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Reading the landscape at volcano-tectonic locations within the Tharsis Montes, Mars

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In the Tharsis volcanic province on Mars the volcano Arsia Mons is comparable in size to a mantle plume volcanic region on Earth, such as Iceland. The volcano has a caldera with a diameter of 110 km. Extending from the NE and SW sides of Arsia Mons are landforms that form an irregular pattern, or a network of 1 km deep valleys and near circular vent-like depression areas. These suggest large scale erosion and removal of material into the surrounding lowland area up to a distance of 1000 km. This observation of erosion can only be valid if supported by a powerful erosive agent capable of substantial mass wasting and widespread material transport.
By anology with Earth-like volcanoes these valley landforms coincide with rifting or crustal extension, or the location to which magma travels from a centrally located magma chamber. Thus these sites represent areas of chamber wall failure and probably one of the most active volcano regimes in Arsia Mons.
It is suggested that the primary erosive agent responisble for the valley formation is jökulhlaups or meltwater released through magma/ice interaction.
A focus is presented on the SW side of Arsia Mons where two main valleys cut into the volcano flank that grade into numerous smaller and narrower canyons of a similar depth, above which isolated bowl-like and elongated depresions are observed. The visualized ersoion process assumes volcanism at depth where magma was in contact with ice. Subsurface meltwater flowed from the caldera rim area and in the process eroded a channel. The valley formation site, namely at the volcano lower level, is where all meltwater had to pass. In contrast, the area above the valleys, where fewer eruptive sites occur, is characterized with circular isolated depressions or less erosion. This implies large volumes of ice appear to be part of the volcano stratigraphy. The nature of the suggested ice source is, however, unclear.