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Eskers and other evidence of wet-based glaciation in Phlegra Montes, Mars.

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Although glacial landsystems produced under warm/wet based conditions are very common on Earth, glaciological and landform evidence indicates that glaciation on Mars during the Amazonian period (3 Ga to present) has been characterised by cold/dry based glaciers, consistent with the prevailing cold, hyperarid conditions. However, this presentation describes a system of sinuous ridges, interpreted as eskers (1), emerging from the degraded piedmont terminus of a Late Amazonian (∼150 Ma) glacier in the southern Phlegra Montes region of Mars. This is probably the first identification of martian eskers that can be directly linked to their parent glacier. Together with their contextual landform assemblage, the eskers are indicative of glacial melting and subglacial meltwater routing but the confinement of the system to a well-defined, regionally significant graben, and the absence of eskers elsewhere in the region, suggests that melting was a response to locally enhanced geothermal heat flux, rather than regional, climate-induced warming. Now, however, new observations reveal the presence of many assemblages of glacial abrasion forms and associated channels that could be evidence of more widespread wet-based glaciation in Phlegra Montes, including the collapse of several distinct ice domes. This landform assemblage has not been described in other glaciated, mid-latitude regions of the martian northern hemisphere. Moreover, Phlegra Montes are flanked by lowlands displaying evidence of extensive volcanism, including contact between plains lava and piedmont glacial ice. These observations suggest that the glaciation of Phlegra Montes might have been strongly conditioned by both volcanism and more restricted forms of ground-heating. These are important new insights both to the forcing of glacial dynamic and melting behaviour on Mars by factors other than climate and to the production of liquid water on Mars during the Late Amazonian.

(1) Gallagher, C. and Balme, M. (2015). Eskers in a complete, wet-based glacial system in the Phlegra Montes region, Mars, Earth and Planetary Science Letters, 431, 96-109.