A nosotros los alumnos de geología nos gusta mucho realizar las prácticas de campo, porque tenemos la oportunidad de tomar muchas fotografías de estructuras geológicas, montañas y de afloramientos.

Eres estudiante o maestro de geología y tienes fotografías de afloramientos de tu área de estudio o de viajes de campo?

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Bernardo García-Amador

bernardo.garcia@ingenieria.unam.edu

quien está a cargo de organizar esta información.

NOTAS GEOCIENTÍFICAS

Extraterrestrial Remote Sensing and Planetary Processes

Gary Prost*

G.L. Prost GeoConsulting of El Cerrito, California

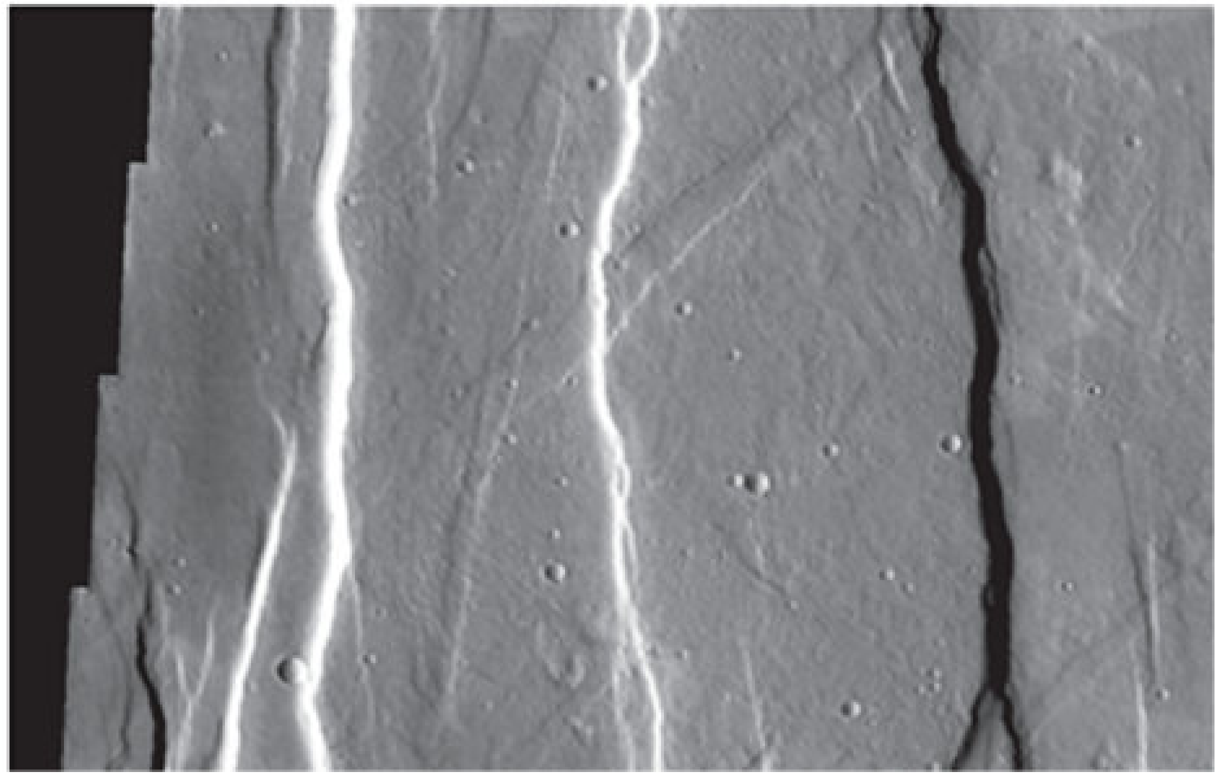
It turns out that landforms on other planets and moons are strikingly similar to landforms on earth. The surface materials and atmospheres may be different, with temperatures and pressures differing as well, but the processes are remarkably alike. Astrogeology is the ultimate in remote sensing: the analysis of geologic systems from afar with little or no chance of field work. It is all about understanding planetary processes remotely. Earth-based analogs suggest explanations for planetary landforms. Planetary landforms, on the other hand, provide almost pure endmembers for Earth processes such as wind-driven dunes, stream channel erosion, mass wasting, impact structures, fold structures, and other erosional, depositional, and structural features found on Earth. Whereas features on Earth are often obscured by the atmosphere, vegetation, and soil, and sometimes snow, ice, and water, there is no vegetation and little atmosphere, soil, liquids or ice on other planetary surfaces.

There was a time when heated debate existed about whether lunar craters were the result of impacts or volcanism. Scientists wondered whether the lunar surface was solid rock or consisted of rock powder that would swallow up a lunar lander. It was once thought that there could be no water on the moon, and probably none on Mars. These questions at last have been answered, and mostly by remote sensing. Did Mars ever have an Earth-like atmosphere and an ocean? Did life emerge on Mars? Do other planets have a form of plate tectonics? These questions are slowly being answered by remote sensing and in rare cases, landers.

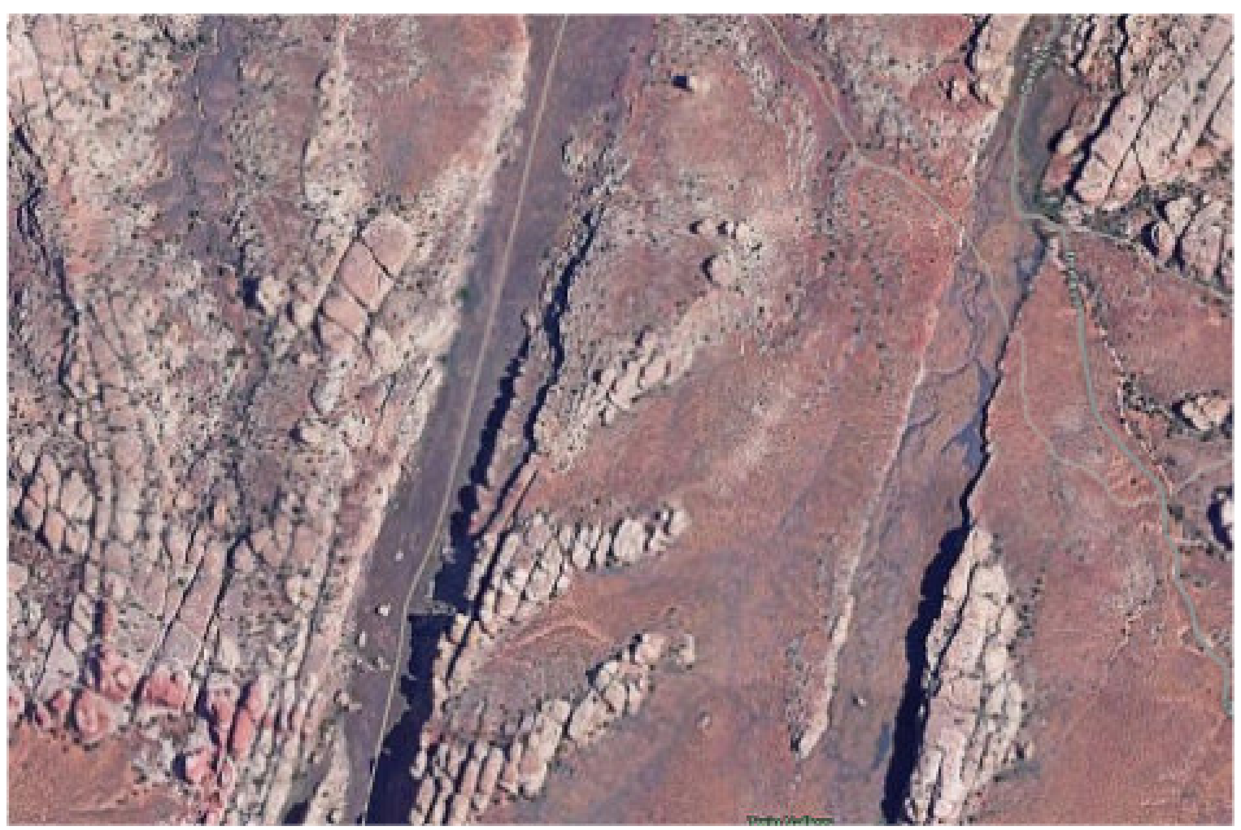
Fifty-five years ago, we got the first grainy, black and white images of the Moon and Mars. We now have geologic maps, derived from high-resolution radar and multispectral images, of the entire Moon and many parts of Mars. Cloud-shrouded Venus has been exposed by radar imagery. We have probed the moons of Jupiter and Saturn. The following images show some examples of extraterrestrial landforms and the geological processes they represent.

For a more in-depth discussion of these processes, please see Prost (2025).

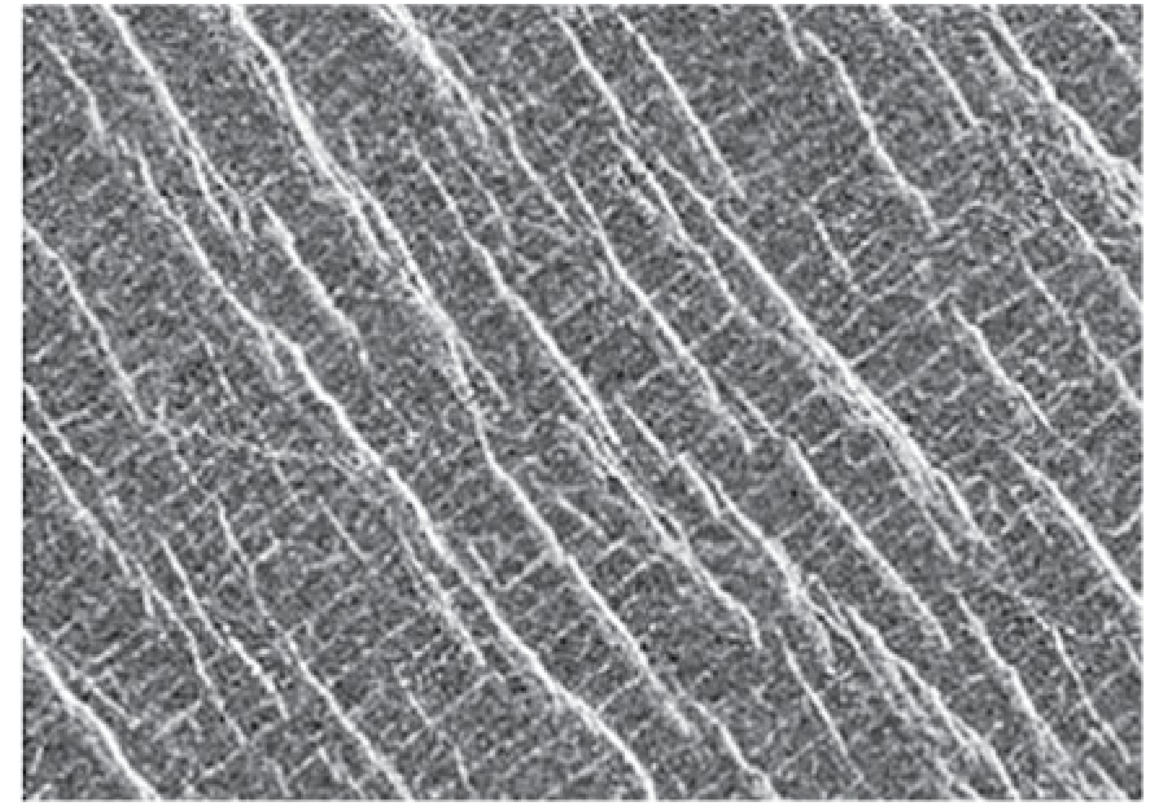
*garyprost01@gmail.com



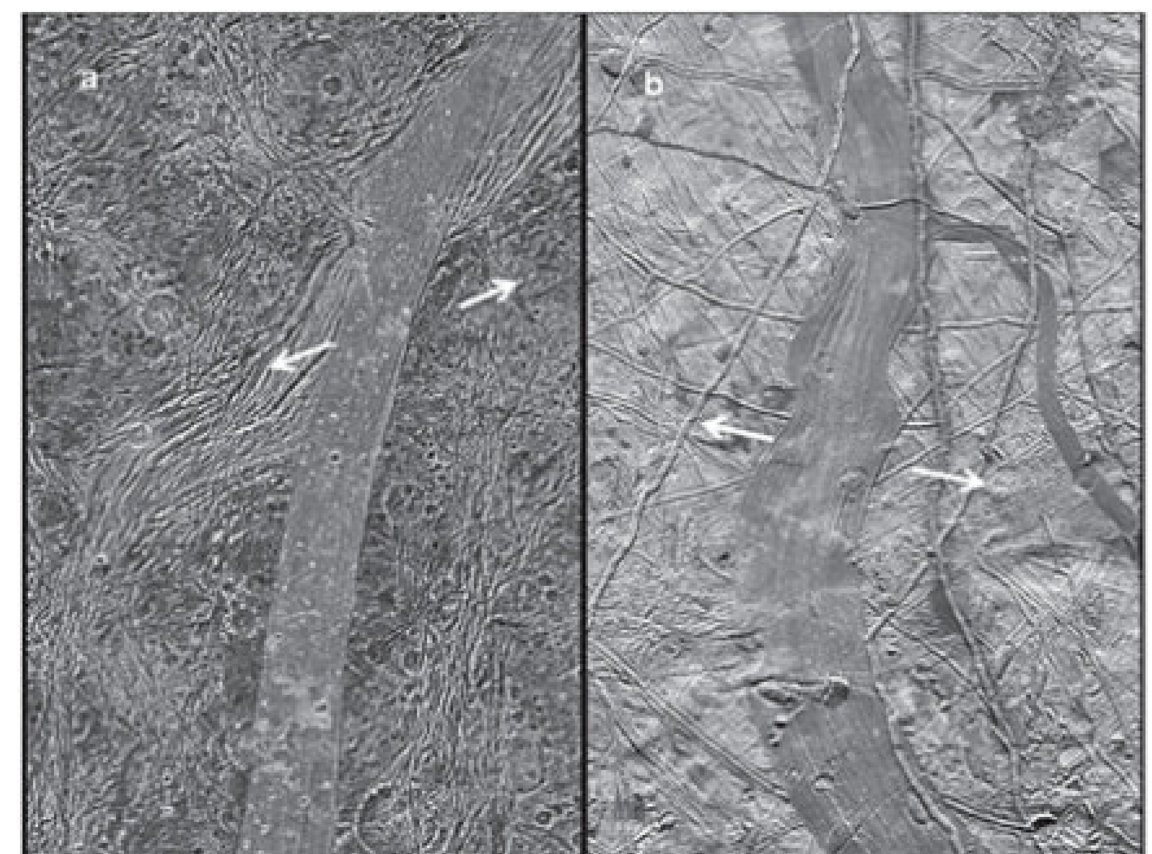
THEMIS image of normal faults, grabens, and relay ramps in the Alba Patera region, Mars. Taken by the Mars Odyssey spacecraft. Courtesy of NASA/JPL-Caltech/Arizona State University.



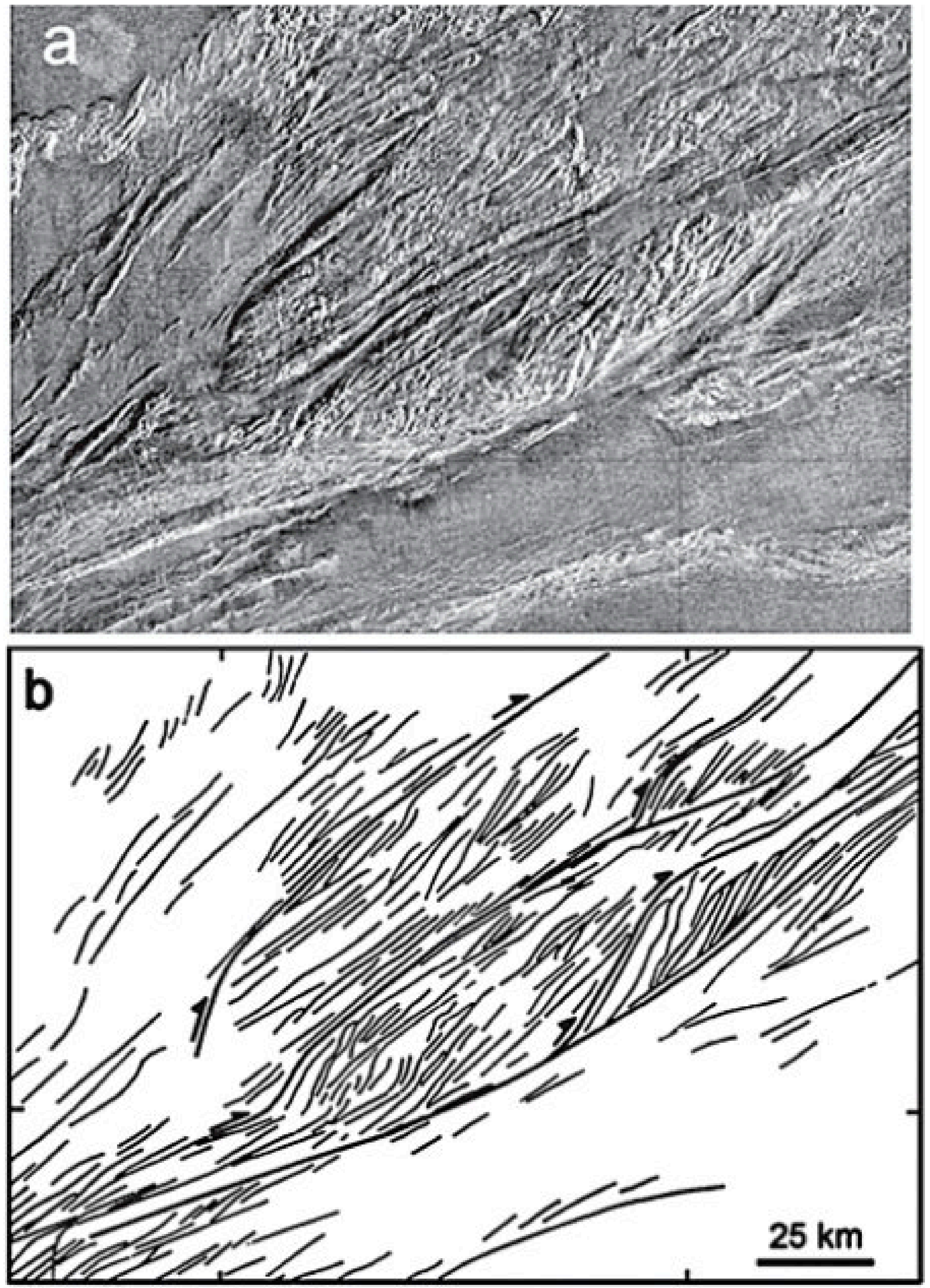
The Grabens, Canyonlands National Park, Utah. Google Maps ©2025 Airbus, Maxar Technologies.



Gridded plains of Sedna Planitia in the Lakshmi region of Venus are thought to be normal faults related to uplift and extension. Fainter lines are spaced at about 1 km and may represent jointing. North is at the top of the image. Magellan image courtesy of NASA.



Possible icy spreading centers. (a) Arbela Sulcus on Ganymede shows about 65 km transtensional strike-slip offset. (b) A band on Europa (right) apparently formed by crustal spreading. Both images were acquired by the Galileo spacecraft and are at the same scale. Courtesy of NASA/JPL.



A striking example of a dextral wrench-fault system can be seen along the Thetis Boundary Shear zone of Venus. (a) Magellan SAR image of the eastern segment, Thetis Boundary Shear Zone. (b) Structural interpretation of the SAR image. NASA image. Interpretation from Kumar (2005).

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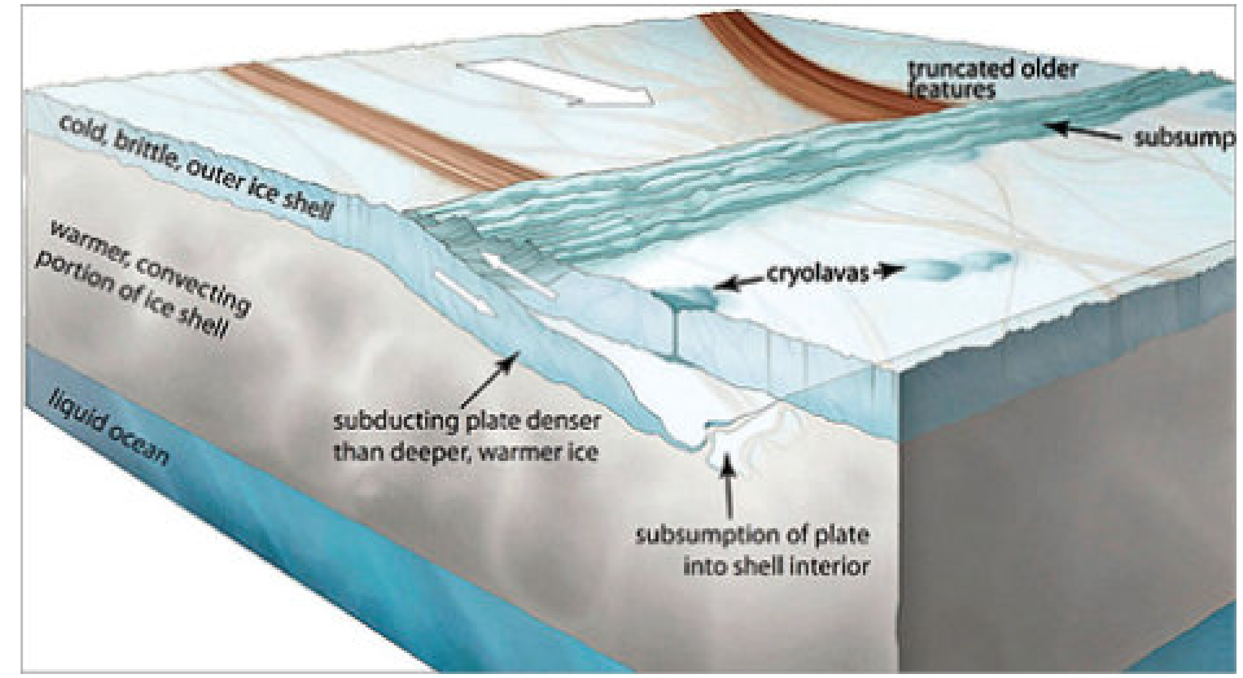
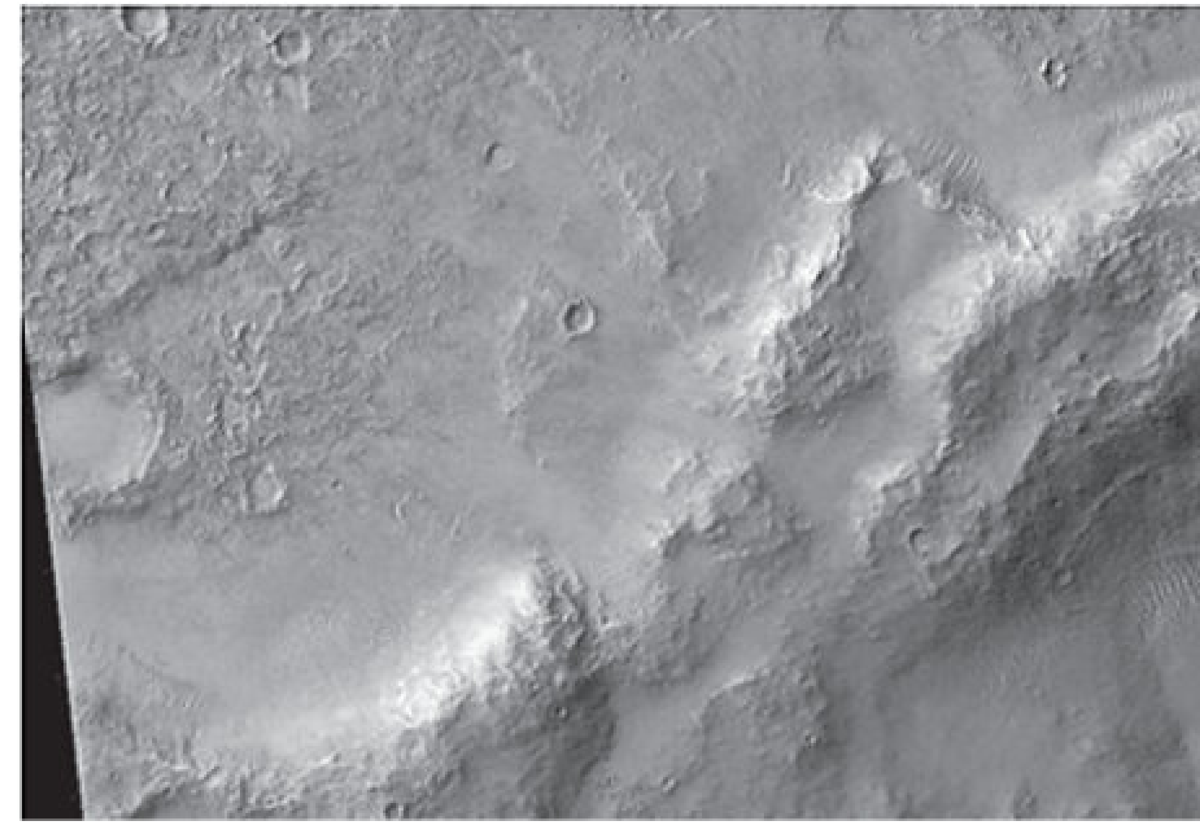


Diagram showing how plate tectonics may work on Europa. From NASA/JPL, 2014.

Ridges in icy crust of Europa are offset by strike-slip faults. Spreading centers and thrust or subduction zones are indicated. This image is ~12 × 15 km. The interpretation is the author's. The image was acquired by the Galileo spacecraft. Courtesy of NASA.

Ovda Regio, Venus. This image measures 300 by 225 km. Note the similarity to the figure below that shows thrusted folds on the Tibetan Plateau. Taken by the Magellan spacecraft. Courtesy of NASA.

True color image of part of the Tsaidam Basin, Tibetan Plateau, China, illustrating multiple northeast-directed thrust sheets with leading-edge anticlines. Image courtesy of CNES/SPOT Image and Google Earth, © 2012 Google.



Fold at Solis Planum, Mars. HiRISE image, Mars Reconnaissance Orbiter. Courtesy of NASA.

Mare Imbrium “wrinkle ridge” (fold), the Moon. Apollo 15 photo courtesy of NASA.

Schiaparelli Crater, Mars, in layered sediments. Note the similarity to the Richat impact structure, Mauritania (below). Mars Global Surveyor image courtesy of NASA/JPL/Malin Space Science Systems.

Oblique view toward the east over the Richat impact structure in the barren Gres de Chinguetti Plateau, central Mauritania. Banding is due to uplifted Paleozoic sedimentary layers. International Space Station image, courtesy of NASA.

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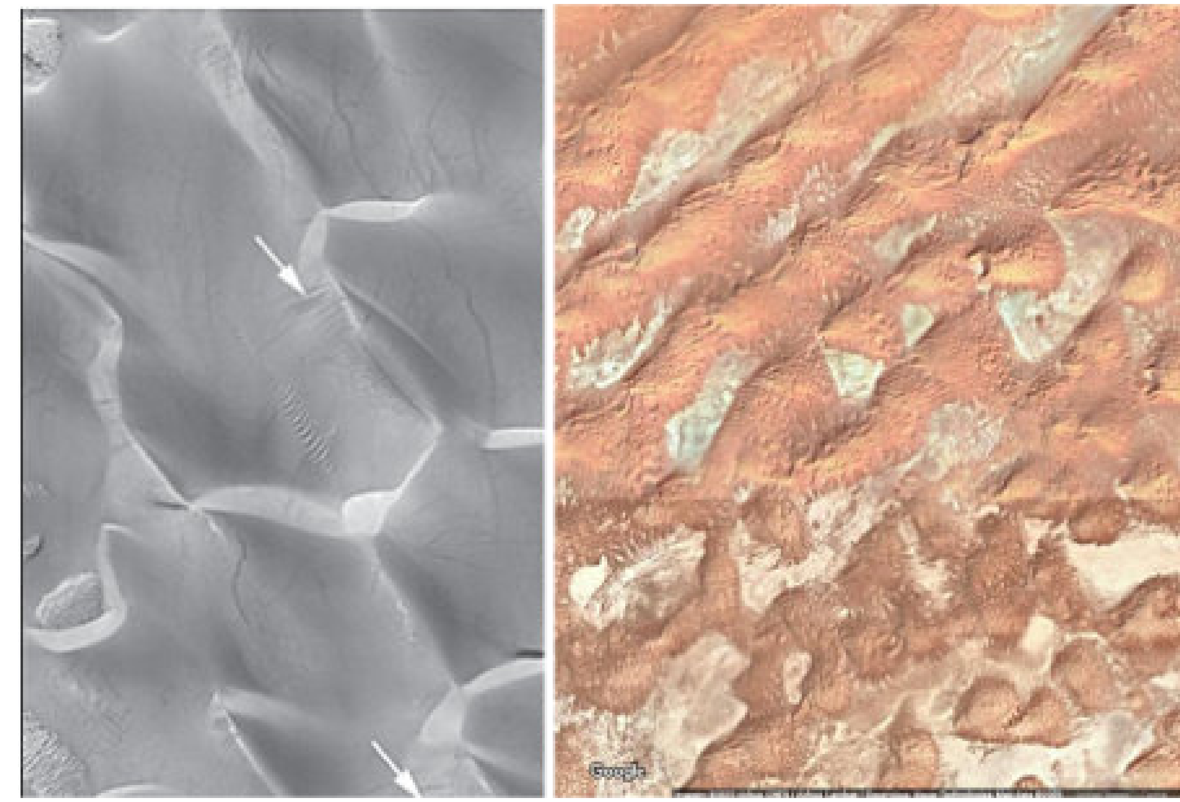
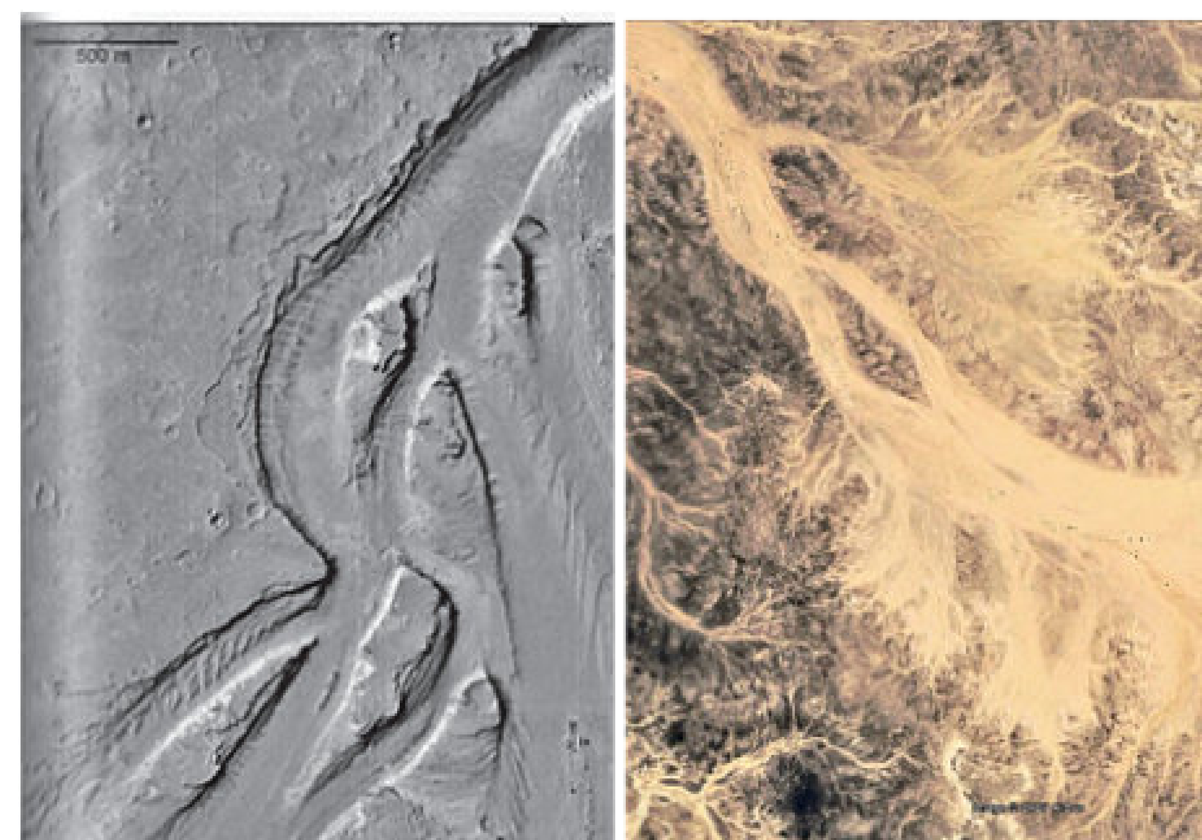
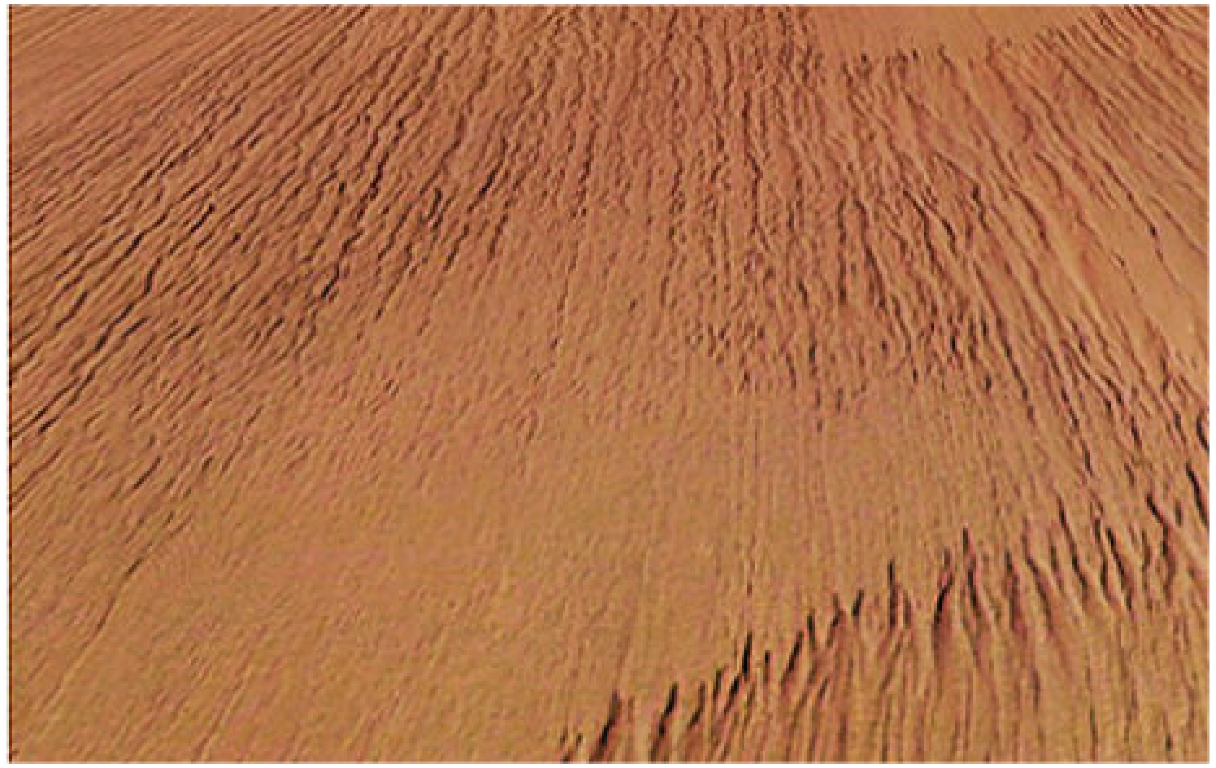


Left: Dune field in Rabe Crater, Mars. Arrows indicate wind direction. Mars Global Surveyor image, courtesy of NASA, Jet Propulsion Lab, and Malin Space Science Systems. Right: Dune field in the Rub al Khali, Saudi Arabia. Google Maps image, ©2025 Airbus, CNES/Airbus, Landsat/Copernicus, Maxar Technologies.

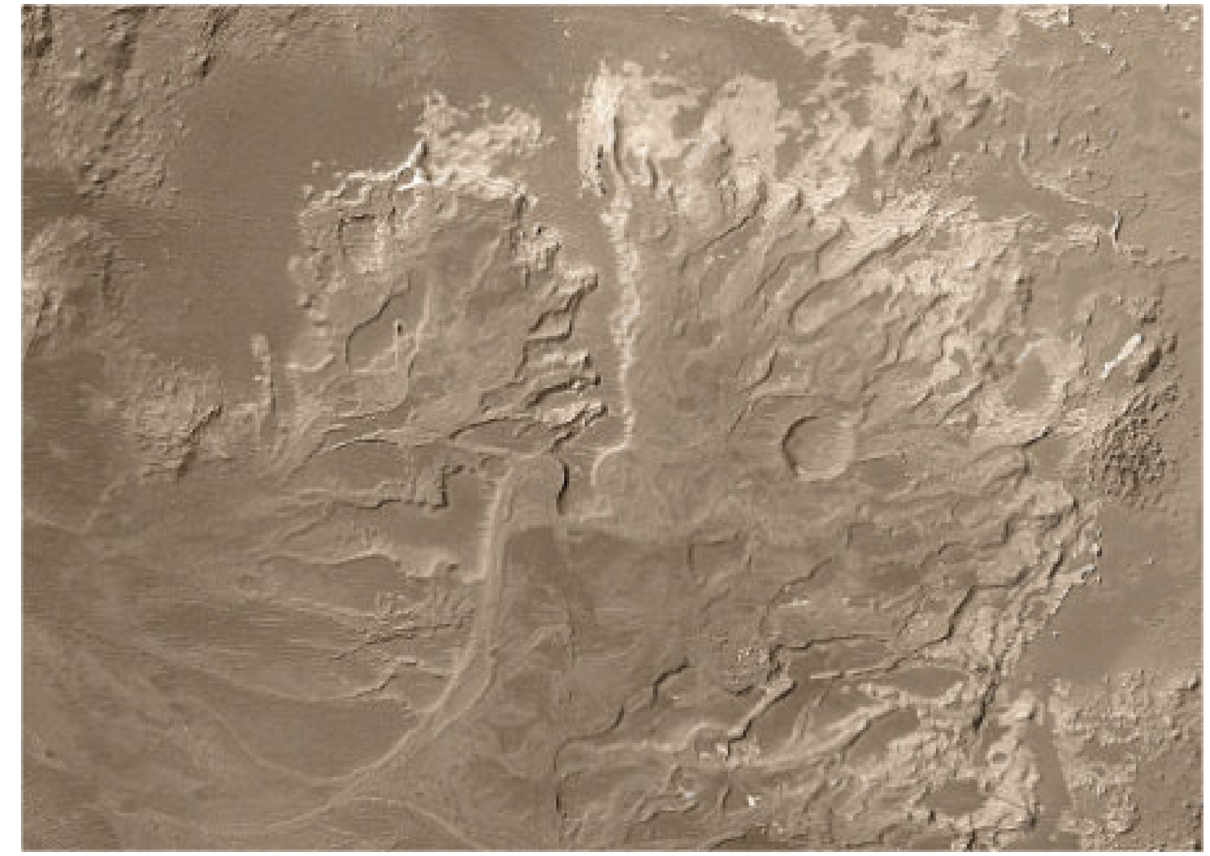


Left: Cerberus Fossae floodwater channels in the Athabasca part of the Marte Vallis system. Mars Orbiter Camera courtesy of NASA/Malin Space Science Systems. Right: Google Earth image of the Wadi Stum area, Oman. ©2025 Airbus.

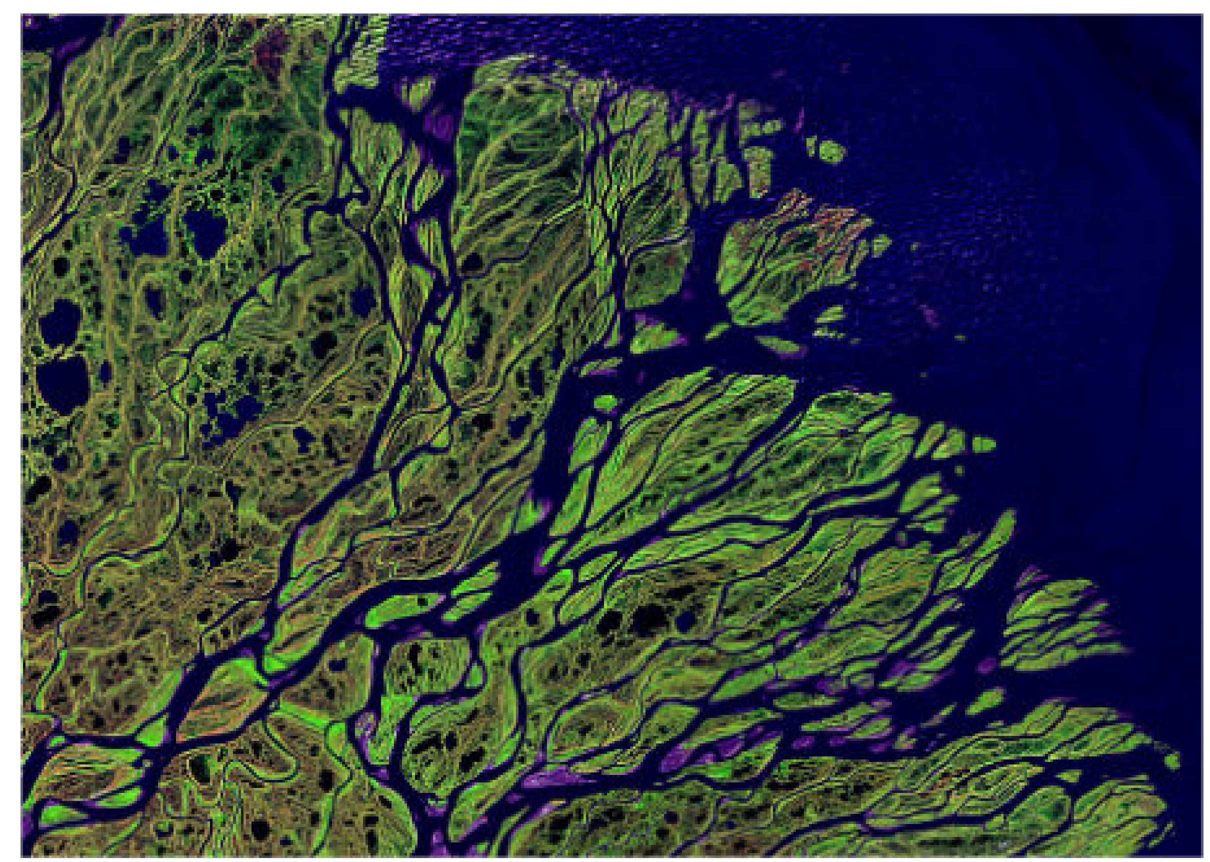


Yardangs near Olympus Mons acquired by Mars Express spacecraft. These are long sharp ridges cut by wind erosion that may have accentuated fractures. Courtesy of European Space Agency.

Oblique view northeast at yardangs (joint-controlled fins of rock) in the Jurassic Kayenta and Wingate sandstones of the San Juan Arm of Lake Powell, Utah. Joints are etched by eolian abrasion. Image courtesy of USDA Farm Service Agency, TerraMetrics, and Google Earth, © 2012 Google.



The Eberswalde delta complex, Eberswalde crater, Mars. Mars Global Surveyor, Mars Orbiter Camera. Image courtesy NASA/JPL/Malin Space Science Systems.



Lena River Delta, Russia. False-color Landsat image courtesy of NASA Visible Earth.

A cut off meander in lava channels, Sedna Planitia, Venus. Magellan radar mage courtesy of NASA.

Meander cutoffs along the Mississippi River between Louisiana and Mississippi. Google Maps.

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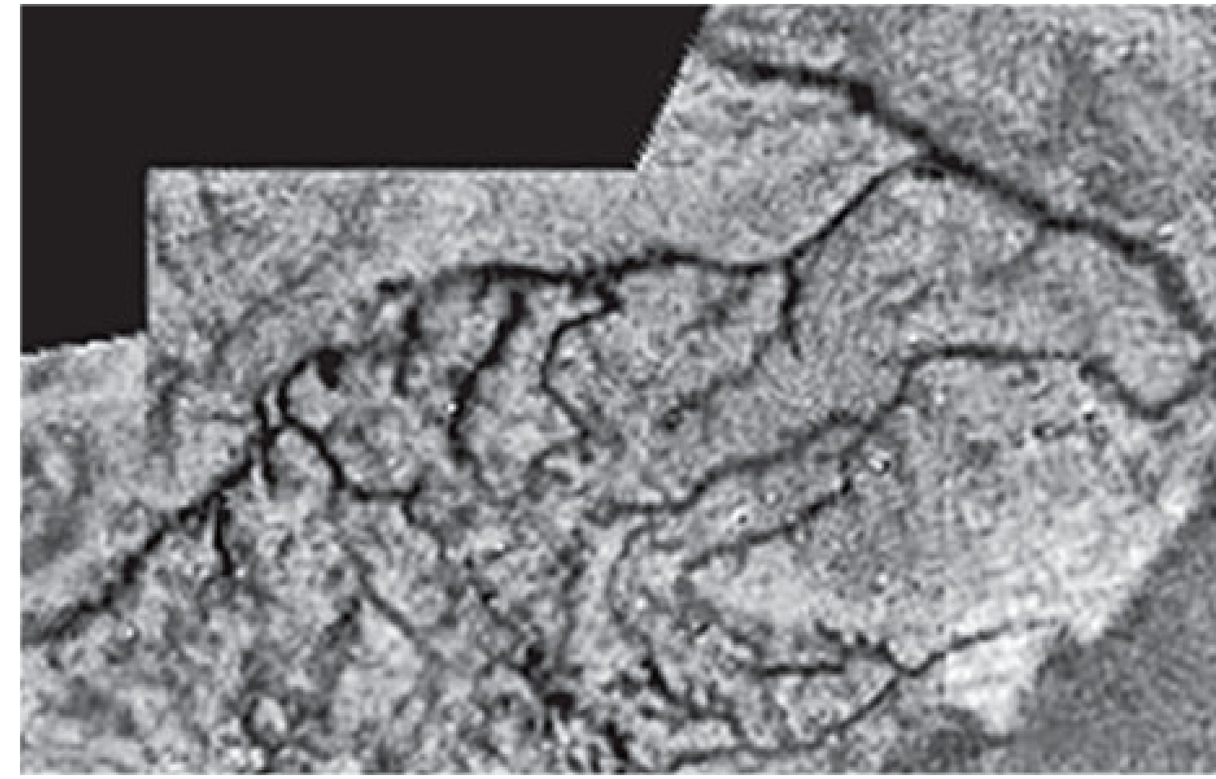
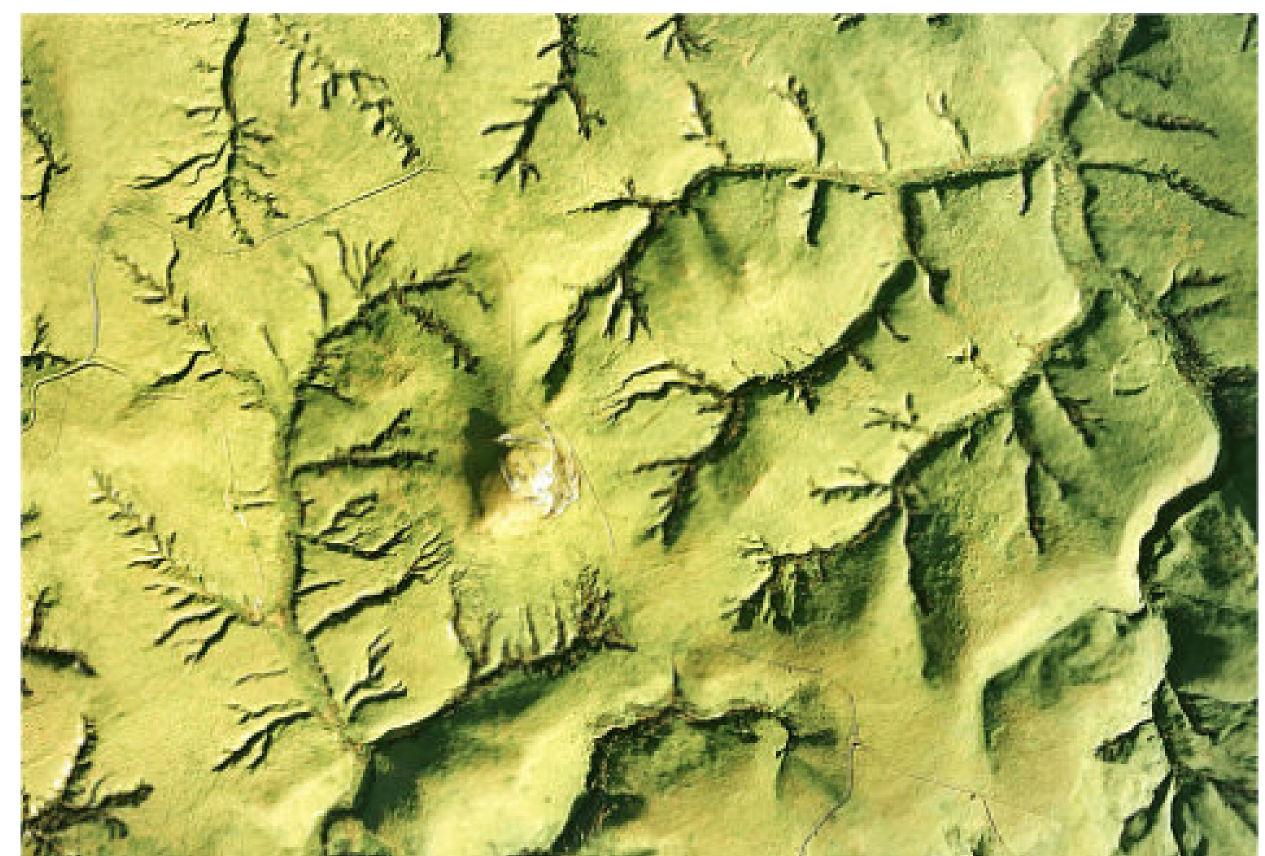
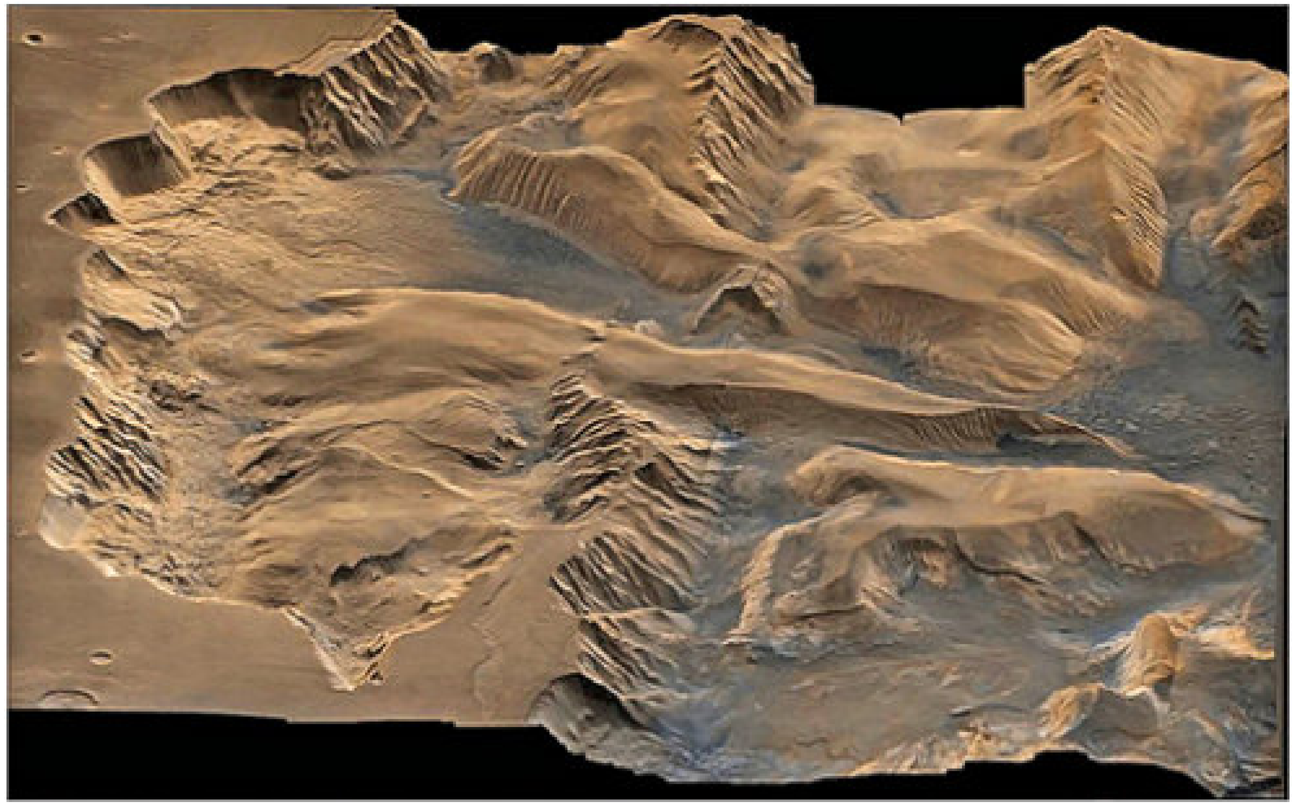


River channels and a lakebed on Titan. This image mosaic is from the Huygens Descent Imager/Spectral Radiometer on the Cassini-Huygens mission. Image credit: NASA/JPL/ESA/University of Arizona.



Airphoto of tundra with dendritic drainage, Soya Hill, China. Courtesy of 国土交通省,
https://commons.wikimedia.org/wiki/File:Soya_Hill_Periglacial_Landforms_Aerial_Photograph.JPG



Oblique view of a landslide in Ophir Chasma (left) and Candor Chasma (right), Valles Marineris, Mars. This Viking mission image was produced by U.S. Geological Survey.

Oblique lidar shaded relief map looking east up the Gros Ventre River valley, Wyoming. The Gros Ventre Slide, which occurred on June 23, 1925, is outlined in black. Image courtesy of the U.S. Geological Survey.

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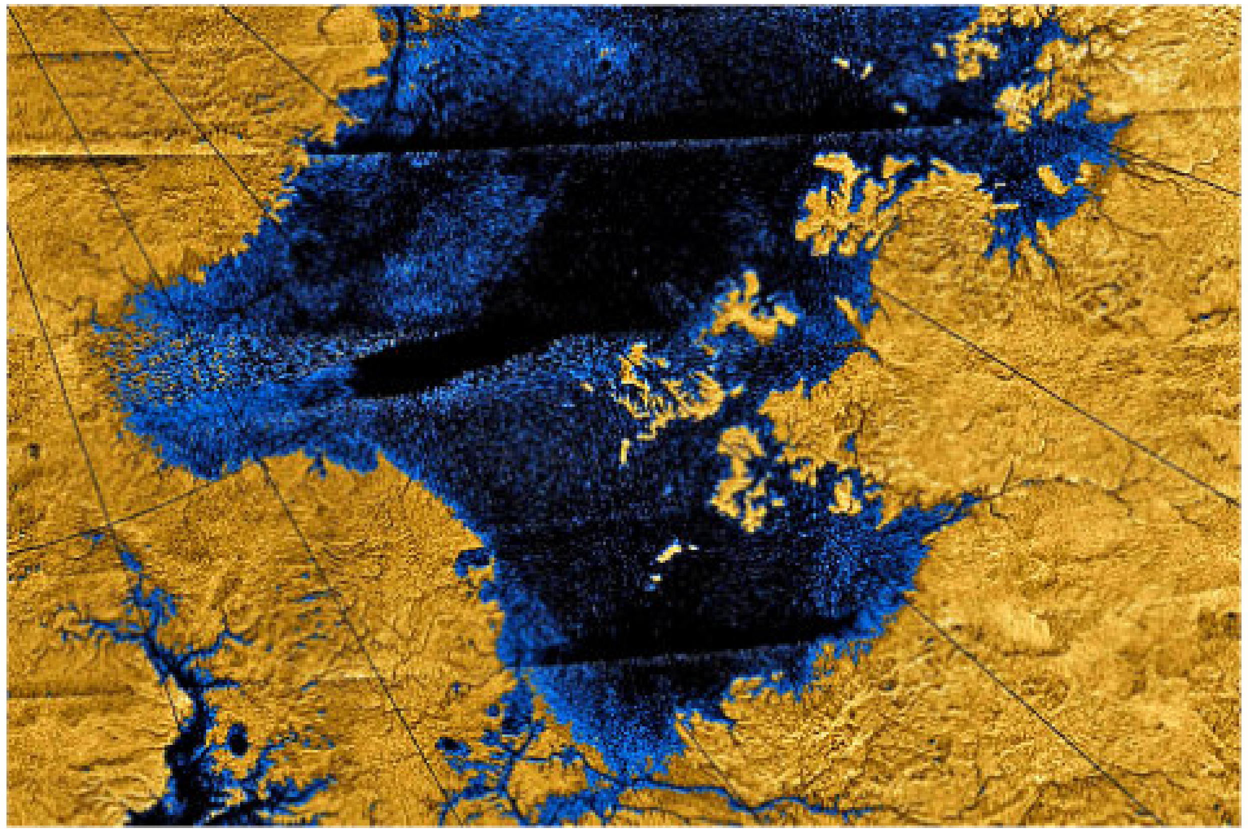
Glacial moraines on Mars and Earth share similar morphologies. Top: Mars Reconnaissance Orbiter image of ridged lines carved onto Mars' landscape by the movement of ice. Image courtesy of NASA/Caltech/University of Arizona. Bottom: Lateral and medial moraines mark the surface of a valley glacier, Wrangell-St. Elias National Park, Alaska. Courtesy of National Park Service/James W. Frank.



Cassini-Huygens radar image of Ligeia Mare Saturn's moon Titan. The blue-black lakes and rivers look just like rivers and lakes on Earth, but here they consist of liquid methane. Image courtesy of NASA/JPL/USGS.

Geysers or volcanism? This image shows water ice erupting from the surface of Enceladus. Cassini image courtesy of NASA/JPL/ESA.

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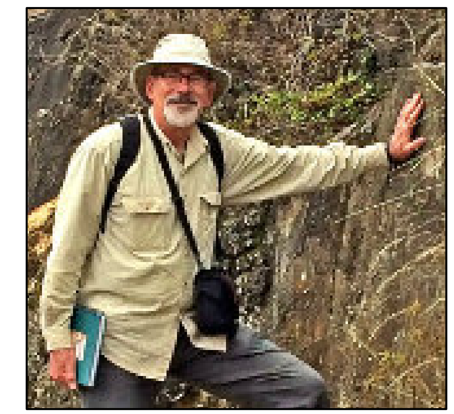
Gary L. Prost (Ph.D.)

Consulting Geologist



Gary L. Prost obtained his BSc in geology from Northern Arizona University and an MSc and PhD in geology at Colorado School of Mines. Over the past 45 years, he has worked for Norandex (mineral exploration), Shell (petroleum exploration), the U.S. Geological Survey (geologic mapping, coal), the Superior Oil Company (mineral and oil exploration), Amoco Production Company (oil exploration, remote sensing, and structural geology), Gulf Canada (international new ventures), and ConocoPhillips Canada (Arctic exploration, gas field development, oil sands development). He spent 20 years working as a satellite image analyst searching for hydrocarbons and minerals in over 30 countries. He has been involved in 2 field discoveries as well as oil and gas field development. His most recent work is leading field trips and educating the public on topics of geological interest. He is the principal geologist for G.L. Prost GeoConsulting of El Cerrito, California. He has published eight books: Remote Sensing for Geoscientists: Image Analysis and Integration (fourth edition, Taylor & Francis, 2025); Rocks and Riches - Exploring California's Stunning Geology; the geological tours of the world series South America's Natural Wonders (Taylor &Francis, 2024); The United Kingdom's Natural Wonders (Taylor & Francis, 2023); and North America's Natural Wonders (2 volumes; Taylor & Francis, 2020); The Geology Companion: Essentials for Understanding the Earth (Taylor & Francis, 2018); and the English–Spanish and Spanish–English Glossary of Geoscience Terms (Taylor & Francis, 1997). He is currently working on Geologic Tours of the World – Western Europe's Natural Wonders, and North Africa-Middle East's Natural Wonders.

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