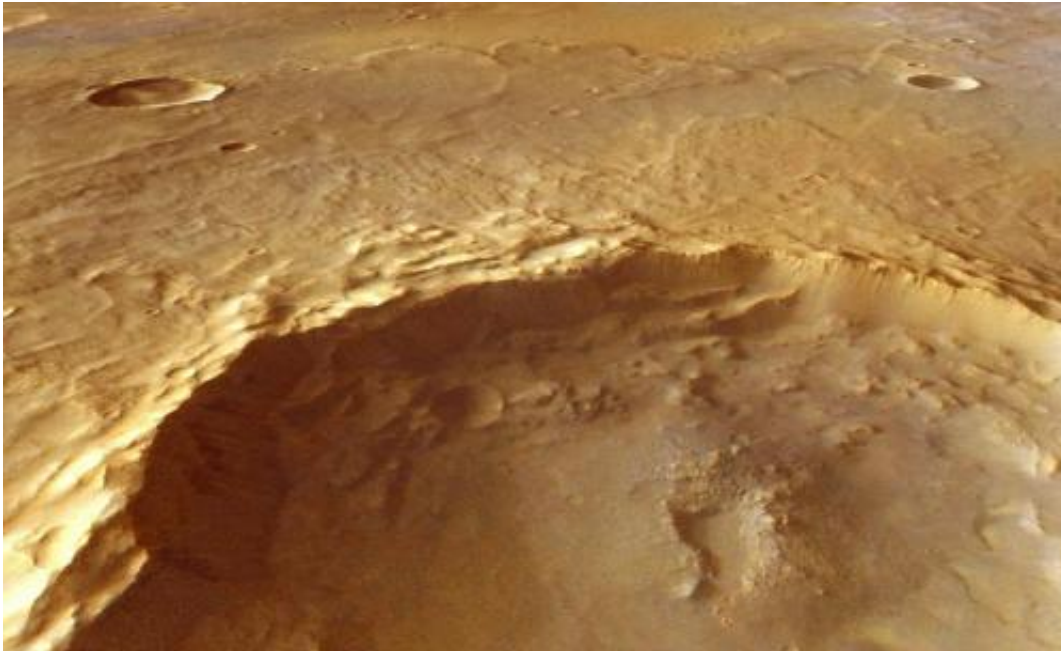


Exhumed rocks reveal Mars water ran deep

June 28 2012



The large 25 km-diameter crater in the foreground of this High Resolution Stereo Camera (HRSC) perspective view has excavated rocks which have been altered by groundwater in the crust before the impact occurred. Using OMEGA (Visible and Infrared Mineralogical Mapping Spectrometer) on ESA's Mars Express and CRISM (Compact Reconnaissance Imaging Spectrometer for Mars) on NASA's Mars Reconnaissance Orbiter (MRO), scientists have identified hydrated minerals in the central mound of the crater, on the crater walls and on the large ejecta blanket around the crater. Hydrated minerals were found in 175 locations associated with other nearby craters in the Tyrrhena Terra region of Mars. Credits: Mars Express HRSC, ESA/DLR/FU Berlin (G. Neukum); NASA/MOLA Science Team; D. Loizeau et al.

(Phys.org) -- By studying rocks blasted out of impact craters, ESA's Mars Express has found evidence that underground water persisted at depth for prolonged periods during the first billion years of the Red Planet's existence.

Impact craters are natural windows into the history of planetary surfaces – the deeper the crater, the further back in time you can probe.

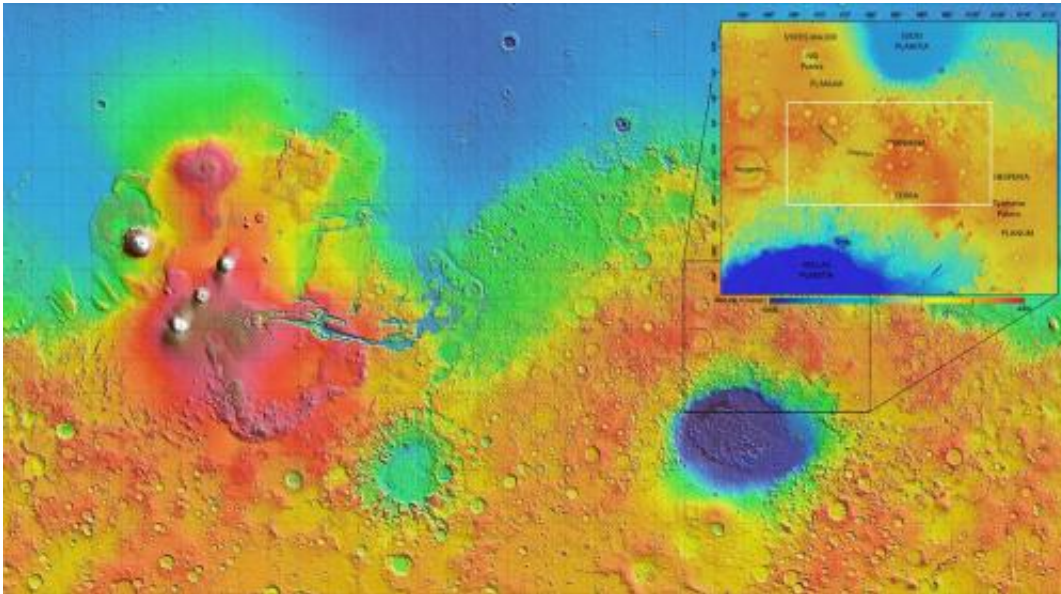
In addition, rocks blasted out during the impact offer a chance to study material that once lay hidden beneath the surface.

In a new study, ESA's [Mars](#) Express and NASA's Mars Reconnaissance Orbiter zoomed in on craters in a 1000 x 2000 km region of the ancient southern highlands, called Tyrrhena Terra, to learn more about the history of water in this region.

Focusing on the chemistry of rocks embedded in the crater walls, rims and central uplifts, as well as the surrounding exhumed material, scientists identified 175 sites bearing minerals formed in the presence of water.

“The large range of crater sizes studied, from less than 1 km to 84 km wide, indicates that these hydrated silicates were excavated from depths of tens of metres to kilometres,” says Damien Loizeau, lead author of the study.

“The composition of the rocks is such that underground water must have been present here for a long period of time in order to have altered their chemistry.”



The 1000 x 2000 km area region of Tyrrhena Terra (outlined by the white box in the inset) sits between two regions of low altitude - Hellas Planitia and Isidis Planitia - in Mars' southern hemisphere, as shown in this global topography map. Hydrated minerals were found in 175 locations associated with impact craters in Tyrrhena Terra, such as inside the walls of craters, along crater rims, or in material excavated by the impact. Analysis suggests that these minerals were formed in the presence of water that persisted at depth for an extended period of time. Credits: NASA/MOLA Science Team /D. Loizeau et al.

While the material excavated by impacts appears to have been in close contact with water, there is little evidence for rocks on the surface lying between the craters in Tyrrhena Terra having been altered by water.

“Water circulation occurred several kilometres deep in the crust some 3.7 billion years ago, before the majority of craters formed in this region,” says co-author Nicolas Mangold.

“The water generated a diverse range of chemical changes in the rocks that reflect low temperatures near the surface to high temperatures at

depth, but without a direct relationship to the surface conditions at that time.”

By comparison, Mawrth Vallis, one of the largest identified clay-rich regions of Mars, displays a more uniform aqueous mineralogy that indicates a closer link with surface processes.

“The role of liquid [water](#) on Mars is of great importance for its habitability and this study using Mars Express describes a very large zone where groundwater was present for a long time,” says Olivier Witasse, ESA’s [Mars Express](#) project scientist.

Provided by European Space Agency

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