



National Optical Astronomy Observatory

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Key Words – Mapping the Surface of Mars

Albedo: ratio of the amount of electromagnetic energy reflected by a surface to the amount of energy incident upon it

Caldera: A large depression at the top of a volcano, caused by collapse or explosion of a volcano. Typically larger than one mile in diameter (0.6 km).

Chryse Planitia: A smooth circular plain in the northern equatorial region of Mars close to the Tharsis region. It is 1600 km in diameter and with a floor 2.5 km below the average planetary surface altitude, and is thought to be an ancient impact basin.

Cinder cones: A volcanic cone, formed from volcanic ash and coarse materials exploding from the vent.

Composite volcano: (also called a Stratovolcano) is a tall, conical mountain (volcano) composed of both hardened lava and volcanic ash. The shape of these volcanoes is characteristically steep in profile because lava flows that formed them were highly viscous, and so cooled and hardened before spreading very far.

Continental plates: Huge mobile sections of the Earth's crust

Datum: a fixed or established point of reference, usually with a fixed elevation.

Fault: A moving fracture between two huge plates on the Earth's crust.

Impact crater: A circular depression on a surface, usually referring to a planet, moon, asteroid, or other celestial body, caused by a collision of a smaller body (meteorite) with the surface.

Associated with impact craters:

- **Rim:** The raised area around the edge of the crater that was created by the violence of the impact that created the crater.
- **Ejecta:** Material that was thrown high into the air and landed outside the crater in a blanket-like shape.
- **Rays:** A type of ejecta that consist of long, pointing streaks.
- **Walls:** The sides of the crater
- **Floor:** The bottom of the crater
- **Central uplift:** If the impact was violent enough to melt the rock which became the floor of the crater, then a peak will form at the center of the crater. For example, when a rock is thrown into a pond or lake, the splash of water will have a central peak associated with the impact.



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Lava: Hot molten rock, often associated with a volcano.

Mariner 4 (1964-1965): The spacecraft flew past Mars on July 14, 1965, collecting the first close-up photographs of another planet. The pictures, played back from a small tape recorder over a long period, showed lunar-type impact craters (just beginning to be photographed at close range from the Moon), some of them touched with frost in the chill Martian evening. The Mariner 4 spacecraft was not expected to survive much longer than the eight months to its Mars flyby encounter, but actually lasted about three years in solar orbit, continuing long-term studies of the solar wind environment and making coordinated measurements with Mariner 5, a sister ship launched to Venus in 1967.

Mars Global Surveyor (MGS—1997-present): Launched November 7, 1996, Mars Global Surveyor became the first successful mission to the red planet in two decades. After a year and a half spent trimming its orbit from a looping ellipse to a circular track around the planet, the spacecraft began its prime mapping mission in March 1999. It has continued to observe the planet from a low-altitude, nearly polar orbit ever since.

Mars Orbiter Camera (MOC): This camera (onboard the Mars Global Surveyor) produces a daily wide-angle image of Mars similar to weather photographs of the Earth. In addition, the narrow-angle lens with [image motion compensation](#) captures images of objects as small as 0.5 meters (1.7 feet) across. One dramatic example from the spacecraft's Mars Orbiter Camera shows wheel tracks of NASA's Mars Exploration Rover Spirit and the rover itself.

Mars Orbiter Laser Altimeter (MOLA): This experiment measures the height of Martian surface features like mountains and depths of valleys.

Mauna Loa: Located on the big island of Hawaii, this volcano is the largest shield volcano on Earth. It rises over 5.4 miles (9 km) from its base on the sea floor.

Olympus Mons: The largest volcano in the solar system. This shield volcano is almost 17 miles (27 km) high and its base is almost 430 miles (700 km) across.

Permafrost: a layer of soil at varying depths below the surface in which the temperature has remained below freezing continuously from a few to several thousands of years

Principle of Cross-cutting Relationships: Rocks or geological features such as canyons, rivers or cracks in rocks, may be cut by other rocks or by other geological features.

Principle of Horizontal Bedding: Rocks that are deposited by water, such as limestone, or rocks that are deposited by wind, such as sandstone, are deposited in nearly horizontal layers.



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Principle of Superposition: Strata located at the bottom of an undisturbed stack of rocks are older than the layers at the top of the stack.

Plug dome: The steep-sided, rounded mound formed when viscous (mostly silica) lava wells up into a volcanic crater and is too stiff to flow away. It piles up as a dome-shaped mass, often completely filling the vent from which it emerged.

Shield Volcano: A gently sloping volcano in the shape of a flattened dome, built almost exclusively of lava flows.

Spatter cones: A steep-sided volcanic cone, formed from gas-charged lava fountains that spew lava high into the air.

Strata: Rock layers

Stratification: Many layers of rock, one laid on top of the other in a process called layering.

Thermal Emission Spectrometer (TES): This instrument (onboard the Mars Global Surveyor) studies the atmosphere and maps the mineral composition of the surface by analyzing infrared radiation, scanning for heat emitted from the surface of Mars

Topography: precise detailed study of the surface features of a region

Valles Marineris: (Latin for Mariner Valley, named after the Mariner 9 Mars orbiter of 1971-72 which discovered it.) is a vast canyon system that runs along the Martian equator just east of the Tharsis region. Valles Marineris is 4000 km (2500 mi) long and reaches depths of up to 7 km (4 mi) and widths of up to 200 km (125 mi).

Vent: A fissure in the earth's crust (or in the surface of some other planet) through which molten lava and gases erupt

Volcanic Crater: A depression at the top of a volcano, caused by a collapse or explosion of a volcano. Typically smaller than one mile in diameter (0.6 km).

Wavelength: Light waves come in many sizes. The size of a wave is measured as its wavelength, which is the distance between any two corresponding points on successive waves, usually peak-to-peak or trough-to-trough. The wavelengths of the light we can *see* range from 400 to 700 billionths of a meter. Instruments found on spacecraft such as the Mars Global Surveyor can measure infrared light which is just beyond the visible region humans can see.