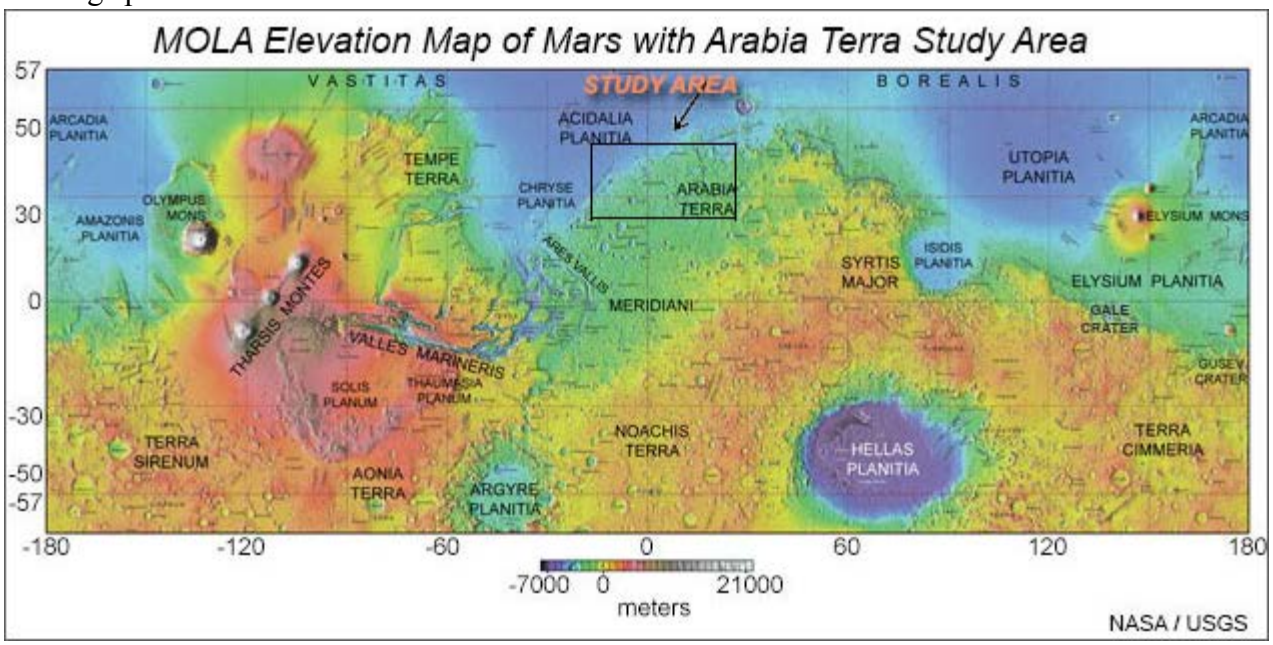
PLANETARY SCIENCE RESEARCH DISCOVERIES
CosmoSparks
Quick Views of Big Advances

Eden Patera, Mars—New Category of Ancient Martian Volcanism?

The volcanic nature of Mars is indisputable, ranging from cosmochemical evidence in Martian meteorites [***Data link*** from the Meteoritical Bulletin] to remote sensing data from landed rovers and orbiting spacecraft.

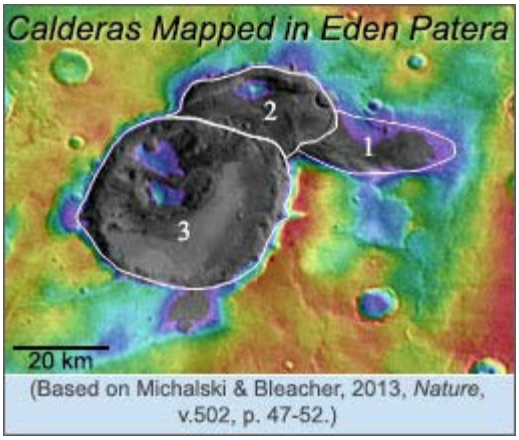


Elevation map of Mars based on data from the Mars Orbiter Laser Altimeter (MOLA) on NASA's Mars Global Surveyor spacecraft. Lowlands have colors of purple, blue, and green. Highlands are in yellow, orange, red, and white. Northern Arabia Terra (see arrow) is at the boundary between the northern lowlands and southern highlands; the area studied by Michalski and Bleacher that they interpret as a previously unidentified igneous province is outlined with a black rectangle. Click the map for a high resolution version from the U.S. Geological Survey.

The igneous rocks, lava plains, and shield volcanoes we've come to associate with volcanic activity on the Red Planet have a new landform-partner according to Joseph Michalski (Planetary Science Institute, Arizona and Natural History Museum, London) and Jacob Bleacher (NASA Goddard Space Flight Center, Maryland). They interpret some large depressions in northern Arabia Terra (see map), an area swarming with degraded impact craters, as something completely different: ancient volcanic caldera complexes, a.k.a. supervolcanoes. In contrast to the well-known Martian shield volcanoes with central calderas (e.g. Olympus Mons), Michalski and Bleacher's caldera complexes do not sit on topographic highs, hence are described as plains-style. They cite the best example as Eden patera (see below), a 55 x 85 kilometer depression in which they mapped three calderas that they suggest formed through a combination of collapse due to magma withdraw or magma migration and/or huge ash explosions. Eden patera is located at 11.1W, 33.6N, near six other irregularly shaped depressions described by the authors, in ***Noachian***- to ***Hesperian***-aged ridged plains.

Michalski and Bleacher analyzed the surface morphology of their study area with a suite of orbital topographic and spectral datasets and contend that this region is a previously unidentified igneous province. Furthermore, they say the pyroclastics and outgassed sulphur from the supervolcanoes

could be source materials for the layered deposits and fretted terrain of the equatorial regions of Arabia Terra. It would be interesting to see what new compositional information could be gathered from such ancient volcanic source regions, with instrumented rovers or with a sample return mission, to better understand the igneous history of the planet.



This map section depicts three calderas (numbered) in Eden patera (located at 11.1W, 33.6N), which is Michalski and Bleacher's best example of a plains-style caldera complex in the Arabia Terra study area. The deepest parts are about 1.8 kilometers below the surrounding plains. Data from MOLA and THEMIS daytime infrared.

See Reference:

· Michalski, J. R., and Bleacher, J. E. (2013) Supervolcanoes Within an Ancient Volcanic Province in Arabia Terra, Mars, *Nature,* v. 502, p. 47-52, doi:10.1038/nature12482. [***abstract and related video***].

Written by Linda Martel, Hawai'i Institute of Geophysics and Planetology, for ***PSRD***.