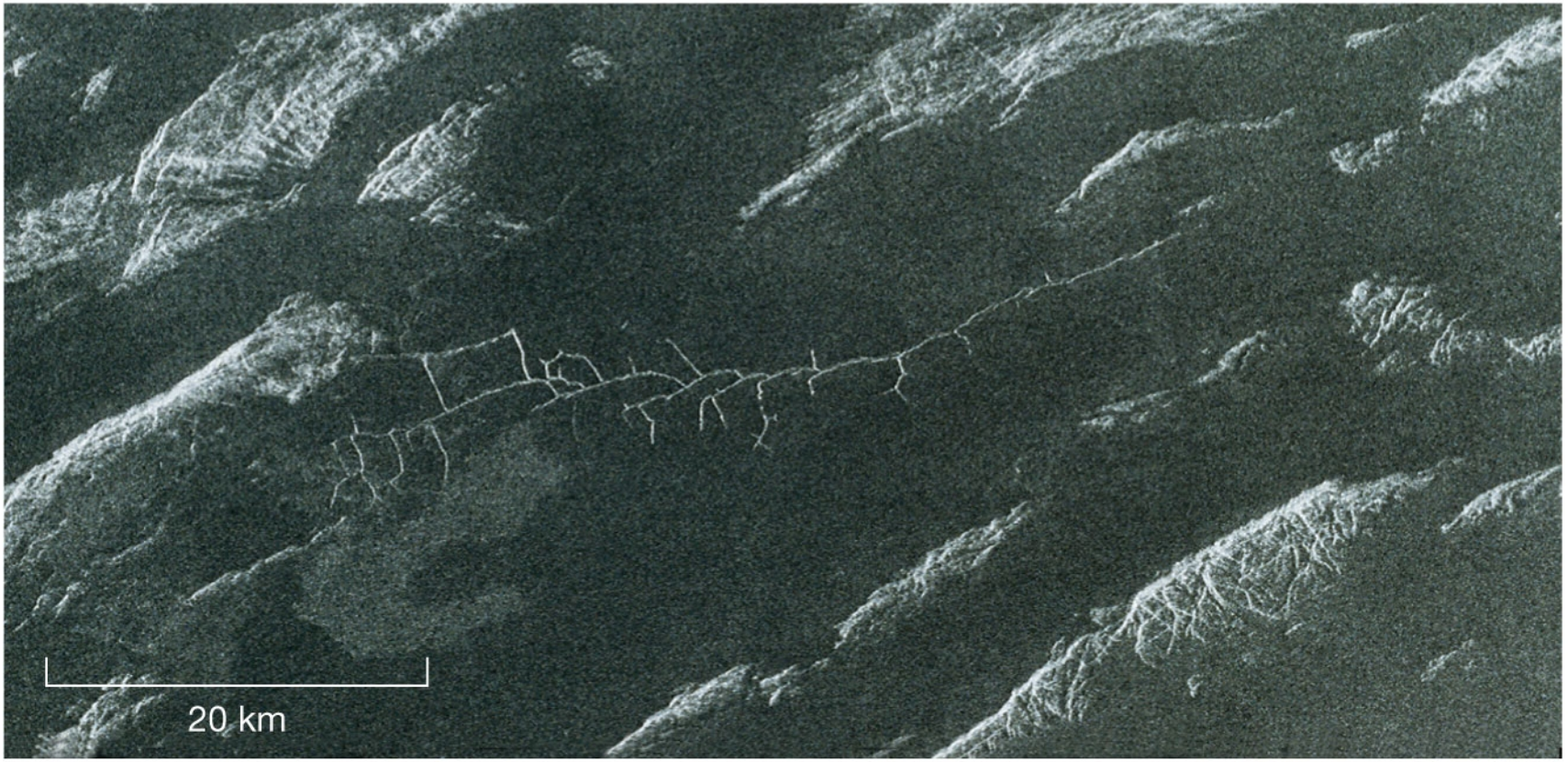
The other is Aphrodite Terra

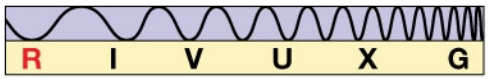




9.4 The Surface of Venus

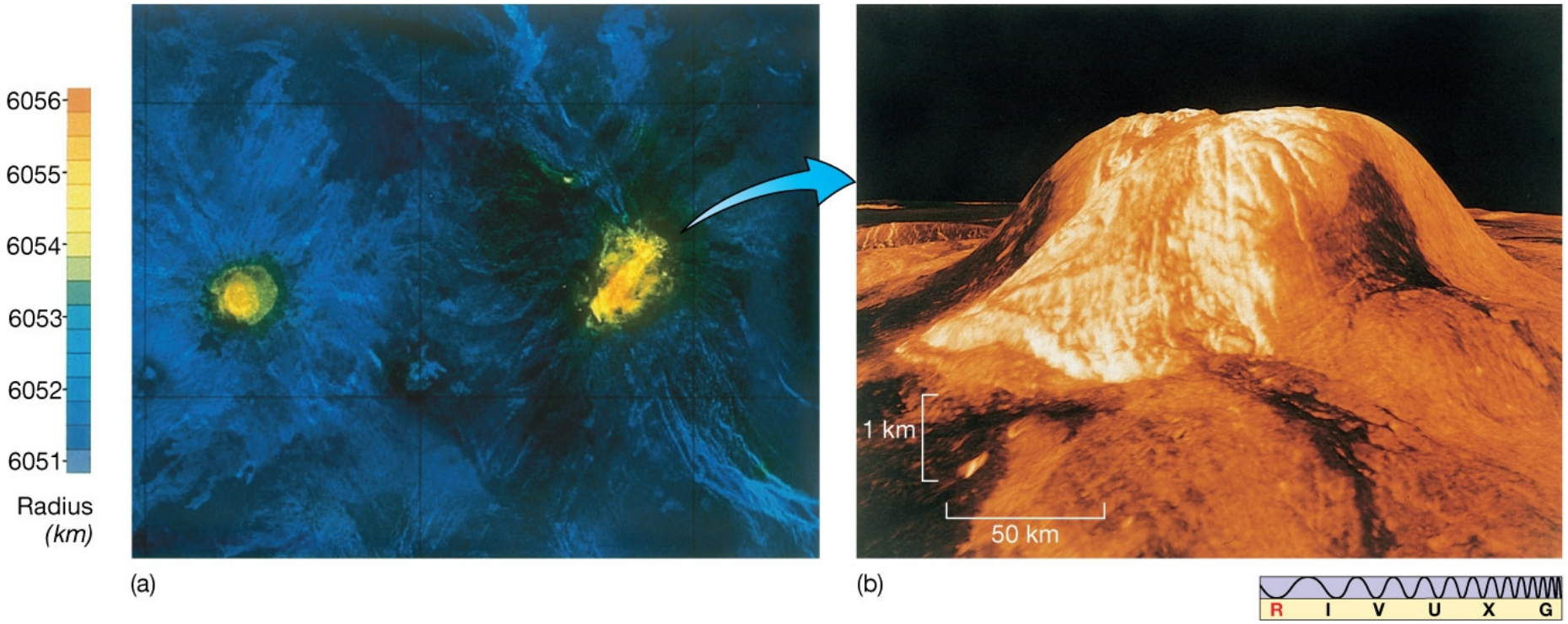
Lava has flowed from cracks on the surface





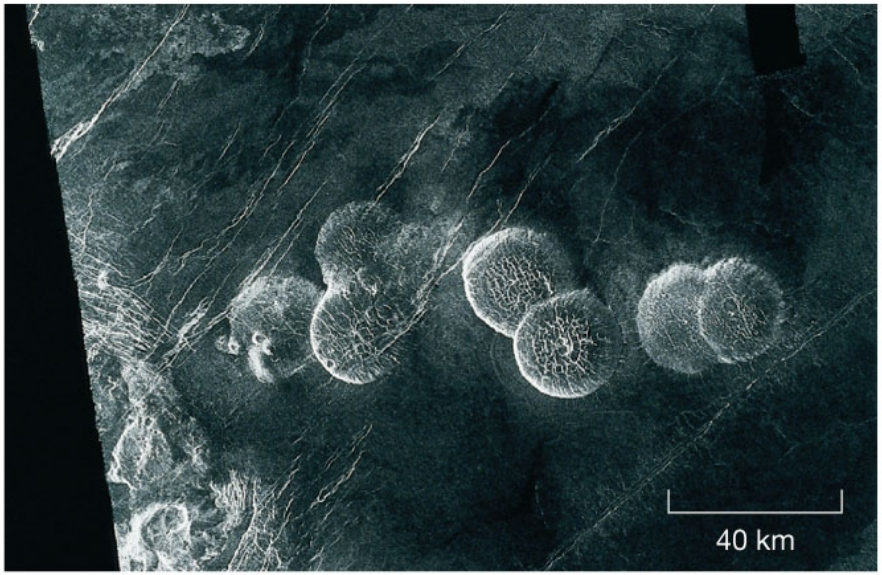
9.4 The Surface of Venus

Volcanoes on Venus; most are shield volcanoes



9.4 The Surface of Venus

Other volcanic features include lava domes and coronas



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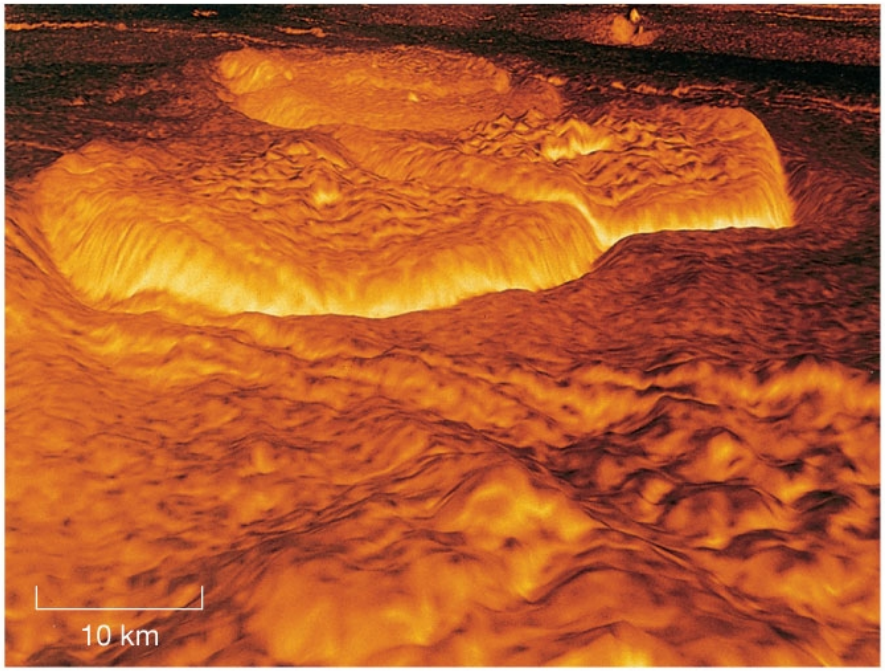
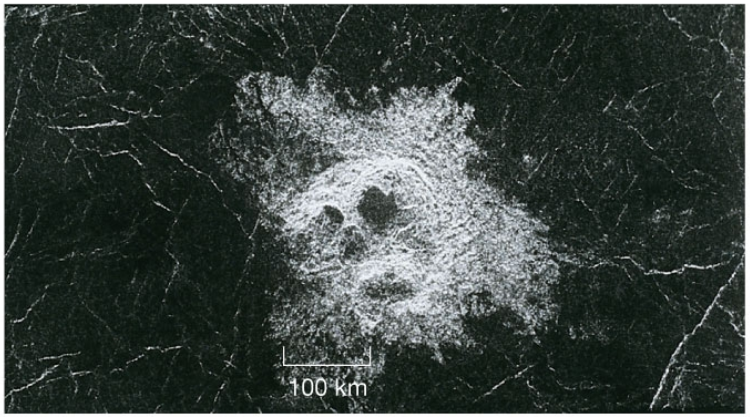


(b)

9.4 The Surface of Venus

Impact craters on Venus, the largest named after Margaret Mead



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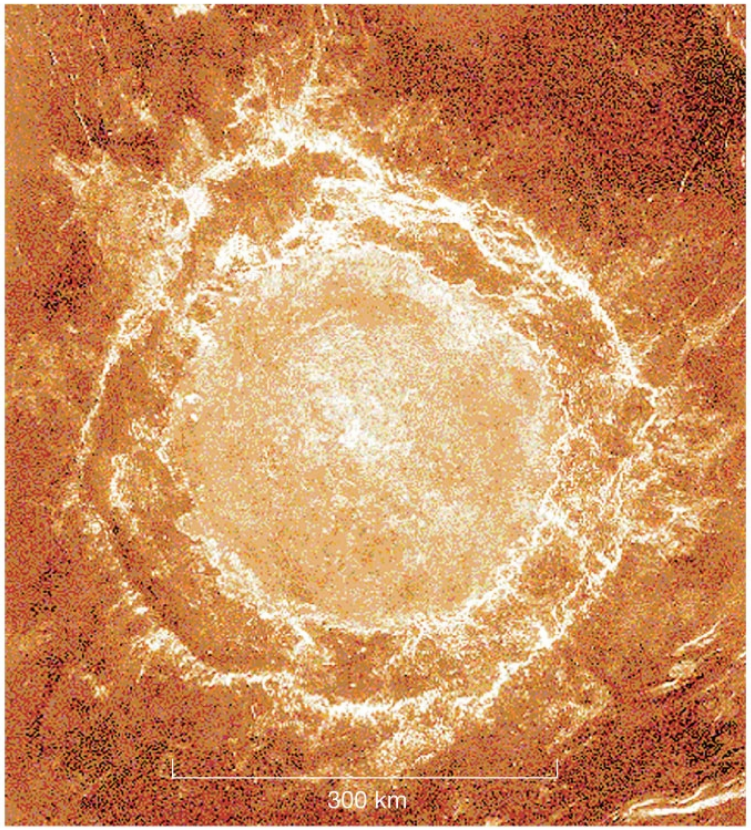
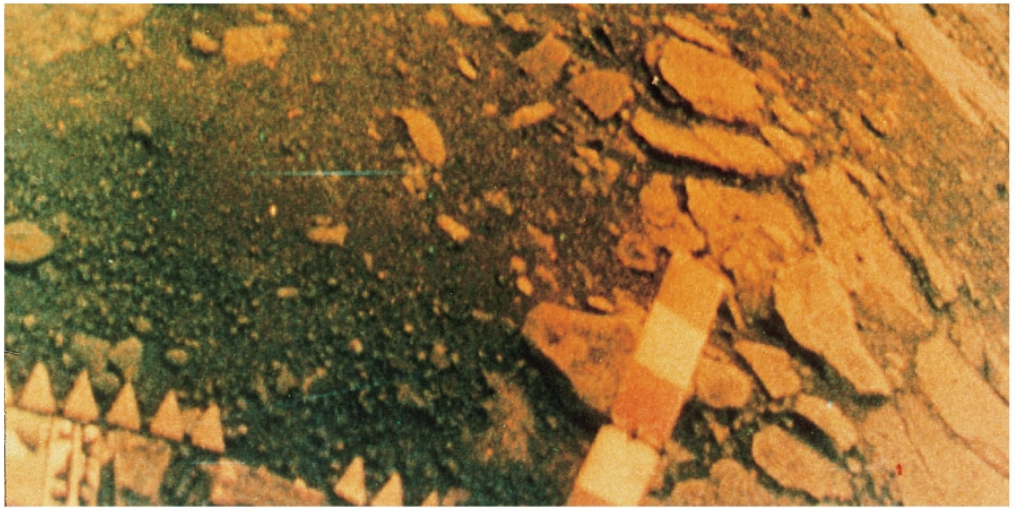


(b)

9.4 The Surface of Venus

Photographs of the surface, from the *Venera* landers

(a)



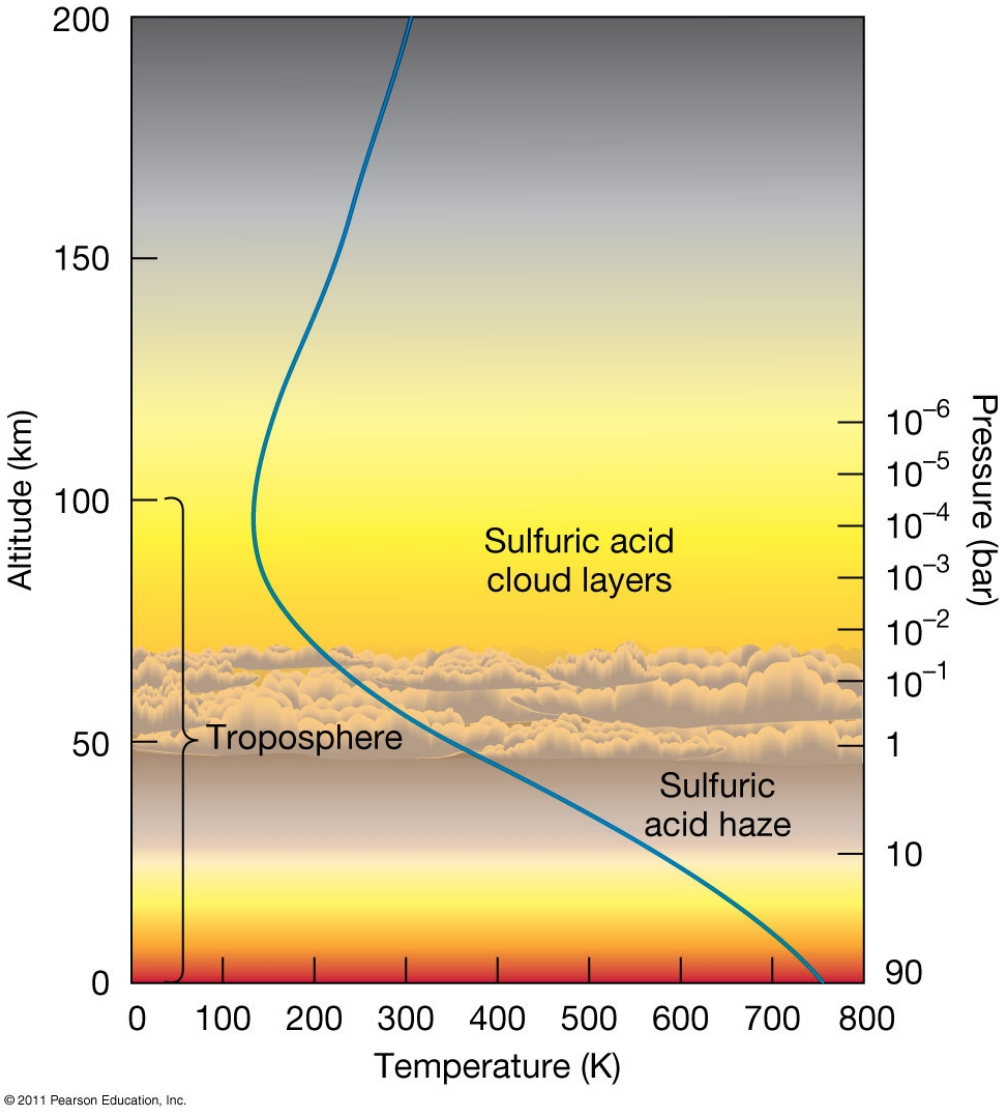
(b)

9.5 The Atmosphere of Venus

Venus's atmosphere is very dense

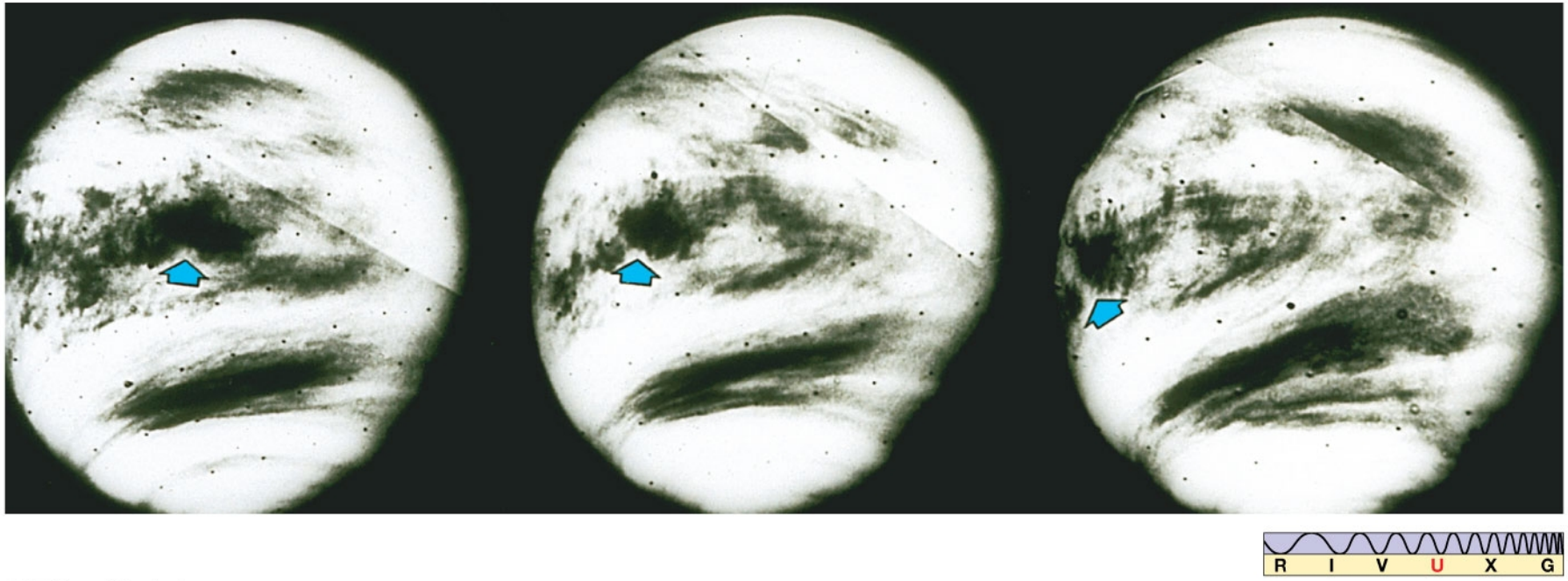
Solid cloud bank 50–70 km above surface

Atmosphere is mostly carbon dioxide; clouds are sulfuric acid



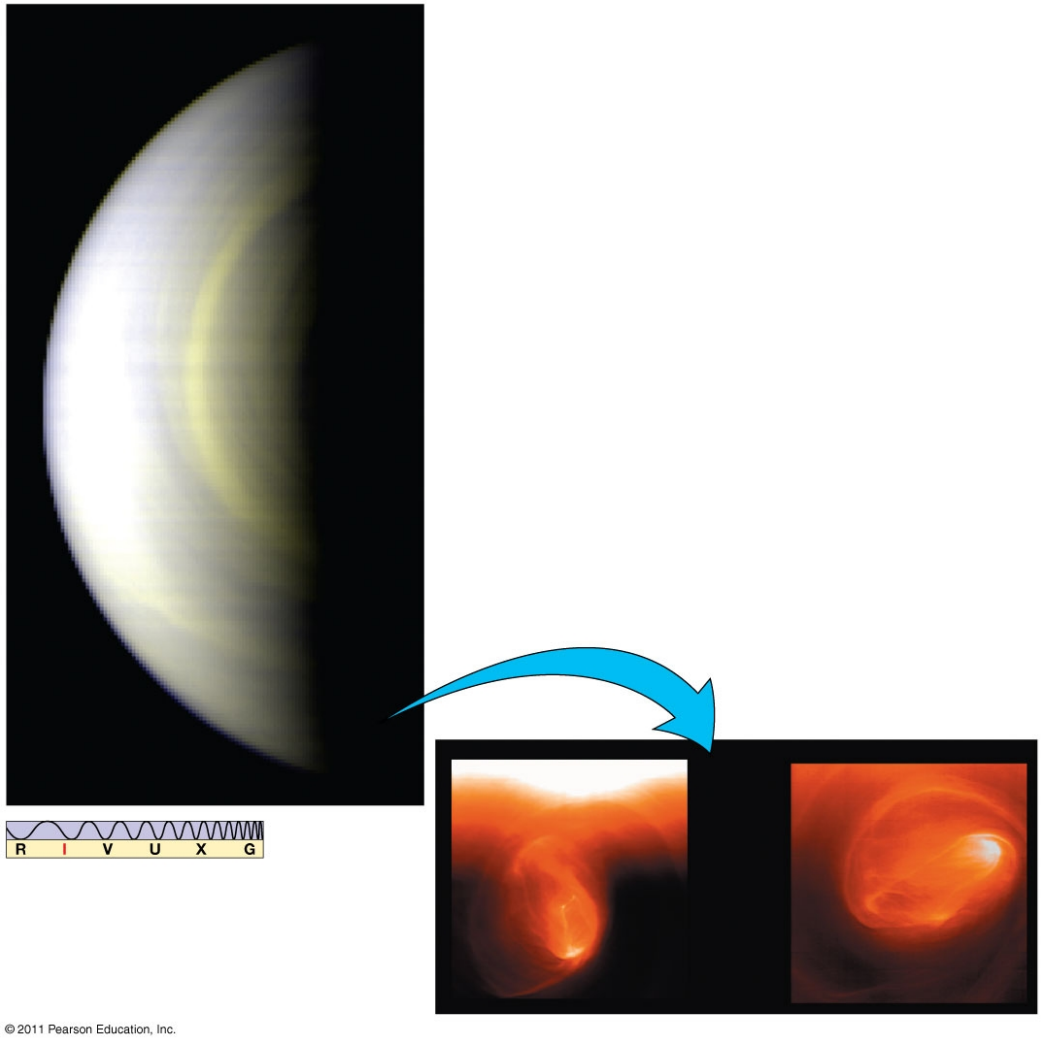
9.5 The Atmosphere of Venus

Upper atmosphere of Venus has high winds, but atmosphere near surface is almost calm



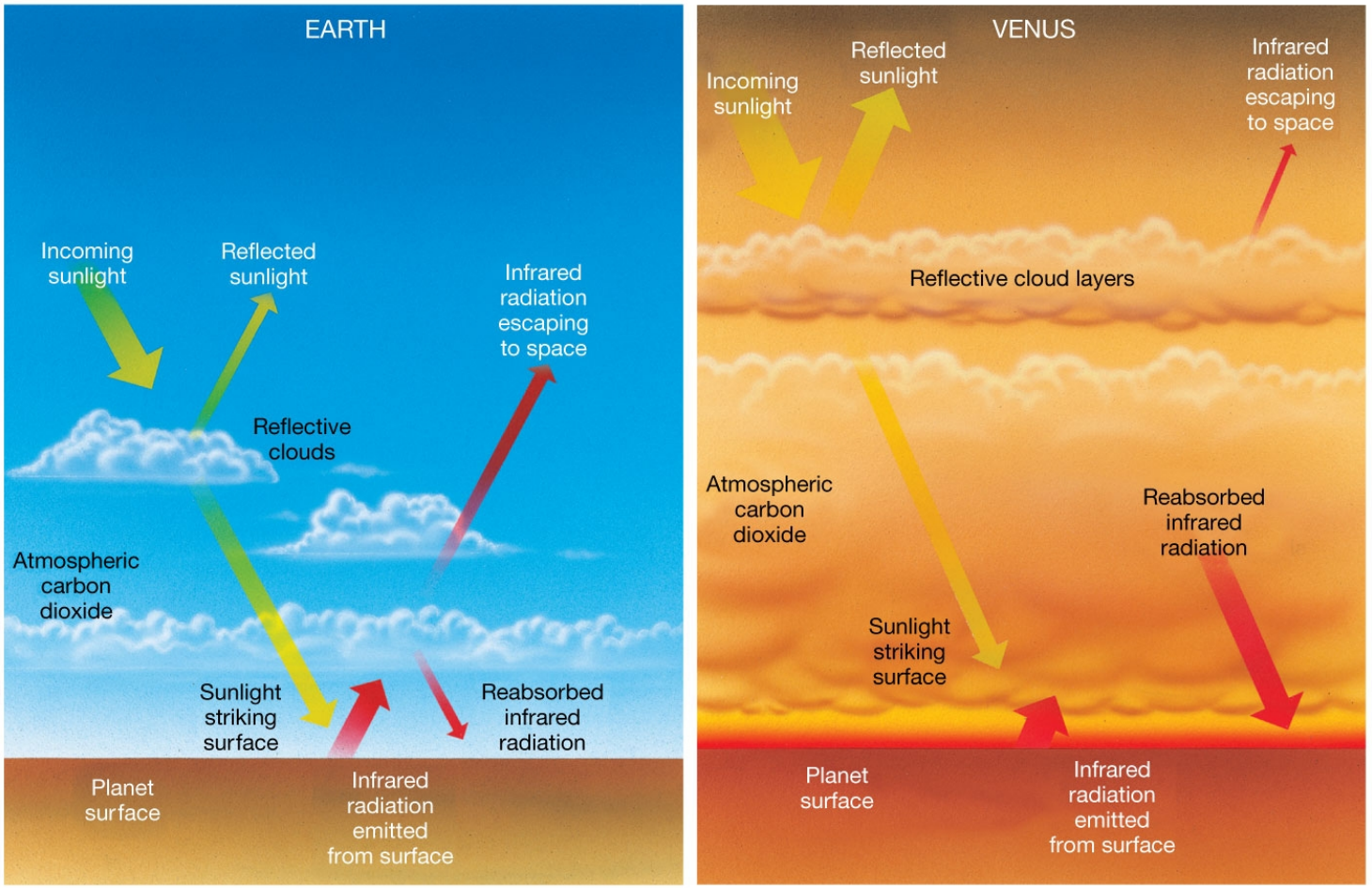
9.5 The Atmosphere of Venus

There are also permanent vortices at the poles; the origin of the double-lobed structure is a mystery



9.5 The Atmosphere of Venus

Venus is the victim of a runaway greenhouse effect—just kept getting hotter and hotter as infrared radiation was reabsorbed



9.6 Venus's Magnetic Field and Internal Structure

No magnetic field, probably because rotation is so slow

No evidence for plate tectonics

Venus resembles a young Earth (1 billion years)—no asthenosphere, thin crust

Summary of Chapter 9

- Venus is never too far from Sun and is the brightest object in the sky (after the Sun and Moon)
- Atmosphere very dense, mostly carbon dioxide
- Surface hidden by cloud cover
- Surface temperature 730 K
- Rotation slow and retrograde

Summary of Chapter 9 (cont.)

- Many lava domes and shield volcanoes
- Venus is comparable to Earth in mass and radius
- Large amount of carbon dioxide in atmosphere, and closeness to Sun, led to runaway greenhouse effect and very hot surface