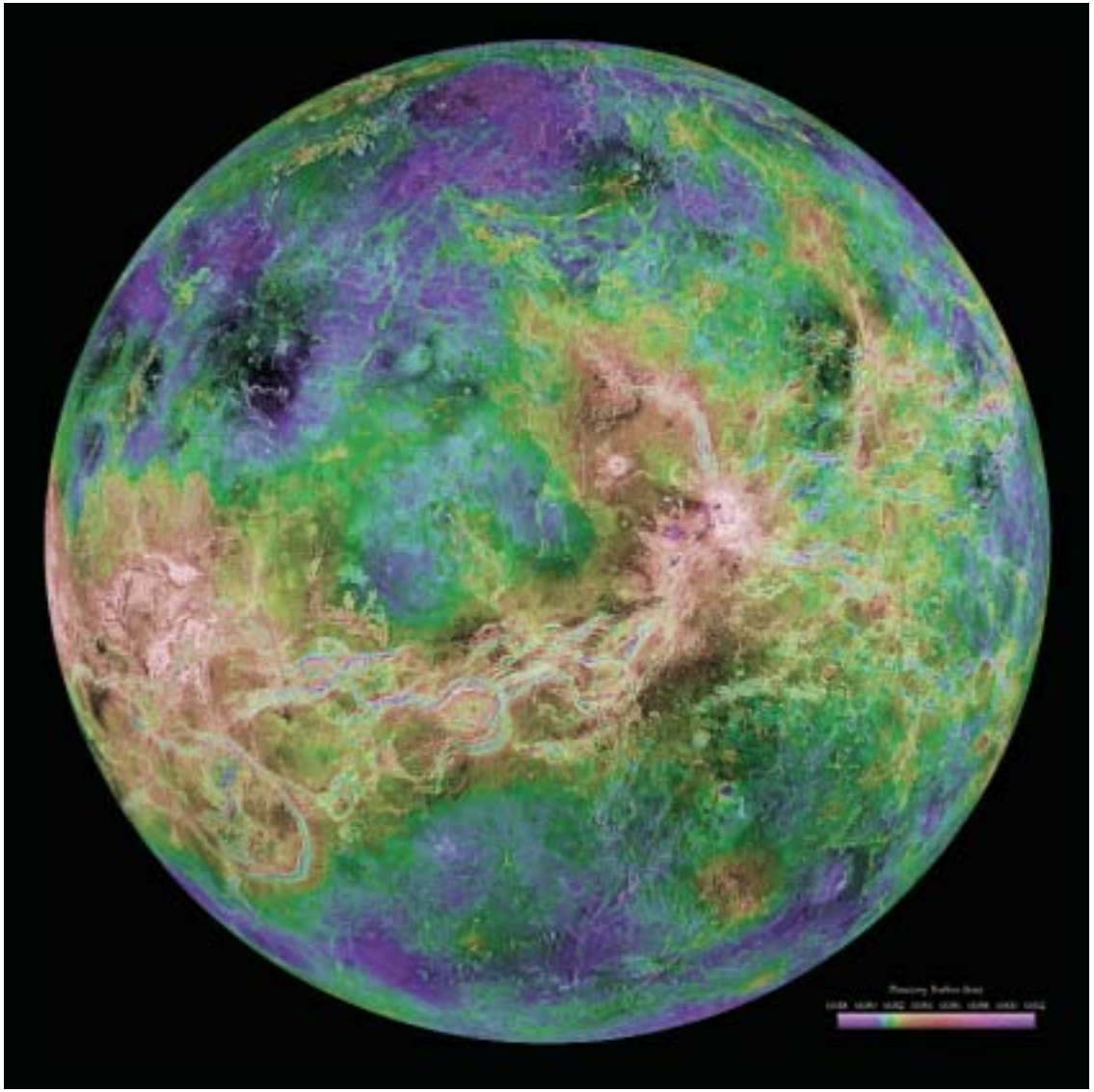
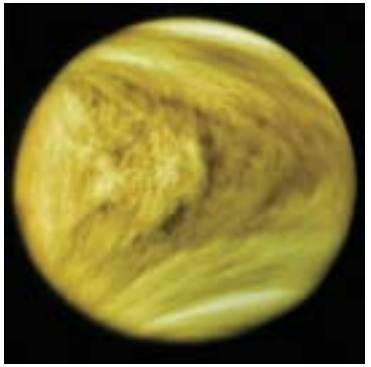
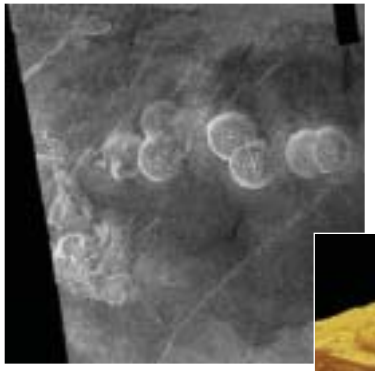
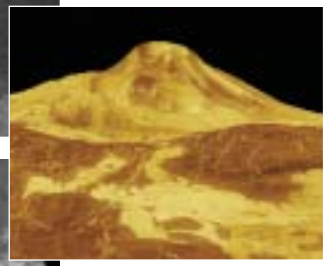
National Aeronautics and
Space Administration

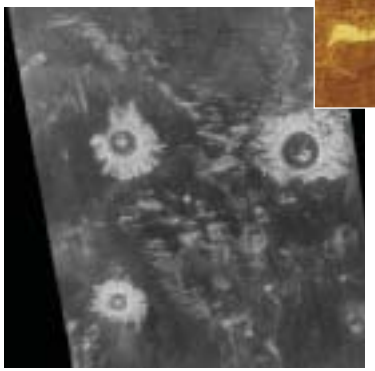
# Venus ♀











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At first glance, if Earth had a twin, it would be **VENUS**. The two planets are similar in size, mass, composition, and distance from the Sun. But there the similarities end. Venus has no ocean. Venus is covered by thick, rapidly spinning clouds that trap surface heat, creating a scorched greenhouse-like world with temperatures hot enough to melt lead and pressure so intense that standing on Venus would feel like the pressure felt 900 meters deep in Earth's oceans. These clouds reflect sunlight in addition to trapping heat. Because Venus reflects so much sunlight, it is usually the brightest planet in the sky.

The atmosphere consists mainly of carbon dioxide (the same gas that produces fizzy sodas), droplets of sulfuric acid, and virtually no water vapor—not a great place for people or plants! In addition, the thick atmosphere allows the Sun's heat in but does not allow it to escape, resulting in surface temperatures over 450 °C, hotter than the surface of the planet Mercury, which is closest to the Sun. The high density of the atmosphere results in a surface pressure 90 times that of Earth, which is why probes that have landed on Venus have only survived several hours before being crushed by the incredible pressure. In the upper layers, the clouds move faster than hurricane-force winds on Earth.

Venus sluggishly rotates on its axis once every 243 Earth days, while it orbits the Sun every 225 days—its day is longer than its year! Besides that, Venus rotates retrograde, or "backwards," spinning in the opposite direction of its orbit around the Sun. From its surface, the Sun would seem to rise in the west and set in the east.

Earth and Venus are similar in density and chemical compositions, and both have relatively young surfaces, with Venus appearing to have been completely resurfaced 300 to 500 million years ago.

The surface of Venus is covered by about 20 percent lowland plains, 70 percent rolling uplands, and 10 percent highlands. Volcanism, impacts, and deformation of the crust have shaped the surface. No direct evidence of currently active volcanoes has been found, although large variations of sulfur dioxide in the atmosphere lead some scientists to suspect that volcanoes may be active.

Although no rainfall, oceans, or strong winds exist to erode surface features, some weathering and erosion does occur. The surface is brushed by gentle winds, no stronger than a few kilometers per hour, enough to move grains of sand, and radar images of the surface show wind streaks and sand dunes. In addition, the corrosive atmosphere probably chemically alters rocks. Impact cratering is also affected by the dense atmosphere: craters smaller than 1.5 to 2 km across do not exist on Venus, largely because small meteors burn up in Venus' dense atmosphere before they can reach the surface.

More than 1,000 volcanoes or volcanic centers larger than 20 km in diameter dot the surface of Venus. There may be close to a million volcanic centers that are over 1 km in diameter. Much of the surface is covered by vast lava flows. In the north, an elevated region named Ishtar Terra is a lava-filled basin larger than the continental United States. Near the equator, the Aphrodite Terra highlands, more than half the size of Africa, extend for almost 10,000 km. Volcanic flows have also produced long, sinuous channels extending for hundreds of kilometers.

With few exceptions, features on Venus are named for accomplished women from all of Earth's cultures.

Venus's interior is probably very similar to that of Earth, containing an iron core about 3,000 km in radius and a molten rocky mantle covering the majority of the planet. Recent results from the *Magellan* spacecraft suggest that Venus' crust is stronger and thicker than had previously been thought.

Venus has no satellites and no intrinsic magnetic field, but the solar wind rushing by Venus creates a pseudo-field around the planet.

## Fast Facts

| | |
|---|---|
| **Namesake** | Roman Goddess of Love and Beauty |
| **Mean Distance from Sun** | 108.2 million km |
| **Orbital Period** | 224.695 days |
| **Orbital Eccentricity** | 0.007 |
| **Orbital Inclination to Ecliptic** | 3.4° |
| **Inclination of Equator to Orbit** | 177.3° |
| **Rotational Period** | 243 d (retrograde) |
| **Diameter** | 12,100 km |
| **Mass** | 0.82 of Earth's |
| **Density** | 5.24 g/cm$^3$ |
| **Gravity** | 0.91 of Earth's |
| **Atmosphere (primary component)** | Carbon Dioxide |
| **Mean Temperature at Solid Surface** | 457 °C |
| **Number of Moons** | 0 |
| **Number of Rings** | 0 |

## Significant Dates

| | |
|---|---|
| **1962** | *Mariner 2* (U.S.) flew by Venus; verified high temperatures. |
| **1970** | *Venera 7* (U.S.S.R.) soft-landed on Venus. |
| **1972** | *Venera 8* (U.S.S.R.) landed on Venus; transmitted nearly an hour of data. |
| **1974** | *Mariner 10* (U.S.), bound for Mercury, flew by Venus; tracked global atmospheric circulation with visible and ultraviolet imagery. |
| **1975** | *Venera 9* (U.S.S.R.) sent the first surface pictures of Venus via its orbiter. |
| **1978** | *Pioneer Venus Orbiter* (U.S.) radar mapped Venus; *Pioneer Venus Multiprobe* (U.S.) dropped four probes through Venusian clouds. |
| **1983** | *Venera 15* and *16* (U.S.S.R.) provided high-resolution mapping radar and atmospheric analyses. |
| **1984** | *Vega 1* and *2* (U.S.S.R.) dropped off landers and balloon probes at Venus while en route to Halley's Comet. |
| **1989** | *Magellan* (U.S.) was launched toward Venus. |
| **1990–94** | *Magellan* (U.S.) mapped 98 percent of the surface of Venus using radar. |

## About the Images

**(Left)** Only radar can penetrate Venus's thick clouds to reveal its topography (blues are low areas; tans are high areas). Aphrodite Terra, a bright highland roughly the size of Africa, winds across Venus's southern hemisphere (false-color image data from *Magellan*, *Arecibo Observatory*, *Pioneer Venus*, and *Venera*).
**(Right, top)** Venus's thick clouds of carbon dioxide produce a "runaway greenhouse effect." The Y-shaped cloud patterns indicate wind speeds up to 500 km per hour in the upper layers of the atmosphere (*Pioneer Venus* near-ultraviolet image).
**(Right, center)** This cluster of large craters in an area the size of Michigan range in diameter from 50 to 37 km (*Magellan*).
**(Right, bottom)** Seven steep-sided and flat-topped domes of lava have oozed onto the plains east of Alpha Regio. They average 25 km in diameter with maximum heights of 750 meters (*Magellan*).
**(Far right)** Bright areas of ancient lava blanket the flanks of the 6-km-high volcano Maat Mons. The vertical scale in this image has been exaggerated 23 times to enhance small features and aid analysis of the area. The color is simulated based on data by the Soviet *Venera 13* and *14* spacecraft (*Magellan*).

References
1) Missions to Venus: *http://solarsystem.nasa.gov/missions/venus_missns/venus-magellan.html*
2) Views of the Solar System—Venus: *http://www.solarviews.com/eng/venus.htm*
3) NASA Planetary Photojournal: *http://photojournal.jpl.nasa.gov*
4) Gazetteer of Planetary Nomenclature: *http://wwwflag.wr.usgs.gov/USGSFlag/Space/nomen/nomen.html*

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