Evidence of giant tsunami on Mars suggests an early ocean

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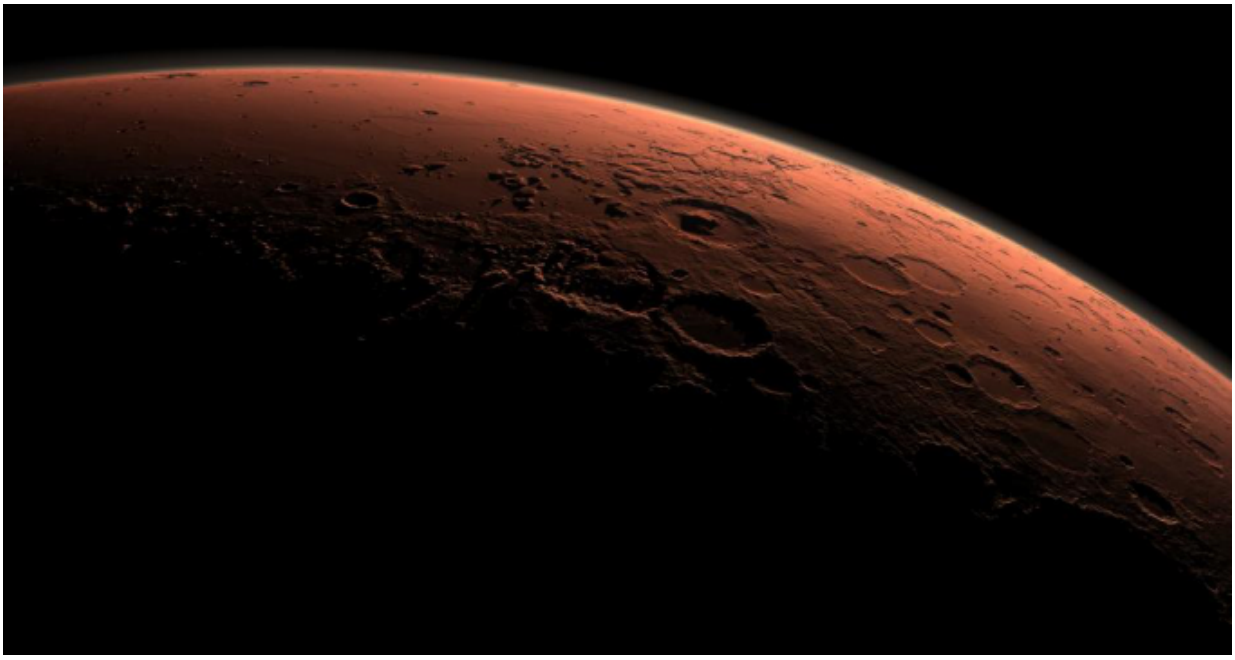

Credit: NASA

(Phys.org)—A team of researchers with members from France, Italy and the U.S. has found what they believe is evidence of a giant tsunami occurring on Mars approximately 3 billion years ago due to an asteroid plunging into an ocean. In their paper published in the *Journal of Geophysical Research*, the group outlines the evidence and why they believe a tsunami is the most likely factor that led to the creation of

some unique planetary formations.

Scientists have been investigating the possibility of oceans on Mars for several years, but have so far been unable to prove they existed. Also, other researchers have found evidence for tsunamis on Mars but have not been able to find an associated oceanic impact crater to go along with it. In this new effort, the researchers believe they have found both.

Prior research uncovered what has been described as thumbprint-looking terrain on the surface of Mars, which some researchers have ascribed to mud moving downhill from volcanoes or being pushed by glaciers. But they might have been created by a very large tsunami, the researchers suggest, and they have found a crater that they believe might have been the cause of it. Lomonosov crater, they suggest, situated in the northern plains, could very well be the scar that was left as a reminder of an asteroid striking in a northern ocean, generating waves hundreds of feet high, eventually spilling onto land and leaving enormous deposits behind. If such an asteroid did strike the ocean, the team continues, after diving through the water, it would have created a crater on the ocean floor. That crater would have been a void that would be suddenly filled with water from all sides, smashing together, creating a secondary tsunami following behind the first. As the first tsunami was receding over land, the second tsunami would have struck, and it was those two acting together that the researchers believe caused the characteristic thumbprint ridges to come about. They have used numerical modeling of wave propagation to back up their claims.

The researchers contend that no other reasonable explanation exists for the creation of the ridges, which, they suggest, offers a degree of evidence of not just a tsunami but an ocean on Mars.

More information: Francois Costard et al. Modeling tsunami propagation and the emplacement of thumbprint terrain in an early Mars

ocean, *Journal of Geophysical Research: Planets* (2017). DOI: 10.1002/2016JE005230

Abstract

The identification of lobate debris deposits in Arabia Terra, along the proposed paleoshoreline of a former northern ocean, has renewed questions about the existence and stability of ocean-sized body of water in the early geologic history of Mars. The potential occurrence of impact-generated tsunamis in a northern ocean was investigated by comparing the geomorphologic characteristics of the Martian deposits with the predictions of well-validated terrestrial models (scaled to Mars) of tsunami wave height, propagation direction, runup elevation, and distance for three potential sea levels. Our modeling suggests several potential impact craters ~30–50 km in diameter as the source of the tsunami events. Within the complex topography of flat-floored valleys and plateaus along the dichotomy boundary, the interference of the multiple reflected and refracted waves that are observed in the simulation may explain the origin of the arcuate pattern that characterizes the thumbprint terrain.