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**ASTRONOMY**

**Chapter 10 EARTHLIKE PLANETS: VENUS AND MARS**  
PowerPoint Image Slideshow





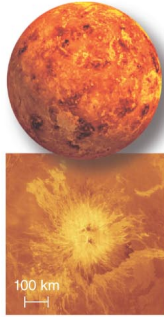
### 10.2 Venus

**Venus**

- ▶ Distance from Sun: .72 AU
- ▶ Density: 5.3 g/cm<sup>3</sup>
- ▶ Orbit: 225 days
- ▶ Rotation period (day): 243 days; backwards
- ▶ Temperature: 900 F
- ▶ Surface: Volcanoes, Few craters


**Exploration**


- ▶ 1962 Mariner
- ▶ 1960s Soviet missions
- ▶ 1970 Venera landed (23 min), Pioneer
- ▶ 1980s Venera 15&16, Magellan



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### Figure 10.5

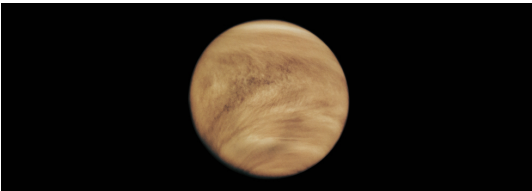




▶ **Percival Lowell (1855–1916).** This 1914 photograph shows Percival Lowell observing Venus with his 24-inch telescope at Flagstaff, Arizona.


### Figure 10.2

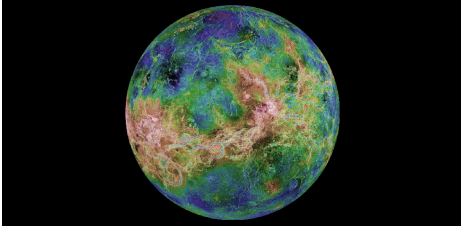




▶ **Venus as Photographed by the Pioneer Venus Orbiter.** This ultraviolet image shows an upper-atmosphere cloud structure that would be invisible at visible wavelengths. Note that there is not even a glimpse of the planet's surface. (credit: modification of work by NASA)

### Figure 10.6





▶ **Radar Map of Venus.** This composite image has a resolution of about 3 kilometers. Colors have been added to indicate elevation, with blue meaning low and brown and white high. The large continent Aphrodite stretches around the equator, where the bright (therefore rough) surface has been deformed by tectonic forces in the crust of Venus. (credit: modification of work by NASA/JPL/USGS)

### Venus geologically active

These two volcanic peaks are probably much like the shield volcanoes that make up the Hawaiian Islands on Earth.

The round bluffs are steep stratovolcanoes, apparently built from a "thick" lava.

Shield volcanoes have fractured and fissured the crust.

This central image shows the full surface of Venus, 98% of which was mapped by Magellan. Notice the three large, rounded "coronae" called Sofya Terra, Lada Terra, and Aphrodite Terra.

Impact craters, like this one, are relatively rare on Venus and are distributed uniformly over the surface.

This round cone was probably made by a mantle plume. It is dotted with small volcanoes that have spread and surrounded by narrow, straight ridges.

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### Figure 10.7

**Impact Craters on Venus.**

(a) These large impact craters are in the Lavinia region of Venus. Because they are rough, the crater rims and ejecta appear brighter in these radar images than do the smoother surrounding lava plains. The largest of these craters has a diameter of 50 kilometers.

(b) This small, complex crater is named after writer Gertrude Stein. The triple impact was caused by the breaking apart of the incoming asteroid during its passage through the thick atmosphere of Venus. The projectile had an initial diameter of between 1 and 2 kilometers.

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### Cratering on Venus

▶ Impact craters, but fewer than Moon, Mercury, Mars

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### Figure 10.8

▶ Pancake-Shaped Volcanoes on Venus. These remarkable circular domes, each about 25 kilometers across and about 2 kilometers tall, are the result of eruptions of highly viscous (sludgy) lava that spreads out evenly in all directions. (credit: modification of work by NASA/JPL)

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### Volcanoes on Venus

▶ Many volcanoes

▶ (image shows a twin peak volcano)

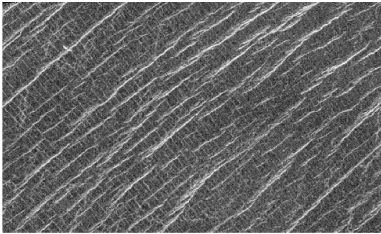
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### Figure 10.9

▶ The "Miss Piggy" Corona. Fotla Corona is located in the plains to the south of Aphrodite Terra. Curved fracture patterns show where the material beneath has put stress on the surface. A number of pancake and dome volcanoes are also visible. Fotla was a Celtic fertility goddess. Some students see a resemblance between this corona and Miss Piggy of the Muppets (her left ear, at the top of the picture, is the pancake volcano in the upper center of the image). (credit: NASA/JPL)

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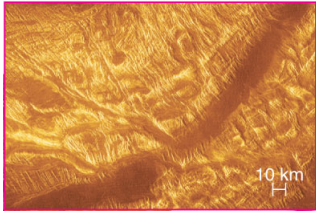
Figure 10.10



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- ▶ **Ridges and Cracks.** This region of the Lakshmi Plains on Venus has been fractured by tectonic forces to produce a cross-hatched grid of cracks and ridges. Be sure to notice the fainter linear features that run perpendicular to the brighter ones. As this is a radar image, the brightness of the ridges indicates their relative height. This image shows a region about 80 kilometers wide and 37 kilometers high. Lakshmi is a Hindu goddess of prosperity. (credit: modification of work by Magellan Team, JPL, NASA)

Tectonics on Venus



▶ Fractured and contorted surface indicates tectonic stresses

10 km

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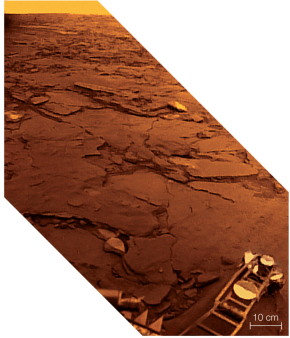
Figure 10.11



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- ▶ **Surface of Venus.** These views of the surface of Venus are from the Venera 13 spacecraft. Everything is orange because the thick atmosphere of Venus absorbs the bluer colors of light. The horizon is visible in the upper corner of each image. (credit: NASA)

Erosion on Venus

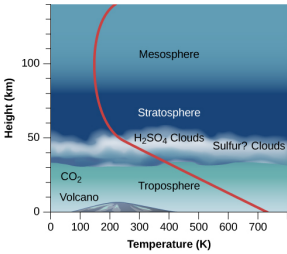


▶ Photos of rocks taken by lander show little erosion

10 cm

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10.3 ATMOSPHERE OF VENUS



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- ▶ **Venus' Atmosphere.** The layers of the massive atmosphere of Venus shown here are based on data from the Pioneer and Venera entry probes. Height is measured along the left axis, the bottom scale shows temperature, and the red line allows you to read off the temperature at each height. Notice how steeply the temperature rises below the clouds, thanks to the planet's huge greenhouse effect.

Atmosphere of Venus



▶ Venus has a very thick carbon dioxide atmosphere with a surface pressure 90 times that of Earth.

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### Atmosphere of Venus



- ▶ Reflective clouds contain droplets of sulfuric acid.
- ▶ The upper atmosphere has fast winds that remain unexplained.

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### Greenhouse Effect on Venus



- ▶ Thick carbon dioxide atmosphere produces an extremely strong greenhouse effect.
- ▶ Earth escapes this fate because most of its carbon and water are in rocks and oceans.

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