GEOLOGIC MAPPING IN THE SOUTHERN UTOPIA BASIN: 2020 STATUS REPORT.

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ABSTRACT

In the southern Utopia basin of Mars, enigmatic landforms commonly referred to as pitted cones are being investigated to further understand their origin. Previous investigations have interpreted pitted cones as either pyroclastic cones, mud volcanoes or pingoes. Given the disparate and noteworthy nature of these proposed formation mechanisms and the occurrence of pitted cones in the northern lowlands, other sedimentary basins and in chaotic terrains, constraining the origins of these landforms is important for understanding the planet’s geologic history during the Late Hesperian to Early Amazonian, when the pitted cones are interpreted to have formed.

Analyses of CTX and HiRISE images in the southern Utopia basin reveal crosscutting and superposition relationships that indicate the pitted cones formed contemporaneously with the surrounding Vastitas Borealis Formation (VBF). Further, at least three distinct phases of rifting are found to have occurred contemporaneous with the formation of the local VBF, pitted cones, and newly identified shield-like hills. Based on these findings, we propose that the pitted cones, shields and rifts are intrinsic features of the VBF, rather than being the result of a post-depositional, exogenic process such as igneous volcanism or subsurface ice accumulation. Therefore these landforms are evidence of a dynamic time in Mars’ history when landscape evolution was driven by mobilization of sediment slurries (i.e., mud) within the subsurface and on the surface. Since these landforms consist of deposits that originated in fluid-rich, subsurface environments, they are high-priority and easily accessible sites for future investigations into past habitable environments on Mars.