

4 INSIDE TRACK and VENUS

SYNOPSIS

INSIDE TRACK – Mercury

Of the nine planets, Mercury orbits on the inside track – the closest planet to the Sun. Baked and irradiated, Mercury is a cratered little world – a pristine record of the impactors that rained from space during the early Solar System. Mercury is weird. It has double sunrises and a day twice as long as its year. Even stranger, there may be ice in deep craters at the poles – deposited by comets and perpetually shadowed from the scorch of the Sun.

VENUS – Planet From Hell

Venus is Earth gone wrong - a lifeless planet with a dense and choking atmosphere and temperatures to melt lead. Constantly shrouded in cloud, Venus could once have been Earth's twin with oceans and continents, even simple life. But there is a theory that as the Sun matured and its luminosity increased, Venus became hell. Today it is a brutal landscape entirely resurfaced by molten lava oozing from thousands of volcanoes. Venus is the hottest planet.

BACKGROUND

With the Sun just 58-million kilometres away, Mercury is scorched and irradiated as no other planet. It is named after the messenger of the gods. And why not – for the ancients saw the Sun as a god and Mercury is closest to the Sun.

Mercury is the smallest inner planet. Earth is 18 times as massive. Mercury is one of the four rocky inner planets – the terrestrials - together with Venus, Earth and Mars. As the Solar System formed, they condensed from the heavier elements. Lighter elements were blown far beyond by the solar wind to form the gas giants of Jupiter, Saturn, Uranus and Neptune.

From Earth, Mercury and Venus are never high in the sky. Mercury is the most difficult to see, barely clearing the horizon at dusk and dawn. On the inside track, Mercury has the tightest orbit of the planets taking just 88 days to circle the Sun. Earth takes 365 days, our year.

The year on Mercury is shorter than its day. Its day lasts 176 Earth days. The reason is Mercury's incredibly slow rotation. There is an even weirder effect produced by the elliptical orbit of Mercury. Each time it passes closest to the Sun, Mercury speeds up, then slows at its most distant. The result – when Mercury is nearest the Sun - is a double sunrise.

Early in its history, Mercury may have been struck by a large planetesimal. The impact could have blown off the planet's outer mantle. That would explain, relative to its size, Mercury's huge iron core – 70 per cent of its volume, twice the proportion found in other terrestrial planets.

Mercury's battered surface is a record of the early Solar System – the whacks and smacks that cratered this barren little world. Four-billion years ago another planetesimal gouged a crater 1,300-kilometres wide, the Caloris Basin. Spattered later with smaller craters, Caloris had probably filled with lava. Volcanic activity lasted a billion years but for the past three billion all has been quiet.

Mercury's daytime temperatures top 450 degrees Celsius. At night they are down to minus 180. Radar mapping hints at some permanent ice. But how, so close to the Sun? Deposited by comets, ice may survive in deep craters at the poles perpetually shadowed from solar glare.

Much is to be learned of Mercury. Only half the planet has been photographed – and that back in the 1970s. New missions will complete the mapping. They will tell us more of Mercury's wispy atmosphere of helium and of the planet's surprisingly strong magnetic field.

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Venus, always shrouded in cloud, is second planet from the Sun, orbiting at a distance of 108-million kilometres. With a diameter of just over 12-thousand kilometres, Venus is almost as big as Earth – often dubbed a twin. But few twins are so different. Earth is clear-faced and temperate. Venus is a veiled inferno where clouds blow around the planet in four days.

From Earth, Venus is by far the brightest planet - big and brilliant just after sunset and immediately before dawn. Venus takes 225 days to circle the Sun. When earthly radar pierced its clouds in 1961, Venus was discovered to rotate incredibly slowly – just once in 243 days - and in the opposite direction to Earth. Why? Possibly a giant planetesimal had hit Venus, altering its tilt, even flipping it over.

In 1970, the Russians soft-landed a robot probe. They radioed home the first pictures of a surface where the Sun never shines. It was a brutal landscape strewn with slabs of volcanic rock. Conditions were so hostile, the lander frazzled in minutes. The atmosphere is like soup – over 90 times denser than Earth's. It blankets the planet, trapping heat. At a uniform 475 degrees Celsius, Venus is the hottest planet.

Later, American probes scanned Venus. Almost 99 per cent of the planet was mapped – the all-enveloping cloud penetrated by radar. Volcanic shields and lava flows make up 85 per cent of the surface. To the north is the continent of Ishtar Terra. To the south is Aphrodite Terra, a continent the size of Africa. It has mountains, canyons and a gigantic

plateau where the volcanic peak of Maat Mons stands five kilometres from the mean elevation of the planet.

Venus is the most volcanic place in the Solar System, erupting for possibly billions of years – sulphurous fumes adding to the toxic atmosphere, lava constantly relaying the surface.

Venus is Earth gone wrong, a runaway greenhouse effect, a lifeless, waterless world with choking atmosphere of 96 per cent carbon dioxide and temperatures to melt lead. So what befell our unfortunate twin?

Like Earth four billion years ago, and far enough from the Sun for life to take hold, Venus could have had continents lapped by oceans and simple life. But the young planet was dangerously close to the Sun. Earth is at the centre of the habitable zone of the Solar System, Mars at the far edge, Venus at the inner edge.

So, as the Sun matured and its luminosity increased, Venus heated up. The vapour of oceans boiling dry may well have turned Venus into a suffocating, smog-ridden greenhouse. Earth lost its twin.

Weblinks for INSIDE TRACK

[http://en.wikipedia.org/wiki/Mercury_\(planet\)](http://en.wikipedia.org/wiki/Mercury_(planet)) - From Wikipedia, the free encyclopedia, a detailed entry on the planet Mercury, its internal structure, orbit, rotation and exploration by spacecraft.

http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/mercury.html - From the “StarChild” service at NASA’s Goddard Space Flight Center, an introduction to the planet Mercury written for young people. Information available at two levels.

<http://www.dustbunny.com/afk/planets/mercury/> - From the “Astronomy for Kids” website, a good summary on the planet Mercury.

<http://nssdc.gsfc.nasa.gov/planetary/factsheet/mercuryfact.html> - NASA’s Mercury fact sheet.

<http://photojournal.jpl.nasa.gov/targetFamily/Mercury> - NASA’s image access page for a range of pictures of Mercury’s surface features from the Mariner 10 (Mariner Venus Mercury) mission.

<http://history.nasa.gov/SP-423/sp423.htm> - A web-based version of NASA’s Atlas of Mercury using Mariner 10 images of the planet.

<http://messenger.jhuapl.edu/> - From the Johns Hopkins University, a comprehensive overview of the MESSENGER spacecraft and its mission to Mercury, including the reasons why scientists are interested in studying the planet.

http://www.esa.int/esaSC/120391_index_0_m.html - From the European Space Agency, an overview of the BepiColombo spacecraft and its mission to the planet Mercury.

http://stardate.org/resources/ssguide/planet_form.html - From the University of Texas McDonald Observatory, a useful summary of how the planets formed.

<http://www.astronomynotes.com/solfluf/s11.htm> - A more detailed review of the formation of the Solar System by Nick Strobel, Bakersfield College Physical Science Department.

Weblinks for VENUS

[http://en.wikipedia.org/wiki/Venus_\(planet\)](http://en.wikipedia.org/wiki/Venus_(planet)) – From Wikipedia, the free encyclopedia, a comprehensive entry on the planet, its mythology, atmosphere, surface and exploration by spacecraft.

http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/venus.html - From the “StarChild” service at NASA’s Goddard Space Flight Center, an introduction to the planet Venus written for young people. Information available at two levels.

<http://www.dustbunny.com/afk/planets/venus/> - From the “Astronomy for Kids” website, a handy summary on the planet Venus.

<http://nssdc.gsfc.nasa.gov/planetary/factsheet/venusfact.html> - NASA’s Venus fact sheet.

<http://photojournal.jpl.nasa.gov/targetFamily/Venus> - NASA’s image access page for a wide range of pictures of the planet Venus from various space missions.

http://en.wikipedia.org/wiki/Magellan_probe - From Wikipedia, the free encyclopedia, a detailed summary of the Magellan radar mapping mission, the spacecraft itself and some of the mission results, with links to other Magellan-related websites.

<http://www.astrosociety.org/education/publications/tnl/18/18.html> - From the Astronomical Society of the Pacific’s “Universe in the Classroom” series, a useful site containing answers to a number of important questions about both the Magellan spacecraft and the planet Venus.

<http://www.vt-2004.org/> - From the European Southern Observatory, background information on the 2004 transit of Venus with a range of helpful links especially for teachers and students.

<http://astrobiology.arc.nasa.gov/topics/venus.html> - From NASA's Ames Research Center, a fascinating website about the possibilities for past life on Venus, the origin the habitability of the planet and its runaway greenhouse effect.

http://www.esa.int/esaMI/Venus_Express/index.html - The European Space Agency's Venus Express home page, packed with information about the planet and the reasons for studying it.