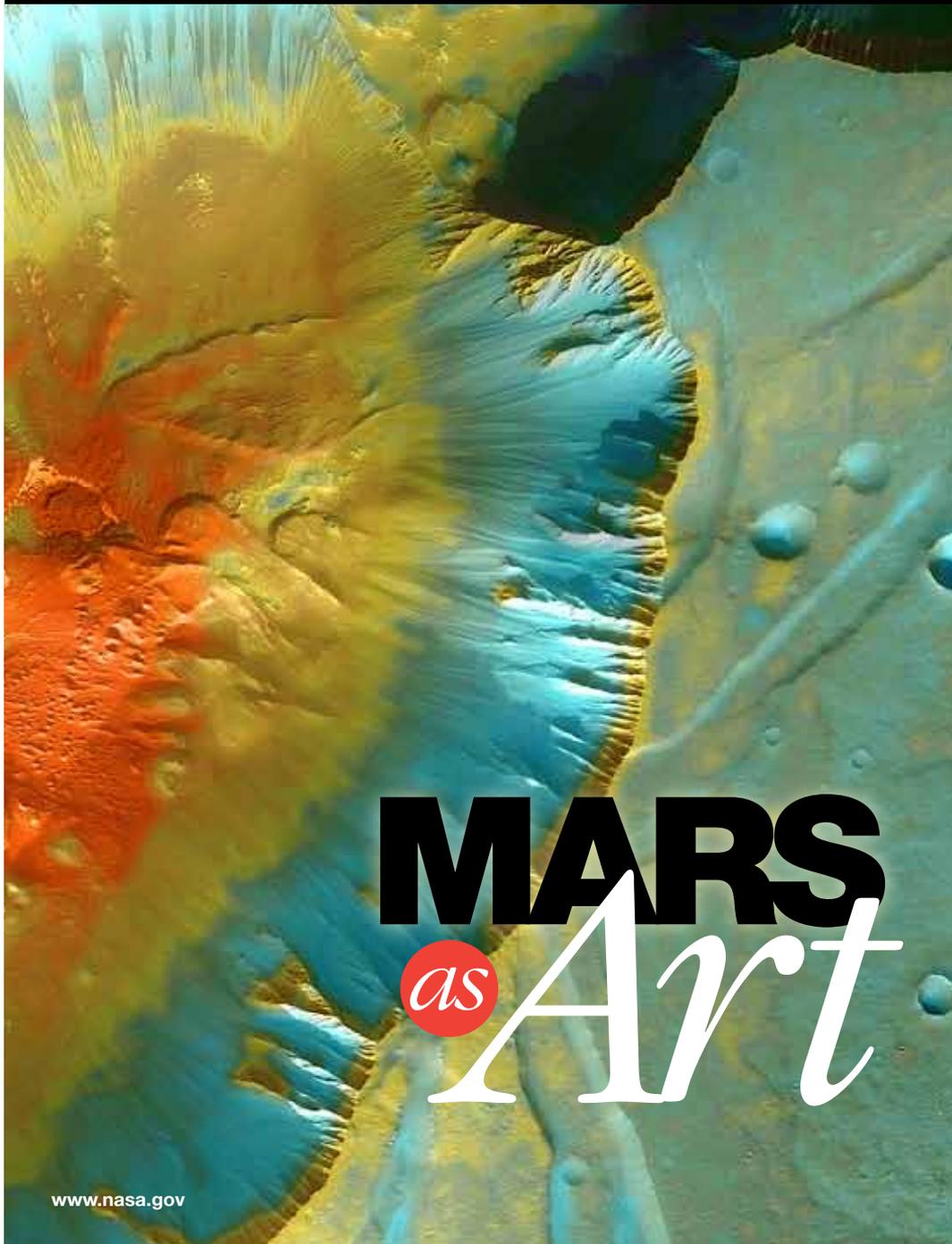


National Aeronautics and Space Administration



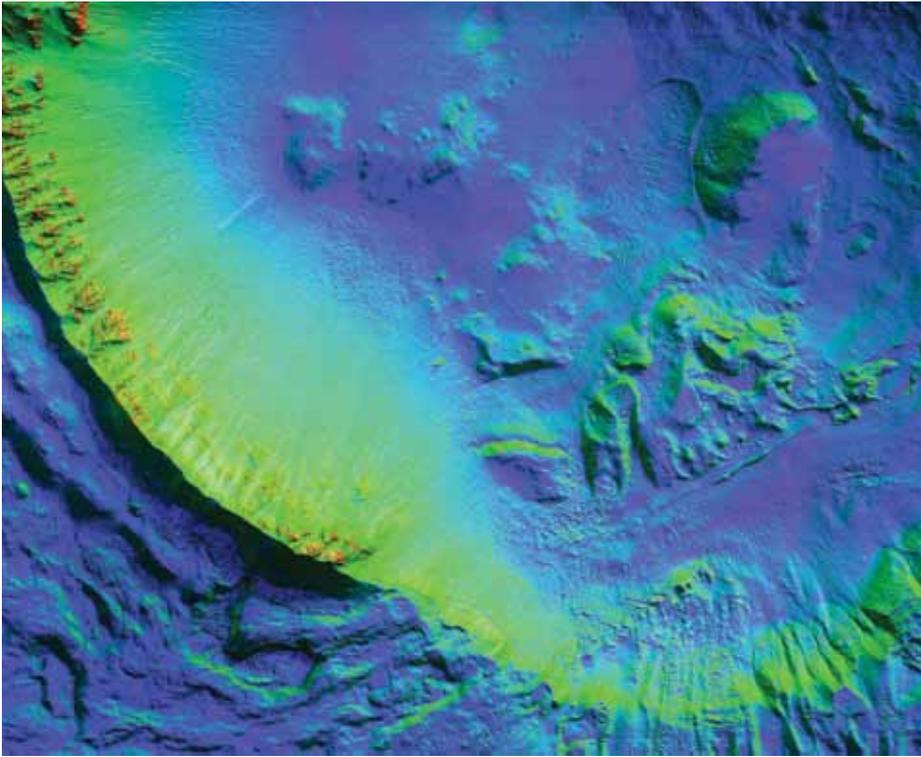
MARS *as* Art

www.nasa.gov

Welcome to Mars as Art

Spacecraft have imaged the surface of Mars for nearly four decades, providing insights into the history, climate, and geology of our nearest planet. The Mars as Art exhibition showcases selected images returned by spacecraft from NASA and the European Space Agency (ESA). Selected by a panel of professional artists, photographers, and photo editors, these images are chosen for their aesthetic rather than scientific value. Mars as Art represents actual images of Mars taken from orbit and from the planetary surface by visiting spacecraft.

For more information about NASA's Mars Exploration Program, visit
<http://www.nasa.gov/mars>



Bright Gully Deposits on Mars

This unnamed impact crater is about 8 kilometers in diameter and contains numerous gullies. A bright deposit was found to form on the lower slopes of one of them in recent time. Scientists questioned whether this was an indication of liquid water or dry materials (sand) flowing down the side of the crater. After analysis, the presence of liquid water in this flow event cannot be ruled out, but the available evidence is consistent with a dry granular flow.

Image Credit: HiRISE Science Team



Icy New Impact

This crater, formed in 2008, exposes shallow, clean ice that is not uncommon in the middle-to-high latitudes on Mars. Sublimation, the process that occurs when a solid changes into a gas without an intermediary liquid stage, creates an ice-free layer on the surface that may be several feet deep, hiding the ice underneath until exposed by an impact.

Image Credit: NASA/JPL/University of Arizona



Sand Dunes Near the North Pole

This picture was taken during the Martian summer with only small patches of ice remaining at the surface; they show up as bright, somewhat blue, spots on slopes that provide some shading from the Sun. Geologists would classify these dunes as “sand-starved” because the ground between the dunes has almost no sand. This surface shows a pattern of cracks that is typical of the permafrost’s seasonal expansion and contraction. It is also possible that this subsurface ice exists inside the dunes. If so, the dunes are not currently moving and are being “stabilized” by this ice.

Image Credit: NASA/JPL/University of Arizona



Small Floral-Shaped Volcano

This is a small volcano superimposed on the flanks of a larger one of the Cerberus Tholi.

This smaller feature has a single vent opening, aligned along a Cerberus Fossae trough, and it has lava flows radiating away from this vent in all directions, resembling a flower.

These flows appear somewhat darker than their surroundings, though this might be due to roughness as much as to the flow's relative youth. Note that there are some small impact craters superimposed on this feature, indicating that these flows are not entirely young.

Image Credit: HiRISE Science Team

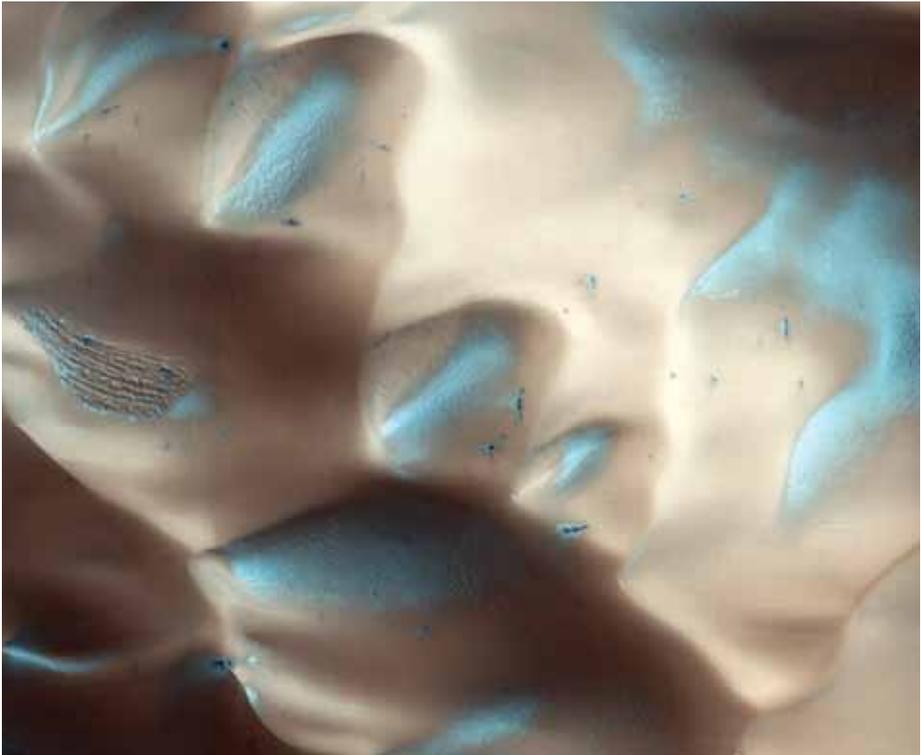


Spirit Rover Studies Rock Outcrop at “Home Plate”

NASA's Mars Exploration Rover Spirit acquired this false-color image on Mars during the rover's 746th Martian day, or sol, after using the rock abrasion tool to brush the surfaces of rock targets informally named “Stars” (left) and “Crawfords” (right). Small streaks of dust extend for several centimeters behind the small rock chips and pebbles in the dusty, red soils. Because the rover was looking southwest when this image was taken, the wind streaks indicate that the dominant wind direction was from the southeast.

Stars and Crawfords are on a rock outcrop located on top of “Home Plate.” The outcrop is informally named “James ‘Cool Papa’ Bell,” after a Negro League Baseball Hall of Famer who played for both the Pittsburgh Crawfords and the Kansas City Stars. To some science team members, the two brushed spots resemble the eyes of a face, with rocks below and between the eyes as a nose and layered rocks at the bottom of the image as a mouth.

Image Credit: NASA/JPL-Caltech/USGS/Cornell University



Frost-Covered Dunes in a Crater

Dunes are often found on crater floors. In the winter, at high northern latitudes, the terrain is covered by carbon-dioxide ice (dry ice). In the spring, as this seasonal ice sublimates, many unusual features unique to Mars are visible.

On the floor of this crater where there are no dunes, the ice forms an uninterrupted layer. On the dunes, however, dark streaks form as surface material from below the ice is mobilized and deposited on top of the ice. In some cases this mobile material probably slides down the steep face of the dune, while in other cases it may be literally blown out in a process of gas release—similar to removing a cork from a champagne bottle.

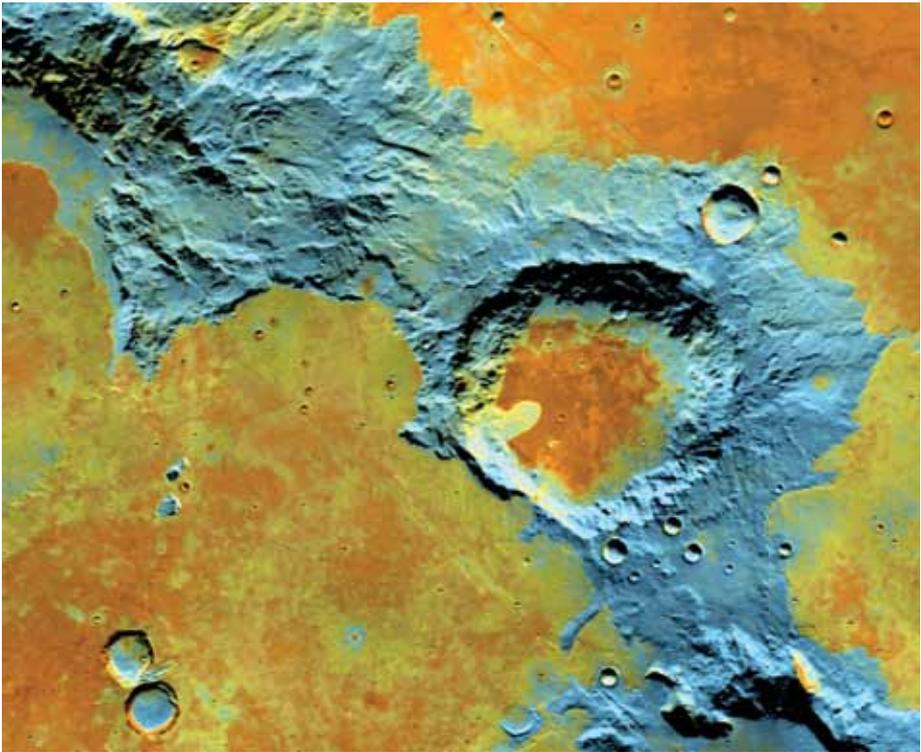
Image Credit: NASA/JPL/University of Arizona



East Rim of Endeavour Crater

NASA's Mars Exploration Rover Opportunity used its panoramic camera to record this eastward horizon view on the 2,407th Martian day, or sol, of the rover's work on Mars (October 31, 2010). The view is presented in false color to make differences in surface materials more visible. A portion of Endeavour Crater's eastern rim, nearly 30 kilometers (19 miles) in the distance, is visible over the Meridiani Planum.

Image Credit: NASA/JPL-Caltech/Cornell University

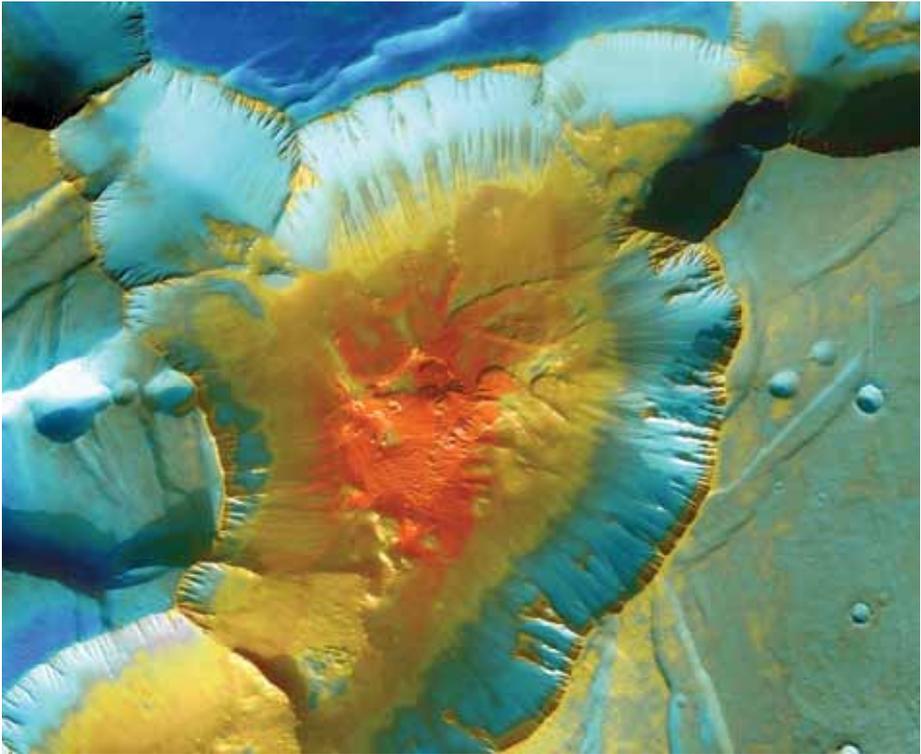


Terra Sirenum

On the southwest edge of the immense volcanic region of Tharsis, lava from its giant volcanoes flowed down to meet the old cratered landscape of Terra Sirenum. Scientists cannot say how many years separate the flows from the terrain they engulfed, but the relationship between the two tells a complex tale.

This false-color mosaic image combines separate frames taken by the Thermal Emission Imaging System (THEMIS), a special camera on NASA's Mars Odyssey orbiter.

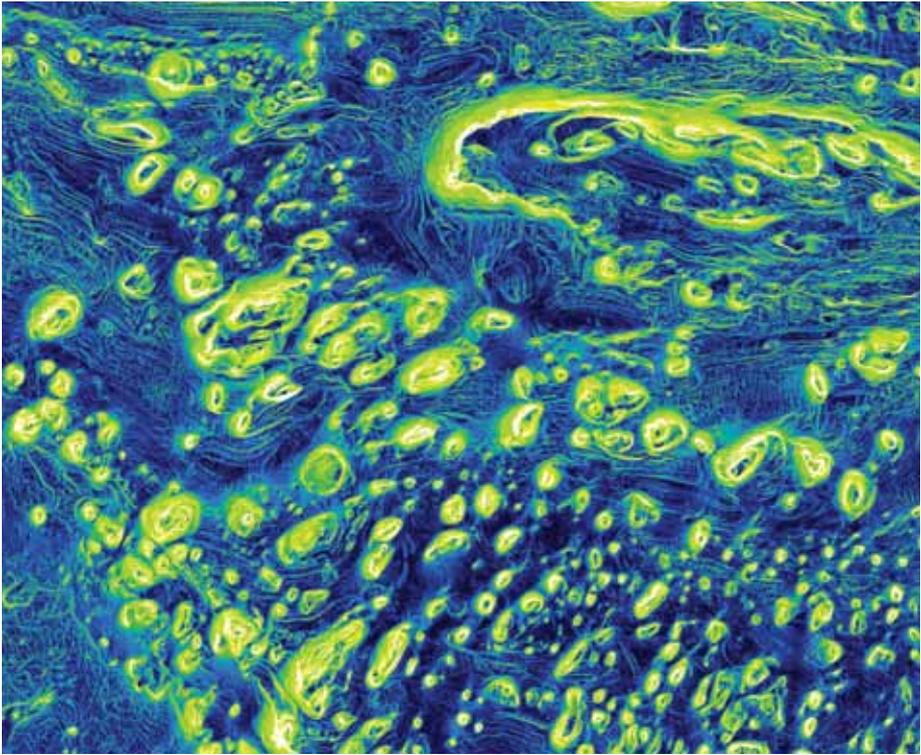
Image Credit: NASA/JPL-Caltech/University of Arizona



Canyon Junction

A false-color mosaic focuses on one junction in Noctis Labyrinthus where Mars canyons meet to form a depression 4,000 meters (13,000 feet) deep. Dust (blue tints) lies on the upper surfaces, while rockier material (warmer colors) lies below. The pictures used to create this mosaic image were taken by the Thermal Emission Imaging System (THEMIS) instrument on NASA's Mars Odyssey orbiter.

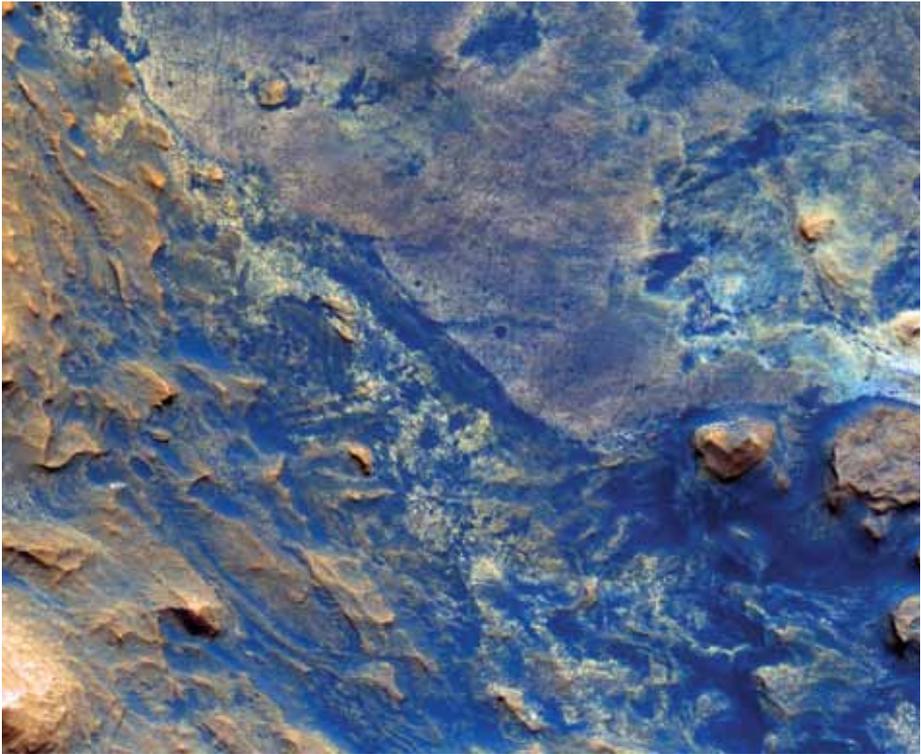
Image Credit: NASA/JPL-Caltech/University of Arizona



Martian Mosaic

This mosaic was made from images taken at infrared wavelengths in daytime and nighttime by the Thermal Emission Imaging System (THEMIS) on Mars Odyssey orbiter. The largest crater visible (left) is Sharonov Crater and is 100 kilometers (62 miles) wide.

Image Credit: NASA/JPL/University of Arizona



Gale Crater

There is a layered mound in Gale crater that is more than 5 kilometers (3.1 miles) thick, nearly twice as thick as the layers exposed in Arizona's Grand Canyon. The lowermost (bottom of image) layers contain hydrated minerals. The Curiosity rover will be landing near here to explore the geologic history contained in these layers. Scientists do not know how old the rocks are, but the rocks almost certainly get younger towards the top and represent a sequence in time.

Image Credit: NASA/JPL/University of Arizona



Stickney Crater, Phobos

The large impact crater known as Stickney is the largest crater on the Martian moon Phobos. Some scientists believe the grooves and crater chains are related to the formation of Stickney, whereas others think they may have formed as a result of the ejecta from impacts on Mars that later collided with Phobos. The lined textures on the walls of Stickney and other large craters are landslides formed from materials falling into the crater interiors.

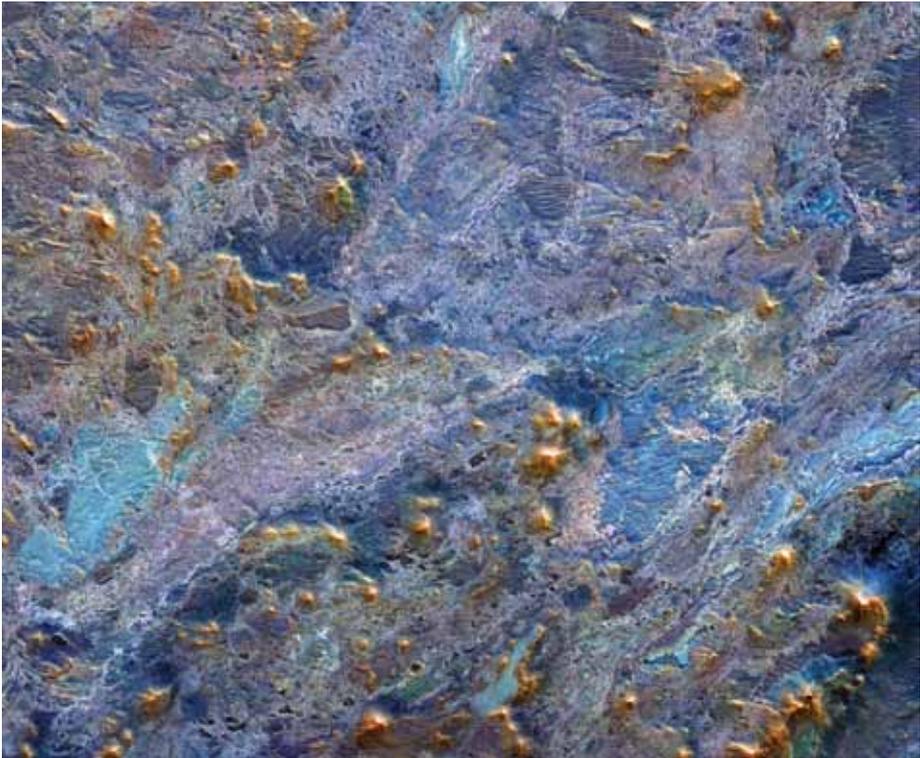
Image Credit: NASA/JPL/University of Arizona



Cerberus Fossae

Mars, like Earth, appears to have experienced global climate changes over the past few million years. The effects of Earth's ice ages are well-recorded in polar ice in Greenland and Antarctica. Similarly, layered deposits in both polar regions on Mars appear to record ancient Martian climate variations.

Image Credit: NASA/JPL/University of Arizona



Nili Fossae

This enhanced-color portion of the floor of Nili Fossae contains a wonderful mixture of rock types known as a *mélange*. Nili Fossae is a graben, or down-dropped valley. Much of the *mélange* is the ejecta from a large crater to the southeast; impact cratering is a great way to mix up rock types. Many of the minerals have been altered by water. The parallel sharp-crested ridges are windblown sediments.

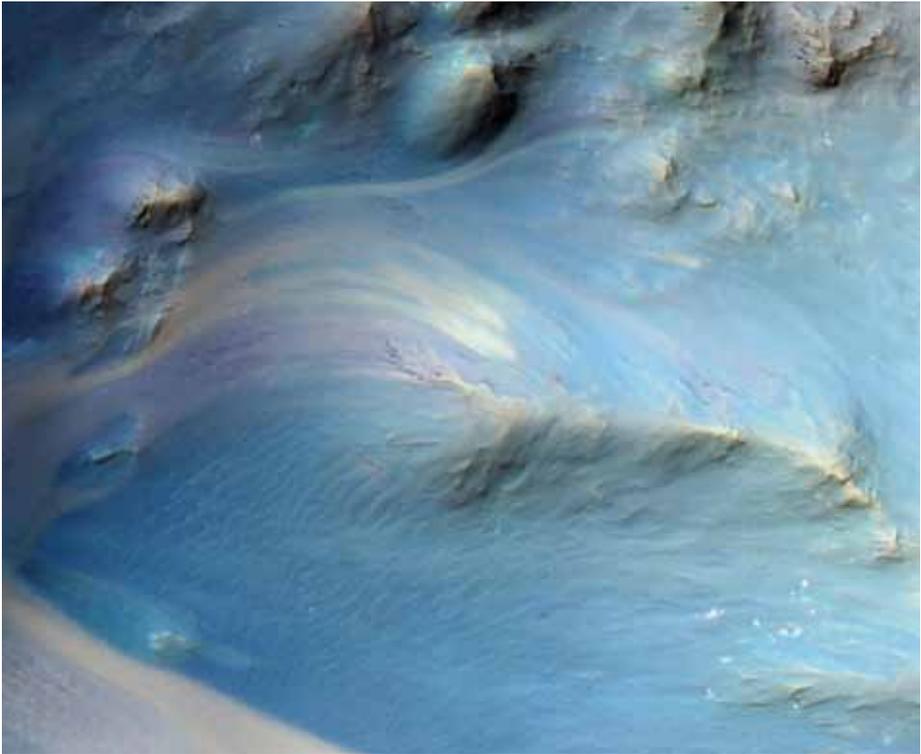
Image Credit: NASA/JPL/University of Arizona



Dust Devils on Mars

This beautiful observation shows a gorgeous pattern of dust devil tracks. Like on Earth, they often expose materials just underneath the surface, which in this case, makes for stunning patterns.

Image Credit: HiRISE Science Team



Colorful Streaks

This is an image of a central pit of an impact crater in the Martian ancient highlands. The central uplifts of large impact craters often collapse to form pits on Mars, but they are still structural uplifts and often expose deep bedrock with diverse rock types that have a variety of colors. This enhanced color sub-image displays colorful streaks where the bedrock is eroding, moving downhill a bit, and then getting swept by the wind.

Image Credit: NASA/JPL/University of Arizona



Seasonal Processes—Omega Sublimation

Mars's seasonal polar caps are composed primarily of carbon-dioxide frost. This frost sublimates (changes from solid directly to gas) in the spring, boosting the pressure of Mars's thin atmosphere. In the fall, the carbon dioxide condenses, causing the polar caps to reach as far as ~55 degrees latitude by late winter. In the study of seasonal processes we observe the caps as they increase and decrease in size to investigate both large-scale effects on Mars as well as the local details of the sublimation and condensation processes. By learning about current processes on a local level we can learn more about how to interpret the geological record of climate changes on Mars.

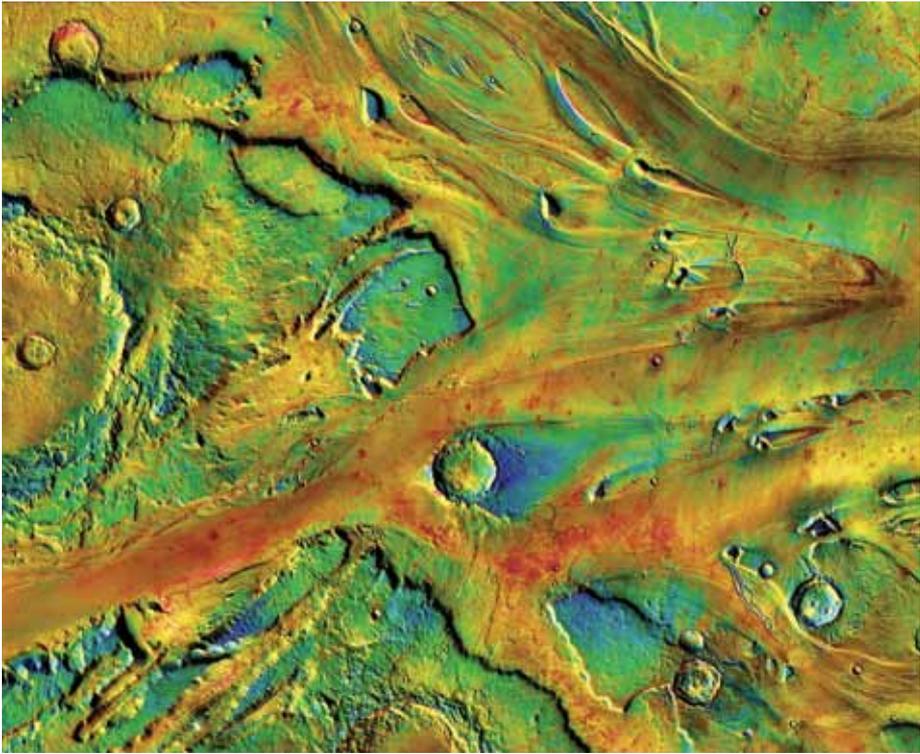
Image Credit: HiRISE Science Team



Mars Crater Ice

The European Space Agency's (ESA's) Mars Express obtained this view of an unnamed impact crater located on Vastitas Borealis, a broad plain that covers much of Mars's far northern latitudes. The circular patch of bright material located at the center of the crater is residual water ice. The colors are very close to natural, but the vertical relief of the topography is exaggerated three times. This patch of ice is present all year round, remaining after frozen carbon dioxide overlaying it disappears during the Martian summer.

Image Credit: ESA/DLR/Freie Universität Berlin (G. Neukum)



Kasei Channels

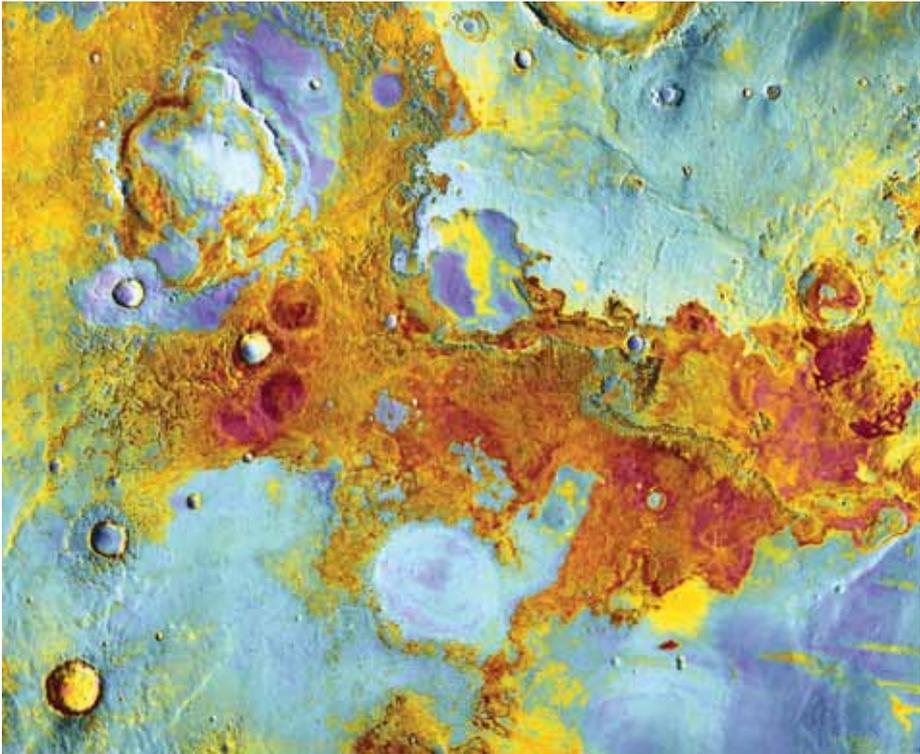
Ancient floods carved Kasei Valles

Billions of years ago, floodwaters emerged from Echus Chasma on the northern side of Valles Marineris, the “Grand Canyon” of Mars. The waters then poured across the landscape as they headed for the northern lowlands, carving a giant channel named Kasei Valles.

In the scene here, the floodwaters moved generally left to right, dividing and merging to erode a network of linked channels. Where the floods encountered hills and craters in their path, they often left a streamlined mesa behind the feature, pointing like a pennant downstream.

False colors display the nature of the ground surface. Areas in cool tints have more fine-grain materials (such as sand and dust) at the surface, while redder tints indicate areas with harder sediments and outcrops of rock.

Image Credit: NASA/JPL/University of Arizona



Meridiani Planum

When the Mars Exploration Rover, Opportunity, landed on Meridiani Planum in January 2004, it quickly found what it had been sent from Earth to find: evidence of liquid water in the Martian past.

Opportunity was targeted on Meridiani because remote sensing from orbit by the Thermal Emission Spectrometer (TES) on NASA's Mars Global Surveyor showed that portions of Meridiani contain up to 20 percent gray crystalline hematite at the surface. Hematite is an iron-oxide mineral, and on Earth the gray crystalline variety forms mostly in association with liquid water.

On the ground, Opportunity discovered the hematite lies within BB-sized spherules, dubbed "blueberries" by scientists. Blueberries that litter the surface at the landing site are embedded within outcrops of soft, layered sandstone rocks.

As geologists reconstruct it, the blueberries formed when strongly acidic groundwater drenched the basaltic sandstone, which was rich in goethite, another iron-bearing mineral. The water altered the goethite into hematite, forming spherules within the rocks. Then, over unknown ages, as the acid-rotted sandstones weathered away, the tougher spherules came free and collected on the surface.

Image Credit: NASA/JPL/University of Arizona



Ridge of Polar-Layered Deposits

Mars, like Earth, appears to have experienced global climate changes over the past few million years. Changes in the tilt—relative to the Sun—of the rotation axes of both Earth and Mars are thought to have influenced their climates, but these changes were greater in the Martian case.

For this reason and because of the apparent lack of recent oceans on Mars, it should be simpler to determine the causes and history of climate changes on Mars. HiRISE is returning images of the polar-layered deposits on Mars that have the potential to help to unravel Mars's climate history.

Analysis of HiRISE data should result in a better understanding of the timescales involved in the deposition of the layered deposits and provide important information regarding the climate history of Mars.

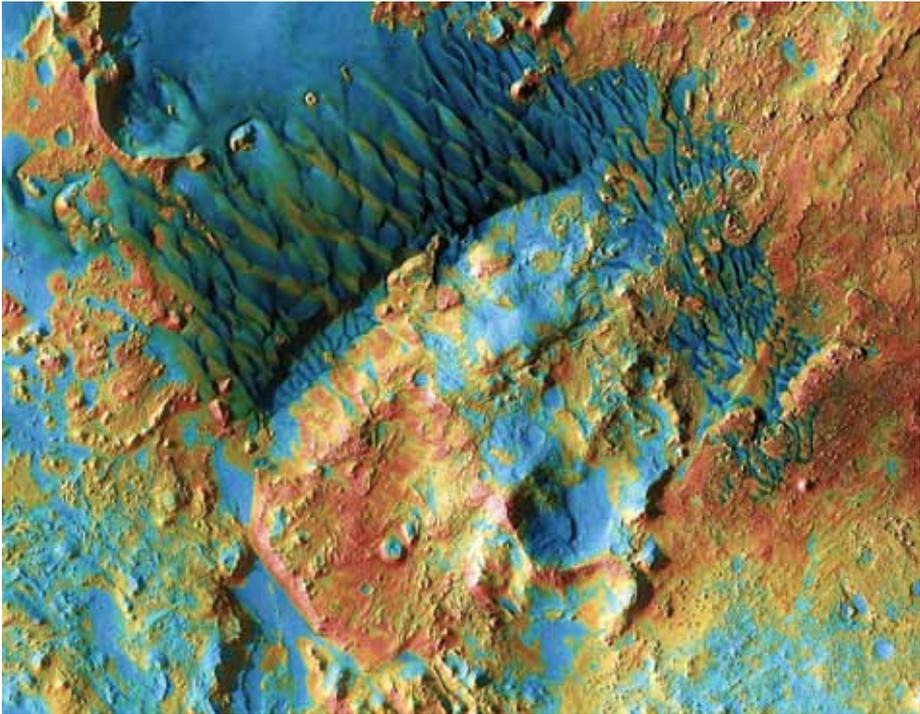
Image Credit: NASA/JPL/University of Arizona



Mazatzal in Color

The enhanced-color image taken by the microscopic imager on the Mars Exploration Rover Spirit shows the rock dubbed “Mazatzal” after a portion of its surface was brushed clean by the rover’s rock abrasion tool. This image was taken at Gusev Crater.

Image Credit: NASA/JPL-Caltech



Arabia Dunes

The battered region of Arabia Terra is among the oldest terrain on Mars. A dense patchwork of craters from countless impacts testifies to the landscape's ancient age, dating back billions of years.

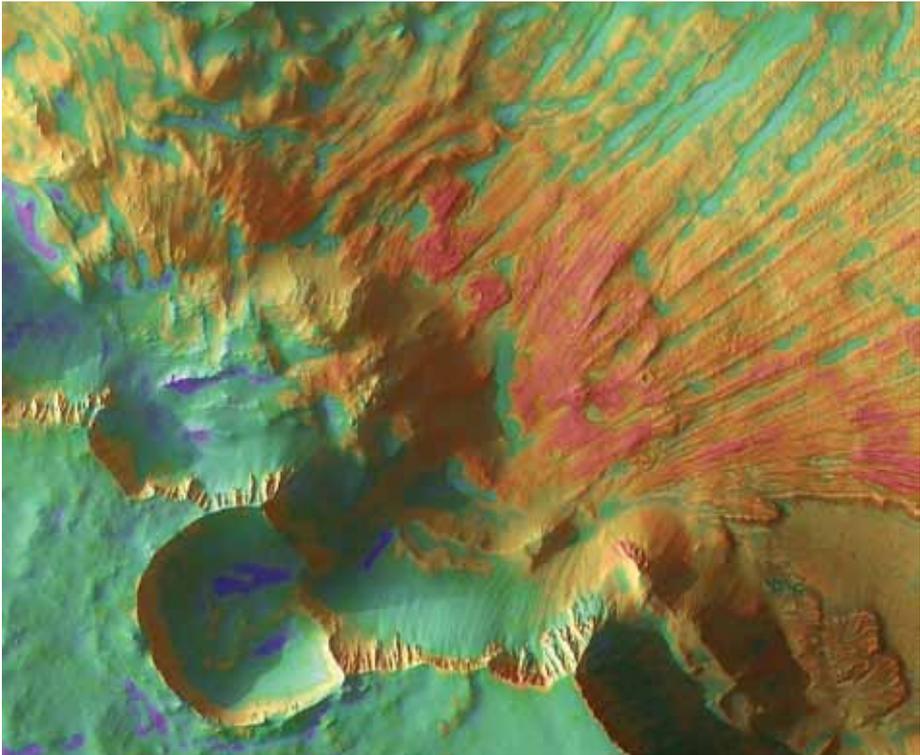
In eastern Arabia lies an anonymous crater, 120 kilometers (75 miles) across. The floor of this crater contains a large exposure of rocky material, a field of dark sand dunes, and numerous patches of what is probably fine-grained sand. The shape of the dunes hints that prevailing winds have come from different directions over the years.

This false-color image, made from frames taken by the Thermal Emission Imaging System (THEMIS) aboard NASA's Mars Odyssey orbiter, shows the center of the crater's floor. The image combines a daytime view at visible wavelengths with a nighttime view at infrared (heat-sensing) wavelengths, giving scientists clues to the physical nature of the surface.

Fine-grained materials, such as dust and the smallest sand particles, heat up quickly by day and cool off equally quickly at night. However, coarser materials—bigger sand particles, gravel, hardened sediments, and rocks—respond more slowly to the same daily cycle.

This means that when THEMIS views these coarse materials late in the Martian night, they appear warmer than the pools and patches of fine-grain sand. In the image here, areas that are cold at night appear in blue tints, while the warmer areas show in yellows, oranges, and reds.

Image Credit: NASA/JPL/University of Arizona

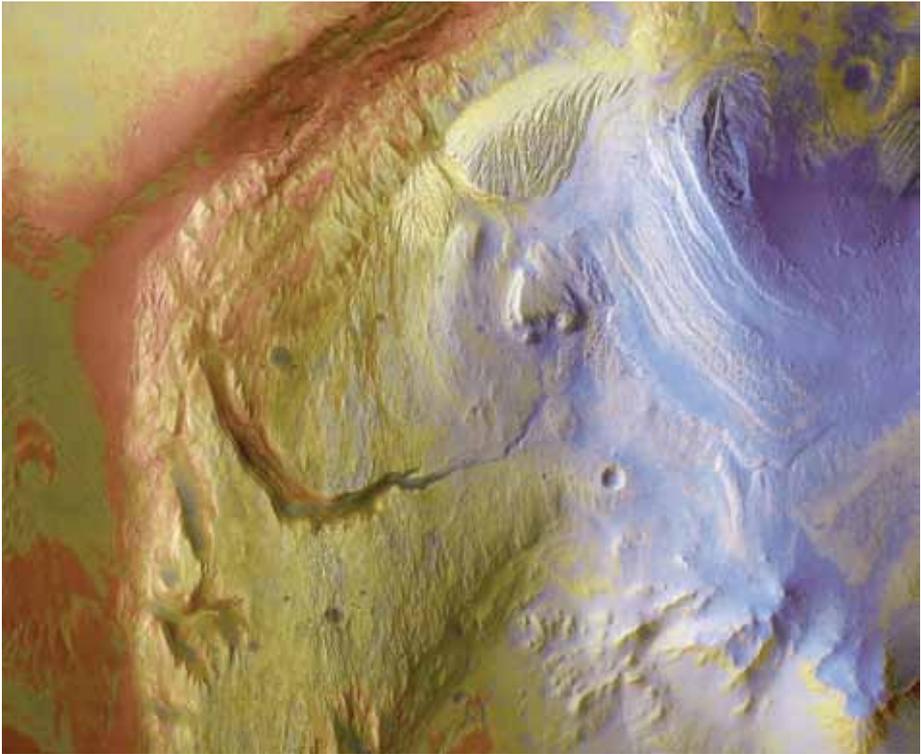


Noctis Landslide

What triggered a Martian landslide?

Landslides are common features in canyons on both Earth and Mars, and they happen the same way. Erosion undermines a canyon wall until abruptly millions of tons of rock come crashing down. In the case seen here, the impact of a meteorite landing near the edge of the canyon may have done more than just blast a crater 6.5 kilometers (4 miles) wide. The impact may also have triggered the massive landslide, either at the time of impact or shortly after.

Image Credit: NASA/JPL/University of Arizona



Gale Crater's History Book

Gale Crater forms a large natural repository for much of Martian geologic history. This ancient impact scar has a diameter of about 154 kilometers (96 miles) and lies close to where the cratered highlands drop off onto the northern lowlands in Elysium. Based on its size and state of preservation, scientists estimate Gale formed over 3 billion years ago.

What draws scientific interest the most is a big mound of layered debris filling about a third of the crater's floor. Wrapping around the crater's central peak—visible at lower right in the image—the mound stands about 5.5 kilometers (3.4 miles) higher than the northern crater floor and about 4.5 kilometers (2.8 miles) above the southern floor. The mound's highest parts even rise somewhat higher than Gale's southern rim.

Image Credit: NASA/JPL/University of Arizona



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