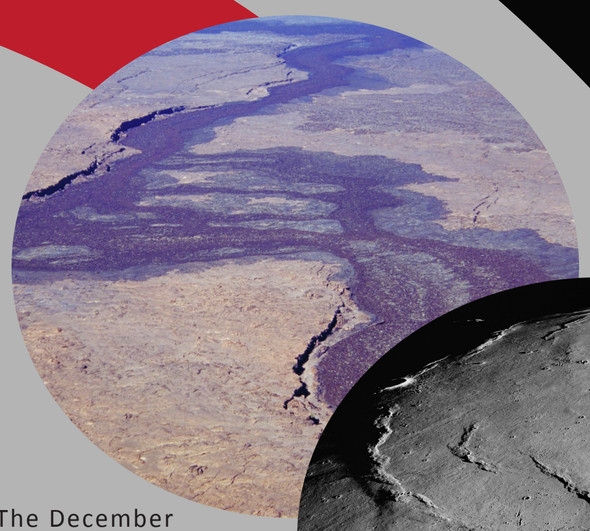
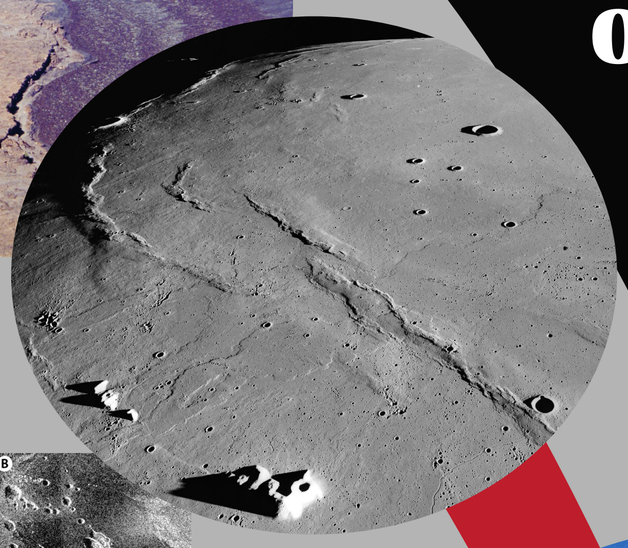
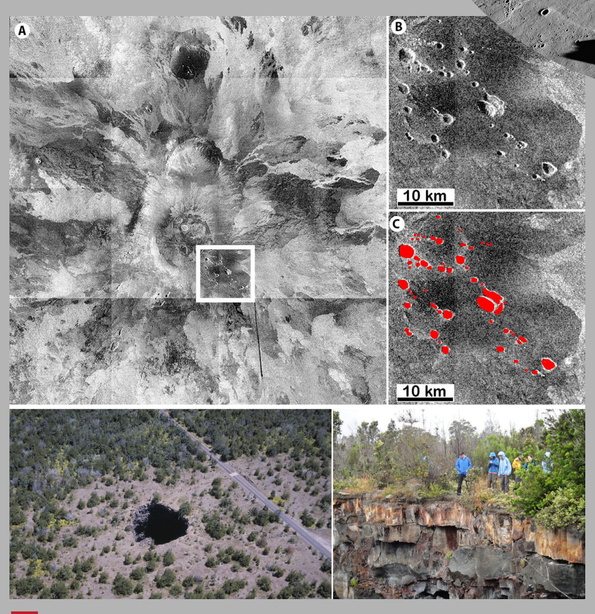
VOLCANOES
of Hawai'i and the Planets





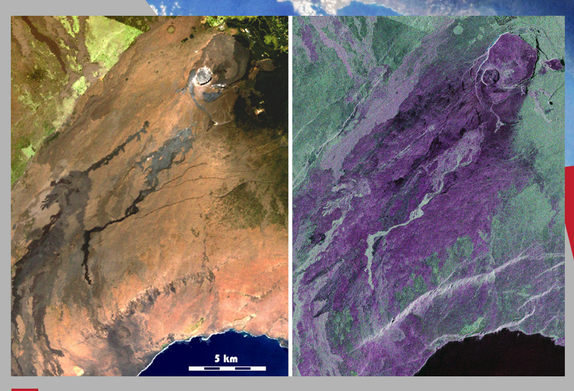
Above: The December 1974 lava flow on Kilauea. Right: A view from the Apollo Command Module of the ancient lava flows in Mare Imbrium on the Moon.

Every time astronauts blast into space for another mission to the International Space Station, they get an exciting view of the volcanoes in Hawaii. Hawaiian eruptions are some of the best studied in the world and give detailed information on the way that volcanoes work. Surprisingly, because of their similar composition and shape, Mauna Loa and Kilauea volcanoes are also studied by geologists who look at the other planets. Hawaii has also been a place where "remote sensing" instruments such as imaging radars and spectrometers have been tested to better understand the geology of the planets. Indeed, Hawaii is the next best place to be if you are working on the Moon, Mars, Venus, Mercury and the moons of Jupiter and Saturn!



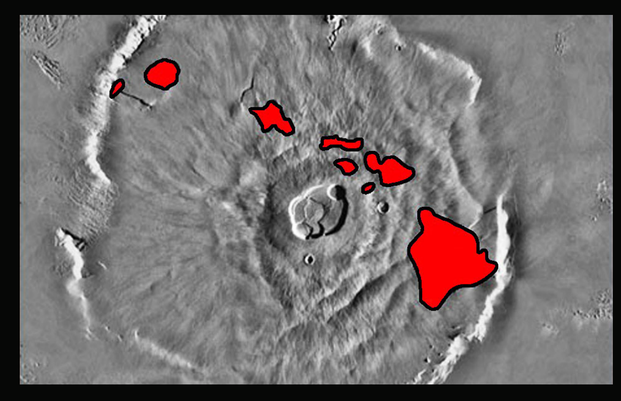
Pit Craters on Venus and Kilauea

Pit craters can be interpreted to be the surface expression of dikes in volcanic areas, and can be used to help define the internal structure of a volcano. In addition, pit craters may be "skylights" into lava tubes, and thus have attracted interest as possible shelters for astronauts on the surface of the Moon, or as possible sites for astrobiological activity on Mars. Fine examples of pit craters can be seen on the flanks of Maat Mons volcano, Venus (Top). The insert marks the location of parts B and C. Part B shows the pit craters and Part C identifies these pits in red. The upper part of Kilauea's East Rift Zone is marked by a very prominent line of craters (bottom). These craters are derived purely by collapse, as evidenced by the lack of any build-up of materials around their rims.



Multispectral and Radar Images of Kilauea

Numerous satellite and aircraft images of Hawaii have been collected since 1984. Here we compare a Landsat satellite image (left) with an aircraft radar image (right) collected from NASA's unmanned aerial vehicle radar (UAVSAR). Comparing the colors and contrast of these images provides valuable information that helps us understand volcanism on Mars (using multispectral data) and Venus or the Moon (using radar). For instance, the radar-bright portions of the image are either rough lava flows or radar-facing scarps. Radar-dark features are smooth pahoehoe lava flows or ash deposits.



Olympus Mons, Mars – Hawai'i Comparison

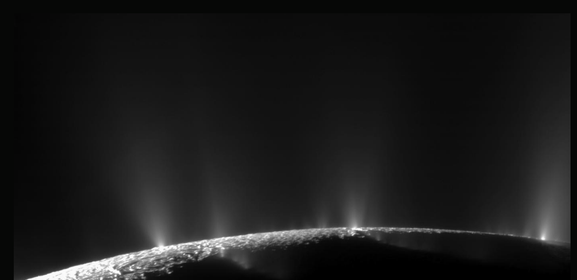
The Martian volcano Olympus Mons (18°N, 133°W) is one of the largest volcanoes in the Solar System. It is 600 km across and 27 km high. In this view, Olympus Mons is compared to the Hawaiian Islands at the same scale. Notice that the Island of Oahu would fit easily inside the summit crater ("caldera") of Olympus Mons. The great size of volcanoes on Mars is partially due to the lower gravity and the lack of plate tectonics. It is likely that Olympus Mons erupted for a very long time, perhaps one or two billions of years.

Kupaianaha Lava Lake, Hawai'i, and the Volcanoes of Io

Several eruptions in Hawai'i have included active lava lakes, including the Kupaianaha eruption in the late 1980s. At left we see vigorous fountaining on the active lake surface. Incandescent lava has a temperature of ~1,150°C, while the shiny lake surface is much cooler, perhaps only 400°C. Lava lakes are common on Io, such as Tupan Patera (at right), which is a volcanic depression ~75 km across. The black material is recent, still warm lava. But compare the scale of this feature – insert compares Kilauea at the same scale as Tupan Patera!

Lava Channels, Hawai'i and the Moon

During many eruptions of Pu'u O'o at Kilauea, Hawai'i, pahoehoe lava flows form solid edges ("levees") and the lava moves more rapidly in a central channel (top). Similar channels can also be seen within certain lunar and Martian lava flows. The Apollo 15 mission visited one such lunar feature called Hadley Rille (26.4°N, 3.7°E). Hadley Rille is a valley that was probably formed as a lava channel during a major volcanic eruption on the Moon over 3 billion years ago. Here we can see astronaut James Irwin and the lunar rover at the edge of the Rille, which is over 300 m deep. Pu'u O'o photo by Scott Rowland.



Fire Fountain Eruptions at Pu'u O'o and Enceladus

The eruptions of Pu'u O'o at Kilauea created large plumes that spread ash on the surrounding countryside. Similar explosions, this time of water ice crystals, are believed to characterize the bright jets of material ejected off of the surface of Enceladus, a moon of Saturn. Numerical models of volcanic eruptions have been developed to explain the eruptions of lava in Hawaii, and these models are frequently adapted to include the differences in surface gravity, atmospheric pressure and magma composition.

PRPDC HAWAI'I

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The Pacific Regional Planetary Data Center (PRPDC) is one of nine national centers around the United State that archive NASA planetary data, and make them available to the general public. An additional seven centers are located around the world. One of the foci of the PRPDC is showing volcanoes in Hawaii as planetary analogs. To see more examples of this planetary volcanology comparison, please visit:
http://www.higp.hawaii.edu/prpdc/pva/index.html

For a listing of all the national regional planetary image facilities (RPIFs), visit:
http://www.higp.hawaii.edu/prpdc/rpifs.html

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